Engineering Services Exam, 2010

इंजीनियरिंग सेवा परीक्षा, 2010
Engineering Service Examination

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

T.B.C. : Q-GUG-K-DFA

Test Booklet Series

A

Serial No. 018789

TEST BOOKLET

CIVIL ENGINEERING

PAPER I

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

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES ***NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C,** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet.*** You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**

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

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

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

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

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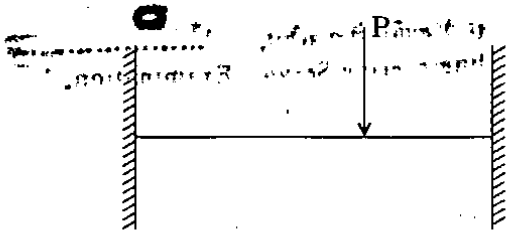
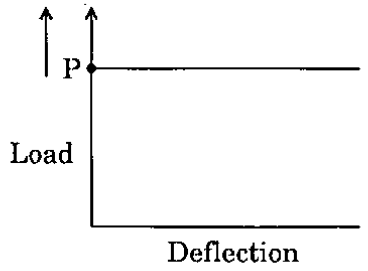
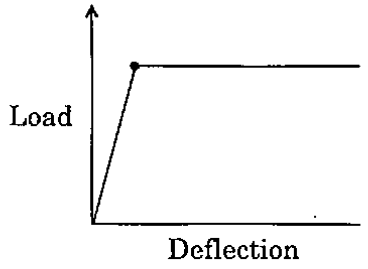
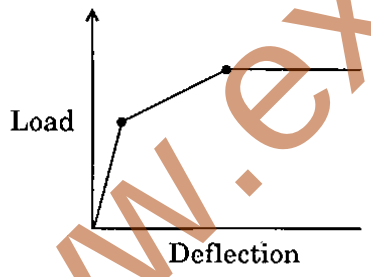
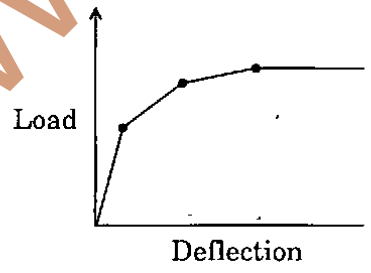
1. 

Which one of the following diagrams corresponds to the load-deflection characteristics upto plastic collapse of the beam shown ?

(a) 

(b) 

(c) 

(d) 

2. At the location of a plastic hinge,

(a) Radius of curvature is infinite

(b) Curvature is infinite

(c) Moment is infinite

(d) Flexible stress is infinite

3. Consider the following stipulations in designing a laced column :

1. Single lacing systems on opposite planes shall preferably be in the same direction so that one is the shadow of the other.
2. Lacing bar should be a flat section.
3. The slenderness ratio of the lacing bars for compression shall not exceed 180.
4. Laced compression members are to be provided with tie plates at ends.

Which of the above observations is/are correct ?

(a) 1 only

(b) 1 and 3

(c) 2 and 4

(d) 1 and 4

4. At a section along the span of a welded plate girder, in which the web is spliced, the bending moment at a section is M. The girder is comprised of top flange; web and bottom flange plates all of equal areas. The share of the bending moment taken by splice plates would be

(a) M

(b) $\frac{M}{3}$

(c) $\frac{M}{7}$

(d) $\frac{M}{13}$

5. A steel plate is 300 mm wide and 10 mm thick. A rivet of nominal diameter 18 mm is driven. The net sectional area of the plate is

(a) 1800 mm^2

(b) 2805 mm^2

(c) 2820 mm^2

(d) 3242 mm^2

6. For an I-beam, the shape factor is 1·12; the factor of safety in bending stress is 1·5. If the allowable stress is increased by 20% for wind or earthquake loads, then the load factor is

(a) 1·10

(b) 1·25

(c) 1·35

(d) 1·40

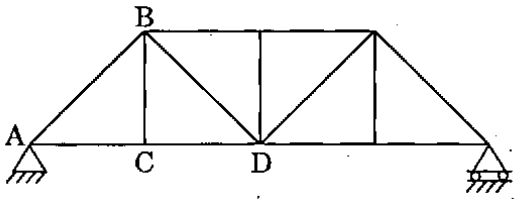
7. PERT calculations yield a project length of 60 weeks with a variance of 9 weeks. Probability factor corresponding to 95% probability is 1·647, then the number of weeks required to complete the project with a probability of 95% is

(a) 60·94

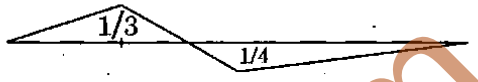
(b) 62·94

(c) 64·94

(d) 66·94

8. 

The influence line for force in member BC is

(a) 

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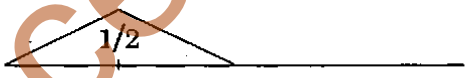
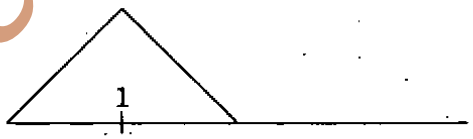
(c) 

(d) 

9. Consider the following statements :

1. PERT is activity-oriented and adopts deterministic approach.
2. CPM is event-oriented and adopts probabilistic approach.
3. PERT is event-oriented and adopts probabilistic approach.

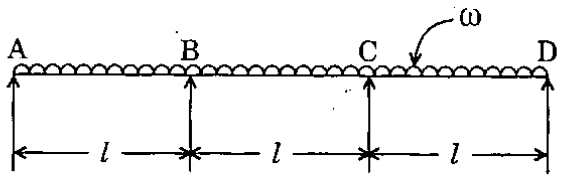
Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2

(c) 2 and 3

(d) 3 only

10. 

For the continuous beam shown, what is the reaction at A at collapse, by plastic analysis ?

(a) $\frac{5\,\omega l}{12}$

(b) $\frac{\omega l}{2}$

(c) $\frac{7\,\omega l}{12}$

(d) $\frac{13\,\omega l}{24}$

11. Consider the following statements :

1. Shape factor
2. Length of the beam
3. Type of loading
4. Yield strength of material

Which of these affect the influence length of plastic hinge in a beam ?

(a) 1 only

(b) 1 and 3

(c) 2 and 3

(d) 3 and 4

12. In PERT analysis, the time estimates of activities correspond to

(a) Normal distribution

(b) Poisson's distribution

(c) β-distribution

(d) Binomial distribution

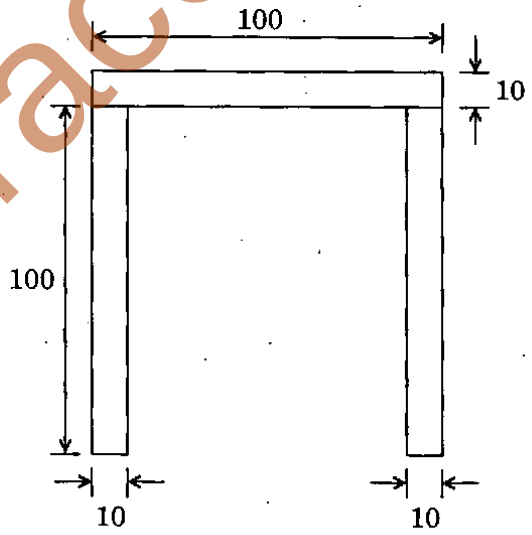
13. A propped cantilever of span L is subjected to a concentrated load at midspan. If M_P is the plastic moment capacity of the beam, the value of collapse load will be

(a) $\frac{12\,M_P}{L}$

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

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

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

14. 

The identical rectangle strips are joined to form a "hat" section. What is the plastic moment capacity ?

(a) $50 \times 10^3\ \sigma_y$

(b) $100 \times 10^3\ \sigma_y$

(c) $155 \times 10^3\ \sigma_y$

(d) $300 \times 10^3\ \sigma_y$

Where σ_y is Yield strength of steel

15. A father notes that when his teenage daughter uses the telephone she takes no less than 5 minutes for a call but sometimes as much as an hour. 15 minutes calls are more frequent than calls of any other duration. If the daughter's calls were to be represented as an activity in PERT project, the expected duration of each phone call is

(a) $14\frac{5}{6}$ minutes

(b) $16\frac{5}{6}$ minutes

(c) $18\frac{5}{6}$ minutes

(d) $20\frac{5}{6}$ minutes

16. The maximum longitudinal pitch allowed in bolted joints of tension members is

(a) 16 times the diameter of the bolt

(b) 32 times the diameter of the bolt

(c) 16 times the thickness of the plate

(d) 32 times the thickness of the plate

17. The base plate of a roof truss is attached to the concrete pier with the help of 16 mm diameter mild steel anchor bolts of grade f_y = 250 MPa. What is the maximum pull the base can be subjected to, if the root area of bolt = 0·75 times shank area ?

(a) 30 kN

(b) 67·5 kN

(c) 90 kN

(d) 120 kN

18. Consider the following conditions with respect to plastic analysis :

1. Sum of internal and external forces and moments must be equal to zero.
2. At ultimate collapse load, the number of plastic hinges must be just enough to form a mechanism.

Which of the above conditions is/are correct ?

(a) 1 only

(b) 2 only

(c) Neither 1 nor 2

(d) Both 1 and 2

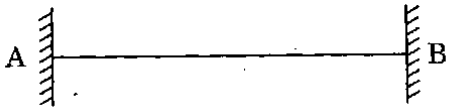
19. Poisson's ratio is defined as the ratio of

(a) Longitudinal stress and longitudinal strain

(b) Lateral strain and longitudinal strain

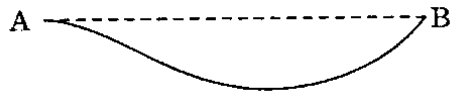
(c) Longitudinal stress and lateral stress

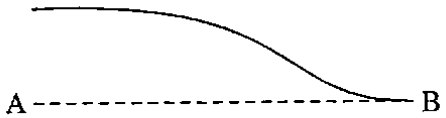
(d) Lateral stress and longitudinal stress

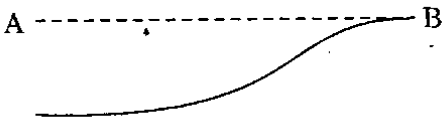
20. 

The influence line diagram for the support moment at A of the fixed beam AB of constant EI is

(a) 

(b) 

(c) 

(d) 

21. The use of 'Concordant cables' in prestressed continuous beams induces

(a) Initial support reactions

(b) No initial support reactions

(c) Excess cracking

(d) Excess deflection

22. Which one of the following is ***not*** required in concrete mix-design ?

(a) Degree of quality control of concrete

(b) Workability of concrete

(c) Characteristic compressive strength of concrete at 28 days

(d) Initial setting time of cement

23. The absolute maximum bending moment that a simply supported girder of span 10 m experiences when two concentrated loads 20 kN and 30 kN spaced 2 m apart (30 kN as leading at the right) crosses the girder from left to right, is

(a) 112·2 kN-m

(b) 96·6 kN-m

(c) 136·8 kN-m

(d) 105·8 kN-m

24. A solid shaft rotating at 180 rpm is subjected to a mean torque of 5000 Nm. What is the power transmitted by the shaft in kW ?

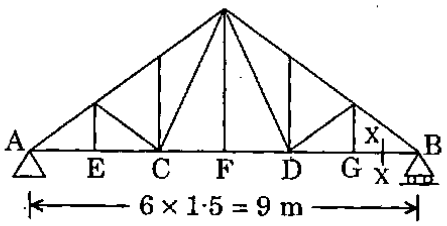
(a) 25 π

(b) 20 π

(c) 60 π

(d) 30 π

25.



For the roof truss shown in figure, bottom chord is of ISMB 200 [r_x = 83 mm, r_y = 22 mm].

Bottom chord bracings are available at C and D. Bottom member AE will be in compression due to wind. What is the critical slenderness ratio used for the design of member AE ?

(a) 18

(b) 36

(c) 68

(d) 136

26. Consider the following statements :

In a simply supported beam subjected to uniformly distributed load throughout the length, at which points is the stress due to (i) Flexure and (ii) Shear equal to zero selectively :

1. At support section at neutral fibre.
2. At mid span section at neutral fibre.
3. At mid span section at top fibre.
4. At support section at bottom fibre.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2

(c) 2 and 3

(d) 2 and 4

27. Consider the following statements :
Ultrasonic pulse velocity test to measure the strength of concrete is

1. Used to measure the strength of wet concrete.
2. Used to obtain estimate of concrete strength of finished concrete elements.
3. A destructive test.
4. A non-destructive test.

Which of the above statements is/are correct ?

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

28. A solid shaft has length and diameter 'L_s' and 'D' respectively. A hollow shaft of length L_h, external diameter 'D', and internal diameter 'd' respectively. Both are of the same material. The ratio of torsional stiffness of hollow shaft to that of solid shaft is

(a) $\left[1 + \left(\frac{d}{D}\right)^4\right] \cdot \frac{L_s}{L_h}$

(b) $\left[1 - \left(\frac{d}{D}\right)^4\right] \cdot \frac{L_h}{L_s}$

(c) $\left[1 - \left(\frac{d}{D}\right)^4\right] \cdot \frac{L_s}{L_h}$

(d) $\left[1 - \left(\frac{D}{d}\right)^4\right] \cdot \frac{L_s}{L_h}$

29. A live load 20 kN/m, 6 m long, moves on a simply supported girder AB 12 m long. For maximum bending moment to occur at 4 m from left end A, where will the head of load be, as measured from A ?

(a) 4 m
(b) 6 m
(c) 8 m
(d) 10 m

30. A building with a gabled roof will experience pressure on its leeward slope which is

(a) Always positive
(b) Always negative
(c) Sometimes positive and otherwise negative
(d) Zero

31. The live load for a sloping roof with slope 15°, where access is not provided to the roof, is taken as

(a) 0·65 kN/m^2
(b) 0·75 kN/m^2
(c) 1·35 kN/m^2
(d) 1·50 kN/m^2

32. The batten plates used to connect the components of a built-up column are designed to resist

(a) Longitudinal shear only
(b) Transverse shear only
(c) Longitudinal shear and moment arising from transverse shear
(d) Vertical shear only

33. The duration of any activity in case of a PERT programme is calculated as a weighted average of three time estimates namely the optimistic time to, the pessimistic time tp and the most probable time tm, which is given as

(a) $\left(\frac{to + tm + 4tp}{6}\right)$

(b) $\left(\frac{to + 4tm + tp}{6}\right)$

(c) $\left(\frac{4to + tm + tp}{6}\right)$

(d) $\left(\frac{3to + 2tm + tp}{6}\right)$

34. In ISMC 400 channels placed back to back at a spacing of 26 cm carry an axial load of 160 tonnes. The lacing system should be designed to resist a transverse shear of

(a) 16 tonnes

(b) 12 tonnes

(c) 8 tonnes

(d) 4 tonnes

35. Consider the following statements of network :

1. Only one time estimate is required for each activity.
2. Three time estimates for each activity.
3. Time and cost are both controlling factors.
4. It is built-up of event-oriented diagram.

Which of the above statements are correctly applicable to CPM network ?

(a) 1 and 3

(b) 1 and 2

(c) 2 and 4

(d) 3 and 4

36. If a simply supported concrete beam, prestressed with a force of 2500 kN, is designed by load balancing concept for an effective span of 10 m and to carry a total load of 40 kN/m, the central dip of the cable profile should be

(a) 100 mm

(b) 200 mm

(c) 300 mm

(d) 400 mm

37. A circular shaft which has a diameter of 100 mm is subjected to a torque of 5 kN-m. The shear stress, in N/mm^2, induced in the shaft would be

(a) $\frac{160}{\pi}$

(b) $\frac{120}{\pi}$

(c) $\frac{125}{\pi}$

(d) $\frac{80}{\pi}$

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

List I (Type)	*List II (Recommended Slenderness ratio)*
A. Single angle in roof trusses	1. 80 – 150
B. Double angles in roof trusses	2. 30 – 60
C. Single I section in columns	3. 100 – 180
D. Double I section in columns	4. 60 – 100

Code :

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

39. Flexibility matrix for a beam element is written in the form :

$$[A] = \frac{L^3}{6\,EI}\begin{bmatrix} 2 & 5 \\ 5 & 16 \end{bmatrix}$$

What is the corresponding stiffness matrix ?

(a) $\frac{6\,EI}{L^3}\begin{bmatrix} 16 & 5 \\ 5 & 2 \end{bmatrix}$

(b) $\frac{6\,EI}{7\,L^3}\begin{bmatrix} 16 & 5 \\ 5 & 2 \end{bmatrix}$

(c) $\frac{6\,EI}{L^3}\begin{bmatrix} 16 & -5 \\ -5 & 2 \end{bmatrix}$

(d) $\frac{6\,EI}{7\,L^3}\begin{bmatrix} 16 & -5 \\ -5 & 2 \end{bmatrix}$

40. Consider the following statements relating to structural analysis :

1. Flexibility matrix and its transpose are equal.
2. Elements of main diagonal of stiffness matrix are always positive.
3. For unstable structures, coefficients in leading diagonal matrix can be negative.

Which of the above statements is/are correct ?

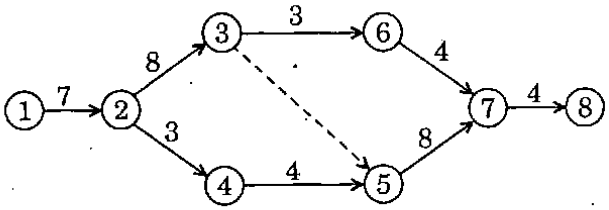
(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 3 only

41.



In the above network, the duration of activities are written along their arrows. The critical path of the activities is along

(a) 1 – 2 – 3 – 5 – 7 – 8

(b) 1 – 2 – 3 – 6 – 7 – 8

(c) 1 – 2 – 4 – 5 – 7 – 8

(d) 1 – 2 – 3 – 4 – 5 – 7 – 8

42. Flexibility matrix for a beam element is

$$[F] = \frac{1}{EI}\begin{bmatrix} 36 & 9 \\ 9 & 4 \end{bmatrix}$$

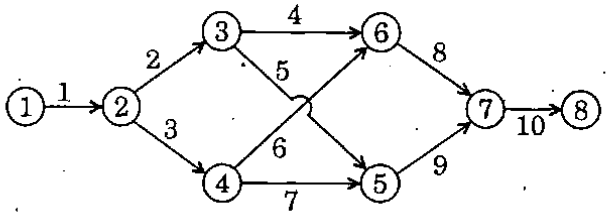
What is the corresponding stiffness matrix [S] ?

(a) $[S] = \frac{EI}{63}\begin{bmatrix} 36 & -9 \\ -9 & 4 \end{bmatrix}$

(b) $[S] = \frac{EI}{63}\begin{bmatrix} 36 & 9 \\ 9 & 4 \end{bmatrix}$

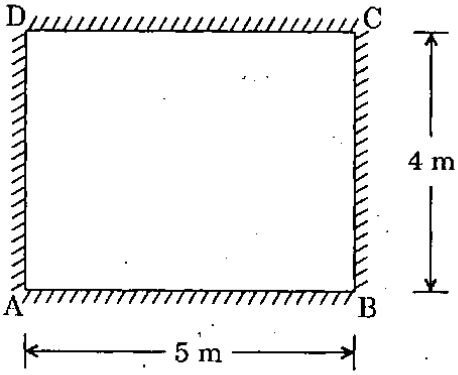
(c) $[S] = \frac{EI}{63}\begin{bmatrix} 4 & -9 \\ -9 & 36 \end{bmatrix}$

(d) $[S] = \frac{EI}{63}\begin{bmatrix} 4 & 9 \\ 9 & 36 \end{bmatrix}$

43. 

The above figure indicates a project network; the number at each activity represents its normal duration in days. The critical path is along

(a) 1 – 2 – 3 – 6 – 7 – 8
(b) 1 – 2 – 4 – 5 – 7 – 8
(c) 1 – 2 – 3 – 5 – 7 – 8
(d) 1 – 2 – 4 – 6 – 7 – 8

44. 

The RC slab, simply supported on all edges as in above figure, is subjected to a total UDL of 12 kN/m^2. The maximum shear force / unit length along the edge 'BC' is

(a) 16 kN
(b) 12 kN
(c) 8 kN
(d) 30 kN

45. Consider the following statements about the air entraining admixture in concrete :

1. Improve workability
2. Improve durability
3. Reduce segregation during placing
4. Decrease concrete density

Which of the above statements are correct ?

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

46. Which one of the following is relevant to Activity on Node (AON) ?

(a) Dummy activities may be many
(b) There will be no dummy activities
(c) It is used for quite complex project
(d) It is easier to associate with time flow of activities

47. Consider the following activities :

1. Pouring of concrete
2. Erection of formwork
3. Curing of concrete
4. Removal of formwork

What is the correct sequence on a network of these activities ?

(a) 1 – 2 – 3 – 4
(b) 2 – 1 – 4 – 3
(c) 2 – 1 – 3 – 4
(d) 1 – 3 – 2 – 4

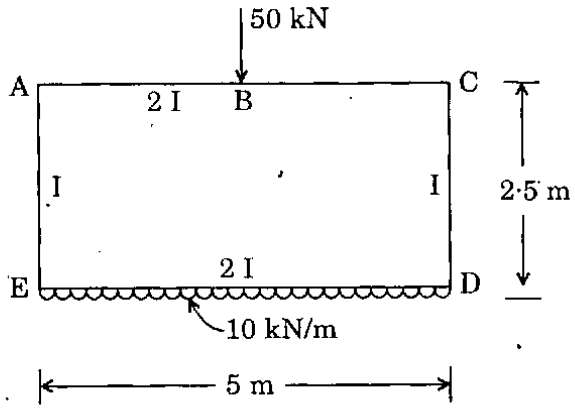
48. A solid circular shaft subjected to a torque T produces maximum shear stress f_s, which is the maximum principal value in the material. The corresponding diameter of the shaft should be

(a) $\sqrt[3]{\frac{\pi . f_s}{16 . T}}$

(b) $\sqrt[3]{\frac{32 . T}{\pi . f_s}}$

(c) $\sqrt[3]{\frac{\pi}{16 . T . f_s}}$

(d) $\sqrt[3]{\frac{16 . T}{\pi . f_s}}$

49. 

The distribution factors for members AE and AC of the box section are

(a) 0·5 and 0·5

(b) 0·6 and 0·4

(c) 0·25 and 0·75

(d) 1 and zero

50. A steel beam is replaced by a corresponding aluminium beam of same cross-sectional shape and dimensions, and is subjected to same loading. The maximum bending stress will

(a) Be unaltered

(b) Increase

(c) Decrease

(d) Vary in proportion to their modulus of elasticity

51. A building contractor discovers from his record that in the last 200 slab castings his mixer machine broke down 21 times. During each breakdown, he had to pay on an average about Rs. 2,500 for idle labour. A standby mixer machine, if hired on the day of slab casting, would cost him Rs. 200 per day. The expected loss is more than the mitigation expense of hiring the mixer by

(a) Rs. 151·50

(b) Rs. 241·50

(c) Rs. 262·50

(d) Rs. 283·50

52. Consider the following statements :

Admixtures are added to concrete to

1. Increase its strength.
2. Reduce heat of hydration.
3. Delay the setting of cement.
4. Reduce water-cement ratio.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2

(c) 2 and 3

(d) 3 and 4

53. A beam of symmetrical I-section, made of structural steel has an overall depth of 300 mm. If the flange stresses developed at the top and bottom of the beam are 1200 kg/cm^2 and 300 kg/cm^2 respectively, then the depth of neutral axis from the top of the beam would be

(a) 250 mm

(b) 240 mm

(c) 200 mm

(d) 180 mm

54. Consider the following statements :

1. Strength of concrete cube is inversely proportional to water-cement ratio.
2. A rich concrete mix gives a higher strength than a lean concrete mix since it has more cement content.
3. Shrinkage cracks on concrete surface are due to excess water in mix.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 only

(d) 2 and 3 only

55. The load carrying capacity of a column designed by working stress method is 500 kN. The ultimate collapse load of the column is

(a) 500 kN

(b) 662·5 kN

(c) 750 kN

(d) 1100 kN

56. Consider the following statements :

1. The crushing strength of concrete is fully governed by water-cement ratio.
2. Vibration has no effect on strength of concrete at high water-cement ratios.
3. Workability of concrete is affected by improper grading of aggregates.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 2 and 3 only

(c) 2 only

(d) 3 only

57. Consider the following statements regarding the slope of cost-time curve :

1. It is given by difference between normal cost and crash cost divided by crash time.
2. It is given by difference between crash cost and normal cost divided by difference between crash time and normal time.
3. It is given by difference of crash cost and normal cost divided by normal time.
4. It is given by crash cost divided by crash time.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 and 3

(c) 2 only

(d) 3 and 4

58. If P is the percentage of water required for determination of normal consistency of cement, then percentage of water to be added for determination of initial setting time is

(a) 0·70 P

(b) 0·75 P

(c) 0·80 P

(d) 0·85 P

59. Consider the following statements in work breakdown structure :

1. It is a graphical representation of entire programme.
2. The Top-Down approach to planning is adopted.
3. The Down-Top approach to planning is adopted.
4. It is suitable for complex projects.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 and 4

(c) 3 and 4

(d) 4 only

60. Consider the following statements :

Entrainment of air in concrete is done so as to

1. Increase the workability.
2. Increase the strength.
3. Increase the resistance to freezing and thawing.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 1 only

(c) 1 and 3 only

(d) 3 only

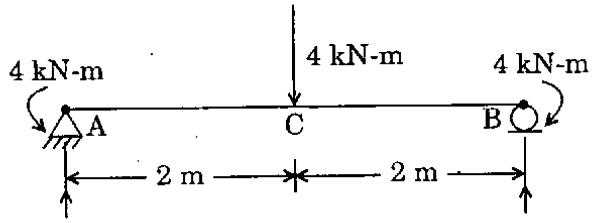
61. Consider the following statements :

1. In work-breakdown structure top-down approach is adopted.
2. Bar-chart depicts interdependencies of activities.
3. Controlling can be better achieved in milestone chart.

Which of the above statements are correct ?

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

62.



A simply supported beam is loaded as in figure. The bending moment at C is

(a) 4 kN-m (Sagging)
(b) 4 kN-m (Hogging)
(c) 8 kN-m (Sagging)
(d) Zero

63. If the Euler load for a steel column is 1000 kN and crushing load is 1500 kN, the Rankine load is equal to

(a) 2500 kN
(b) 1500 kN
(c) 1000 kN
(d) 600 kN

64. A simply supported beam of T-section is subjected to a uniformly distributed load acting vertically downward. Its neutral axis is located at 25 mm from the top of the flange and the total depth of the section is 100 mm. The ratio of maximum tensile stress to maximum compressive stress in the beam is

(a) 2·0
(b) 2·5
(c) 3·0
(d) 4·0

65. A two-dimensional stress system has like stresses $\sigma_x = 100$ N/mm^2 and $\sigma_y = 200$ N/mm^2 in two mutually perpendicular directions. The x, y co-ordinates of the centre of the Mohr's circle are

(a) (0, 150)
(b) (150, 0)
(c) (– 50, 0)
(d) (50, 0)

66. A cement bag contains 0·035 cubic meter of cement by volume. How many bags will one tonne of cement comprise ?

(a) 16
(b) 17
(c) 18
(d) 20

67. Consider the following statements :

1. Total float can affect all activities in the chain.
2. Free float can affect only the preceding activities.
3. Independent float affects only the particular concerned activity.

Which of the above statements is/are correct ?

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

68. Consider the following statements :

1. Cambium layer is between sapwood and heartwood.
2. Heartwood is otherwise termed as deadwood.
3. Timber used for construction is obtained from heartwood.

Which of the above statements is/are correct ?

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

69. Consider the following statements :

1. The resources are considered to be unlimited.
2. The resources are considered to be limited.
3. The start times of some of the activities are so shifted within their available floats that the uniform demand is created for the resources.

Which of the above statements is/are correct ?

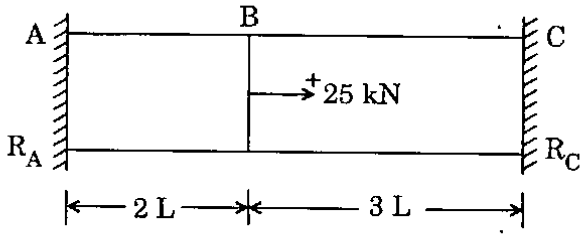
(a) 1 only

(b) 1, 2 and 3

(c) 2 and 3 only

(d) 1 and 3 only

70.



A prismatic bar ABC is subjected to an axial load of 25 kN; the reactions R_A and R_C will be

(a) $R_A = -10$ kN and $R_C = -15$ kN

(b) $R_A = 10$ kN and $R_C = -35$ kN

(c) $R_A = -15$ kN and $R_C = -10$ kN

(d) $R_A = 15$ kN and $R_C = -40$ kN

71. The capacity of a single ISA 100 × 100 × 10 mm as tension member connected by one leg only using 6 rivets of 20 mm diameter is

(a) 333 kN

(b) 253 kN

(c) 238 kN

(d) 210 kN

The allowable stress is 150 N/mm^2.

72. Consider the following statements :

1. Strength of brick masonry is influenced by type of mortar.
2. Brick masonry with lime mortar achieves full strength earlier than cement mortar masonry.
3. Mortar strength decides the strength of masonry.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 1 only

(c) 1 and 3 only

(d) 3 only

73. A single-acting reciprocating pump has a stroke of 30 cm, speed of 115 rpm and a piston of 30 cm diameter. It discharges 39 l.p.s. through a height of 15 m. The slip of the pump is

(a) 2·8%

(b) 3·2%

(c) 3·6%

(d) 4·0%

74. Consider the following statements for a beam of rectangular cross-section and uniform flexural rigidity EI subjected to pure bending :

1. The bending stresses have the maximum magnitude at the top and bottom of the cross-section.
2. The bending stresses vary linearly through the depth of the cross-section.
3. The bending stresses vary parabolically through the depth of the cross-section.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 1 only

(c) 2 only

(d) 1 and 2 only

75. If the load acting on a commonly conventional sized RC column increases continuously from zero to higher magnitudes, the magnitude of the uniaxial ultimate moment that can be allowed on the column

(a) Increases

(b) Decreases

(c) Increases and then decreases

(d) Remains constant

76. In RCC beams, as the percentage areas of tensile steel increases

(a) Depth of neutral axis increases

(b) Depth of neutral axis decreases

(c) Depth of neutral axis does not change

(d) Lever arm increases

77. The average compressive strength of a burnt clay brick is less than 12·5 N/mm^2. The allowable rating of efflorescence is

(a) Moderate

(b) Serious

(c) Heavy

(d) Zero

78. Two beams carrying identical loads, simply supported, are having same depth but beam A has double the width as compared to that of beam B. The ratio of the strength of beam A to that of beam B is

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

(b) $\frac{1}{4}$

(c) 2

(d) 4

79. Shear span is defined as the zone where

(a) Bending moment is zero

(b) Shear force is zero

(c) Shear force is constant

(d) Bending moment is constant

80. If the hinged end of a propped cantilever of span L settles by an amount δ, then the rotation of the hinged end will be

(a) $\frac{\delta}{L}$

(b) $\frac{2\delta}{L}$

(c) $\frac{3\delta}{2L}$

(d) $\frac{4\delta}{3L}$

81. The correct statement in respect of a centrifugal pump is

(a) The discharge varies in direct proportion to speed as also square of the diameter

(b) The head varies as the square of the speed as also of the square of the diameter

(c) The discharge varies in inverse proportion to speed as also the cube of the diameter

(d) The power varies as the head and square of the diameter

82. Consider the following statements :

1. Bricks lose their strength by 25% when soaked in water.
2. Minimum crushing strength of brick in buildings should be 35 kg/cm^2.
3. The size of modular type bricks is 20 cm × 10 cm × 10 cm including mortar thickness.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

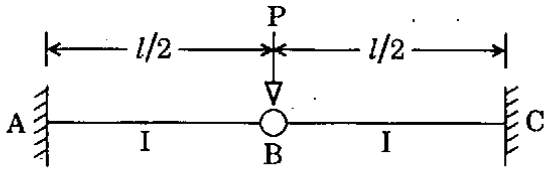
83. The limit of proportionality in the material of a structural steel member, when subjected to simple tension, is 280 N/mm^2. The principal stresses in the member are σ_1 = 122 N/mm^2 (Tensile) and σ_2 = 60 N/mm^2 (Compressive). μ = 0·3. According to maximum strain theory, the factor of safety is

(a) 2·5

(b) 1·5

(c) 2

(d) 3

84. 

What is the deflection at the hinge for the beam shown ?

(a) 0

(b) $\frac{Pl^3}{3EI}$

(c) $\frac{Pl^3}{24EI}$

(d) $\frac{Pl^3}{48EI}$

85. A belt designated as Hex bolt M 16 × 70 NL will have

(a) Diameter of 16 mm

(b) Diameter of 70 mm

(c) Length of 16 mm

(d) Cross-sectional area of 16 × 70 cm^2

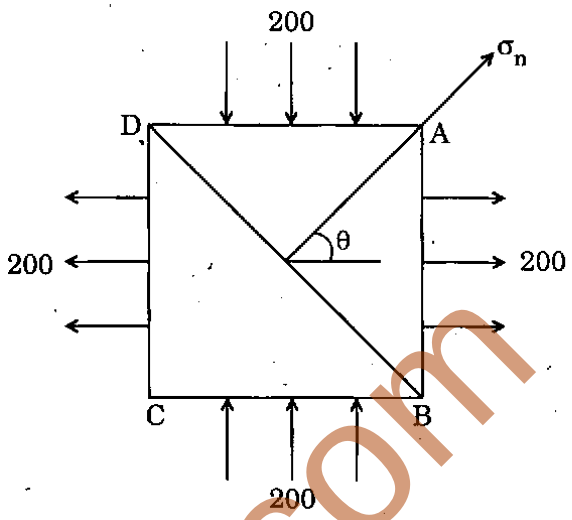
86. In the limit state method, balanced design of a reinforced concrete beam gives

(a) Smallest concrete section and maximum area of reinforcement

(b) Largest concrete section and maximum area of reinforcement

(c) Smallest concrete section and minimum area of reinforcement

(d) Largest concrete section and minimum area of reinforcement

87. 

A square element is subjected to principal stresses in N/mm^2 as in figure. The intensity of normal stress σ_n on plane BD is

(a) $200\sqrt{2}$

(b) 100

(c) 200

(d) 0

88. A crawler-tractor weighs 9 ton and a rubber-tyred tractor capable of exerting the same maximum drawbar pull weighs 7·5 ton. 65% of weight of the latter is carried by the two driving wheels. Tractive coefficient for crawler track and rubber tyre is respectively 0·48 and 0·90. Which tractor is more suitable for use where the running surface is concrete ?

(a) Crawler-tractor

(b) Rubber-tyred tractor

(c) Either

(d) Neither

89. The advantage in using plywood is that the

(a) Tensile strength is equal in all directions

(b) Higher tensile strength in longer direction

(c) Higher tensile strength in shorter direction

(d) Lower tensile strength in longer direction

90. Consider the following statements :

If there is a state of pure shear τ at a point then

1. The Mohr's circle is tangential to the y-axis.
2. The centre of the Mohr's circle coincides with the origin.
3. Unlike principal stresses are each numerically equal to τ.
4. Principal stresses are like.

Which of the above statements is/are correct ?

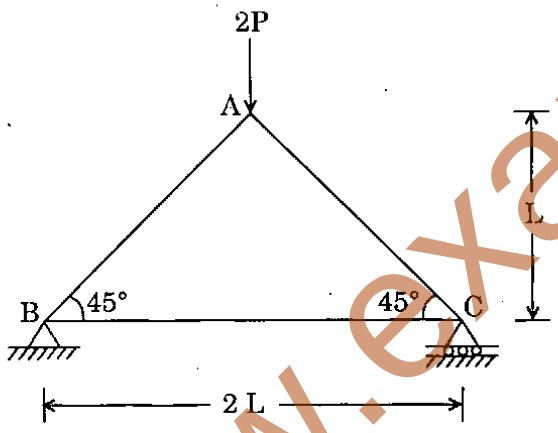
(a) 1 only

(b) 1 and 2

(c) 2 and 3

(d) 3 and 4

91.



A simple plane truss acted upon by a load 2P at the apex A is shown. The axial force in the member AB is

(a) P

(b) $\sqrt{2}$ P

(c) $\frac{\sqrt{3}}{2}$ P

(d) $\sqrt{3}$ P

92. A four-wheel tractor whose operating weight is 13,000 kg is pulled along a haul road having a slope of 4% at a uniform speed with a rolling resistance of 10 kg/ton for 1% slope. The tension in the toe cable is 1105 kg. The rolling resistance of the haul road is

(a) 35 kg/ton

(b) 45 kg/ton

(c) 55 kg/ton

(d) 65 kg/ton

93. On a particular construction project, the contractor on an average employed 100 workers with 50 hours per week. The project lasted for 35 weeks and during this period, 14 disabling injuries occurred. The injury-frequency rate is

(a) 6

(b) 7

(c) 8

(d) 9

94. The maximum percent of moment redistribution allowed in RCC beams is

(a) 10%

(b) 20%

(c) 30%

(d) 40%

95. A structural member carrying a pull of 700 kN is connected to a gusset plate using rivets of 20 mm diameter. If the pull required for shearing the rivets, to crush the rivets and to tear the plate per pitch length are 60 kN, 35 kN and 70 kN respectively, then the number of rivets required is

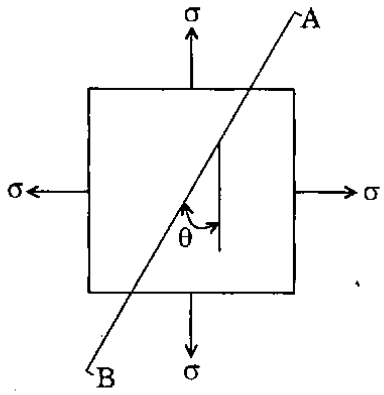
(a) 12

(b) 18

(c) 20

(d) 22

96.



A point in two-dimensional stress state subjected to biaxial stress is shown in figure. What is the normal stress acting on the plane AB ?

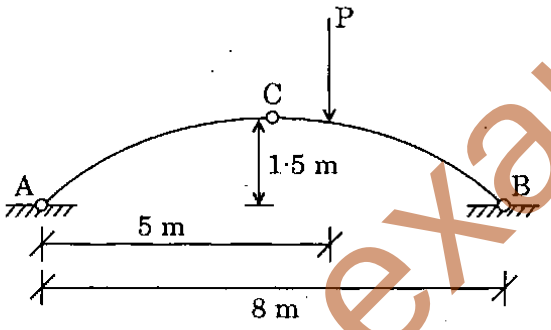
(a) Zero

(b) σ

(c) $\sigma \cos^2 \theta$

(d) $\sigma \sin \theta \cdot \cos \theta$

97.



A three-hinged symmetrical arch is loaded as shown in figure. Which one of the following is the magnitude of the correct horizontal thrust ?

(a) $\frac{4}{3}$ P

(b) P

(c) $\frac{3}{4}$ P

(d) $\frac{3}{8}$ P

98. Which one of the following statements is correct as regards tensile strength of wood ?

(a) Minimum in the direction parallel to the grains

(b) Maximum in the direction parallel to the grains

(c) Maximum in the direction across the grains

(d) Same in all directions

99. Consider the following characteristics regarding timber :

1. Stronger variety
2. Ability to take very smooth finish
3. Toughness
4. Difficult to season

Which of the above characteristics is/are essential for timber to be used as beams ?

(a) 1 only

(b) 2 and 3

(c) 3 and 4

(d) 1 and 3

100. A unit of equipment costs Rs. 25 Lakh and has a life of 5 years with no salvage value. The average annual cost of this equipment based on straight-line depreciation is

(a) Rs. 5 Lakh

(b) Rs. 10 Lakh

(c) Rs. 15 Lakh

(d) Rs. 20 Lakh

Directions : *Each of the next twenty (20) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :*

Codes :

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

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

(c) A is true but R is false

(d) A is false but R is true

101. *Assertion (A) :* A hollow circular shaft has more power transmitting capacity than a solid shaft of same material and same weight per unit length.

Reason (R) : In a circular shaft, shear stress developed at a point due to torsion is proportional to its radial distance from the centre of the shaft.

102. *Assertion (A) :* Load deflection characteristics of a fixed beam subjected to uniformly distributed load is linear up to collapse.

Reason (R) : Except at the zones of plastic hinge, rest of the components are in the elastic range.

103. *Assertion (A) :* Low heat cement is used in the construction of large dams.

Reason (R) : Very high compressive strength is achieved by low heat cement in 28 days.

104. *Assertion (A) :* Higher strength is achieved when superplasticizer is added to cement concrete mix.

Reason (R) : By adding superplasticizer, the quantity of mixing water is reduced.

105. *Assertion (A) :* In order to obtain higher degree of workability in cement concrete, both water content and proportion of cement should be increased.

Reason (R) : Increase in water-cement ratio decreases the strength of cement concrete; a mix with higher workability must have higher proportion of cement in it.

106. *Assertion (A) :* The principle of superposition is valid whenever the strain or stress to be obtained is directly proportional to the applied loads.

Reason (R) : Strain energy depends on the product of stress and strain.

107. *Assertion (A) :* Force method of analysis is not convenient for computer programming.

Reason (R) : Band width of flexibility matrix is much larger compared to that of stiffness matrix.

108. *Assertion (A) :* The moment distribution and slope-deflection methods of structural analysis are essentially stiffness methods.

Reason (R) : In the moment distribution method, the slope-deflection equations are solved without writing them explicitly.

109. *Assertion (A) :* Compared to rectangular hollow section, circular hollow section possesses more plastic moment of resistance over its yield moment.

Reason (R) : Circular hollow section has higher shape factor than rectangular hollow section.

110. *Assertion (A) :* In a helically reinforced concrete column, the concrete core is subjected to triaxial state of stress.

Reason (R) : Helically reinforced concrete columns are very much suitable for earthquake resistant structures.

111. *Assertion (A) :* In the case of mild steel, the tensile strength (expressed as per unit area) of smaller diameter bars are more than that of larger diameter bars.

Reason (R) : In the case of smaller diameter mild steel bars, the ratio of outer hard core to total area (outer hard core + inner soft core) is more.

112. *Assertion (A) :* The behaviour of an over-reinforced beam is more ductile than that of under-reinforced beam.

Reason (R) : Over-reinforced beam contains more steel and steel is more ductile than concrete.

113. *Assertion (A) :* Activity-on-node network eliminates the use of dummy activities.

Reason (R) : It is self-sufficient as it contains all activity times on the nodes itself.

114. *Assertion (A) :* A 'dummy' job is assigned 'zero' time to perform.

Reason (R) : It is used mainly to specify precedence relationship.

115. *Assertion (A) :* The time-grid diagram facilitates to readout the float for any activity by inspecting the diagram.

Reason (R) : In the time-grid diagram, floats are represented by broken horizontal lines as appropriate.

116. *Assertion (A) :* The probability of completion of a multi-path project at the expected project completion duration is 50%.

Reason (R) : The standard deviate for the critical path duration is zero.

117. *Assertion (A) :* In the analysis of statically determinate planar trusses by the method of joints, not more than two unknown bar forces can be determined.

Reason (R) : There are only two equations of force equilibrium available for a co-planar concurrent system.

118. *Assertion (A) :* A drag line is a suitable equipment for excavating or digging earth and depositing it on nearby bank.

Reason (R) : In drag-line, there is no need of a separate hauling unit.

119. *Assertion (A) :* Mueller – Breslau principle is a most widely used method to determine qualitative influence lines in an indeterminate structure.

Reason (R) : The determination of the qualitative influence lines is often of great value in ascertaining the most severe stresses at specified sections of a structure.

120. *Assertion (A) :* Losses in prestress in pre-tensioned beams are more than the losses in post-tensioned beams.

Reason (R) : This is partially due to the effect of elastic shortening.

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Engineering Services Examination, 2010.

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T.B.C. : Q-GUG-K-DFB

Test Booklet Series

A

Serial No. 018741

TEST BOOKLET

CIVIL ENGINEERING

PAPER II

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

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES ***NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C,** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet.*** You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**

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

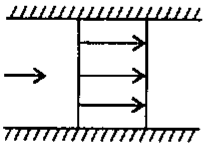
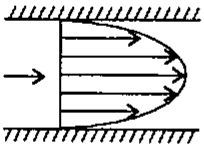
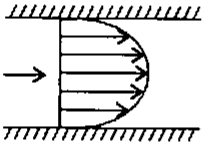
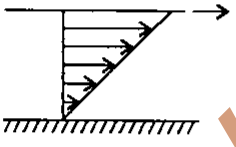
    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.

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

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

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

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

List I (Velocity distribution)	*List II (Types of flow)*
A. 	1. Couette
B. 	2. Ideal fluid
C. 	3. Poiseuille
D. 	4. Turbulent

Code :

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

2. An unconfined aquifer of porosity 30% and permeability 35 m/day and specific yield of 0·20 has an area of 100 km^2. If the water table falls by 0·25 m during a drought, the volume of water lost from storage, in million cubic metres, is

(a) 2·0

(b) 5·0

(c) 1·0

(d) 4·0

3. Consider the following statements :

1. High water training is undertaken to protect against damage due to floods.

2. Low water training is undertaken to provide sufficient depth for navigation.

3. Mean water training is undertaken to provide efficient disposal of sediment load.

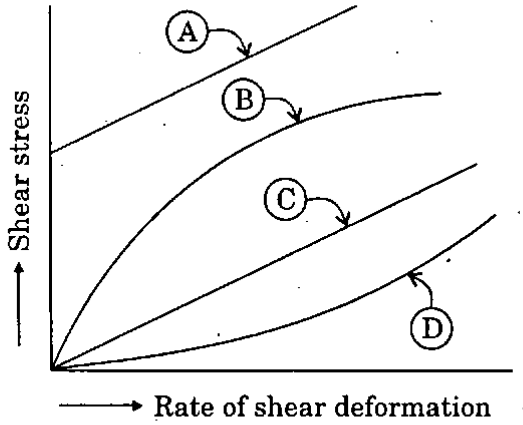
Which of the above statements is/are correct ?

(a) 1 and 2 only

(b) 1, 2 and 3

(c) 2 and 3 only

(d) 2 only

4. 

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

List I (Curve identification in figure)	*List II (Nature of fluid)*
A. Curve A	1. Newtonian
B. Curve B	2. Dilatant
C. Curve C	3. Ideal Bingham plastic
D. Curve D	4. Pseudo-plastic

Code :

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

5. Shallow ponds in which dissolved oxygen is present at all depths are called

(a) Aerobic lagoons

(b) Aerobic ponds

(c) Facultative lagoons

(d) Facultative ponds

6. Consider the following statements :

1. Each year, black cotton soil appreciably shrinks during dry season and swells during rainy season. This alternate cycle of shrinking and swelling causes severe stresses in structures supported directly by such soil.
2. Black cotton soil contains predominantly a clay mineral called kaolinite, which is responsible for causing appreciable shrinking and swelling.
3. Shrinking and swelling of black cotton soils are observed only upto a certain depth below the ground level. Below that level, there is neither shrinking nor swelling.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 3 only

(c) 2 and 3 only

(d) 1 and 3 only

7. Consider the following statements :

The function of a launching apron at the end of downstream impervious apron of a weir is

1. To protect the downstream pile from the scour holes progressing in the upstream direction.
2. When the scour holes are formed, to provide for the stones of the falling apron to settle down in the holes and cover them.
3. To provide relief of the uplift pressure at the downstream end.
4. To provide extra length for proper formation of hydraulic jump.

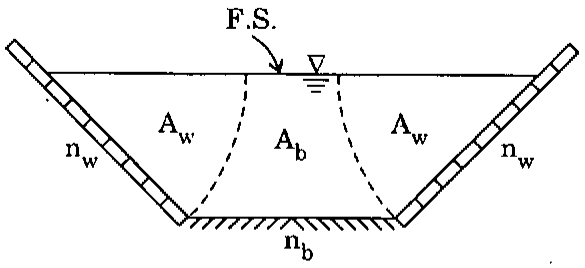
Which of the above statements is/are correct ?

(a) 1, 2, 3 and 4

(b) 3 only

(c) 2 only

(d) 1 and 2 only

8. 

The two sides of a trapezoidal channel are lined with cement plaster, $n_w = 0{\cdot}012$, while the earthen bed has $n_b = 0{\cdot}025$, the area is divided into three parts as in the figure.

Consider the following assumptions to find the discharge through this section :

1. The average velocity is the same for all the 3 parts.
2. Discharge is the same in all the 3 parts.
3. Bed slope is the same for all the 3 parts.
4. Hydraulic mean radius is the same for all the 3 parts.

Which of the above assumptions are correct ?

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

9. Consider the following statements :

1. A differential free swell value of 40% indicates a soil with a high degree of expansiveness.
2. A swelling pressure of less than 20 kN/m^2 is not of much consequence.
3. The swelling pressure is a unique parameter for a swelling soil and is not influenced by other factors.

Which of the above statements is/are correct ?

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

10. Heavy scour at the head and shank of guide banks can lead to undermining of the stone pitching and consequent failure of the guide bank. This situation is avoided by providing

(a) Spurs
(b) Vertical cutoffs
(c) Marginal bunds
(d) Launching apron

11. Noise pollution in a road-side building can be reduced by

(a) providing a ditch around the building and filling it with water
(b) providing a steel mesh around the building
(c) providing a thick bush around the building
(d) planting tall trees around the building and fencing them with barbed wires

12. A submerged pipe outlet is an example of

(a) Semi-modular outlet
(b) Non-modular outlet
(c) Rigid module
(d) Adjustable proportional module

13. A ski-jump bucket is generally used as an energy dissipator when the tail water

(a) is greater than 1·1 times the required conjugate depth for the formation of hydraulic jump; and the river bed rock is 'good'
(b) depth is lesser than the depth required for the jump formation; and the bed of the river channel is composed of 'sound' rock
(c) depth is equal to the depth required for the jump formation, and the river bed rock is 'good'
(d) depth is 1·3 times the required for the jump formation and the river bed is composed of 'weak' rock

14. The wave height, in metres, generated on the surface of a reservoir, having a fetch length F = 30 km, due to wind blowing on the surface of the reservoir at a velocity of 30 km/hr, is

(a) 0·26 m
(b) 0·96 m
(c) 0·52 m
(d) 1·2 m

15. Consider the following devices as likely to concern with water hammer phenomenon in their design/operation :

1. Hydraulic ram
2. Hydraulic accumulator
3. Penstock
4. Surge tank
5. Draft tube

Which of the above devices is/are so concerned ?

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

16. Consider the following statements :

1. Westergaard's theory of stress distribution is more appropriate for soil deposits which exhibit large lateral strain.
2. Newmark's influence chart can be used for the determination of vertical stress under any slope of a loaded area.

Which of the above statements is/are correct ?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

17. The maximum height of a low gravity dam of elementary profile made of concrete of relative density 2·5 and safe allowable stress of foundation material 3·87 MPa without considering uplift force is about

(a) 113 m
(b) 217 m
(c) 279 m
(d) 325 m

18. In the facultative pond systems, the aerobic zone may get extended downwards due to

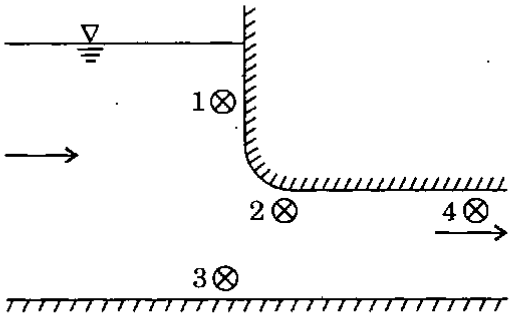
(a) calm waters along with weak sunlight
(b) mixing by wind action along with weak sunlight
(c) mixing by wind action along with penetration by sunlight
(d) calm waters along with penetration by sunlight

19. Consider the following statements :

1. The yield of a retaining wall required to reach plastic equilibrium in active case is more than that in positive case.
2. Culman's graphical method is a simplified version of the more general trial wedge method.
3. For a masonry gravity retaining wall Coulomb's theory of earth pressure is preferred for designing.

Which of the above statements is/are correct ?

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

20. 

A sluice inlet in a dam with streamlined entrance is shown in figure. If cavitation is expected to occur, it will first appear at the point

(a) 1
(b) 2
(c) 3
(d) 4

21. A homogeneous earth dam is 43 m high with 3 m as free board and a 30 m long horizontal filter at the downstream end. The flownet drawn in the dam section consists of 5 flow channels and 15 potential drops. If the dam is 500 m long and the permeability of the material of the dam is uniformly 3×10^{-3} m/s, the total discharge permeating through the body of the dam will be

(a) 0·0004 m^3/s

(b) 0·0036 m^3/s

(c) 0·0039 m^3/s

(d) 0·20 m^3/s

22. With a bit rate of 50 bps and a cycle time of 30 seconds the total information content of a navigation data set is

(a) 80 bits

(b) 20 bits

(c) 100 bits

(d) 1500 bits

23. In a pipe network of municipal water supply, a parallel pipe is sometimes installed over a portion of the pipe mainly for

(a) reducing water hammer pressure

(b) decreasing the pumping power need

(c) increasing the head available at the node

(d) increasing the discharge

24. The discharge required for Rabi and Kharif crops are 0·4 m^3/s and 0·3 m^3/s respectively. The capacity and time factors are 0·8 and 0·5 respectively at each season. The design discharge of the distributary at its head is

(a) 0·8 m^3/s

(b) 0·16 m^3/s

(c) 1·0 m^3/s

(d) 1·24 m^3/s

25. In an aerobic attached-culture system, the biomass at the biofilm-medium surface interface experiences

(a) Aerobic and endogenous metabolism

(b) Anaerobic and endogenous metabolism

(c) Anaerobic and exogenous metabolism

(d) Aerobic and exogenous metabolism

26. Calibration of a current meter for use in channel flow measurement is done in a

(a) Wind tunnel

(b) Water tunnel

(c) Towing tank

(d) Flume

27. Considerable loss of shear strength due to shock or disturbance is exhibited by

(a) Under-consolidated clays

(b) Normally consolidated clays

(c) Over-consolidated clays

(d) Organic soil

28. Consider the following statements :

In aerial photogrammetry the 'filter' is placed in front of the lens to

1. reduce the effect of atmospheric haze.
2. protect the lens from dust.
3. provide uniform light distribution over the format.

Which of the above statements is/are correct ?

(a) 1 and 2 only

(b) 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

29. A partially open sluice gate is suddenly raised to its full opening. The resulting surge waves at the gate are

(a) a positive wave travels towards the gate from the upstream side while a negative wave travels downstream from the gate

(b) a positive wave travels from the gate onto the upstream side while a positive wave travels downstream from the gate

(c) a negative wave travels from the gate onto the upstream side while a positive wave travels downstream from the gate

(d) a negative wave travels towards the gate from the upstream side whereas a positive wave travels downstream from the gate

30. Consider the following statements :

Apparent cohesion in sands is exhibited mainly due to

1. Reduction in density.
2. Increase in density.
3. Capillary moisture in pores.

Which of the above statements is/are correct ?

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

31. A catchment of area 200 ha has a runoff coefficient 0·5. A storm of duration larger than the time of concentration of the catchment and of intensity 3·6 cm/h causes a peak discharge (m^3/s) of

(a) 5
(b) 10
(c) 100
(d) 360

32. Consider the following statements :

The coefficient of permeability k depends upon

1. Void ratio of the soil.
2. Duration of flow.
3. Equivalent diameter of the soil grains.
4. Shape of the particle.

Which of the above statements are correct ?

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

33. A culvert is designed for a flood magnitude of return period 100 years and has expected life of 20 years. The risk in this hydrologic design is

(a) $1 - 0{\cdot}99^{20}$
(b) $1 - 0{\cdot}01^{20}$
(c) $1 - 0{\cdot}09^{20}$
(d) $1 - 0{\cdot}10^{20}$

34. A soil has discharge velocity of 5×10^{-7} m/s and a void ratio of 0·50. Its seepage velocity will be

(a) 15×10^{-7} m/s
(b) 10×10^{-7} m/s
(c) 20×10^{-7} m/s
(d) 30×10^{-7} m/s

35. Zigzag deposition and movement of sand on sea beach is called

(a) Littoral drift
(b) Beach drift
(c) Trough action
(d) Sedimentation

36. 'Iso-centre' is the point

(a) in which the tilted axis of the camera meets the vertical photograph
(b) in which the bisector of the angle of tilt meets the vertical photograph
(c) in air space, the location of the optical centre of the lens of the camera at the time of exposure
(d) where the perpendicular from the nodal point meets the photograph

37. Consider the following statements :

1. The hydraulic head at a point in the soil includes piezometric head as well as datum head.
2. Piping in soil occurs when effective pressure becomes equal to zero.
3. Piping in soil occurs when soil is highly porous.

Which of the above statements is/are correct ?

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

38. A catchment consists of 30% area with runoff coefficient 0·40 with the remaining 70% area with runoff coefficient 0·60. The equivalent runoff coefficient will be

(a) 0·48
(b) 0·54
(c) 0·63
(d) 0·76

39. Ombrometer (pluviometer) is used to measure

(a) Soil moisture stress of a plant
(b) Rainfall depth
(c) Leaf area
(d) Root zone depth

40. Secondary clarifier of an activated sludge process must be designed for effluent clarification and solids thickening, both of which relate directly to the

(a) Surface area
(b) Transport velocity due to sludge withdrawal
(c) Gravity settling of solids relative to the water
(d) Underflow solids concentration

41. A direct-runoff hydrograph due to an isolated storm was triangular in shape with a base of 80 h and peak of 200 m^3/s. If the catchment area is 1440 km^2, the effective rainfall of the storm is

(a) 20 cm
(b) 10 cm
(c) 5 cm
(d) 2 cm

42. Consider the following statements :

1. Poorly graded or uniform sands compact to low dry unit weights.
2. Heavy clays with high plasticity have very low maximum dry unit weight.
3. In clay soils, the maximum dry weight tends to decrease as plasticity increases.

Which of the above statements is/are correct ?

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

43. The declination of a celestial body is the arc of the declination circle intercepted between that body and the

(a) Prime vertical through that body
(b) Azimuth of the body
(c) Equinoxes of the Earth
(d) Equator of the Earth

44. The shape of the recession limb of a hydrograph depends on

(a) Basin as well as storm characteristics
(b) Storm characteristics only
(c) Basin characteristics only
(d) Base flow only

45. If L is the perimeter of a closed traverse, ΔD is the closing error in departure, the correction for the departure of a traverse side of length l, according to Bowditch rule, is

(a) $\Delta D \frac{L}{l}$

(b) $\Delta D \frac{l^2}{L}$

(c) $\frac{L\,l}{\Delta D}$

(d) $\Delta D \frac{l}{L}$

46. Consider the following statements :

1. In clay soils, the maximum dry weight tends to decrease as plasticity increases.
2. In clay soils, the maximum dry unit weight tends to increase as plasticity increases.
3. Heavy clays with high plasticity have the minimum dry unit weight and high OMC.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

47. Which one of the following traffic signal systems is useful when there is continuous operation of group of vehicles along the main road ?

(a) Simultaneous system

(b) Alternate system

(c) Simple progressive system

(d) Flexible progressive system

48. In accordance to 'Gauss rule', weights to be assigned are proportional to

(a) 1/(Sum of the residual errors of observations)

(b) 1/(Sum of the square of the residual errors of observations)

(c) Sum of the square roots of the residual errors of observations

(d) Sum of the cube roots of the residual errors of observations

49. In a wet soil mass, air occupies one-sixth of its volume and water occupies one-third of its volume. The void ratio of the soil is

(a) 0·25

(b) 0·50

(c) 0·75

(d) 1·0

50. Consider the following statements regarding specific energy of the flow in an open channel :

1. There is only one specific energy curve for a given channel.
2. Alternate depths are the depths of flow at which the specific energy is the same.
3. Critical flow occurs when the specific energy is minimum for the flow rate.

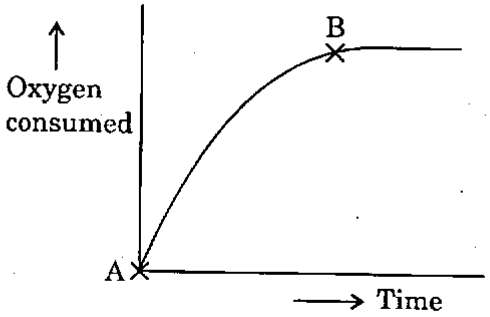
Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

51. 

The above figure shows B.O.D. curve when the experiment was conducted at 20° C. If the experiment is conducted at 30° C, then the portion AB of the curve

(a) shifts to the left

(b) shifts to the right

(c) remains unchanged

(d) shrinks

52. An S-curve hydrograph has been obtained for catchments of 270 km^2 from a 3-hour unit hydrograph. The equilibrium discharge (m^3/s) for the S-curve is

(a) 750

(b) 277·8

(c) 250

(d) 187

53. Consider the following statements :

In a sewage treatment process

1. Detention time required for anaerobic decomposition is more as compared to that for aerobic decomposition.
2. Anaerobic decomposition is more energy-consuming as compared to aerobic decomposition.
3. Anaerobic decomposition is a more sensitive process as compared to aerobic decomposition.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 2 only

(c) 3 only

(d) 1 and 3 only

54. Altimetry may be depicted most accurately by

(a) Hachures

(b) Relief shading

(c) Layer tinting

(d) Contour lines

55. Consider the following statements :

1. Peat and muck are organic soils.
2. Peat is an inorganic soil whereas muck is an organic soil.
3. Indurated clay is a type of clay which does not soften under prolonged wetting.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 2 only

(c) 3 only

(d) 1 and 3 only

56. Consider the following statements which are related to the phenomenon of cavitation in fluid flow :

1. Cavitation occurs when local velocity is decreased so that local pressure increases to a high degree.
2. Cavitation occurs if elevation is high thereby decreasing ambient pressure.
3. Cavitation occurs if local velocity is increased so that the local pressure decreases.
4. Cavitation is dependent on vapour pressure of the fluid.

Which of the above statements are correct ?

(a) 1, 2 and 3

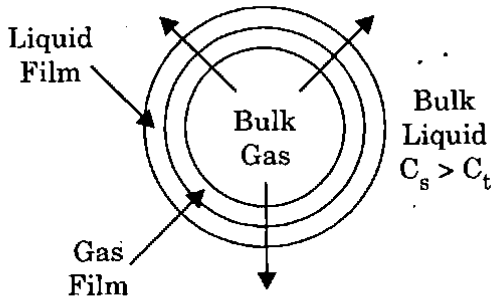
(b) 1, 2 and 4

(c) 1, 3 and 4

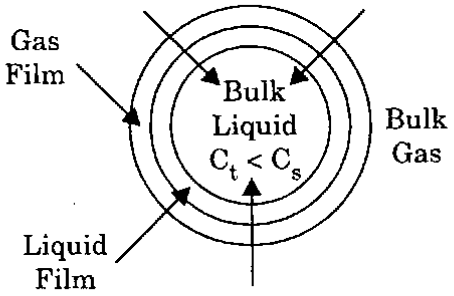
(d) 2, 3 and 4

57. In a liquid-gas system, when the water is dispersed in air, the absorption of gas is represented by

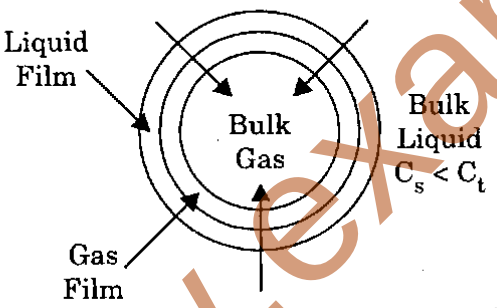
(a)



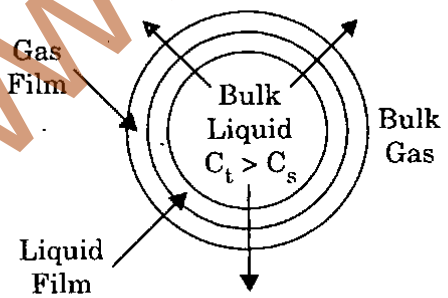
(b)



(c)



(d)



58. The coefficient of variation of the rainfall for six rain gauge stations in catchments was found to be 29·54%. The optimum number of stations in the catchments for an admissible 10% error in the estimation of the mean rainfall will be

(a) 3

(b) 6

(c) 9

(d) 12

59. A specimen of clayey silt contains 70% silt size particles. Its liquid limit = 40 and plastic limit = 20. In liquid limit test, at moisture content of 30%, required number of blows was 50. Its plasticity index, activity and consistency index will respectively be

(a) 20, 0·67 and 0·5

(b) 20, 1·5 and 2·0

(c) 30, 1·5 and 0·72

(d) 20, 0·286 and 0·38

60. The difference between the apparent solar time and mean solar time is known as

(a) Real time

(b) Average time

(c) Equation of time

(d) Sidereal time

61. Consider the following statements about theodolites :

1. Transit theodolite is a theodolite in which the telescope can be transited.
2. EDMI is a theodolite fitted with a micrometer for measurements.
3. A double reading theodolite is one in which diametrically opposite segments of the graduated circle are brought into view and the readings are averaged.

Which of the above statements are correct ?

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

62. Consider the following statements :

1. Sensitivity of a natural soil deposit cannot be less than 1·0.
2. A saturated loose sand deposit liquefies when water flows through it in upward direction under critical hydraulic gradient.
3. A quick clay has very high sensitivity.

Which of the above statements are correct ?

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

63. The terminal velocity of a small sphere settling in a viscous fluid varies as the

(a) inverse square of the diameter
(b) inverse of the diameter
(c) first power of its diameter
(d) inverse of the fluid viscosity

64. Consider the following statements :

1. At shrinkage limit, the soil remains fully saturated.
2. The shear strength of all soils at liquid limit is the same.
3. The shear strength of all soils at plastic limit is the same.

Which of the above statements is/are correct ?

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

65. Refraction error is the least in case of

(a) Stadia tacheometry
(b) Tangential tacheometry
(c) Subtense bar tacheometry
(d) Omnimeters

66. In all reaction turbines, maximum efficiency is obtained if the

(a) Guide vane angle is 90°
(b) Blade angle is 90° at the inlet
(c) Blade angle is 90° at the outlet
(d) Angle of the absolute velocity vector at the outlet is 90°

67. Liquefaction of foundation soil during an earthquake shall not be the reason for cracking of

(a) only floors in the building
(b) walls and roof in the building
(c) beams and columns in the building
(d) only balcony in the building

68. Consider the following statements :

In a water supply system

1. Drain valves are provided at elevated, or higher, points to remove accumulated air.
2. Reflux valve allows flow in one direction only.
3. Drain valves are provided at low points to remove silt and other deposits.

Which of the above statements is/are correct ?

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

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

List I (Type of survey)		*List II (Method / Instrument)*
A.	Traffic volume study	1. Workspot interview method
B.	Speed and delay study	2. Doppler radar
C.	Spot-speed study	3. Floating car method
D.	Multiple character studies	4. Automatic vehicle counter and classifier
		5. Electronic detector

Code :

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

70. Consider the following statements :

1. The minimum value of group index for a soil can be taken as zero.
2. The maximum possible value of group index for a soil is twenty.

Which of the above statements is/are correct ?

(a) Both 1 and 2
(b) 1 only
(c) 2 only
(d) Neither 1 nor 2

71. A light-house is visible just above the horizon at a certain station at the sea level. Distance between the station and the light-house is 60 km. The height of the light-house is

(a) 243·5 m
(b) 4·0 m
(c) 287·5 m
(d) 5·4 m

72. Consider the following statements :

The disadvantages of employing steel pipes in conveyance and distribution of water are, they

1. cannot withstand high negative pressures or vacuums that may be created in them, especially the combined effects of vacuum and external loads of backfill and traffic.
2. are easily affected by acidic or alkaline waters and even atmospheric agencies may produce adverse effects on them.
3. cannot be used for high pressures. (Generally not used for pressures above 7 kg/cm^2)

Which of the above statements is/are correct ?

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

73. Consider the following statements :

The moment of momentum equation in fluid dynamics can be used

1. To find the torque exerted on sprinklers by water.
2. To determine the force in a flow passage, when stream changes direction/magnitude.

Which of the above statements is/are correct ?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

74. Garret's diagrams are used to

(a) separate base flow from total runoff
(b) correct inconsistency in rainfall data
(c) determine reservoir capacity
(d) design channels

75. Consider the following statements :

The critical value of Reynolds number at which the boundary layer changes from laminar to turbulent depends upon

1. Turbulence in ambient flow.
2. Surface roughness.

Which of the above statements is/are correct ?

(a) Neither 1 nor 2
(b) 1 only
(c) 2 only
(d) Both 1 and 2

76. In a transit theodolite, error due to eccentricity of verniers is eliminated by reading

(a) both verniers
(b) both right swing and left swing
(c) right and left faces
(d) different parts of main scale

77. An airplane is cruising at a speed of 800 km/h at an altitude where the air temperature is 0° C. The flight Mach number at this speed is nearly

(a) 1·3
(b) 0·67
(c) 0·25
(d) 2·4

78. Light reflecting devices used to guide the driver along the proper alignment are called

(a) Rumble strips
(b) Delineators
(c) Attenuators
(d) Litter bin

79. Consider the following statements :

In reciprocating pumps, the air vessels are used

1. To get continuous supply of liquid at a uniform rate.
2. To save the power required to drive the pump.
3. To run at much higher speed without any danger of separation.

Which of the above statements are correct ?

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

80. Consider the following statements :

1. For a well graded sand, the coefficient of curvature should lie between 1 and 3.
2. A soil having uniformity coefficient smaller than about 2·0 is considered uniform.

Which of the above statements is/are correct ?

(a) Both 1 and 2
(b) Neither 1 nor 2
(c) 1 only
(d) 2 only

81. The correct sequence of treatment of typical turbid surface water is

(a) Flocculation, Coagulation, Sedimentation, Filtration

(b) Flocculation, Coagulation, Filtration, Sedimentation

(c) Coagulation, Flocculation, Filtration, Sedimentation

(d) Coagulation, Flocculation, Sedimentation, Filtration

82. Consider the following statements :

1. Mica is a clay mineral.
2. The shape of clay particle is usually flaky.
3. A particle of kaolinite is electrically charged.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 1 and 3 only

(c) 2 and 3 only

(d) 2 only

83. If super-elevation is not provided on a horizontal curve of a highway, then on which portion of the road, are pot holes likely to develop ?

(a) Outer edge of road

(b) Inner edge of road

(c) Centre of road

(d) Shoulder of road

84. Consider the following statements :

The appropriate method(s) for removal of fluorides from water comprise

1. Addition of alum and lime followed by clarification.
2. Passing through beds of activated alumina.

Which of the above statements is/are correct ?

(a) Neither 1 nor 2

(b) Both 1 and 2

(c) 1 only

(d) 2 only

85. Consider the following statements :

1. Pumps in series operation can be the head to increase.
2. Pumps in series operation increase the flow rate.
3. Pumps in parallel operation increase the flow rate.
4. Pumps in parallel operation can be the head to increase.

Which of the above statements are correct ?

(a) 1 and 3

(b) 1 and 2

(c) 2 and 3

(d) 3 and 4

86. Consider the following pairs in the context of a theodolite :

1.	Plunging	:	The process of turning the telescope over its supporting axis through 180° in a vertical plane.
2.	Face left	:	When the vertical circle of the theodolite is on the left of the observer while taking the reading.
3.	Telescope normal	:	It implies 'bubble up' and face of the vertical circle left.
4.	Swinging the telescope	:	It implies turning the telescope in a vertical plane.

Which of these pairs are correctly matched in case of theodolite ?

(a) 1, 2 and 4

(b) 1, 3 and 4

(c) 2, 3 and 4

(d) 1, 2 and 3

87. In an open cylindrical tank filled with water, a hole is made at the mid-point at the bottom. The spiral motion of the outgoing water is

(a) Rotational

(b) Irrotational

(c) Forced vortex

(d) Turbulent

88. For setting out right angles, the instrument used is

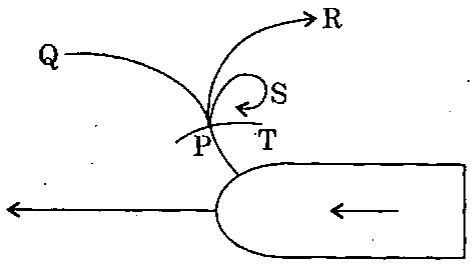
(a) Optical square

(b) Abney level

(c) Alidade

(d) Ceylon ghat tracer

89.



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

List I (Name of curve)		*List II (Curve in figure)*
A.	Equipotential line	1. PQ
B.	Pathline	2. PR
C.	Streakline	3. PS
D.	Streamline	4. PT

Code :

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

90. Consider the following in the context of variations in magnetic declination :

1. Secular
2. Diurnal
3. Annual
4. Regular

Which of these are relevant ?

(a) 1, 2 and 3

(b) 1, 2 and 4

(c) 2 and 3 only

(d) 3 and 4 only

91. Full amount of super-elevation on a horizontal curve is provided at the

(a) beginning of the transition curve

(b) centre of the circular curve

(c) end of the transition curve

(d) centre of the transition curve

92. For a homologous model of a pump built to a scale ratio of 1 : 2, fluid and speed being the same in model and prototype, the ratio of model power to prototype power is

(a) $\frac{1}{2 \cdot 82}$

(b) $\frac{1}{4}$

(c) $\frac{1}{8}$

(d) $\frac{1}{32}$

93. Consider the following statements :

In water treatment, the addition of chlorine inactivates the cells of pathogenic bacteria through

1. Penetration of the chlorine species through the cell walls.
2. Suffocation of the cells.
3. Reaction of the chlorine species with the enzyme system of the cells.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

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

List I (Measuring Device)	*List II (Soil Parameter)*
A. Pycnometer	1. Compressibility
B. Hydrometer	2. Permeability
C. Oedometer	3. Specific gravity
D. Permeameter	4. Particle size analysis

Code :

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

95. Error due to inclination of line of collimation in levelling across a river can be eliminated by

(a) Reversion

(b) Reciprocal ranging

(c) Reciprocal levelling

(d) Keeping level in middle

96. Consider the following statements :

1. A streamline is an imaginary line within the flow for which the normal at any point relates to the acceleration at that point.
2. Convective acceleration is the change in velocity with respect to distance only.
3. Temporal acceleration expresses variation of velocity with respect to time only.
4. Both convective acceleration and temporal acceleration can coexist.

Which of these statements are correct related to fluid kinematics ?

(a) 1, 2, 3 and 4

(b) 1, 2 and 3 only

(c) 2 and 3 only

(d) 2, 3 and 4 only

97. A centrifugal pump will start delivering the liquid only when

(a) Manometer head is greater than total head

(b) Head developed tends to exceed the manometric head

(c) Head developed in a centrifugal pump is due to pressure head only

(d) Head developed is negligible

98. Consider the following :

1. Line ranger
2. Reciprocal ranging
3. Random line method
4. Optical square

Which of these are the correct methods of ranging employed to solve the problem of vision obstructed but with chaining free ?

(a) 1, 2, 3 and 4

(b) 2 and 3 only

(c) 2 and 4 only

(d) 3 and 4 only

99. In a water treatment, the optimum time of flocculation is usually given as 30 minutes. In case the time of flocculation is increased beyond this value, then the flocs will

(a) become heavy and settle down in flocculation itself

(b) entrap air and will float in the sedimentation tank

(c) break up and defeat the purpose of flocculation

(d) stick to the paddles

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

List I (Deposit)	*List II (Soil structure)*
A. Coarse grained soil	1. Flocculated
B. Silt deposit	2. Cohesive matrix
C. Clay deposit	3. Honeycomb
D. Composite soil	4. Single-grained

Code :

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

Directions : *Each of the next twenty (20) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :*

Codes :

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

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

(c) A is true but R is false

(d) A is false but R is true

101. *Assertion (A) :* Energy dissipation in a hydraulic jump is mainly caused by the large eddies in turbulence.

Reason (R) : Large eddies transport the fluid over large distances, thus causing the mixing effect of turbulence.

102. *Assertion (A) :* An economical channel section gives maximum discharge for a given cross-sectional area.

Reason (R) : An economical channel section has smooth surface for reduced friction.

103. *Assertion (A) :* The possibility of piping failure in earth dams is more if black cotton soil is the foundation material.

Reason (R) : The highly expansive black cotton soils are the most common soils wherever Basalt rock is present.

104. *Assertion (A) :* The movement of two blocks of wood welted with hot glue requires greater and greater effort as the glue is drying up.

Reason (R) : Viscosity of liquids varies inversely with temperature.

105. *Assertion (A) :* In the border strip method of irrigation, the size of the strip depends on soil characteristics, slope of the land and discharge.

Reason (R) : Border strip method is a controlled type of subsurface irrigation method.

106. *Assertion (A) :* Reynolds number of a fluid flow is indicative of the relative dominance of the effects of momentum transfer between adjacent layers of the flow over the viscous stresses.

Reason (R) : For flow at high Reynolds numbers, the velocity profile is logarithmic.

107. *Assertion (A) :* A seepage passing through the body of an earth dam affects the weight of dam.

Reason (R) : The specific weight of submerged soil is not dependent on the porosity of soil.

108. *Assertion (A) :* In a strainer type tube well, strainer pipes are surrounded by wire mesh.

Reason (R) : This prevents the fine particles from entering the well pipe.

109. *Assertion (A) :* Break point chlorination ensures a residual of free available chlorine.

Reason (R) : A super high chlorine dose inactivates the pathogens in a very short time.

110. *Assertion (A) :* Flow net is dependent on the permeability of soil through which flow is taking place.

Reason (R) : The flow net is useful in finding the discharge.

111. *Assertion (A) :* At the same voids ratio desiccated clay is stronger than saturated clay.

Reason (R) : Desiccation impacts (induces) pre-compressive forces in the soil structure.

112. *Assertion (A) :* Lining a canal is always beneficial and economical.

Reason (R) : The seepage losses are greatly reduced and extra water is available for irrigation.

113. *Assertion (A) :* Worn out (smooth) tyres offer higher friction factors on dry pavements than new tyres with treads well intact.

Reason (R) : Reduced pneumatic pressure is held in tubes which carry smooth tyres over them.

114. *Assertion (A) :* In plane table photogrammetry, the areas to be mapped are taken from either end of a base line.

Reason (R) : The position of the detail point with reference to the base line is obtained by intersection of rays drawn to it from each end of the base.

115. *Assertion (A) :* Tie bars are used in cement concrete slabs across the longitudinal joints.

Reason (R) : Tie bars are designed to act as load transfer devices.

116. *Assertion (A) :* Traffic 'Smog' is likely to occur in regions where vehicle mileage is considerable and there is a low incidence of sunlight.

Reason (R) : Traffic 'Smog' is caused by the reaction of oxides of nitrogen and some of the hydrocarbons in presence of bright sunlight.

117. *Assertion (A) :* In an intersection design, the relative speed is dependent on the absolute speed of intersecting vehicles and the angles between them.

Reason (R) : When the angle of merging is small, the relative speed will be high.

118. *Assertion (A) :* The pandrol clip is a fit and forget type of fastening and is made from silicone manganese spring steel bar and heat treated.

Reason (R) : The pandrol clip has a point contact and causes indentation on the rail due to heavy toe load and small contact area.

119. *Assertion (A) :* In the overall design and layout of a harbour (or port), differentiation is made between 'entrance' and 'channel' depths.

Reason (R) : The 'scend' (or pitching) of a vessel may be larger at the entrance to the channel than within the channel.

120. *Assertion (A) :* The paved area adjacent to the terminal building and hangers used for loading and unloading, servicing and parking of aircraft is called as apron.

Reason (R) : The size of the apron depends on the size and number of gate positions and the way the gate positions are arranged.

SPACE FOR ROUGH WORK

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Civil Engineering (Paper-II)

Q. No.	Booklet Series			
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1.	B	D	A	B
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3.	B	D	D	B
4.	A	C	A	B
5.	B	A	C	D
6.	D	C	D	B
7.	C	A	D	D
8.		A	C	D
9.	B	C	A	D
10.	D	B	A	C
11.	C	B	A	A
12.	B	C	B	D
13.	B	A	C	A
14.	B	A	D	B
15.	B	A	D	D
16.	D	B	A	A
17.	A	C	B	B
18.	C	B	B	A
19.	C	B	C	D
20.	B	B	A	D
21.	D	C	C	C
22.	D	D	C	D
23.	D	C	B	C
24.	C	B	A	B
25.	A	D	C	D
26.	C	D	B	D
27.	A	D	B	D
28.	A	D	A	D
29.	C	C	B	C
30.	B	A	B	A

Q. No.	Booklet Series			
	A	B	C	D
31.	B	D	A	D
32.	C	D	D	D
33.	A	B	A	B
34.	A	C	A	C
35.	A	D	C	D
36.	B	D	C	D
37.	C	C	B	C
38.	B	D	B	D
39.	B	C	A	C
40.	B	D	B	D
41.	D	A	D	B
42.	C	A	D	C
43.	D	D	D	C
44.	C	A	C	A
45.	D	C	A	D
46.	D	D	C	B
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49.	D	A	C	B
50.	D	A	B	C
51.	A	A	B	D
52.	C	B	C	B
53.	D	C	A	□
54.	D	D	A	C
55.	D	D	A	D
56.	D	A	B	B
57.	B	B	C	A
58.	C	B	B	B
59.	D	C	B	B
60.	C	A	B	B

Q. No.	Booklet Series			
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61.	A	B	B	D
62.	A	B	C	D
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68.	C	D	B	A
69.	A	D	B	C
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71.	A	A	D	B
72.	B	D	B	C
73.	C	A	□	A
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75.	D	D	D	A
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85.	A	C	D	C
86.	D	B	D	D
87.	B	B	D	D
88.	A	A	D	C
89.	D	B	C	A
90.	A	B	B	A

Q. No.	Booklet Series			
	A	B	C	D
91.	C	A	D	A
92.	D	D	D	B
93.	D	A	B	C
94.	D	A	C	D
95.	C	C	D	D
96.	D	C	D	A
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98.	B	B	D	B
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102.	C	C	B	C
103.	B	C	B	B
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107.	B	B	D	B
108.	A	B	D	A
109.	B	B	D	B
110.	B	C	C	B
111.	A	D	A	A
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113.	A	□	A	A
114.	A	C	B	A
115.	C	D	D	C
116.	C	B	A	C
117.	B	A	B	B
118.	B	B	A	B
119.	A	B	D	A
120.	B	B	D	B

Civil Engineering (Paper-I)

Q. No.	Booklet Series			
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1.	D	B	A	C
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28.	C	B	B	B
29.	C	B	A	B
30.	B	□	D	□

Q. No.	Booklet Series			
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31.	A	A	A	A
32.	B	A	D	A
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36.	□	A	A	A
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47.	C	D	C	B
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59.	B	C	D	B
60.	C	C	B	D

Q. No.	Booklet Series			
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67.	D	C	B	C
68.	B	□	C	C
69.	C	B	C	C
70.	C	B	B	B
71.	D	C	A	A
72.	C	A	D	D
73.	D	□	D	B
74.	D	D	C	D
75.	C	C	D	A
76.	A	A	B	B
77.	A	D	C	D
78.	C	C	D	B
79.	C	D	B	D
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82.	D	B	B	D
83.	C	C	D	D
84.	D	A	C	C
85.	A	A	B	B
86.	C	B	C	D
87.	D	C	A	D
88.	□	B	B	B
89.	A	A	B	C
90.	C	D	□	C

Q. No.	Booklet Series			
	A	B	C	D
91.	B	A	A	D
92.	B	D	A	C
93.	□	A	D	D
94.	C	A	C	D
95.	C	□	B	C
96.	B	A	A	A
97.	B	A	A	A
98.	B	C	B	C
99.	D	B	C	C
100.	C	A	A	C
101.	B	A	C	B
102.	B	B	D	B
103.	C	D	B	C
104.	A	A	B	A
105.	A	C	B	A
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111.	A	A	C	A
112.	D	D	A	D
113.	A	D	□	A
114.	A	C	D	A
115.	□	D	C	□
116.	A	B	A	A
117.	A	C	D	A
118.	C	D	C	C
119.	B	B	D	B
120.	A	D	B	A