

BPSE AE
Previous Year Paper
Paper 5 (Civil) 2022

05/AAS/E-2022-5

Serial No.

514188

Candidate's Roll Number

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Question Booklet Series

Question Booklet

D

Paper—V

CIVIL ENGINEERING

Time Allowed : 1 Hour

Maximum Marks : 100

(Objective)

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **50** questions in all.
2. All questions carry equal marks.
3. Attempt all questions.
4. Immediately after commencement of the examination, you should check up your Question Booklet and ensure that the Question Booklet Series is printed on the top right-hand corner of the Booklet. The Booklet contains 7 printed pages and no page or question is missing or unprinted or torn or repeated. If you find any defect in this booklet, get it replaced immediately by a complete booklet of the same series.
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. An Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. You must write your Name, Roll No. and other particulars on the first page of the Answer Sheet provided, failing which your Answer Sheet will not be evaluated.
7. You will encode your Roll Number and the Question Booklet Series A, B, C or D as it is printed on the top right-hand corner of this Question Booklet with Black/Blue ballpoint pen in the space provided on Page-2 of your Answer Sheet. If you do not encode or fail to encode the correct series of your Question Booklet, your Answer Sheet will not be evaluated correctly.
8. Questions and their responses are printed in English only in this Booklet. Each question comprises four responses—(A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
9. In the Answer Sheet, there are four brackets—(A), (B), (C) and (D) against each question. To answer the questions you are to mark with Black/Blue ballpoint pen ONLY ONE bracket of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. Any erasure or change is not allowed.
10. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. After the examination has concluded, you must hand over your Answer Sheet to the Invigilator. Thereafter, you are permitted to take away the Question Booklet with you.
11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.

1. A single-rolling load of 8kN rolls along a girder of 15 m span. The absolute maximum bending moment will be
 (A) 60 kN-m (B) 40 kN-m
 (C) 20 kN-m (D) 30 kN-m
2. Which of the following is not the displacement method?
 (A) Moment distribution method
 (B) Kani's method
 (C) Column analogy method
 (D) Equilibrium method
3. Select the correct statement.
 (A) Flexibility matrix is a rectangular symmetrical matrix.
 (B) Stiffness matrix is a triangular symmetrical matrix.
 (C) Both (A) and (B)
 (D) None of the above
4. To generate the j th column of the flexibility matrix
 (A) a unit force is applied at coordinate j and the forces are calculated at all coordinates
 (B) a unit force is applied at coordinate j and the displacements are calculated at all coordinates
 (C) a unit displacement is applied at coordinate j and the displacements are calculated at all coordinates
 (D) a unit displacement is applied at coordinate j and the forces are calculated at all coordinates
5. True meridians are generally preferred to magnetic meridians, because
 (A) these converge to a point
 (B) these change due to change in time
 (C) these remain constant
 (D) None of the above
6. If in a pin-jointed plane frame $(m+r) > 2j$ (where m is number of members, r is reaction components and j is number of joints), then the frame is
 (A) stable and statically indeterminate
 (B) stable and statically determinate
 (C) unstable
 (D) None of the above
7. While using three moments equation, a fixed end of a continuous beam is replaced by an additional span of
 (A) zero moment of inertia
 (B) zero length
 (C) infinite length
 (D) None of the above
8. The characteristic strength of concrete is defined as that compressive strength below which not more than
 (A) 2% of results fall
 (B) 10% of results fall
 (C) 5% of results fall
 (D) None of the above

9. The maximum strain at the level of compression steel for a rectangular section having effective cover to compression steel as d' and neutral axis depth from compression face as x_u is
- (A) $0.002 \times \left(1 - \frac{x_u}{d'}\right)$
 (B) $0.0035 \times \left(1 - \frac{d'}{x_u}\right)$
 (C) $0.002 \times \left(1 - \frac{d'}{x_u}\right)$
 (D) $0.0035 \times \left(1 - \frac{x_u}{d'}\right)$
10. The chances of diagonal tension cracks in RCC member reduce when
- (A) flexural and shear force act simultaneously
 (B) only shear force acts
 (C) axial compression and shear force act simultaneously
 (D) axial tension and shear force act simultaneously
11. In a prestressed member, it is advisable to use
- (A) high strength concrete only
 (B) high strength concrete and high tensile strength
 (C) low strength concrete only
 (D) low strength concrete but high tensile strength
12. If the permissible stress in steel in tension is 140 N/mm^2 , then the depth of neutral axis for a singly reinforced rectangular balanced section will be
- (A) $0.45d$ (B) $0.30d$
 (C) $0.40d$ (D) $0.35d$
13. Gantry girders are designed to resist
- (A) longitudinal and vertical loads
 (B) lateral, longitudinal and vertical loads
 (C) lateral and longitudinal loads
 (D) lateral loads
14. A fully prestressed concrete beam is one in which
- (A) working loads are completely resisted by prestressing force
 (B) no tension is permitted
 (C) no cracking is permitted
 (D) None of the above
15. One of the main characteristics influencing the ____ of concrete is its permeability to the ingress of water, oxygen, carbon dioxide, chloride, sulphate and other potentially deleterious substances.
- (A) suitability
 (B) consistency
 (C) durability
 (D) flexibility

16. Unless otherwise specified by engineer-in-charge, the reinforcement shall be placed within which of the following tolerances?
- For effective depth, 200 mm or less ± 10 mm
 - For effective depth, more than 200 mm ± 10 mm
 - Both (A) and (B)
 - None of the above
17. The weight of a steel rod per meter length is
- $D^2/162$, where D is diameter of steel rod in mm
 - $L^2/162$, where L is length of steel rod in mm
 - $R^2/162$, where R is radius of steel rod in mm
 - None of the above
18. As per the provisions of IS 456-2000, the modulus of elasticity of concrete mix M25 is
- 15000 N/mm²
 - 28500 N/mm²
 - 5700 N/mm²
 - 2500 N/mm²
19. The diameter of main bars in RCC columns shall not be less than
- 12 mm
 - 6 mm
 - 8 mm
 - 10 mm
20. The state of pure shear stress is produced by
- equal tension in two directions at right angles
 - tension in one direction and equal compression in perpendicular direction
 - equal compression in two directions at right angles
 - None of the above
21. In case of a retaining wall retaining a surcharge, if overall height of the wall is H , then the width of the base slab would be
- 0.50H
 - 0.40H
 - 0.55H
 - 0.70H
22. If the thickness is small in comparison with length and width, such structural members are called as
- two-dimensional
 - three-dimensional
 - one-dimensional
 - None of the above
23. In hydrometer analysis for a soil mass
- both meniscus correction and dispersing agent correction are additive
 - both meniscus correction and dispersing agent correction are subtractive
 - meniscus correction is subtractive and dispersing agent correction is additive
 - meniscus correction is additive and dispersing agent correction is subtractive

24. If the plasticity index of U-line lies close and above A-line of the plasticity chart, the clay mineral is
 (A) kaolinite
 (B) montmorillonite
 (C) illite
 (D) None of the above
25. The effective stress is
 (A) an abstract quantity
 (B) equal to pore pressure
 (C) equal to total stress
 (D) None of the above
26. The total and effective stresses at a depth of 10 m below the top level of water in a swimming pool are respectively
 (A) zero and zero
 (B) 100 kPa and 100 kPa
 (C) 100 kPa and zero
 (D) 100 kPa and 50 kPa
27. A soil sample has liquid limit of 54%, plastic limit of 27% and natural moisture content of 25%. The soil is dominated by
 (A) silt
 (B) clay
 (C) fine sand
 (D) organic material
28. The critical hydraulic gradient leading to zero state of stress that would produce a quick condition in a sand stratum of specific gravity 2.70 and void ratio 0.70 is equal to
 (A) 1.5 (B) 1.0
 (C) 1.2 (D) 1.3
29. The seepage velocity of a soil specimen with discharge velocity of 20×10^{-3} m/s and void ratio of 0.8 is
 (A) 50×10^{-3} m/s
 (B) 40×10^{-3} m/s
 (C) 45×10^{-3} m/s
 (D) 55×10^{-3} m/s
30. Geologic cycle for the formation of soil is
 (A) upheaval $\rightarrow$ transportation $\rightarrow$ deposition $\rightarrow$ weathering
 (B) weathering $\rightarrow$ upheaval $\rightarrow$ transportation $\rightarrow$ deposition
 (C) transportation $\rightarrow$ upheaval $\rightarrow$ weathering $\rightarrow$ deposition
 (D) weathering $\rightarrow$ transportation $\rightarrow$ deposition $\rightarrow$ upheaval
31. The law of shear strength for a dry sand specimen tested in direct shear test under shear stress of 100 kPa and normal stress of 200 kPa is
 (A) $0.5\sigma'_f$ (B) $1.05\sigma'_f$
 (C) $1.5\sigma'_f$ (D) $2.5\sigma'_f$
32. The depth of tensile zone near the surface of a cohesive fill is
 (A) $\frac{c}{\gamma} \sqrt{N_\phi}$ (B) $\frac{\gamma}{c} \sqrt{N_\phi}$
 (C) $\frac{2c}{\gamma} \sqrt{N_\phi}$ (D) $2 \frac{c}{\gamma \sqrt{N_\phi}}$
33. In a saturated clay layer consolidating with single drainage, the initial isochrone is
 (A) triangular (B) square
 (C) rectangular (D) parabola

34. As per Indian Standard Code of practice, the frequency ratio (ratio of operating frequency of machine to the natural frequency of soil) should not be in the range of
- 0.5 to 1.5
 - 1.0 to 2.5
 - 1.5 to 3.0
 - 3.0 to 6.0
35. The maximum load carried by a pile, when it continues to sink without further increase of load, is known as
- ultimate load carrying capacity
 - ultimate bearing capacity
 - ultimate bearing resistant
 - All of the above
36. The stress increment at a depth of 10 m below a corner of a rectangular load of intensity 250 kPa and influence stress factor of 0.0179 is
- 4.48 kPa
 - 5.25 kPa
 - 4.25 kPa
 - 6.1 kPa
37. Negative skin friction on piles
- is caused due to relative settlement of the soil
 - is caused in soft clays
 - decreases the pile capacity
 - All of the above
38. A compacted soil sample exhibited maximum dry density of 21.5 kN/m^3 and a minimum dry density of 15.5 kN/m^3 . The compactability factor is
- 0.79
 - 0.39
 - 0.59
 - None of the above
39. Under-reamed piles are generally
- bored piles
 - driven piles
 - precast piles
 - All of the above
40. A typical correlation between relative compaction and relative density for granular soils is
- $RC = 70 + 0.2D_r$
 - $RC = 80 + 0.2D_r$
 - $RC = 80 + 0.5D_r$
 - $RC = 90 + 0.2D_r$
41. In the case of well foundation, the Indian Standard Code recommends that tilt and shift of well should respectively be
- 1 in 50 and 2
 - 1 in 60 and 1
 - 1 in 60 and 2
 - 1 in 50 and 1
42. The friction circle method is based on the assumption that the resultant reaction along a slip surface is tangential to a circle of radius
- $R^2 \sin \phi$
 - $R \sin \phi$
 - $R \cos \phi$
 - $R \sin \phi \cos \phi$

43. In a loaded beam, the point of contraflexure occurs at a section where
- bending moment is minimum
 - bending moment is zero or changes sign
 - bending moment is maximum
 - shearing force is maximum
44. A three-hinged arch is carrying uniformly distributed load over the entire span. The arch is free from bending moment and shear force if its shape is
- circular
 - parabolic
 - elliptical
 - None of the above
45. The ratio of strengths of solid to hollow shafts, both having outside diameter D and hollow shaft having inside diameter $D/2$, in torsion, is
- $1/4$
 - $1/2$
 - $1/16$
 - $15/16$
46. For a beam of uniform strength keeping its depth constant, the width will vary in proportion to
- bending moment (M)
 - $\sqrt{M}$
 - M^2
 - None of the above
47. For a given material, Young's modulus is 200 GN/m^2 and modulus of rigidity is 80 GN/m^2 . The value of Poisson's ratio is
- 0.15
 - 0.20
 - 0.25
 - 0.30
48. Internal forces at every cross-section in an arch are
- shear force and bending moment
 - normal thrust, shear force and bending moment
 - normal thrust and bending moment
 - normal thrust and shear force
49. Muller-Breslau principle for obtaining influence lines is applicable for
- statically indeterminate structure
 - statically indeterminate structures, the material of which is plastic and follows Stokes' law
 - trusses, statically determinate beams, frames and statically indeterminate structures, the material of which is elastic and follows Hooke's law
 - None of the above
50. Castigliano's first theorem is applicable
- only for statically determinate structures
 - only when principle of superposition is valid
 - only when the system behaves elastically
 - None of the above
