

Ph.D. Entrance Exam – 2024, NITTTR Chandigarh



**NATIONAL INSTITUTE OF TECHNICAL TEACHERS  
TRAINING AND RESEARCH**  
(DEEMED TO BE UNIVERSITY UNDER DISTINCT CATEGORY)  
**CHANDIGARH**

**Ph.D. Entrance Examination 2024**

Subject / Branch / Department :	CIVIL ENGINEERING
Roll No. :	/
Candidate Name :	/
Date of Examination :	/

**Maximum Marks: 25 (There is no negative marking)**

- Notes:** (a) Only one option to be tick-marked out of the four options given as answer  
(b) The Candidate must put his/her signature with date at the bottom of each page  
(c) For any rough work, please use ONLY back-sides of pages which are left blank

- Bulking of sand is caused due to
  - Surface moisture
  - Air voids
  - Viscosity
  - Clay content
- Characteristic compressive strength of concrete is obtained from 15cm size cube test at the end of
  - 3 Days
  - 7 Days
  - 14 Days
  - 28 Days
- Vicat's apparatus is used for determining
  - Fineness of cement
  - Compressive Strength of cement
  - Setting Time of cement
  - Soundness of cement

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4. While aligning a hill road with a ruling gradient of 6%, a horizontal curve of radius 40 m is encountered. The maximum grade compensation (in percentage, up to two decimal places) to be provided for this case would be \_\_\_\_\_
- (A) 0.5  
(B) 1.5  
(C) 1.75  
(D) 2.5
5. A sheet pile has an embedment depth of 12 m in a homogeneous soil stratum. The coefficient of permeability of soil is  $10^{-6}$  m/s. Difference in the water levels between two sides of the sheet pile is 4 m. The flow net is constructed with 5 number of flow lines and 11 number of equipotential lines. The quantity of seepage (in  $\text{cm}^3/\text{s}$  per m, up to one decimal place) under the sheet pile is
- (A) 0.6  
(B) 1.6  
(C) 2.6  
(D) 3.6
6. The sand of which zone is the coarsest ?
- (A) Zone 1  
(B) Zone 2  
(C) Zone 3  
(D) Zone 4
7. The safety within a roundabout and the efficiency of a roundabout can be increased, by
- (A) increasing the entry radius and increasing the exit radius  
(B) increasing the entry radius and decreasing the exit radius  
(C) decreasing the entry radius and increasing the exit radius  
(D) decreasing the entry radius and decreasing the exit radius
8. The following observations are made while testing aggregate for its suitability in pavement construction:
- Mass of oven-dry aggregate in air = 1000 g
  - Mass of saturated surface-dry aggregate in air = 1025 g
  - Mass of saturated surface-dry aggregate under water = 625 g
- Based on the above observations, the water absorption is
- (A) 2.5 %  
(B) 5 %  
(C) 6 %  
(D) 8 %

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9. The plate test was conducted on a clayey strata by using a plate of  $0.3\text{m} \times 0.3\text{m}$  dimensions, and the ultimate load per unit area for the plate was found to be  $180\text{kPa}$ . The ultimate bearing capacity of a  $2\text{m}$  wide square footing would be (kPa)
- (A) 27  
(B) 180  
(C) 120  
(D) 200
10. A pre-tensioned rectangular concrete beam  $150\text{ mm}$  wide and  $300\text{ mm}$  depth is prestressed with three straight tendons, each having a cross-sectional area of  $50\text{ mm}^2$ , to an initial stress of  $1200\text{ N/mm}^2$ . The tendons are located at  $100\text{ mm}$  from the soffit of the beam. If the modular ratio is 6, the loss of stress (in  $\text{N/mm}^2$ ) due to the elastic deformation of concrete only is
- (A) 8  
(B) 16  
(C) 32  
(D) 34
11. The laboratory test on a soil sample yields the following results: natural moisture content =  $18\%$ , liquid limit =  $60\%$ , plastic limit =  $25\%$ , percentage of clay sized fraction =  $25\%$ . The plasticity index is
- (A)  $25\%$   
(B)  $30\%$   
(C)  $35\%$   
(D)  $85\%$
12. The super elevation is
- (A) Directly proportional to the velocity of vehicles  
(B) Inversely proportional to the velocity of vehicles  
(C) Directly proportional to the width of pavement  
(D) Inversely proportional to the width of pavement
13. A strip footing is resting on the ground surface of a pure clay bed having an undrained cohesion  $C_u$ . The ultimate bearing capacity of the footing is equal to
- (A)  $2\pi C_u$   
(B)  $\pi C_u$   
(C)  $(\pi+1) C_u$   
(D)  $(\pi+2) C_u$

14. A uniformly distributed line load of  $500 \text{ kN/m}$  is acting on the ground surface. Based on Boussinesq's theory, the ratio of vertical stress at a depth  $2 \text{ m}$  to that at  $4 \text{ m}$ , right below the line of loading, is
- (A) 0.25  
(B) 0.5  
(C) 2.0  
(D) 4.0
15. For a wastewater sample, the three-day biochemical oxygen demand at incubation temperature of  $20^\circ\text{C}$  (BOD-3day,  $20^\circ\text{C}$ ) is estimated as  $200 \text{ mg/L}$ . Taking the value of the first order BOD reaction rate constant as  $0.22 \text{ day}^{-1}$ , the five-day BOD (expressed in  $\text{mg/L}$ ) of the wastewater at incubation temperature of  $20^\circ\text{C}$  (BOD-5day,  $20^\circ\text{C}$ ) would be
- (A) 256  
(B) 276  
(C) 296  
(D) 316
16. The value of group index of a soil varies from
- (A) 0 to 10  
(B) 0 to 20  
(C) 20 to 30  
(D) 30 to 40
17. OMC-SP and MDD-SP denote the optimum moisture content and maximum dry density obtained from standard Proctor compaction test, respectively. OMC-MP and MDD-MP denote the optimum moisture content and maximum dry density obtained from the modified Proctor compaction test, respectively. Which one of the following is correct?
- (A)  $\text{OMC-SP} < \text{OMC-MP}$  and  $\text{MDD-SP} < \text{MDD-MP}$   
(B)  $\text{OMC-SP} > \text{OMC-MP}$  and  $\text{MDD-SP} < \text{MDD-MP}$   
(C)  $\text{OMC-SP} < \text{OMC-MP}$  and  $\text{MDD-SP} > \text{MDD-MP}$   
(D)  $\text{OMC-SP} > \text{OMC-MP}$  and  $\text{MDD-SP} > \text{MDD-MP}$
18. A water supply board is responsible for treating  $1500 \text{ m}^3/\text{day}$  of water. A settling column analysis indicates that an overflow rate of  $20 \text{ m/day}$  will produce satisfactory removal for a depth of  $3.1 \text{ m}$ . It is decided to have two circular settling tanks in parallel. The required diameter (expressed in  $\text{m}$ ) of the settling tanks is
- (A) 3.9  
(B) 4.9  
(C) 5.9  
(D) 6.9

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19. The results of a consolidation test on an undisturbed soil, sampled at a depth of 10 m below the ground level are as follows: Saturated unit weight :  $16\text{kN/m}^3$ , Pre-consolidation pressure :  $90\text{kPa}$ . The water table was encountered at the ground level. Assuming the unit weight of water as  $10\text{kN/m}^3$ , the over-consolidation ratio of the soil is
- (A) 0.67  
(B) 1.50  
(C) 1.77  
(D) 2.00
20. The relationship between the specific gravity of sand ( $G$ ) and the hydraulic gradient ( $i$ ) to initiate quick condition in the sand layer having porosity of 30% is
- (A)  $G = 0.7i + 1$   
(B)  $G = 1.43i - 1$   
(C)  $G = 1.43i + 1$   
(D)  $G = 0.7i - 1$
21. As per IS 456 for the design of reinforced concrete beam, the maximum allowable shear stress ( $T_{\text{max}}$ ) depends on
- (A) grade of concrete and grade of steel  
(B) grade of concrete only  
(C) grade of steel only  
(D) grade of concrete and percentage of reinforcement
22. The spot speeds (expressed in km/hr) observed at a road section are 66, 62, 45, 79, 32, 51, 56, 60, 53, and 49. The median speed (expressed in km/hr) is
- (A) 45.5  
(B) 50.5  
(C) 54.5  
(D) 59.5
23. The porosity ( $n$ ) and the degree of saturation ( $S$ ) of a soil sample are 0.7 and 40%, respectively. In a  $100\text{m}^3$  volume of the soil, the volume (expressed in  $\text{m}^3$ ) of air is
- (A) 22  
(B) 32  
(C) 42  
(D) 52

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24. The dowel bars are used in rigid pavements for
- (A) Resisting tensile stresses
  - (B) Resisting bending stresses
  - (C) Resisting shear stresses
  - (D) Transferring load from one portion to another
25. For M25 concrete with creep coefficient of 1.5, the long-term static modulus of elasticity (expressed in MPa) as per the provisions of IS:456 is
- (A) 5000
  - (B) 10000
  - (C) 15000
  - (D) 20000

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