



# ESE 2022

Civil Engineering

Subject Test

(SOM, Building Materials, Soil Mechanics)

(October 8th - October 10th 2021)

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Questions &  
Answer Key

1. For a circular column section, how much savings in material can be achieved by using a hollow section as compared to a solid section if the external diameter of the hollow section is two times its internal diameter? Assume all other relevant quantities to be the same.
- A. 45  
B. 34  
C. 23  
D. 11

Ans. C

2. The bursting pressure for a cold drawn seamless steel tubing of 60mm inside diameter with 2mm wall thickness is (the ultimate strength of steel is  $380 \text{ MN/m}^2$ )
- A.  $25.33 \text{ MN/m}^2$   
B.  $24.33 \text{ MN/m}^2$   
C.  $26.33 \text{ MN/m}^2$   
D.  $50.66 \text{ MN/m}^2$

Ans. A

3. A cantilever beam, 3m long, carries a uniformly distributed load over the entire length. If the slope at the free end is  $1^\circ$ , the deflection at the free end is
- A. 49.27 mm  
B. 39.27 mm  
C. 30.27 mm  
D. 20.27 mm

Ans. B

4. A beam of triangular cross-section is subjected to a shear force of 50 kN. The base width of the section is 250 mm and the height is 200 mm. The beam is placed with its base horizontal. The shear stress at neutral axis will be nearly
- A.  $2.2 \text{ N/mm}^2$   
B.  $2.7 \text{ N/mm}^2$   
C.  $3.2 \text{ N/mm}^2$   
D.  $3.7 \text{ N/mm}^2$

Ans. B

5. A chain, working a crane, has sectional area of  $625 \text{ mm}^2$  and transmits a load of 10 kN. When the load is being lowered at a uniform rate of 40 m/min, the chain gets jammed suddenly at which time the length of the chain unwound is 10m. Assuming  $E = 200 \text{ GPa}$ , the stress induced in the chain due to this sudden jamming is
- A.  $100.6 \text{ N/mm}^2$   
B.  $120.4 \text{ N/mm}^2$   
C.  $140.2 \text{ N/mm}^2$   
D.  $160.0 \text{ N/mm}^2$

Ans. B

6. **Assertion (A):** In certain special situations, omitting the shear effect deformations can lead to significant errors.

**Reason (R):** In general, when the bending moments vary along the length of the beam, the shearing stress resultants will be present and will influence deformation.

- A. both A and R are true and R is the correct explanation of A  
B. both A and R are true but R is not a correct explanation of A  
C. A is true but R is false  
D. A is false but R is true

Ans. B

7. The rotation at the support of a simply supported beam of length 5 m due to a point load of 50 kN at the centre is  
Flexural rigidity of beam is  $2 \times 10^{11}$  N-mm<sup>2</sup>
- A. 0.039 rad  
B. 0.39 rad  
C. 0.089 rad  
D. 0.89 rad

Ans. B

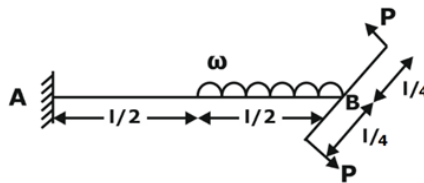
8. If E is young's modulus and I is moment of inertia, then the expression  $EI \frac{d^3y}{dx^3}$  at any section for a beam is equal to
- A. load intensity at the section  
B. shear force at the section  
C. bending moment at the section  
D. slope at the section

Ans. B

9. A lift of weight W is lifted by a rope with an acceleration f. If the area of cross-section of the rope is A, the stress in the rope is
- A.  $W(1+f/g)/A$   
B.  $(1-g/f)/A$   
C.  $W(2+f/g)/A$   
D.  $W(2+g/f)/A$

Ans. A

10. The beam shown in the figure given below will be subjected to



- A. Bending  
B. Twisting  
C. Combined bending and twisting  
D. Direct compression

Ans. C

11. The pozzolana Portland cement gains final strength
- A. in the same time as ordinary Portland cement  
B. in less time than ordinary Portland cement  
C. in more time than ordinary Portland cement  
D. None of the above

Ans. C

12. The high alumina cement has certain properties as mentioned below :
- 1) High alumina cement has high early compressive strength and high heat of hydration than ordinary Portland cement
  - 2) High alumina cement is not suitable to be used in cold regions.
- Which of the following statement (s) correct ?

- A. only 1  
B. only 2  
C. Both 1 and 2  
D. Neither 1 nor 2

Ans. A



18. The most appropriate value for the minimum amount of water required for 5 bags of cement is:

- A. 40 kg
- B. 90 kg
- C. 120 kg
- D. 160 kg

Ans. B

19. Grading of aggregates for concrete is mainly done to?

- A. Obtain concrete of denser quality.
- B. Obtain concrete of light weight
- C. To decrease the cost of concrete
- D. Quick setting

Ans. A

20. Consider the following statements:

- a. Phyllite is a foliated metamorphic rock created from shales.
- b. In Acid test, the stones in chipped form (100gm) are put in 5% solution of HCl or H<sub>2</sub>SO<sub>4</sub> for 3 hours and then taken out.
- c. In Crystalline test, a sample of stone is placed in solution of Na<sub>2</sub>SO<sub>4</sub> at room temperature for 2 hours and then taken out.
- d. Slate stone is used for making electrical switch board and used in cisterns & urinal partitions.

Which of the above are correct?

- A. (a) and (d)
- B. (b) and (c)
- C. (a), (c) and (d)
- D. (b), (c) and (d)

Ans. C

21. A dry soil is acted upon by a tension force of 0.2 N/m. The effective size of soil grains can be taken as 0.11 mm. What will be the maximum rise attained due to capillary?

Take  $\gamma_w = 9.81 \text{ kN/m}^3$ .

- A. 0.74 m
- B. 1.48 m
- C. 0.37 m
- D. none of these

Ans. A

22. A footing is resting on fully saturated clayey strata. For checking the initial stability, shear parameters are used from which one of the following

- A. Consolidated non-drained tests
- B. Unconsolidated drained tests
- C. Unconsolidated non-drained tests
- D. Unconsolidated non-drained tests with pore pressure measurement

Ans. D

23. Assertion(A): For a saturated clayey soil, the effective stress increases immediately after increasing the surcharge.

Reason(R): Effective stress is given as the difference between total stress and pore water pressure.

- A. Both A and R are true and R is the correct explanation of A
- B. Both A and R are true but R is not a correct explanation of A
- C. A is true but R is false
- D. A is false but R is true

Ans. D

24. The water seeping below the body of the hydraulic structure, endangers the stability of the structure by

- i. Undermining
- ii. Piping
- iii. Direct uplift
- iv. Heaving action

Which of the above cause failure of the structure?

- A. i and ii only
- B. ii and iii only
- C. ii and iv only
- D. i, ii and iii only

Ans. D

25. Consider the following points related to unified soil classification system:

- (i) The soil particles above 4.75 mm termed as coarse grained soil.
- (ii) The soil particle below 4.75 mm are fine grained soil.

Which of the above statements are correct?

- A. i and ii both
- B. i only
- C. ii only
- D. Neither i nor ii

Ans. D

26. Consider the following statements:

- 1). If the soil is not black in colour, it is unlikely to be a swelling soil.
- 2). The swelling pressure of a fine-grained soil depends on its initial water content and density.
- 3). The swelling pressure of a fine-grained soil depends on the nature of the pore fluid.

Which of these statements are correct?

- A. 1, 2 and 3
- B. 1 and 2 only
- C. 1 and 3 only
- D. 2 and 3 only

Ans. D

27. Consider the following statements:

- 1). A sand with its void ratio higher than its critical void ratio increases in volume when sheared.
- 2). A sand with its void ratio lower than its critical void ratio increases in volume when sheared.
- 3). For a sand at critical void ratio, the volume change during shear is minimum.

Which of these statements are correct?

- A. 1, 2 and 3
- B. Only 1 and 2
- C. Only 2 and 3
- D. Only 1 and 3

Ans. C

