DSSSB
AE (Civil)

Previous Year Paper

28 Nov, 2022 Shift 1

GOVT. OF NCT OF DELHI
Delhi Subordinate Services Selection Board
FC-18, Institutional Area, Karkardooma, Delhi – 110092.
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Participant ID	
Participant Name	
Test Center Name	
Test Date	28/11/2022
Test Time	8:30 AM - 10:30 AM
Subject	Assistant Engineer (Civil) Section A

Section : **Discipline1**

Q.1 Which of the following statements pertaining to friction acting on surfaces is/are true or false?

S1: If friction is neglected, the reactions are always normal to the surfaces of contact.

S2: The maximum value of static friction (or limiting friction when motion impends) $= \frac{N}{f_s}$, where f_s is co-efficient of static friction and N is the normal force.

Ans

✗ A. Both S1 and S2 are false

✗ B. Both S1 and S2 are true

✓ C. S1 is true and S2 is false

✗ D. S1 is false and S2 is true

Question ID : **75322922320**

Q.2 Which of the following statements pertaining to free body diagram in statics are correct?

S1: A free body diagram of a system in equilibrium should comprise a force system in equilibrium.
S2: If a system of bodies is in equilibrium, it is not necessary that each subsystem and each constituent body must also be in equilibrium.
S3: The force due to gravitation acting through the centre of mass of bodies are classified as external forces.

Ans

✗ A. S2 and S3 only

✗ B. S1 and S2 only

✗ C. S1, S2 and S3

✓ D. S1 and S3 only

Question ID : **75322922318**

Q.3 Match the items under List 1(salient points in a stress-strain curve) with those under List 2 (characteristics of salient points), for mild steel.

List 1
P. Yield point
Q. Elastic limit
R. Proof stress
S. Ultimate stress

List 2
1. Stress up to which a specified permanent set in percentage of strain remains on unloading when the specimen is unloaded.
2. Maximum stress ordinate in a stress-strain diagram.
3. Stress beyond which, when the material is loaded, plastic deformations take place.
4. Stress up to which the material recovers to its original length on removal of the load.

Ans
✗ A. P-4, Q-1, R-3, S-2
✗ B. P-3, Q-4, R-2, S-1
✗ C. P-4, Q-3, R-1, S-2
✓ D. P-3, Q-4, R-1, S-2

Question ID : **75322922337**

Q.4 With respect to the theory of bending in beams, identify the assumption which forms the basis for following the condition: 'Strain in the compression zone and tension zone follow a linear variation with zero value at the neutral axis'.

Ans
✓ A. Sections which are plane before bending remain plane after bending.
✗ B. The material is homogeneous, isotropic and obeys Hooke's law.
✗ C. Modulus of elasticity of materials is the same in tension and compression.
✗ D. Each layer of material is free to expand or contract under stress.

Question ID : **75322922330**

Q.5 The principle of conservation of angular momentum for a rigid body is applicable when:

Ans
✗ A. external forces and moments are absent
✗ B. internal forces add to zero
✓ C. resultant external moment is zero
✗ D. external forces add to zero

Question ID : **75322922328**

Q.6 A hollow circular section of external diameter 100 mm, and thickness 20 mm is to be used as a beam. If the maximum stress permissible in the material is 100 MPa, determine the maximum bending moment (in kN.m units) the section can carry.

Ans

✗ A. $3.125\ \pi$

✓ B. $2.72\ \pi$

✗ C. $1.36\ \pi$

✗ D. $1.563\ \pi$

Question ID : **75322922331**

Q.7 A timber beam of rectangular cross-section carries a uniformly distributed load of 20 kN/m over the entire span of 4 m. If the permissible maximum shear stress in the beam is 1.0 MPa, determine the maximum depth of the beam based on shear stress criteria. Take the width of the beam as 1/3 of its depth.

Ans

✗ A. $200\sqrt{2}$ mm

✓ B. $300\sqrt{2}$ mm

✗ C. 200 mm

✗ D. $150\sqrt{2}$ mm

Question ID : **75322922329**

Q.8 The rectilinear motion of a particle is given by $s = v^2 - 9$, where s is the displacement (in m units) and v the velocity. When time $t = 0$, $s = 0$ and $v = 3$ m/s. Determine the $s - t$ relation of motion.

Ans

✗ A. $s = 0.25t^2$

✓ B. $s = 3t + 0.25t^2$

✗ C. $s = 3t + 0.5t^2$

✗ D. $s = 3t - 0.25t^2$

Question ID : **75322922322**

Q.9 The free body diagram of a satellite rotating about the earth will show the satellite isolated from its surroundings and:

Ans

✓ A. force of gravity and centrifugal force acting on it

✗ B. only force of gravity acting on it

✗ C. only centrifugal force acting on it

✗ D. only centripetal force acting on it

Question ID : **75322922319**

Q.10 According to Bernoulli's virtual work principle, for a body to be in equilibrium, the virtual work should be:

Ans

✗ A. minimum

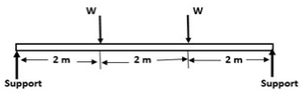
✗ B. any value between zero and one

✗ C. maximum

✓ D. zero

Question ID : **75322922327**

Q.11 A rectangular beam section 300 mm wide and 400 mm deep is used on a span of 6 m for the loading shown in the given figure. Find the maximum value of W so that the permissible stress of 50 MPa is not exceeded in the material.



Ans

✗ A. 266.7 kN

✓ B. 200 kN

✗ C. 100 kN

✗ D. 133.3 kN

Question ID : **75322922332**

Q.12 The assumptions on Euler's theory on columns is given. Identify the INCORRECT assumption.

Ans

✓ A. The theory is applicable to short columns.

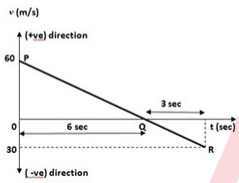
✗ B. The load on column is truly axial.

✗ C. The column fails by buckling

✗ D. The column is prismatic and has the same cross-section throughout.

Question ID : **75322922334**

Q.13 The velocity-time (v-t) plot for a particle in motion for 9 seconds from the start ($t = 0$) with an initial velocity of 60 m/s is shown by the line PQR in the given figure. The particle is subjected to a constant deceleration. Determine the displacement of the particle at the end of 9 seconds.



Ans

✗ A. 270 m

✗ B. 180 m

✓ C. 135 m

✗ D. 450 m

Question ID : **75322922323**

Q.14 In mechanics, a dynamical problem can be solved as a statical problem using:

Ans

✗ A. the impulse and momentum method

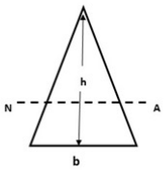
✓ B. D'Alembert's principle

✗ C. Newton's third law

✗ D. the work energy method

Question ID : **75322922325**

Q.15 For a beam of triangular cross section as in the given figure, the distance from the neutral axis (NA) of the beam to the layer of maximum shear stress is:



Ans

✗ A. h/8 downward

✗ B. h/8 upward

✓ C. h/6 upward

✗ D. h/6 downward

Question ID : **75322922333**

Q.16 A square bar of 30 mm side has modulus of elastic of 200 GPa and modulus rigidity of 80 GPa. The Poisson's ratio of the material is:

Ans

✗ A. 0.2

✗ B. 0.4

✓ C. 0.25

✗ D. 0.3

Question ID : **75322922336**

Q.17 A particle of mass 2 kg moves in a straight line under the influence of a force which increases linearly with time at the rate 60 N/s, it being 40 N initially. Determine the velocity of the particle after a lapse of 5 seconds, if it started from rest at the origin.

Ans

✗ A. 170 m/s

✗ B. 1750 m/s

✓ C. 475 m/s

✗ D. 950 m/s

Question ID : **75322922324**

Q.18 A prismatic bar having a volume V is subjected to a tensile force P in the longitudinal direction. If the longitudinal strain is e, determine the final volume of the bar. (Take μ as Poisson's ratio of the material)

Ans

✗ A. $(1-e)(1-\mu)^2 V$

✗ B. $(1-e)^3(1-\mu e) V$

✓ C. $(1+e)(1-\mu e)^2 V$

✗ D. $(1-e)^3(1+\mu e)^2 V$

Question ID : **75322922335**

Q.19 The principle of virtual work states that:

Ans

✗ A.
the virtual work done on a rigid body or a system of rigid bodies that are not in equilibrium is zero for any virtual displacements compatible with the constraints of the system

✗ B.
the virtual work done on a rigid body or a system of rigid bodies in equilibrium is infinity for any virtual displacements compatible with the constraints of the system

✓ C.
the virtual work done on a rigid body or a system of rigid bodies in equilibrium is zero for any virtual displacements compatible with the constraints of the system

✗ D.
the virtual work done on a rigid body or a system of rigid bodies in equilibrium is a constant for any virtual displacements compatible with the constraints of the system

Question ID : **75322922321**

Q.20 The co-efficient of friction between two surfaces is a constant of proportionality between the applied tangential force and the normal reaction:

Ans

✗ A. at the instant of application of the force

✗ B. at an instant after the motion takes place

✓ C. at the instant of impending motion

✗ D. at the instant when the body is at rest

Question ID : **75322922326**

Section : **Discipline2**

Q.1 The sequential order in which different stages of a construction project, based on the principles of planning, is:

Ans

✓ A.
Briefing – Designing – Tendering – Constructing – Commissioning

✗ B.
Designing – Briefing – Tendering – Constructing – Commissioning

✗ C.
Designing – Tendering – Briefing – Constructing – Commissioning

✗ D.
Briefing – Tendering – Designing – Constructing – Commissioning

Question ID : **75322922356**

Q.2 The stiffness matrix for the analysis of a beam is $\frac{6EI}{7L^3}\begin{bmatrix}16 & -5\\ -5 & 2\end{bmatrix}$, where EI is flexural rigidity and L is the span. The flexibility matrix for the case is:

Ans

✗ A. $\frac{L^3}{6EI}\begin{bmatrix}2 & 5\\ 5 & 8\end{bmatrix}$

✗ B. $\frac{7L^3}{6EI}\begin{bmatrix}2 & 5\\ 5 & 16\end{bmatrix}$

✓ C. $\frac{L^3}{6EI}\begin{bmatrix}2 & 5\\ 5 & 16\end{bmatrix}$

✗ D. $\frac{6EI}{7L^3}\begin{bmatrix}2 & 5\\ 5 & 8\end{bmatrix}$

Question ID : **75322922346**

Q.3 A bar having modulus of elasticity of material = 200 GPa, is subjected to an axial pull of 20 kN. If the bar has a circular cross section which tapers from 40 mm diameter to 20 mm diameter over a length of 500 mm, determine the increase in the length of the bar (in mm units).

Ans

✓ A. $0.25\ \pi$

✗ B. $0.7\ \pi$

✗ C. $0.5\ \pi$

✗ D. $0.125\ \pi$

Question ID : **75322922338**

Q.4 Match the items in List 1 (properties of cement) with those under List 2 (methods/tests).

List 1

P. Soundness

Q. Fineness

R. Consistency

S. Tensile strength

List 2

1.Vicat apparatus test

2. Auto clave test

3. Briquette method

4. Air permeability method

Ans

✗ A. P-4, Q-2, R-3, S-1

✗ B. P-1, Q-4, R-2, S-3

✓ C. P-2, Q-4, R-1, S-3

✗ D. P-3, Q-4, R-2, S-1

Question ID : **75322922355**

Q.5 Which of the following is NOT an example of an indeterminate structure?

Ans
✗ A. Two hinged arch
✗ B. Fixed beam
✓ C. Simply supported beam with overhanging on both the sides
✗ D. Continuous beam

Question ID : **75322922353**

Q.6 A three hinged arch parabolic in shape given by the equation $y = \frac{4h}{l^2}(lx - x^2)$, where (x,y) is any point on the arch, h the central rise, l the span of the arch, is subjected to a uniformly distributed load of w per unit length. The shear force at a distance $\frac{l}{4}$ from the left hinge is:

Ans
✗ A. $\frac{wl^2}{16h}$
✗ B. $\frac{wl^2}{2h}$
✗ C. $\frac{wl^2}{4h}$
✓ D. zero

Question ID : **75322922348**

Q.7 Identify the method which does NOT belong to the category of displacement methods.

Ans
✗ A. Slope deflection method
✗ B. Moment distribution method
✗ C. Stiffness matrix method
✓ D. Method of consistent deformation

Question ID : **75322922352**

Q.8 Influence lines for redundant structures can be obtained by:

Ans
✗ A. Maxwell Betti's Reciprocal Theorem
✗ B. Castigliano's theorem
✓ C. the Muller Breslau Principle
✗ D. the Unit Load Theorem

Question ID : **75322922351**

Q.9 A square steel rod of side a and length l having modulus of elasticity E and poisons ratio $\frac{1}{m}$, is subjected to tensile stress of f_x, compressive stress of f_y and tensile stress of f_z along the X, Y and Z directions respectively. Estimate the resultant strain along the X-direction.

Ans

✗ A. $\frac{1}{E}\left[f_x - \frac{f_y}{m} + \frac{f_z}{m}\right]$

✗ B. $\frac{1}{E}\left[f_x - \frac{f_y}{m} - \frac{f_z}{m}\right]$

✗ C. $\frac{1}{E}\left[f_x + \frac{f_y}{m} + \frac{f_z}{m}\right]$

✓ D. $\frac{1}{E}\left[f_x + \frac{f_y}{m} - \frac{f_z}{m}\right]$

Question ID : **75322922340**

Q.10 Determine the deflection at the centre of a simply supported beam of span 4 m (with pin jointed supports at the two ends) with two equal unlike couples of 10 kNm at the two ends. (Take EI = constant for the beam).

Ans

✗ A. 10/EI

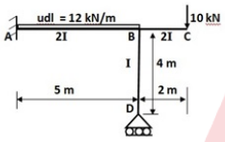
✗ B. 5/EI

✓ C. 20/EI

✗ D. 40/EI

Question ID : **75322922343**

Q.11 The figure shows an unsymmetrical frame with fixed support at A and roller support at D. The slope deflection equations formulated at joint B for BA and BD are: (Notations: M indicates moment and θ indicates the slope at the respective points)



Ans

✓ A. $M_{BA} = 1.6EI\,\theta_B - 25;$
$M_{BD} = EI\,\theta_B + 0.5EI\theta_D$

✗ B. $M_{BA} = 1.6EI\,\theta_B - 45;$
$M_{BD} = EI\,\theta_B + 0.5EI\theta_D - 20$

✗ C. $M_{BA} = 1.6EI\,\theta_B - 5;$
$M_{BD} = 0.5EI\,\theta_B + EI\theta_D$

✗ D. $M_{BA} = EI\,\theta_B - 25;$
$M_{BD} = 0.5EI\,\theta_B + EI\theta_D$

Question ID : **75322922350**

Q.12 The time dependent plastic deformation of materials that could happen under constant load or stress conditions and is generally represented by plots of strain versus time is known as:

Ans

✔ A. creep

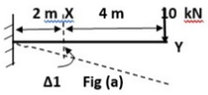
✘ B. fatigue

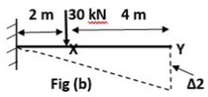
✘ C. endurance limit

✘ D. tenacity

Question ID : **75322922341**

Q.13 A cantilever beam of span 6 m is shown in the figure. It is subjected to a load of 10 kN at the free end Y and the deflection at a section X (2 m from the support) is Δ_1 as in Fig(a). The same beam is subjected to a concentrated load of 30 kN at section X and the deflection at the free end Y is Δ_2 as in Fig (b). Determine the ratio of deflections $\left(\frac{\Delta_1}{\Delta_2}\right)$.





Ans

✘ A. 0.5

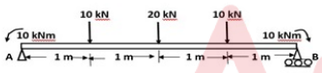
✔ B. 0.333

✘ C. 0.667

✘ D. 0.25

Question ID : **75322922344**

Q.14 A simply supported beam AB of span 4 m, with supports (A-hinge, B-roller) is subjected to loadings as in the given figure. Determine the bending moment at the centre of the beam (i.e., 2 m from the supports).



Ans

✘ A. 20 kNm (Hogging)

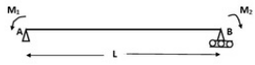
✔ B. 20 kNm (Sagging)

✘ C. 30 kNm (Sagging)

✘ D. 30 kNm (Hogging)

Question ID : **75322922342**

Q.15 What is the stiffness matrix for the evaluation of M_1 and M_2 acting on the beam of span L, and flexural rigidity EI shown in the given figure, subjected to end moments M_1 and M_2 at the supports A and B?
(Support A is hinge and B is roller)



Ans

✗ A. $\begin{bmatrix} \frac{EI}{L} & \frac{2EI}{L} \\ \frac{2EI}{} & \frac{EI}{} \end{bmatrix}$

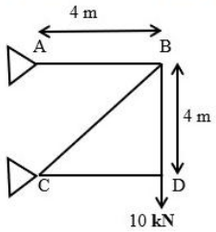
✗ B. $\begin{bmatrix} \frac{EI}{L} & \frac{4EI}{L} \\ \frac{4EI}{} & \frac{EI}{} \end{bmatrix}$

✓ C. $\begin{bmatrix} \frac{4EI}{L} & \frac{2EI}{L} \\ \frac{2EI}{} & \frac{4EI}{} \end{bmatrix}$

✗ D. $\begin{bmatrix} \frac{EI}{2L} & \frac{2EI}{L} \\ \frac{2EI}{} & \frac{EI}{} \end{bmatrix}$

Question ID : **75322922347**

Q.16 For the truss shown in the given figure (supports A and C are hinge type), the force in member BC is:



Ans

✓ A. $10\sqrt{2}$ (compressive)

✗ B. $\frac{10}{\sqrt{2}}$ (tensile)

✗ C. $10\sqrt{2}$ (tensile)

✗ D. $\frac{10}{\sqrt{2}}$ (compressive)

Question ID : **75322922349**

Q.17 Match the items under List 1 (unknowns to be evaluated) with those under List 2 (analysis methods).

List 1

P. Displacement, rotations, and sway of plane frames

Q. Degrees of freedom

R. Rotations by incremental iteration and unknown sways of plane frames

S. Redundant forces

List 2

1. Moment distribution method
2. Flexibility method
3. Stiffness method
4. Kani's method

Ans

✗ A. P-3, Q-2, R-4, S-1

✓ B. P-4, Q-3, R-1, S-2

✗ C. P-3, Q-1, R-4, S-2

✗ D. P-4, Q-3, R-2, S-1

Question ID : **75322922345**

Q.18 The dimensions of five types of burnt clay bricks B1, B2, B3, B4 and B5 taken from five sites are given below. Identify the bricks which fall under the category of standard modular size of common burnt clay building brick as per IS 1077 : 1992. (All dimensions of bricks are mm units).

B1: 230 × 110 × 70

B2: 190 × 100 × 90

B3: 190 × 90 × 90

B4: 190 × 90 × 40

B5: 230 × 110 × 30

Ans

✗ A. B2, B3, and B4 only

✓ B. B3 and B4 only

✗ C. B1 and B5 only

✗ D. B1 and B2 only

Question ID : **75322922354**

Q.19 The ratio of Euler's critical load of a circular column of radius r to that of a square column of side a, if both the columns are of the same material, same length and end conditions, is:

Ans

✓ A. $3\pi\left(\frac{r^4}{a^4}\right)$

✗ B. $\frac{\pi}{3}\left(\frac{a^4}{r^4}\right)$

✗ C. $\pi\left(\frac{r^4}{a^4}\right)$

✗ D. $\frac{\pi}{3}\left(\frac{r^4}{a^4}\right)$

Question ID : **75322922339**

Q.20 Which of the following statements pertaining to steel is/are true or false?

S1: Mild steel has higher ultimate compressive and tensile strength when compared to high carbon steel.
S2: The ratio of Young's modulus of high tensile steel to that of mild steel is about unity.

Ans

✔ A. S1 is false and S2 is true

✗ B. Both S1 and S2 are true

✗ C. S1 is true and S2 is false

✗ D. Both S1 and S2 are false

Question ID : **75322922357**

Section : **Discipline3**

Q.1 According to IS 456 : 2000, the minimum eccentricity value to be adopted in the design of a reinforced concrete column of square size (with side a), having an unsupported length L is:

Ans

✗ A. $\left(\frac{L}{300}+\frac{a}{30}\right)$ subject to a minimum of 20 mm

✗ B. $\left(\frac{L}{400}+\frac{a}{20}\right)$ subject to a minimum of 10 mm

✗ C. $\left(\frac{L}{350}+\frac{a}{20}\right)$ subject to a minimum of 25 mm

✔ D. $\left(\frac{L}{500}+\frac{a}{30}\right)$ subject to a minimum of 20 mm

Question ID : **75322922368**

Q.2 Among the assumptions on which the design of reinforced concrete structures is done, based on limit state of collapse, identify the INCORRECT one from the given options.

Ans

✔ A.
Stress-strain curve of concrete is assumed to follow a linear variation.

✗ B.
Maximum stress in the characteristic stress strain curve of concrete in flexural compression is restricted to 0.67 F_{ck} (where F_{ck} is characteristic compressive strength of concrete)

✗ C. Tensile strength of concrete is neglected.

✗ D.
Design stress of reinforcement is derived from representative stress strain curves.

Question ID : **75322922361**

Q.3 Determine the maximum load that a tie bar of size 50 mm × 8 mm can carry, adopting a factor of safety of 2.5. A specimen of the same quality of steel (as that of the tie bar) of cross-sectional area 250 mm^2, tested in the laboratory was able to withstand a maximum load of 125 kN.

Ans

✗ A. 500 kN

✗ B. 125 kN

✔ C. 80 kN

✗ D. 312.5 kN

Question ID : **75322922376**

Q.4 Which of the following statements pertaining to providing lateral reinforcement in reinforced cement concrete (RCC) columns is/are true/false?

S1: The purpose of providing lateral ties in a short RCC column is to increase the load carrying capacity of the column.
S2: It is not mandatory to provide lateral reinforcement in RCC columns.

Ans
✗ A. Both S1 and S2 are true
✗ B. S1 is true and S2 is false
✗ C. S1 is false and S2 is true
✓ D. Both S1 and S2 are false

Question ID : **75322922367**

Q.5 When fillet welds are subjected to normal stress (σ) and shear stress (τ), the equivalent stress on the weld (*f*) is computed as:

Ans
✗ A. $\sqrt{3\sigma^2+\tau^2}$
✓ B. $\sqrt{\sigma^2+3\tau^2}$
✗ C. $\sqrt{\sigma^2+\tau^2}$
✗ D. $\sqrt{0.5\sigma^2+3\tau^2}$

Question ID : **75322922375**

Q.6 What is the minimum period before striking the formwork to reinforced cement concrete beams (with props to be refixed immediately after removal of formwork)?

Ans
✗ A. 3 days
✓ B. 7 days
✗ C. 14 days
✗ D. 21 days

Question ID : **75322922360**

Q.7 Which of the following statements pertaining to a compression member following IS 800 : 2007 is/are INCORRECT?

S1: The effective length is calculated from the actual length of the member, considering the rotational and relative translational boundary conditions at the ends.
S2: The elastic critical stress in compression decreases with decrease in slenderness ratio.
S3: The cross sectional area is taken as the effective sectional area for all compression members fabricated by welding or riveting for compact or semi compact sections.
S4: Common hot rolled and built-up steel members used for carrying axial compression, usually fail by flexural buckling.

Ans
✗ A. S2 and S4
✗ B. S3 and S4
✗ C. S1 only
✓ D. S2 only

Question ID : **75322922374**

Q.8 Which of the following statements pertaining to fresh concrete is/are true or false?

S1: As the compaction factor increases, slump increases.
S2: Slump test helps in qualitatively understand the strength of concrete.

Ans
✗ A. Both S1 and S2 are true
✗ B. S1 is false and S2 is true
✓ C. S1 is true and S2 is false
✗ D. Both S1 and S2 are false

Question ID : **75322922359**

Q.9 A reinforced concrete beam is subjected to the following bending moments:
Moment due to dead load = 40 kNm; Moment due to live load = 60 kNm; Moment due to seismic load = 20 kNm.
The design bending moment for limit state of collapse is:

Ans
✗ A. 180 kNm
✗ B. 144 kNm
✓ C. 150 kNm
✗ D. 120 kNm

Question ID : **75322922363**

Q.10 As per IS 456 : 2000, for 2 way slabs, with shorter span (less than 3.5 m) and imposed load less than 3 kN/m^2 , the span to overall depth ratio of continuous slabs, with mild steel reinforcement is:

Ans
✓ A. 40
✗ B. 28
✗ C. 35
✗ D. 32

Question ID : **75322922370**

Q.11 A reinforced concrete rectangular beam having a width = 240 mm and effective depth = 300 mm is designed as a balanced section, using the limit state method. The concrete used is M25 grade and the reinforcing steel is Fe415 grade.
The position of neutral axis from compression side is:

Ans
✗ A. 126 mm
✓ B. 144 mm
✗ C. 150 mm
✗ D. 156 mm

Question ID : **75322922362**

Q.12 Which of the following statements pertaining to characteristic of bond in reinforced cement concrete is INCORRECT?

Ans

✔ A. Flexural bond resists the 'pulling out' of the bars which are in tension.

✘ B. Flexural bond causes a variation in axial tension along the length of a reinforcing bar.

✘ C. Flexural bond stress is high at locations of high shear.

✘ D. Flexural bond is critical at points where the shear is significant.

Question ID : **75322922371**

Q.13 Which of the following statements pertaining to the working stress method of design (WSM) of reinforced concrete structures is/are true or false?

S1: WSM assumes a factor of safety being the ratio of the strength of the material to the permissible stress in material.
S2: WSM discriminates between different types of loads in design that act simultaneously, but have different degrees of uncertainty, through partial safety factors.

Ans

✘ A. S1 is false and S2 is true

✘ B. Both S1 and S2 are true

✘ C. Both S1 and S2 are false

✔ D. S1 is true and S2 is false

Question ID : **75322922364**

Q.14 In order to limit the vertical deflection, according IS 456-2000, the value of span to effective depth ratios for span up to 10 m in the case of simply supported reinforced concrete beam is:

Ans

✘ A. 26

✘ B. 7

✔ C. 20

✘ D. 35

Question ID : **75322922369**

Q.15 In the working stress method of design of reinforced concrete, the stress in steel is linearly related to that in the adjoining concrete by a constant factor known as:

Ans

✘ A. modular ratio, being the ratio of modulus of elasticity of concrete to that of steel

✘ B. safety factor, being the ratio of characteristic strength of steel to concrete

✘ C. section factor, being the ratio of modulus of section of concrete to steel

✔ D. modular ratio, being the ratio of modulus of elasticity of steel to that of concrete

Question ID : **75322922365**

Q.16 In a battened steel column, battens are provided by plates with their ends rivetted to the main column section. The shear force to be resisted (along the column axis) by the batten plate V_b is:

[Notations: V_t - transverse shear force; C - longitudinal distance between centre-to-centre of battens; N - number of parallel planes of battens, S - minimum transverse distance between the centroid of the rivet group connecting the batten to the main member]

Ans

✗ A. $\frac{CV_t}{2N^2S}$

✗ B. $\frac{CV_t}{2NS}$

✗ C. $\frac{CV_t}{N^2S}$

✓ D. $\frac{CV_t}{NS}$

Question ID : **75322922373**

Q.17 According to IS 456 : 2000, for M25 concrete, the modulus of elasticity of concrete can be in the acceptable range of:

Ans

✓ A. 20000 to 30000 N/mm^2

✗ B. 30000 to 40000 N/mm^2

✗ C. 15000 to 20000 N/mm^2

✗ D. 10000 to 15000 N/mm^2

Question ID : **75322922358**

Q.18 As per IS 800 : 2007, in design, the effective slenderness ratio of battened columns shall be taken as _____ times the maximum actual slenderness ratio of the column.

Ans

✓ A. 1.1

✗ B. 0.9

✗ C. 1.2

✗ D. 0.8

Question ID : **75322922377**

Q.19 A simply supported beam of span 15 m is subjected to a uniformly distributed load. The minimum effective depth required as per IS 456 : 2000 to check the deflection of the beam when modification factor for tension is 0.9 is:

Ans

✗ A. 1.35 m

✗ B. 1.7 m

✗ C. 0.8 m

✓ D. 1.25 m

Question ID : **75322922366**

Q.20 In the design of simply supported plate girders, stiffeners are provided for improved strength capabilities. Match the items in List 1 (locations of stiffeners) with those in List 2 (types of stiffeners) as per good design practice and relevant codal provisions.

List 1
P. At supports
Q. Away from the centre of span
R. Away from support
S. Longitudinally somewhere in the compression flange

List 2
1. Flange splice
2. Web splice
3. Horizontal stiffener
4. Bearing stiffener

Ans
✗ A. P-3, Q-2, R-1, S-4
✗ B. P-4, Q-2, R-3, S-1
✗ C. P-2, Q-1, R-4, S-3
✓ D. P-4, Q-1, R-2, S-3

Question ID : **75322922372**

Section : **Discipline4**

Q.1 The most expected failure for shallow foundations in very dense sand is:

Ans
✗ A. local or punching shear
✗ B. local shear only
✓ C. general shear
✗ D. punching shear only

Question ID : **75322922392**

Q.2 Which of the following statements pertaining to shear strength tests on clay soils is/are true or false?

S1: Theoretically, for similar saturated clay specimens, the unconfined compression test and unconsolidated undrained triaxial tests should yield the same undrained shear strength c_u values.
S2: The failure envelope for normally consolidated clay and over- consolidated clay obtained from drained direct shear tests is identical.

Ans
✓ A. S1 is true and S2 is false
✗ B. Both S1 and S2 are false
✗ C. Both S1 and S2 are true
✗ D. S1 is false and S2 is true

Question ID : **75322922387**

Q.3 As per Indian Standard Soil Classification, identify the soil type with the following details: Fine grained soil with more than 50% passing through 75 micron IS sieve, has liquid limit value between 35% and 50%, Atterberg limit plots above the A-line.

Ans

✔ A. CI

✘ B. MI

✘ C. OH

✘ D. OI

Question ID : **75322922381**

Q.4 For a normally consolidated clay, the results of a drained triaxial test are as follows: Chamber confining pressure = 100 N/m^2 ; Deviator stress at failure = 160 N/m^2 . Determine the drained angle of friction ϕ'. (The value of cohesion c' for normally consolidated clay is approximated as zero.)

Ans

✘ A. $sin^{-1}\ (0.56)$

✔ B. $sin^{-1}\ (0.44)$

✘ C. $sin^{-1}\ (0.72)$

✘ D. $sin^{-1}\ (0.61)$

Question ID : **75322922386**

Q.5 Match the items under List 1 (collapse load) with those under List 2 (structure details), based on plastic analysis of structures.

List 1

P. $\frac{6M_P}{L}$

Q. $\frac{8M_P}{L}$

R. $\frac{16M_P}{L}$

S. $\frac{4M_P}{L}$

List 2

1. Fixed beam with a uniformly distributed load of intensity w.
2. Propped cantilever beam with a concentrated load at the centre.
3. Simply supported beam with a concentrated load at the centre.
4. Fixed beam with a point load at the centre.
5.

[Notations: L - span of beam; Mp - plastic moments]

Ans

✘ A. P-3, Q-4, R-1, S-2

✘ B. P-2, Q-3, R-1, S-4

✘ C. P-3, Q-1, R-2, S-4

✔ D. P-2, Q-4, R-1, S-3

Question ID : **75322922378**

Q.6 The in-situ void ratio of a compacted granular soil deposit is 0.5. The maximum and minimum void ratios of soil were determined to be 0.75 and 0.35, respectively. Determine the relative density of the deposit.

Ans

✗ A. 80%

✗ B. 37.5%

✗ C. 45.4%

✓ D. 62.5%

Question ID : **75322922383**

Q.7 As per IS 800 : 2007, when lacings are provided for compression member (say laced steel columns), the lacing shall be designed to carry a transverse shear equal to:

Ans

✗ A. 5% of axial force in the member

✗ B. 25% of axial force in the member

✓ C. 2.5% of axial force in the member

✗ D. 10% of axial force in the member

Question ID : **75322922380**

Q.8 Which of the following statements is correct?

Ans

✗ A. Under reamed piles are generally provided in sandy soils.

✗ B. The unit of bearing capacity factors is kN/m^3.

✗ C. Negative skin friction occurs in piles driven in dense sand.

✓ D. The unit of pile capacity due to end bearing and skin friction is kN.

Question ID : **75322922390**

Q.9 Which of the following statements pertaining to compaction in soils is/are true or false?

S1: For a given type of compaction, the higher the compactive effort, higher the maximum dry unit weight and lower the optimum moisture content.

S2: Cohesive soils have generally low values of optimum moisture content (OMC).

Ans

✗ A. Both S1 and S2 are true

✗ B. Both S1 and S2 are false

✓ C. S1 is true and S2 is false

✗ D. S1 is false and S2 is true

Question ID : **75322922384**

Q.10 Which of the following statements pertaining to the shearing characteristics of sand is/are correct?

S1: The effective angle of shearing resistance of sand is nearly the same for dry and saturated sands, in drained condition.

S2: A sand with its void ratio higher than its critical void ratio, increases in volume when sheared.

Ans

✗ A. Both S1 and S2

✓ B. S1 only

✗ C. Neither S1 nor S2

✗ D. S2 only

Question ID : **75322922389**

Q.11 Determine the shear strength (in kN/m^2 units) in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is 200 kN/m^2 and the pore water pressure is 80 kN/m^2. The effective stress shear strength parameters for the soil are $c' = 20\ kN/m^2$ and $\phi' = 30^0$. [Take $\sqrt{3} = 1.7$ in computations]

Ans

✗ A. 135.5

✓ B. 88

✗ C. 66.2

✗ D. 80

Question ID : **75322922388**

Q.12 When movement of a wall under the earth pressure from a backfill of sandy soil was prevented, the co-efficient of earth pressure was recorded as 0.5. The ratio of co-efficient of active and passive earth pressure of the backfill is:

Ans

✗ A. $\frac{1}{3}$

✗ B. 9

✓ C. $\frac{1}{9}$

✗ D. 3

Question ID : **75322922396**

Q.13 An excavation was made in a saturated soft clay ($\varphi = 0$), with its sides more or less vertical. When the depth of excavation reached 6 m, the sides caved in. What is the approximate value of cohesion of the clay soil? Take unit weight of clay as 20 kN/m^3.

Ans

✗ A. 10 kN/m^2

✗ B. 13.33 kN/m^2

✓ C. 30 kN/m^2

✗ D. 60 kN/m^2

Question ID : **75322922395**

Q.14 If an angular distortion of $\frac{1}{300}$ is allowed in between columns 7.5 m apart, what is the corresponding value of differential settlement?

Ans

✗ A. 2.5 mm

✓ B. 25 mm

✗ C. 12.5 mm

✗ D. 40 mm

Question ID : **75322922393**

Q.15 A soil sample is subjected to laboratory sieve analysis using a complete set of standard IS sieves. Out of 2 kg of soil used in the test, 800 grams was retained on IS 600 micron sieve, 1000 grams was retained on IS 500 micron sieve, and the remaining 200 grams was retained on IS 425 micron sieve. The uniformity co-efficient for the soil is:

Ans

✗ A. 1.412

✗ B. 0.71

✗ C. 0.833

✓ D. 1.2

Question ID : **75322922382**

Q.16 Which of the following assumptions of Coulomb's theory of Earth pressure is INCORRECT?

Ans

✗ A. The backfill of the wall can be inclined to the vertical.

✗ B. The backfill surface is planar and can be inclined.

✓ C. The failure surface is a plane surface which passes through the toe of the wall.

✗ D. The backfill is dry, cohesionless, homogeneous, isotropic soil.

Question ID : **75322922394**

Q.17 Following Rankine's theory of earth pressure, when a soil mass in a backfill is in active Rankine state, the inclination of the failure planes to the horizontal (which is the direction of major principal plane) is:
(Notation ϕ – angle of internal friction)

Ans

✗ A. $90 - \frac{\phi}{2}$

✗ B. $45 + \frac{\phi}{4}$

✗ C. $45 + \frac{\phi}{2}$

✓ D. $45 - \frac{\phi}{2}$

Question ID : **75322922397**

Q.18 Which of the following statements is/are correct?

S1: The compression index of soil decreases with increase in liquid limit.
S2: With the increase in permeability for a soil, time for settlement decreases.
S3: Co-efficient of volume compressibility is directly related to the co-efficient of consolidation.

Ans

✗ A. S1 only

✓ B. S2 only

✗ C. S2 and S3 only

✗ D. S1 and S3 only

Question ID : **75322922385**

Q.19 Following IS 800 : 2007, the design strength of members under axial tension (T_{dg}) due to yielding of gross section is given by:

(Notations: f_y - yield stress of material; A_g - gross area of cross-section ; γ_{m0} - partial safety factor for failure in tension by yielding; f_u - ultimate stress of the material; γ_{m1} - partial safety factor for failure at ultimate stress)

Ans

✗ A. $T_{dg} = \frac{A_g f_u}{Y_{mo}}$

✗ B. $T_{dg} = \frac{A_g f_u}{Y_{m1}}$

✗ C. $T_{dg} = \frac{A_g f_y}{Y_{m1}}$

✓ D. $T_{dg} = \frac{A_g f_y}{Y_{mo}}$

Question ID : **75322922379**

Q.20 Which of the following statements pertaining to the negative skin friction effect on piles is INCORRECT?

Ans

✗ A.
Negative skin friction has an effect of reducing the allowable load on the pile.

✗ B.
Negative skin friction can occur when the pile is driven in a fill material of loose sand deposit.

✓ C.
The upward drag on the pile surface when the soil moves down relative to the pile is known as negative skin friction.

✗ D.
The downward drag on the pile surface when the soil moves down relative to the pile is known as negative skin friction.

Question ID : **75322922391**

Section : **Discipline5**

Q.1 Which of the following statements pertaining to transpiration of plants is/are true or false?

S1: The rate of transpiration is independent of the growth periods of the plant.
S2: For a given plant, all those factors that affect the free water evaporation also affect transpiration.

Ans
✗ A. Both S1 and S2 are false
✓ B. S1 is false and S2 is true
✗ C. Both S1 and S2 are true
✗ D. S1 is true and S2 is false

Question ID : **75322922414**

Q.2 A rectangular open channel, carries a discharge of 8 m^3/s per metre width. The critical depth of flow is 1.87 m and the normal depth of flow is 1.47 m. When the flow depth changes from 1 m to 0.9 m in the flow, the type of gradually varied flow profile is: (M and S indicate mild and steep slope, respectively)

Ans
✗ A. M2
✓ B. S3
✗ C. M3
✗ D. S1

Question ID : **75322922409**

Q.3 Two statements pertaining to boundary layer formation in a flow are given. S1 is an assertion and S2 is a reason.

S1: The flow in a boundary layer is always laminar.
S2: In turbulent flow on a smooth boundary, a laminar sub layer still exists within the boundary layer.

Check the validity of S1 and S2 as true or false.

Ans
✗ A. Both S1 and S2 are true, but S2 is not the correct explanation of S1
✓ B. S1 is false and S2 is true
✗ C. Both S1 and S2 are true and S2 is the correct explanation of S1
✗ D. S1 is true and S2 is false

Question ID : **75322922408**

Q.4 The continuity equation for a three dimensional steady compressible flow is stated as: (Notations: ρ is the mass density of fluid; u, v, w are the velocity components in the X, Y, Z directions, respectively)

Ans
✓ A. $\frac{\partial(\rho u)}{\partial x}+\frac{\partial(\rho v)}{\partial y}+\frac{\partial(\rho w)}{\partial z}=0$
✗ B. $\frac{\partial^2(\rho u)}{\partial x^2}+\frac{\partial^2(\rho v)}{\partial y^2}+\frac{\partial^2(\rho)}{\partial z^2}=0$
✗ C. $\frac{\partial(\rho u)}{\partial x}+\frac{\partial(\rho v)}{\partial y}+\frac{\partial(\rho)}{\partial z}=0$
✗ D. $\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=0$

Question ID : **75322922403**

Q.5 In an open channel flow, among the following gradually varied flow surface profiles, identify the drawdown curve profile. (*M, S, C, H* indicate mild, steep, critical, horizontal slopes, respectively)

Ans

✗ A. C_1

✓ B. H_2

✗ C. S_3

✗ D. M_1

Question ID : **75322922406**

Q.6 For a vertical concentrated load acting on the surface of a semi-infinite elastic mass, the vertical normal stress at a depth *z* is proportional to:

Ans

✓ A. $\frac{1}{z^2}$

✗ B. $\frac{1}{z}$

✗ C. Z^2

✗ D. z

Question ID : **75322922400**

Q.7 Due to a storm of specified magnitude and duration, direct runoff occurs from a basin. The components direct runoff due to the storm is:

Ans

✗ A. surface runoff and infiltration

✗ B. rainfall and evaporation

✓ C. surface runoff, prompt interflow and channel precipitation

✗ D. surface runoff, delayed interflow and base flow

Question ID : **75322922417**

Q.8 Field plot method was used for the measurement of evapotranspiration ET, for a given vegetation type. If P - depth of precipitation, I - irrigation input, R - run-off from field, ΔS - increase in soil moisture storage, in a time interval, then Evapotranspiration ET during the time is given by: (Note: Values of P, I, R, ΔS, ET are in depth units)

Ans

✓ A. $E = P + I - R - \Delta S$

✗ B. $E = P + I + R - \Delta S$

✗ C. $ET = P - I - R + \Delta S$

✗ D. $ET = I - P + R - \Delta S$

Question ID : **75322922413**

Q.9 The sequent depth ratio of a hydraulic jump formed in a rectangular open channel is 4. The Froude number at the beginning of jump is:

Ans
✗ A. $\sqrt{6}$

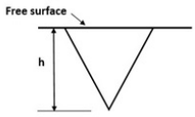
✓ B. $\sqrt{10}$

✗ C. $\sqrt{12}$

✗ D. $\sqrt{8}$

Question ID : **75322922407**

Q.10 Determine the distance to the centre of pressure below the free surface, for a vertical triangular plane area of height h submerged in water as in the given figure, with one side on the free surface, vertex downward.



Ans
✗ A. $\frac{2h}{3}$

✗ B. $\frac{3h}{4}$

✗ C. $\frac{h}{3}$

✓ D. $\frac{h}{2}$

Question ID : **75322922402**

Q.11 A lake is having an average water spread area of 2 km^2 . If the evaporation measured by a Class A evaporation pan is 4 mm/day, the volume of water lost by evaporation from the lake in a month of 30 days is (in m^3 units): (Assume no rainfall during the month. Take pan co-efficient as 0.7)

Ans
✗ A. 240000

✗ B. 343000

✓ C. 168000

✗ D. 16800

Question ID : **75322922412**

Q.12 Which of the following statements pertaining to hydraulic grade line or the energy line in a flow are INCORRECT?

Ans
✗ A.
Whenever the hydraulic grade line falls below the centre line of a conduit carrying a liquid, the local pressures are less than the reference atmospheric pressure.

✗ B.
For a real fluid, the energy line can never be horizontal or sloping upward in the in the direction of flow.

✗ C.
The energy line in a flow of an ideal fluid with no addition of energy will always be horizontal.

✓ D.
Hydraulic grade line in a flow of real fluid with addition of energy will have an upward slope in the direction of flow.

Question ID : **75322922410**

Q.13 The length of a gradually varied flow profile (Δx) between two sections having depth of flow d_1 and d_2 can be estimated by the direct step method using the relation: [Notations: E_1, E_2 - specific energy at two sections; S_0 - bed slope of channel; $\overline{S_e}$ - average friction slope for the reach]

Ans

✗ A. $\Delta x = \frac{(E_2 - E_1)}{2(S_0 - \overline{S_e})}$

✗ B. $\Delta x = \frac{(E_2 - E_1)}{(S_0 + \overline{S_e})}$

✗ C. $\Delta x = \frac{0.5(E_2 + E_1)}{(S_0 - \overline{S_e})}$

✓ D. $\Delta x = \frac{(E_2 - E_1)}{(S_0 - \overline{S_e})}$

Question ID : **75322922405**

Q.14 Which of the following statements pertaining to hydrologic channel routing of floods is/are INCORRECT?

S1: Prism storage would exist if uniform flow occurred at the downstream depth.
S2: Prism storage during the passage of a flood wave is a function of inflow only.
S3: The wedge storage in a river during the passage of a flood wave is positive during rising phase.

Ans

✗ A. S1 only

✓ B. S2 only

✗ C. S3 only

✗ D. S1 and S3 only

Question ID : **75322922415**

Q.15 The observed N value from a standard penetration test conducted on a saturated sandy soil stratum is 35. The corrected N value for dilatancy can be estimated as:

Ans

✓ A. 25

✗ B. 15

✗ C. 20

✗ D. 45

Question ID : **75322922398**

Q.16 Determine the submerged depth of a cube of steel 0.6 m on each side floating in mercury. Take specific gravity mercury and steel as G_m and G_s, respectively.

Ans

✗ A. $0.4\left(\frac{G_m}{G_s}\right)$

✗ B. $0.6\left(\frac{G_m}{G_s}\right)$

✗ C. $0.4\left(\frac{G_s}{G_m}\right)$

✓ D. $0.6\left(\frac{G_s}{G_m}\right)$

Question ID : **75322922401**

Q.17 A tube well in a confined aquifer is being pumped out, at a constant rate for a specified duration. Choose the correct answer pertaining to the drawdown due pumping.

Ans

✔ A. Maximum drawdown occurs in the pumping well.

✘ B. Draw down is zero in the pumping well

✘ C. Maximum drawdown occurs at the radius of influence of pumping well.

✘ D. Maximum drawdown occurs at 0.5 times the radius of influence of pumping well.

Question ID : **75322922416**

Q.18 Match the items in List 1 (names of field exploration) with those in List 2 (soil properties).

List 1

P. Cyclic pile load test
Q. Plate load test
R. Pressure meter test
S. Standard penetration test

List 2

1. Modulus of subgrade reaction
2. Relative density and strength
3. Skin friction and point bearing resistance
4. Elastic constants

Ans

✘ A. P-3, Q-2, R-1, S-4

✔ B. P-3, Q-1, R-4, S-2

✘ C. P-1, Q-3, R-4, S-2

✘ D. P-2, Q-4, R-3, S-1

Question ID : **75322922399**

Q.19 Water flows through a 0.2 m diameter pipe with a velocity of flow of 1 m/s. If the diameter of the pipe reduces to 0.1 m at another section of the pipe, what is the velocity of flow at the reduced section?

Ans

✔ A. 4 m/s

✘ B. 2 m/s

✘ C. 1 m/s

✘ D. 8 m/s

Question ID : **75322922411**

Q.20 If $\frac{\partial p}{\partial x}$ is the pressure gradient and $\frac{\partial v}{\partial y}$ the velocity gradient in a fluid flow, when the separation of boundary layer occurs, the conditions are:

Ans

✔ A. $\frac{\partial p}{\partial x} > 0; \left(\frac{\partial v}{\partial y}\right)_{y=0} < 0$

✘ B. $\frac{\partial p}{\partial x} > 0; \left(\frac{\partial v}{\partial y}\right)_{y=0} > 0$

✘ C. $\frac{\partial p}{\partial x} < 0; \left(\frac{\partial v}{\partial y}\right)_{y=0} > 0$

✘ D. $\frac{\partial p}{\partial x} < 0; \left(\frac{\partial v}{\partial y}\right)_{y=0} < 0$

Question ID : **75322922404**

Section : **Discipline6**

Q.1 Match the items under List 1 (terminologies in irrigation) with those under List 2 (definition of terminologies).

List 1

P. Base period

Q. Intensity of irrigation

R. Capacity factor

S. Time factor

List 2

1. Ratio of mean supply discharge to full supply discharge of a canal.
2. Ratio of the number of days the canal has supplied water to the number of days of the irrigation period.
3. Time between the first and last watering of irrigation water for a crop.
4. Percentage of culturable command area proposed for irrigation in a crop season.

Ans

✔ A. P-3, Q-4, R-1, S-2

✘ B. P-4, Q-3, R-2, S-1

✘ C. P-4, Q-1, R-2, S-3

✘ D. P-3, Q-4, R-2, S-1

Question ID : **75322922434**

Q.2 The total rainfall in a catchment area of 500 km^2 during a 6hour storm is 16 cm. The φ-index for the storm is 1 cm/hour, and initial loss as 0.5 cm. Determine the volume of surface runoff generated for the storm (in m^3 units).

Ans

✘ A. 47.5

✘ B. 80

✔ C. 50

✘ D. 75

Question ID : **75322922422**

Q.3 In an irrigated area, 12 m^3/s of water is diverted to a 0.32 km^2 field area for 4 hours. The soil moisture measurement in the field done after irrigation showed that 0.4 m of water has been stored in the root zone. The water application efficiency in this case is:

Ans
- ✗ A. 66.6%
- ✗ B. 58.5%
- ✗ C. 85%
- ✓ D. 74%

Question ID : **75322922433**

Q.4 The base width of an elementary profile of a gravity dam of height H is B. If G is the specific gravity of the material and C co-efficient of uplift, the relationship for no tension development at the heal of dam is:

Ans
- ✗ A. $B = H\sqrt{G - C}$
- ✗ B. $B = \frac{H}{(G - C)}$
- ✓ C. $B = \frac{H}{\sqrt{G - C}}$
- ✗ D. $B = \frac{H}{C\sqrt{G - C}}$

Question ID : **75322922437**

Q.5 Identify the crop which does NOT belong to Kharif or Rabi crops.

Ans
- ✗ A. Potato
- ✓ B. Coffee
- ✗ C. Jowar
- ✗ D. Rice

Question ID : **75322922425**

Q.6 Find the delta for a crop if the duty for a base period of 100 days is 1728 hectares/cumec.

Ans
- ✓ A. 50 cm
- ✗ B. 149.3 cm
- ✗ C. 44.2 cm
- ✗ D. 55.8 cm

Question ID : **75322922427**

Q.7 The 6 hour unit hydrograph of a catchment is triangular in shape with a base width of 60 hours and a peak discharge of value of 30 m^3/s. The catchment area represented by the unit hydrograph is (in km^2 units):

Ans
- ✗ A. 162
- ✗ B. 300
- ✗ C. 628
- ✓ D. 324

Question ID : **75322922419**

Q.8 Which of the following statements pertaining to the lining of canals is/are correct?

S1: The cross-section area of lined canal is less than that for an unlined canal, for the same discharge.
S2: Lining of canals provides a rough surface, and thereby increases the rugosity co-efficient.
S3: Lined canals have greater evaporation loss than unlined canals.
S4: Lined canals have flatter hydraulic gradient than unlined canals, for carrying the same discharge.

Ans

✗ A. S3 only

✗ B. S2 and S3 only

✗ C. S1 only

✓ D. S1 and S4 only

Question ID : **75322922428**

Q.9 The classification of coastal structures done by stability number N_s (proposed by Van der Meer) is defined as:
(Notations: H - wave height; Δ - relative mean density; D - characteristic dimension of armour unit)

Ans

✗ A. $N_s = \frac{H^2}{\Delta.D}$

✗ B. $N_s = \frac{H^2}{2\Delta.D}$

✓ C. $N_s = \frac{H}{\Delta.D}$

✗ D. $N_s = \frac{H}{\Delta.D^2}$

Question ID : **75322922435**

Q.10 If the net irrigation requirement of an irrigated field is NIR, the gross irrigation requirement GIR at the diversion structure of canal is: (Take η_a – field application efficiency; η_c – conveyance efficiency of canal system)

Ans

✗ A. $GIR = NIR . \eta_a . \eta_c$

✗ B. $GIR = \frac{\eta_c . NIR}{\eta_a}$

✓ C. $GIR = \frac{NIR}{\eta_a . \eta_c}$

✗ D. $GIR = \frac{\eta_a . NIR}{\eta_c}$

Question ID : **75322922424**

Q.11 The details pertaining to a distributary canal for the irrigation interval are as follows: Consumptive use of a crop = 8 cm; irrigation interval = 12 days; effective rainfall = 2 cm; water application efficiency = 75%; conveyance efficiency of canal = 50%. Determine the gross irrigation requirement of the distributary. Ignore the water loss due to deep percolation.

Ans

✗ A. 8 cm

✗ B. 21.33 cm

✗ C. 12 cm

✓ D. 16 cm

Question ID : **75322922432**

Q.12 The variation in duty of water from the head of a distributary canal (D) to that in the field (F) is:

Ans

✗ A. duty of water at D is always greater than duty of water at F

✗ B. duty of water at D is always equal to duty of water at F

✓ C. duty of water at D is always less than duty of water at F

✗ D. duty of water at D can be greater or less than duty of water at F

Question ID : **75322922426**

Q.13 Match the items in List 1 (types of flows) with those under List 2 (typical flow situations in field).

List 1

P. Unsteady flow

Q. Rapidly varied flow

R. Spatially varied flow

S. Uniform flow

List 2

1. Hydraulic jump formed in stilling basin of spillways.
2. Flow in the main canal of an irrigation scheme laid at a constant slope.
3. Sudden closure of sluice gate of a penstock to a power house.
4. Spreading of irrigation water in a field by flooding method.

Ans

✗ A. P-3, Q-4, R-1, S-2

✗ B. P-4, Q-3, R-2, S-1

✓ C. P-3, Q-1, R-4, S-2

✗ D. P-3, Q-1, R-2, S-4

Question ID : **75322922436**

Q.14 If f - actual rate of infiltration in soil, i - intensity of rainfall, f_p - infiltration capacity of soil, identify the correct relationship among them.

Ans

✗ A. $f = f_p$ when $i < f_p$; $f = i$ when $i \geq f_p$

✗ B. $f = i$ when $i \geq f_p$ and $i < f_p$

✗ C. $f = i - f_p$ when $i \geq f_p$; $f = f_p - i$ when $i < f_p$

✓ D. $f = f_p$ when $i \geq f_p$; $f = i$ when $i < f_p$

Question ID : **75322922423**

Q.15 Among the different layout patterns used in a composite pipe drainage system for sub surface drainage, identify the INCORRECT one.

Ans

✗ A. Random system

✗ B. Herringbone system

✗ C. Parallel grid system

✓ D. Side slope system

Question ID : **75322922431**

Q.16 In the case of a diversion weir constructed in a river, having a horizontal impervious floor of length b with a cutoff of depth d at the downstream end of floor, the permissible value of exit gradient G_E, following Khosla's theory is given by:

(take H – height of water stored on the upstream of weir; $\lambda = \frac{1}{2}\left[1 + \sqrt{1 + \left(\frac{b}{d}\right)^2}\right]$)

Ans

✗ A. $G_E = \left(\frac{H}{d}\right)\left(\frac{1}{\pi\lambda}\right)$

✓ B. $G_E = \left(\frac{H}{d}\right)\left(\frac{1}{\pi\sqrt{\lambda}}\right)$

✗ C. $G_E = \left(\frac{H}{d}\right)\left(\frac{\pi}{\sqrt{\lambda}}\right)$

✗ D. $G_E = \left(\frac{d}{H}\right)\left(\frac{1}{\pi\sqrt{\lambda}}\right)$

Question ID : **75322922429**

Q.17 The method of superposition used to derive direct runoff hydrograph from a unit hydrograph, for a catchment is based on the assumption of:

Ans

✗ A. time invariance

✗ B. spatial invariance

✗ C. non-linear response

✓ D. linear response

Question ID : **75322922420**

Q.18 It is proposed to design a weir across a river in alluvial soil. The piezometric head at the bottom of the floor is computed as 10 m. The datum is 3 m below the floor bottom. The assured standing water depth above the floor is 2 m. The specific gravity of floor material is 2.5. The required minimum thickness of the floor is:

Ans
- ✗ A. 1.5 m
- ✗ B. 3.3 m
- ✓ C. 2 m
- ✗ D. 4.2 m

Question ID : **75322922430**

Q.19 The recession limb of a hydrograph of a storm occurring from a basin is:

Ans
- ✗ A. dependent on both storm and catchment characteristics
- ✗ B. dependent on storm and climatic characteristics
- ✗ C. dependent on storm characteristics only
- ✓ D. depends on basin characteristics only

Question ID : **75322922418**

Q.20 A 30 cm diameter well penetrates a confined aquafer of thickness 20 m. Under a steady state pumping rate of 1000 litre per minute, the drawdown at the well was found to be 2 m. If drawdown in the well is increased to 3 m, determine the steady state discharge from the well (in litre/minute units). Assume the radius of influence of the well in both cases as 250 m, and identical conditions to exist in both cases.

Ans
- ✗ A. 444.4
- ✗ B. 666.7
- ✓ C. 1500
- ✗ D. 2250

Question ID : **75322922421**

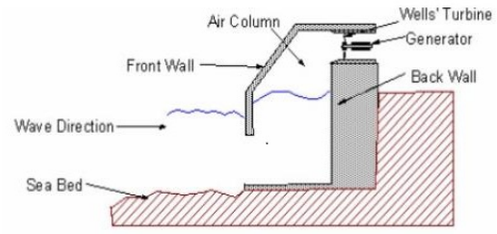
Section : **Discipline7**

Q.1 Determine the quantity of bleaching powder required for a rural water supply scheme so as to chlorinate 20000 litres of water daily, whose chorine demand is 2 mg/l. Assume the bleaching powder has 40% available chlorine.

Ans
- ✗ A. 40 grams
- ✓ B. 100 grams
- ✗ C. 66.67 grams
- ✗ D. 50 grams

Question ID : **75322922448**

Q.2 Identify the method shown in the given figure that is used for converting ocean wave energy into electricity.



Ans

✔ A. Oscillating water column device

✘ B. Float or buoy system

✘ C. Pendular device

✘ D. Tapered channel devices

Question ID : **75322922438**

Q.3 As per IS 10500:2012, the permissible limit of hardness as $CaCO_3$ (in mg/l units) in the absence of alternate source is:

Ans

✘ A. 200

✔ B. 600

✘ C. 500

✘ D. 1000

Question ID : **75322922446**

Q.4 A water sample contains $10^{-8.6}$ ml/L of OH^- ions at 25°C. The pH of this sample is:

Ans

✘ A. 8.6

✘ B. 8.4

✘ C. 5.6

✔ D. 5.4

Question ID : **75322922447**

Q.5 Which of the following statements pertaining to Morison equation used for the computation of wave forces on structures is/are correct?

S1: The total force, in-line with the wave direction can be obtained by addition of drag force and inertia force components.
S2: The total force, in-line with the wave direction can be obtained by difference in the drag force and the inertia force components.
S3: The equation is better suited for small diameter structural members (i.e, diameter less than 0.15 times the wave length).
S4: For low values of Keulegan Carpenter number (KC < 3) the drag force is more significant and for high KC values (KC > 45) inertia force is significant.

Ans
✗ A. S2 only
✗ B. S4 only
✗ C. S2 and S4 only
✓ D. S1 and S3 only

Question ID : **75322922440**

Q.6 Which of the following statements pertaining to activated sludge process (ASP) of waste treatment is INCORRECT?

Ans
✗ A. Lower sludge volume index indicates better settling of sludge.
✗ B. Performance of the ASP in terms of organic matter removal depends on the mean cell residence time of microbial mass in system.
✗ C. Lower F/M values will give higher BOD removal.
✓ D. Higher sludge volume index indicates better settling of sludge.

Question ID : **75322922451**

Q.7 Which of the following statements pertaining to the sewage system design is/are true or false?

S1: The criteria used as the basis for sizing the individual unit operation or process is known as process loading criteria.
S2: Secondary Treatment refers to chemical and biological unit processes.

Ans
✗ A. S1 is false and S2 is true.
✗ B. S1 is true and S2 is false
✗ C. Both S1 and S2 are false
✓ D. Both S1 and S2 are true

Question ID : **75322922454**

Q.8 Which of the following processes is adopted to remove odour and tastes due to volatile gases like hydrogen sulphide and algae in a water treatment plant?

Ans
✓ A. Aeration
✗ B. Filtration
✗ C. Sedimentation
✗ D. Disinfection

Question ID : **75322922449**

Q.9 For water purification in a city, it is decided to use raid sand filter after sedimentation tanks, with the following data: Design loading rate per filter = 200 m^3/m^2 day; Design flow rate = 0.5 m^3/s; Surface area per filter = 55 m^2. The number of filter units required in the plant is:

Ans
- ✗ A. 2
- ✗ B. 3
- ✓ C. 4
- ✗ D. 5

Question ID : **75322922453**

Q.10 In a sewage treatment plant with different unit operations, identify the operation which does NOT come under physical unit operations.

Ans
- ✗ A. Filtration
- ✗ B. Flocculation
- ✓ C. Precipitation
- ✗ D. Screening

Question ID : **75322922455**

Q.11 A residential area of a city has a population of 24,000 spread over an area of 0.5 km^2. Determine the design discharge of a sewer line (in m^3/s units) for the area assuming the rate of water supply as 240 litre/day/person. Assume 75% of water supplied reaches the sewer as waste water. Assume a peak factor value of 2 for design.

Ans
- ✗ A. 0.25
- ✓ B. 0.1
- ✗ C. 0.05
- ✗ D. 0.5

Question ID : **75322922456**

Q.12 The technique that is NOT suitable for controlling the emission of gaseous pollutants is:

Ans
- ✗ A. combustion
- ✗ B. condensation
- ✗ C. absorption
- ✓ D. cyclone separators

Question ID : **75322922457**

Q.13 For sewage treatment using an oxidation pond, when it gets overloaded, a chemical that is added to stimulate the algal growth is:

Ans
- ✓ A. sodium nitrate
- ✗ B. calcium hydroxide
- ✗ C. sodium chloride
- ✗ D. bleaching powder

Question ID : **75322922452**

Q.14 The following details pertain to the crossing of a canal and a drain. Bed level of canal = + 57.8 m; Full supply depth of canal = 1.8 m; Bed level of drain = + 59.4 m; High flood level in drain = + 63.5 m. The cross drainage work is to be designed as:

Ans

✔ A. canal syphon

✘ B. level crossing

✘ C. syphon aqueduct

✘ D. aqueduct

Question ID : **75322922444**

Q.15 The power P (expressed per unit crest length of wave) that can be delivered by the deep water waves is given by: (Notations: H – wave height; ρ – density of water; T – wave period; g – acceleration due to gravity)

Ans

✔ A. $P = \frac{\rho g^2 T H^2}{32\pi}$

✘ B. $P = \frac{\rho g T H^2}{64\pi}$

✘ C. $P = \frac{\rho g T H^2}{16\pi}$

✘ D. $P = \frac{\rho g^2 T H^2}{4\pi}$

Question ID : **75322922439**

Q.16 In the design of a cross-regulator, the piezometric head at the bottom of the floor due to storage of water is estimated as 8.5 m. The datum is 2.5 m below the floor bottom. Assume the standing water depth above the floor is 1 m. Estimate the floor thickness. Take unit weight of water as 10000 N/m^3, and specific gravity of material of floor as 2.5.

Ans

✔ A. 2.0 m

✘ B. 1.2 m

✘ C. 2.4 m

✘ D. 3.4 m

Question ID : **75322922442**

Q.17 In connection with the formation of hydraulic jump on the bottom of ogee spillways, match the items under List 1 [details of Jump Height curve (JHC) and Tail Water Curve (TWC)] with those under List 2 (hydraulic jump formation).

List 1

P. JHC coincides with TWC

Q. JHC lies lower TWC

R. JHC lies above TWC

S. JHC lies lower than TWC at low discharges and JHC lies higher than TWC at high discharges

List 2

1. Submerged jump and no visible standing wave seen.
2. For low discharges, jump is drowned and for higher discharges insufficient tail water depth.
3. Formation of hydraulic jump is perfect for all discharges, with jump formed at toe of spillway.
4. Available tail water depth is less than the depth required for formation of jump.

Ans

✗ A. P-2, Q-1, R-4, S-3

✓ B. P-3, Q-1, R-4, S-2

✗ C. P-3, Q-4, R-2, S-1

✗ D. P-3, Q-4, R-1, S-2

Question ID : **75322922441**

Q.18 The discharge Q over an ogee weir with due consideration for velocity of approach is given by: (Take L - length of weir; H - head over the crest; h_a - head due to velocity of approach, C - co-efficient of discharge)

Ans

✗ A. $Q = C\ L\ (H - h_a)^{3/2}$

✓ B. $Q = C\ L\ (H + h_a)^{3/2}$

✗ C. $Q = C\ L\ (H + h_a)^{5/2}$

✗ D. $Q = C\ L\ (H - h_a)^{1/2}$

Question ID : **75322922445**

Q.19 A water treatment plant has a flow rate of 0.6 m^3/s. The settling basin at the plant has effective settling volume dimensions of length 20 m, depth 3 m, and width 6 m. What percentage of the particles having a settling velocity of 0.004 m/sec is removed?

Ans

✗ A. 75

✗ B. 100

✓ C. 80

✗ D. 92

Question ID : **75322922450**

Q.20 For pipe network analysis, which of the following conditions is INCORRECT?

Ans
✔ A. The piezometric head loss in each line of the circuit is the same.

✘ B. The algebraic sum of pressure drops around each circuit should be equal to zero.

✘ C. At each junction, the continuity condition for a flow should be maintained.

✘ D. The Darcy Weisbach equation should be satisfied for each pipe length.

Question ID : **75322922443**

Section : **Discipline8**

Q.1 Sound propagation from one point to another point is governed by:

Ans
✔ A. wave equation

✘ B. Sabine's formula

✘ C. Bernoulli's equation

✘ D. Pascal's law

Question ID : **75322922466**

Q.2 Which process in Environmental Impact Assessment (EIA) involves taking necessary measures to reduce or remove adverse environmental impacts?

Ans
✔ A. Mitigation

✘ B. Monitoring

✘ C. Scooping

✘ D. Alternatives

Question ID : **75322922476**

Q.3 Zero Liquid Discharge (ZLD) policy as a mandate for gross polluting industries stipulates for:

Ans
✔ A. ensuring treatment and complete recycling of industrial effluents

✘ B. shift to production of products which do not require water

✘ C. only land disposal of waste water and no discharge to surface water bodies

✘ D. treatment of water and injecting into underground aquifers

Question ID : **75322922473**

Q.4 A machine in a room produces a sound pressure level of 100 dB. If one more machine with sound pressure level of 100 dB is installed in the same room, what is the resulting sound pressure level in the room? [Take $\log_{10} 2 = 0.3$; $\log_e 2 = 0.7$; $\log_{10} 3 = 0.5$; $\log_e 3 = 1.1$]

Ans

✗ A. 111 dB

✗ B. 107 dB

✓ C. 103 dB

✗ D. 100 dB

Question ID : **75322922469**

Q.5 Given 4 hours of 90 dBA exposure, 2 hours of 95 dBA exposure, and 2 hours of 85 dBA exposure, estimate the percentage noise dose following HCA (hearing conservation amendment). The permissible exposure limit (PEL) as per OSHA noise HCA for 85 dBA, 90 dBA and 95 dBA are 16, 8 and 4 hours, respectively.

Ans

✗ A. 75%

✓ B. 112.5%

✗ C. 150%

✗ D. 100%

Question ID : **75322922467**

Q.6 The concentration of sulphur dioxide in ambient atmosphere was measured as 32 $\mu g/m^3$.

Express the above sulphur dioxide concentration (in ppm units) under the same conditions. Given $\frac{P}{RT} = 50$ mole/m^3, where P - pressure, T - temperature, R - universal gas constant. Take molecular weight of sulphur dioxide as 64.

Ans

✗ A. 0.1

✓ B. 0.01

✗ C. 0.5

✗ D. 0.05

Question ID : **75322922463**

Q.7 If sound pressure is 0.02 Pa, what is the sound pressure level?
(Take threshold sound pressure for human hearing as 20 micropascal)

Ans

✗ A. 40 dB

✗ B. 80 dB

✗ C. 30 dB

✓ D. 60 dB

Question ID : **75322922470**

Q.8 The permissible limit on time weighted average of the level of sound in decibels on scale A which is relatable to human hearing for a silence zone during day time is:

Ans

✔ A. 50 dB

✘ B. 55 dB

✘ C. 65 dB

✘ D. 70 dB

Question ID : **75322922468**

Q.9 Identify the secondary pollutants from the list of pollutants given below:
Carbon monoxide, Ozone, Oxides of nitrogen, Peroxy acetyl nitrate, Particulate matter, Photochemical smog, Halogens, Sulphur dioxide

Ans

✘ A. Carbon monoxide and Particulate matter

✘ B. Oxides of nitrogen, Particulate matter, Halogens

✘ C. Particulate matter, Halogens, Sulphur dioxide

✔ D. Ozone, Peroxy acetyl nitrate, Photochemical smog

Question ID : **75322922460**

Q.10 Which of the following statements pertaining to noise measurement is/are true or false?

S1: Acoustic energy is inversely proportional to sound pressure.
S2: Decibel scale is a log based scale to quantify sound in the range 0 to 140 dB.

Ans

✘ A. Both S1 and S2 are false

✘ B. S1 is true and S2 is false

✘ C. Both S1 and S2 are true

✔ D. S1 is false and S2 is true

Question ID : **75322922471**

Q.11 A clean filter is found to weigh 10 g. After 24 h in a hi-vol sampler, the filter plus dust weighs 10.1008 g. The air flow at the start and end of the test was 1.8 m^3/minute and 1 m^3/minute, respectively. What is the concentration of particulate matter?

Ans

✘ A. 75 $\mu g/m^3$

✘ B. 40 $\mu g/m^3$

✘ C. 100 $\mu g/m^3$

✔ D. 50 $\mu g/m^3$

Question ID : **75322922464**

Q.12 Identify the method of measurement that is NOT recommended in the National Ambient Air Quality Standards, published by the Central Pollution Control Board (CPCB) in 2009, for the estimation of particulate matter (PM_{10} or $PM_{2.5}$) in the air.

Ans

✗ A. Beta attenuation method

✗ B. Gravimetric method

✗ C. Tapered element oscillating microbalance (TOEM) method

✓ D. UV photometric method

Question ID : **75322922461**

Q.13 According to the National Ambient Air Quality Standards, published by the Central Pollution Control Board (CPCB) in 2009, the permissible annual time weighted average values of sulphur dioxide pollutant for industrial, residential and rural areas (in $\mu g/m^3$ units) is:

Ans

✗ A. 40

✗ B. 80

✗ C. 100

✓ D. 50

Question ID : **75322922458**

Q.14 Which of the following options is NOT an ozone layer depleting chemical?

Ans

✗ A. Methyl chloride

✗ B. Hydrochloric acid

✗ C. Carbon tetrachloride

✓ D. Copper sulphate

Question ID : **75322922477**

Q.15 Which of the following statements pertaining to aspects of Environmental Impact assessment (EIA) study is/are true or false?

S1: In an environmental assessment study, interpretation and evaluation measures shall not consider the uncertainty of possible impacts.

S2: A good EIA report and review include assessment, mitigation measures and related plans.

Ans

✗ A. S1 is true and S2 is false

✓ B. S1 is false and S2 is true

✗ C. Both S1 and S2 are true

✗ D. Both S1 and S2 are false

Question ID : **75322922474**

Q.16 Among the different of projects listed as options, identify the project which does NOT require an Environmental Impact Assessment (EIA) report in India, as per guidelines?

Ans

✗ A. River training project

✗ B. Oil extraction project

✓ C. Projects related to national security

✗ D. Bullet train project

Question ID : **75322922475**

Q.17 Which of the following is NOT an assumption of point source Gaussian plume model in air pollution?

Ans

✗ A. Dispersive transport follows Gaussian distribution away from trajectory

✗ B. Advective transport by wind

✗ C. Constant emission rate

✓ D. Pollutant is non-conservative

Question ID : **75322922472**

Q.18 Among the following urban noises, which does NOT come under community noise?

Ans

✗ A. Noise from political/social gatherings

✓ B. Noise from rail and aircraft

✗ C. Noise from barking of street dogs

✗ D. Loud speaker noise

Question ID : **75322922465**

Q.19 The Mitre Air Quality Index (MAQI) is expressed mathematically as: [Notations: *Is* is an index of pollution for sulphur dioxide, *Ic* is an index of pollution for carbon monoxide, *Ip* is an index of pollution for total suspended particulates, *In* is an index of pollution for nitrogen dioxide, and *Io* is an index of pollution for photochemical oxidants]

Ans

✗ A. $MAQI = [I_s^{0.5} + I_s^{0.5} + I_p^{0.5} + I_n^{0.5} + I_o^{0.5}]^2$

✗ B. $MAQI = [(I_s + I_c + I_p + I_n + I_o)/5]^2$

✓ C. $MAQI = [I_s^2 + I_c^2 + I_p^2 + I_n^2 + I_o^2]^{0.5}$

✗ D. $MAQI = [I_s^2 + I_c^2 + I_p^2 + I_n^2 + I_o^2]^2$

Question ID : **75322922462**

Q.20 Among the various air pollutants, identify the one which is responsible for the formation of acid rain?

Ans

✗ A. Carbon monoxide

✓ B. Sulphur dioxide

✗ C. Peroxy ethanoyl nitrate

✗ D. Ozone

Question ID : **75322922459**

Section : **Discipline9**

Q.1 The major composition of gases emitted from a landfill are:

Ans

✗ A. hydrogen sulphide and carbon dioxide

✓ B. methane and carbon dioxide

✗ C. ethane and carbon monoxide

✗ D. sulphur dioxide and carbon monoxide

Question ID : **75322922484**

Q.2 The liquid waste that drains out from a landfill is known as:

Ans

✗ A. sullage

✗ B. waste water

✓ C. leachate

✗ D. sewage water

Question ID : **75322922487**

Q.3 In an air pollution management strategy using collection devices to control pollutants, if x_1 is the mass flow of pollutant recovered (kg/s), x_2 is the mass flow of pollutant that escapes capture (kg/s), then recovery of pollutant is evaluated as:

Ans

✗ A. $\frac{x_1}{x_2}$

✗ B. $\frac{x_2}{x_1+x_2}$

✓ C. $\frac{x_1}{x_1+x_2}$

✗ D. $\frac{x_2}{x_1}$

Question ID : **75322922479**

Q.4 Rank the following waste management strategies associated with the integrated solid waste management system, starting from most preferred to the least.

A. Waste to energy
B. Recycling
C. Landfills
D. At source reduction and reuse
E. Composting

Ans
✔ A. D-B-E-A-C
✘ B. B-E-D-A-C
✘ C. D-E-B-C-A
✘ D. E-D-B-A-C

Question ID : **75322922488**

Q.5 When moisture content of sludge is reduced from 96% to 90%, its volume is:

Ans
✘ A. reduced by 50%
✘ B. reduced by 40%
✔ C. reduced by 60%
✘ D. reduced by 10%

Question ID : **75322922489**

Q.6 An engineering survey is proposed in a highway alignment project. The survey includes following stages:

1. Preliminary survey
2. Reconnaissance
3. Map study
4. Final location and detailed survey

The sequential order of the stages in which the engineering survey is carried out is:

Ans
✘ A. 2 - 3 - 1 - 4
✘ B. 2 - 1 - 3 - 4
✘ C. 2 - 4 - 1 - 3
✔ D. 3 - 2 - 1 - 4

Question ID : **75322922493**

Q.7 If the load, warping and frictional stresses on a cement concrete pavement slab are $220 N/mm^2$, $300 N/mm^2$ and $10 N/mm^2$, respectively, the critical combination of stresses during the summer season is:

Ans
✘ A. $300\ N/mm^2$
✔ B. $510\ N/mm^2$
✘ C. $520\ N/mm^2$
✘ D. $530\ N/mm^2$

Question ID : **75322922497**

Q.8 Which of the following is NOT a purpose of providing a transition curve at a horizontal circular curve in a highway?

Ans

✗ A. To enable the driver to turn the steering gradually for comfort and safety.

✓ B. To increase the radius of curvature of the circular curve

✗ C. To introduce gradually the centrifugal force between the tangent point and the beginning of the circular curve.

✗ D. To enable gradual introduction of super elevation and extra widening of pavement at the start of the circular curve

Question ID : **75322922494**

Q.9 The description of a chemical conversion process is given below.

1. The destructive distillation of a solid, carbonaceous, material in the presence of heat and in the absence of stoichiometric oxygen, producing gas containing CH_4, CO, and moisture.
2. It is an exothermic process.

Identify the conversion process.

Ans

✗ A. Hydrolysis

✗ B. Incineration

✗ C. Fluidized bed incineration

✓ D. Pyrolysis

Question ID : **75322922486**

Q.10 Which of the following is NOT a characteristic of waste to be categorised as a hazardous waste?

Ans

✗ A. Toxicity

✗ B. Corrosivity

✓ C. Combustibility

✗ D. Ignitability

Question ID : **75322922483**

Q.11 Among the waste materials given in the options, identify the solid waste which are NOT categorised as 'Rubbish'.

Ans

✗ A. Plastics

✗ B. Non-combustible metals

✗ C. Paper and cardboards

✓ D. Residues from burning of wood charcoal

Question ID : **75322922482**

Q.12 Which of the following statements pertaining to aerobic composting of municipal solid waste is/are true or false?

S1: Aerobic composting makes use of aerobic microorganisms, with major end products of carbon dioxide, ammonia, nitrates etc.

S2: It is an endothermic reaction.

Ans

✗ A. Both S1 and S2 are true

✗ B. Both S1 and S2 are false

✓ C. S1 is true and S2 is false

✗ D. S1 is false and S2 is true

Question ID : **75322922492**

Q.13 Identify the air pollution management strategy which CANNOT be considered as sustainable from the given options.

Ans

✗ A. Installing smog towers in highly polluted areas

✗ B. National green highway mission

✓ C. Installing more thermal power plants using coal

✗ D. Promoting the use of electric vehicles

Question ID : **75322922480**

Q.14 The most acceptable economical option for solid waste management is:

Ans

✓ A. composting

✗ B. incineration

✗ C. physico-chemical treatment

✗ D. pyrolysis

Question ID : **75322922491**

Q.15 In a highway road, for a constant value of co-efficient of lateral friction, the value of required super elevation:

Ans

✗ A.
decreases with increase in speed and decrease in radius of the curve

✗ B.
increases with decrease in both speed and radius of the curve

✗ C.
increases with increase in both speed and radius of the curve

✓ D.
increases with increase in speed and decrease in radius of the curve

Question ID : **75322922495**

Q.16 The best procedure for the disposal of batteries containing heavy metals is:

Ans
✔ A. Recycle
✘ B. Open dumping
✘ C. Burning
✘ D. Disposal in landfill

Question ID : **75322922481**

Q.17 The C/N values of municipal solid waste is found to be 24. Identify the material to be added to increase the C/N value of waste in the composting process.

Ans
✘ A. Blood
✘ B. Slaughter house waste
✔ C. Saw dust
✘ D. Sewage sludge

Question ID : **75322922485**

Q.18 Among the different methodologies used for Environmental Impact Assessment (EIA), identify the methodology that is INCORRECT or NOT used.

Ans
✔ A. Group index method
✘ B. Matrix method
✘ C. Ad hoc method
✘ D. Network method

Question ID : **75322922478**

Q.19 A hill road is designed with a ruling gradient of 6%. If a sharp horizontal curve of radius 50 m is encountered, determine the compensated gradient at the curve as per IRC specification.

Ans
✘ A. 4.1
✘ B. 4.4
✔ C. 4.5
✘ D. 5.1

Question ID : **75322922496**

Q.20 The following five sites (A, B, C, D, E) are identified for setting up of a landfill. Some typical features of the sites are as follows:

A. Site 1: Wet land for the last 100 years.
B. Site 2: 100 m away from a river, but within the flood plain of the river.
C. Site 3: Difference between the ground water table and the bottom of liner is 1 m.
D. Site 4: Earthquake zone, 600 m away from fault line fracture.
E. Site 5: Habitation area located at a distance of 800 m.

Identify the sites that are suitable for it.

Ans
✔ A. D and E only
✘ B. A, C and E only
✘ C. A and B only
✘ D. B and C only

Question ID : **75322922490**

Section : **Discipline10**

Q.1 Two straight lines intersect at an angle of 60°. The radius of the circular curve joining the two straight lines is 550 m. Determine the length of the long chord of the curve.

Ans
✔ A. 550 m
✘ B. 275 m
✘ C. 952.6 m
✘ D. 412.5 m

Question ID : **75322922510**

Q.2 At a station O, angle θ was measured with a weight of 3 and angle ϕ was measured with a weight of 4. The weight of the angle (θ + ϕ) is:

Ans
✔ A. 12/7
✘ B. 7/12
✘ C. 7
✘ D. 12

Question ID : **75322922514**

Q.3 The number of observations required in an operation to produce results having a specified accuracy:

Ans
✘ A. varies inversely with the square of the residual error
✔ B. varies inversely with the square of the confidence interval
✘ C. varies directly with the square of the confidence interval
✘ D. varies inversely with the square root of the confidence interval

Question ID : **75322922507**

Q.4 Among the following different roads that exist in a heavy rainfall area, identify the road having minimum value camber.

Ans
✗ A. Thin bituminous surface
✗ B. Water bound macadam
✓ C. Cement concrete
✗ D. Earth road

Question ID : **75322922501**

Q.5 For setting up an open sports ground facility, which is to be square in shape, the sides were measured as 100 m. An error of 0.04 m has occurred in the measurement. Determine the corresponding error in the computed area of the land.

Ans
✗ A. 16 m^2
✓ B. 8 m^2
✗ C. 4 m^2
✗ D. 2 m^2

Question ID : **75322922513**

Q.6 In setting out a simple circular curve by the angular method using a theodolite, the general rule for deflection angle of a chord is:

Ans
✗ A. Deflection angle = Tangential angle
✗ B. Deflection angle = Two times the tangential angle
✓ C.
Deflection angle = Deflection angle of previous chord + Tangential angle of the chord
✗ D. Deflection angle = 1718.9 × Chord length × Radius

Question ID : **75322922516**

Q.7 The observed bearings of a closed traverse ABCDA are given below.
AB: 36° 00'; BA: 216° 45'
BC: 98° 15' ; CB: 276° 00'
CD: 201° 45' ; DC: 23° 15'
DA: 322° 45' ; AD: 142° 45'
Identify the station(s) affected by local attraction.

Ans
✓ A. B and C only
✗ B. A and D only
✗ C. B, C and D only
✗ D. A only

Question ID : **75322922511**

Q.8 An application of low viscous cutback bitumen to an absorbent surface like granular base, on which binder layer is placed, so that it penetrates into the layer below, and forms a watertight surface, is known as:

Ans

✔ A. prime coat

✘ B. tack coat

✘ C. intermediate coat

✘ D. seal coat

Question ID : **75322922498**

Q.9 The relationship between the length l and radius r of an ideal transition curve is stated as:

Ans

✘ A. $l \propto \frac{1}{r^2}$

✘ B. $l \propto r^2$

✘ C. $l \propto r$

✔ D. $l \propto \frac{1}{r}$

Question ID : **75322922509**

Q.10 In the evaluation of pavement performance, the functional performance is NOT addressed by:

Ans

✘ A. present serviceability index

✔ B. pavement response to load application

✘ C. measure of roughness

✘ D. skid resistance evaluation

Question ID : **75322922502**

Q.11 Which of the following is NOT correctly matched?

Ans

✔ A. Soundness test : Stripping value of aggregates

✘ B. Penetration test : Hardness or softness of bitumen

✘ C. Bituminous mix design : Marshall method

✘ D. Los Angeles test : Hardness of aggregates

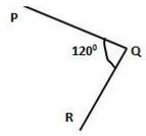
Question ID : **75322922500**

Q.12 The outcome of the spot speed studies carried out at a certain stretch of a highway are as follows:
50th percentile speed = 48 km/h; 75th percentile speed = 55 km/h; 85th percentile speed = 61 km/h; 95th percentile speed = 76 km/h; 98th percentile speed = 85 km/h; 100th percentile speed = 96 km/h.
What is the speed (in km/h units) to be taken to check the geometric design elements?

Ans
✗ A. 61
✗ B. 96
✗ C. 76
✓ D. 85

Question ID : **75322922503**

Q.13 The layout of survey stations P, Q, R in a survey work are shown in the given figure. The bearing of survey line PQ is 152° and the angle PQR is 120°. The bearing of the line QR is:



Ans
✗ A. 2420°
✗ B. 228°
✗ C. 202°
✓ D. 212°

Question ID : **75322922506**

Q.14 As per IRC 67-2001, the shape and background colour of a STOP sign are:

Ans
✗ A. triangular and red
✓ B. octagonal and red
✗ C. circular and yellow
✗ D. circular and white

Question ID : **75322922504**

Q.15 In the case of a vertical parabolic curve, the rate of change of gradient:

Ans
✗ A. is always negative
✗ B. changes from point to point
✗ C. is always positive
✓ D. is constant

Question ID : **75322922508**

Q.16 What is the function of the surcharge disc in a CBR test conducted on a subgrade soil of a highway?

Ans

✗ A. To simulate the traffic load

✗ B. To make an even surface for application of load on soil

✗ C. To simulate a preloading condition so as to consolidate the soil

✓ D. To stimulate the thickness of the pavement

Question ID : **75322922499**

Q.17 Which of the following statements pertaining to rules that govern the distribution of errors to the quantities (angles, lengths or level values) collected from field is INCORRECT?

Ans

✗ A.
The correction to be applied to an observation is directly proportional to the square of the probable error.

✗ B.
The correction to be applied to an observation is inversely proportional to the weight of the observation.

✓ C.
The correction to be applied to an observation is inversely proportional to the square of the probable error.

✗ D.
In the case of levels, the correction to be applied is proportional to the length.

Question ID : **75322922515**

Q.18 It is proposed to carry out a survey for setting up of a national park indicating natural features like water bodies, hills, forests etc. and man-made features like roads, canals, buildings etc. Also, the contour of the terrain at an interval of 1 m has to be incorporated in the map. What is the type of survey to be carried out to prepare a map of the national park area?

Ans

✓ A. Topographic survey

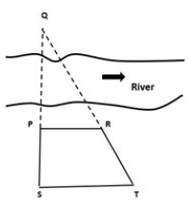
✗ B. Geological survey

✗ C. Cadastral survey

✗ D. Engineering survey

Question ID : **75322922505**

Q.19 In a chain survey work, in order to determine the length across a river of a continuing chain line, the following observations were made as in the given figure. The points S, P and Q are collinear. Also, the points Q, R and T are collinear. PR = PS = 30 m. The angle SPR is 90°. Distance ST = 50 m, angle PST = 90°. Determine the length PQ.



Ans

✗ A. 18 m

✗ B. 30 m

✗ C. 40 m

✓ D. 45 m

Question ID : **75322922512**

Q.20 If the quadrantal bearing of a line is S25° 28' E, its whole circle bearing is:

Ans
✗ A. 115° 28'
✗ B. 205° 28'
✓ C. 154° 32'
✗ D. 64° 32'

Question ID : **75322922517**