

GATE 2023 Civil Engineering (Morning Shift)

Q1. The specific gravity of soil is 2.60. The soil is at 50% degree of saturation with a water content of 15%. The void ratio of the soil is _____.

- (a) 0.87
- (b) 0.78
- (c) 1.28
- (d) 0.35

Q2. Putting on the surface of a half space.

$\sigma_z = \frac{3P}{2\pi} \left[\frac{z^3}{(r^2+z^2)\sqrt{z}} \right]$, at any σ there is variation in σ_z along z , & at specific z , value of σ_z is max. What is laws of Max σ_z

- (a) $z^2 = \frac{3}{2} r^2 h$
- (b) $z^3 = \frac{3}{2} r^2$
- (c) $z^2 = \frac{5}{2} r^2$
- (d) $z^3 = \frac{5}{2} r^2$

Q3. Moisture content of waste = 26%

Energy content of solid waste on dry-weight basis _____ (MJ/kg)

	% by Mass	Energy Content (MJ/kg)
Food Waste	20%	4.5
Paper	45	16.0
Cardboard	5	14.0
Plastics	10	32.0
Other	20	8.0

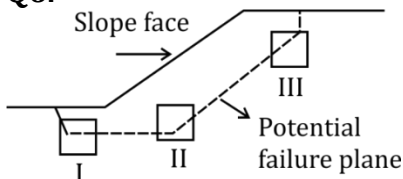
Q4. Which of the following is true about RDF (Refuse Derived Fuel)

- (a) RDF combi made in powdered form
- (b) HHV of unprocessed RDF > HHV of RDF
- (c) Processed from same MSW inorganic fraction of MSW is mostly converted to RDF
- (d) RDF can't be used in conjunction with oil.

Q5. Direct & reserved zenith angle by theodolite are 56° & 303° . Find vertical collimation error?

- (a) $-0^\circ 30'$
- (b) -1°
- (c) $+0^\circ 30'$
- (d) $+1^\circ$

Q6.



P – Triaxial Comp. Test

Q – Triaxial Extension Test

R – Direct Shear or Box Test

S – Vane Shear Test

Most approximate Shear Strength Test for following sample :

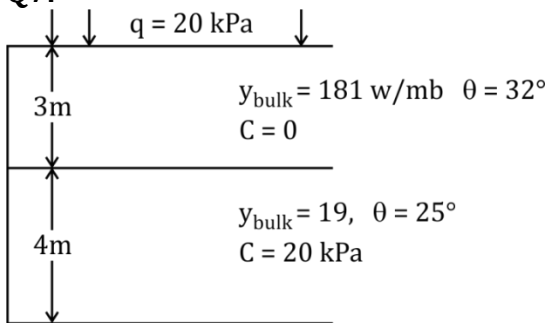
(a) SQR

(b) PRQ

(c) RPQ

(d) QRP

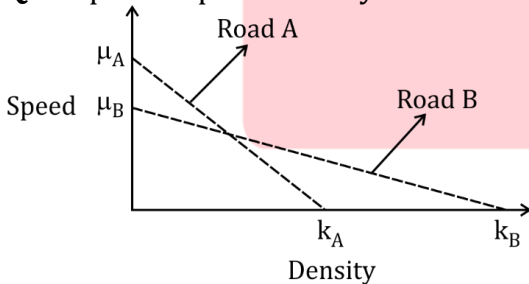
Q7.



Base
Smooth vertical wall, $a\mu$ to Rankine earth pressure, lateral active earth pressure acting at base _____ (kPa)

Q8. Q. From two instrument station A and B, reading wet taken at the top of a Hill at an inclination of $12^\circ 45'$ and $18^\circ 45'$ respectively. From station A, Back sight reading was taken 2.340 m at B.M of R.L 100.00 m. Distance between A and B is 55 m. Find the R.L of top point of Hill?

Q9. A plot of speed-density relationship client of two roads (Road A and Road B) is shown in the figure.



If the capacity of road A is C_A and capacity of Road B is C_B , what is $\frac{C_A}{C_B}$?

(a) $\frac{\mu_A}{\mu_B}$

(b) $\frac{k_A \cdot \mu_B}{k_B \cdot \mu_A}$

(c) $\frac{k_A \cdot \mu_A}{k_B \cdot \mu_B}$

(d) $\frac{k_A}{k_B}$

Q10. A Duck named “Donald Duck” says “All Ducks lie”

- (a) Donald Duck statement is true
- (b) Donald Duck always tells truth
- (c) Donald Duck statement lie
- (d) Donald Duck statement is false

Q11. Based only to the through of the statement some humans the intelligent', which of the following options can be logically interred with certainty?

- (a) All humans are intelligent
- (b) Some non-humans are intelligent
- (c) Some intelligent beings are humans
- (d) Its humans is intelligent

Q12. Eject : Insert :: Advance : _____.

- (a) Retreat
- (b) Loan
- (c) Advent
- (d) Progress

Q13. It Horton’s equation fitted to inflation data for a soi, the infiltration capacity is 10 mm/hr, the final infiltration capacity is 5 mm/hr, and exponential decay constant is 0.5 hr.

Assuming that infiltration takes places at capacity rate the total infiltration (in mm) from a uniform of 12 hr is _____ (round off to one decimal)

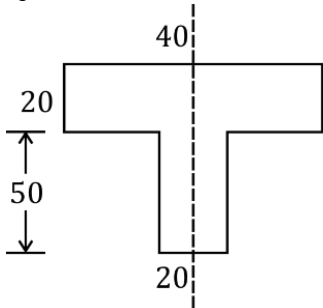
Q14. A hydraulic jump occurs in a from wide horizontal, friction less, rectangular a channel, with a pre jump depth of 0.2 m and post jump depth of 1.0 m. The value of g may be taken of 10 m/s². The value of SP. Force at the pre jump and post jump section o ve same and are equal to (in ms).

Q15. Water borne disease due to viral infection?

- (a) Hepatitis
- (b) Polio
- (c) Cholera
- (d) Typhoid

Sol. Hepatitis is caused due to virus.

Q16. Calculate moment of Inertia about centroid 11^{ll} to x -axis.



Q17. A student is scanning his 10 inch × 10 inch certificate at 600 dpi to correct is to yesterday. What is the % reducing in number fixe's. If the same certificate is scanned at 300 dpi?

- (a) 88
- (b) 50
- (c) 75
- (d) 62

Q18. A Jet of water having velocity of 20 m/s strikes a series of plates readily on a wheel revolving in the same direction as the jet at 15 m/s. What is percentage efficiency of the plates?

- (a) 66.7
- (b) 50
- (c) 88.9
- (d) 37.5

Q19. A single R/F correct bear of balanced section is made of M20 grade correct & Fe 415 grade compression in correct & tensile strain in the bears at ultimate state under flexure as per IS 456 : 2000 are-

- (a) 0.0020 & 0.0018
- (b) 0.0020 & 0.0031
- (c) 0.0035 & 0.0038
- (d) 0.0035 & 0.0041

Q20. True regarding Max. Mixing Depth (MSQ)

- (a) Ventilation coefficient depends on D_{max}
- (b) $D_{max} \downarrow$ have a smaller air pollution potential if meteorological condition are same.
- (c) D_{max} is always equal to height of larger of unstable air
- (d) Vertical dispersion of pollutants occurs upto D_{max}

Q21. For a horizontal curve radius of circular curve is 300m with design speed of 15m/s. If allowable jerk is $U = 75\text{m/s}^3$, what is run length of transition curve _____.

Q22.

RO
TF
Coagulation
Adsorption

Ponding
Freundlich Isotherm
Conc. Polarization
Charge Neutralization

- P Q S
- 2 1 3
- P Q R
- 3 1 4
- P R S
- 4 1 2
- Q R S
- 3 2 4

Q23. Soil $y_{bulk} = 19, \theta = 25^\circ, C = 15$ is formed on a route slope existing at an angle of 35° with H. The critical height of soil formation upto which it would be stable without failure _____

(Soil is formed d to rock bidding phase & no water effect)

- Q24.** With reference to compaction curve
- (a) Compaction curve crosses zero air voids line
 - (b) Compactive effort increases OMCL decreases
 - (c) Peak point Compactive curve give d_{max} γ and OMC
 - (d) Compactive effort increases OMCL increases

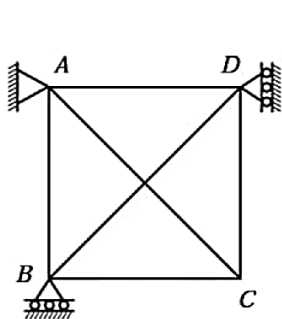
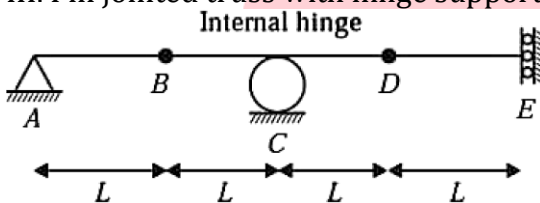
Q25. A canal is used to irrigate area of 100 ha for growing wheat. The time between first and last watering is 120 days, depth of water required is 35 cm. More intense watering is required for 30 days and depth of water required is 12 cm. Neglecting all other losses, calculate the minimum discharge required in the canal in m^3/sec .

- Q26.** Beam with hinge support at A roller at C , guided roller at E and internal hinges at B and D . 2. Pin jointed truss with hinge support at A and roller at B and D . 3. Pin-jointed truss with hinge support at A and roller at C .
- (a) I is stable
 - (b) II is stable
 - (c) All are stable
 - (d) None is stable

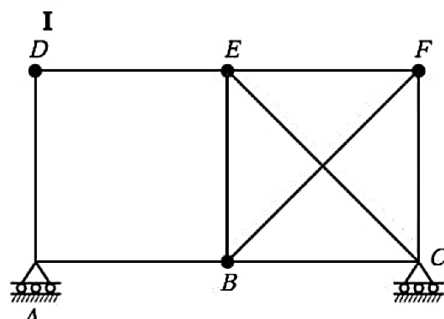
- Q27.** I have not yet decided what will I do this evening I _____ visit a friend.
- (a) might
 - (b) did not
 - (c) would
 - (d) mite

Q28. A hanger is made of two bars of different sizes each bar has a squares cross section the hanger is loaded by three-point loads in the mid vertical plane as shown in the figure. Ignore the self weight of the hanger. What is the maximum tensile stress in n/mm^2 anywhere in the hanger without considering stress concentration effects?

- Q29.**
- I. Beam with hinge support at A roller at C, guided roller at E and internal hinge at B and D.
 - II. Beam with hinge support at A roller at C, guided roller at E and internal hinge at B and D.
 - III. Pin jointed truss with hinge support at A and roller at C.

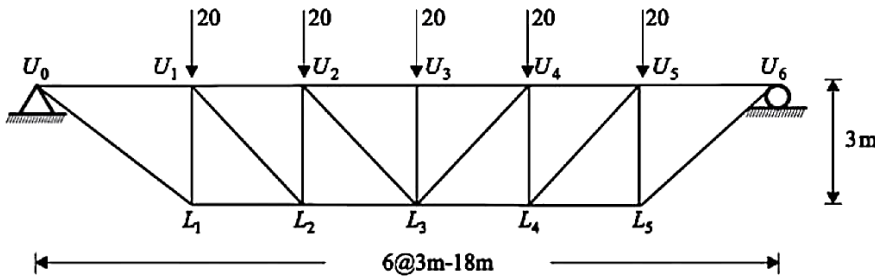


II



III

Q30. An idealized bridge truss is shown in the figure. The force in member $U_2 L_3$, is



Q31. $|G_1| < |G_2|$ and $G_1 \neq G_2 \neq 0$

- (i) $+G_1, +G_2 \rightarrow$ Make sag vertical curve
- (ii) $-G_1, -G_2 \rightarrow$ Make crest vertical curve
- (iii) $+G_1, -G_2 \rightarrow$ Make crest vertical curve
- (a) (i), (ii) and (iii)
- (b) (i), (iii) and (ii)
- (c) (i), and (ii)
- (d) (ii) and (iii)

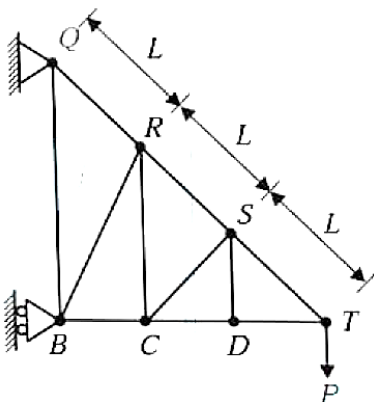
Q32. $M = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 3 & 1 & 2 \end{bmatrix}$

- (a) Eigen vector of M and M^T are same
- (b) Eigen value of M and M^T are same
- (c) Eigen value of $M^{-1} = \frac{1}{\lambda}$
- (d) Eigen value of $M^{-1} = \frac{1}{\lambda}$ and M^T are same

Q33. Match the following:

- | | |
|---------------------|---------------------------------|
| P. Reverse osmosis | I. Ponding |
| Q. Trickling filter | II. Freundlich isotherm |
| R. Coagulation | III. Concentration polarization |
| S. Adsorption | IV. Charge neutralization |

Q34. The joint T carries a vertical load P. the vertical deflection of joint T is $K \frac{PL}{AE}$ what is the value of K?

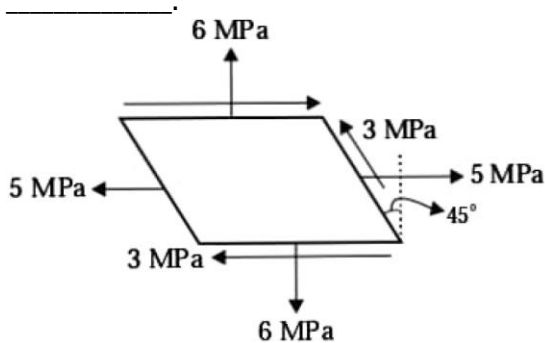


- (a) 9.0
- (b) 1.5
- (c) 4.5
- (d) 3.0

Q35. Consider a doubly reinforcement RCC beam with the option either Fe 250 plain bar in the compression zone. The modulus of elasticity of steel is $2 \times 10^5 \text{ N/mm}^2$. As per IS 456: 2000, In which type of the bars the stress in the compression steel (f_{sc}) can reach the design strength ($0.87 f_y$) at the limit state of collapse?

- (a) Fe 500
- (b) Fe 250
- (c) both
- (d) Nether

Q36. The infinitesimal element shown in the figure (not to scale) represents the state of stress at a point in a body what is the magnitude of the maximum principle stress (in N/mm^2 in integer) at the point?

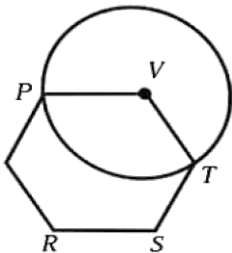


Q37. The probability of occurrence of two independent event A and B are 0.5 and 0.8 respectively probability occurrence of at least A or B.

Q38. The function $f(x) = px^4 + 2x^5 \sin\{-1, 1\}$. The Fourier series expression of $f(x) = a_0 + \sum_{n=1}^{\infty} b_n \cos\left(\frac{n\pi x}{1}\right) + \sum_{n=1}^{\infty} a_n \sin\left(\frac{n\pi x}{1}\right)$. Then which of the following is/are true?

- (a) a_n depends on P
- (b) a_n depends on q
- (c) b_n depends on p
- (d) b_n depends on q

Q39. In the given fig. P2RSTV is a regular hexagon with each side of lens 5 cm. A circle is down its centre V such that it passes through P. What is the area of should region?



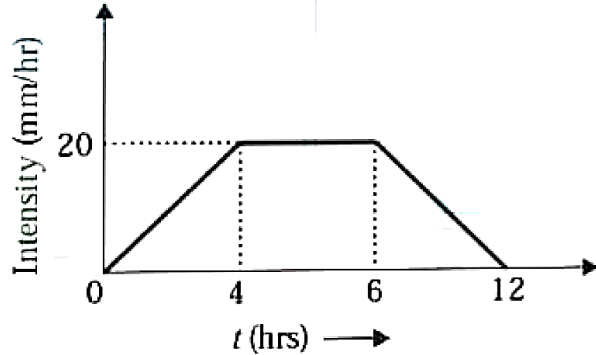
- (a) $\frac{25\pi}{3}$
- (b) 8π
- (c) 6π
- (d) $\frac{20\pi}{3}$

Q40. A square side length 4 cm is given. The boundary of the shaded region is defined by one semi circle on top and two circular area at the bottom each of radius 2 cm as shown

The area of the shaded region is cm^2

- (a) 8
- (b) 4
- (c) 12
- (d) 16

Q41. A 12 hour storm occurs over a Catchment and results in direct run off depth of 100 mm. The time distribution of the rainfall intensity of shown in figure. The ϕ -index of the storm



Q42. Ordinates for 1 hour unit hydrograph for a catchment are given below.

F(s)	0	1	2	3	4	5	6	7
Qm^2/s	0	9	21	18	12	5	2	0

Use the principle of super position, a D hour unit hydrograph for the catchment was derived from this one hour unit hydrograph. The ordinates of this D hour unit hydrograph $3\text{m}^3/\text{s}$ at $f = 1$ and $10\text{m}^3/\text{s}$ at $f = 2$. The value of D.

