MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

Ph.D. Entrance Examination of CIVIL ENGINEERING

Answer Key

Q1. (b)
Q2. (b)
Q3. (b)
Q4. (b)
Q5. (a)
Q6. (d)
Q7. (d)
Q8. (b)
Q9. (b)
Q10. (c)
Q11. (a)
Q12. (d)
Q13.(b)
Q14.(a)
Q15.(a)
Q16.(b)
Q17.(d)
Q18.(d)
Q19.(d)
Q20.(c)
Q21. (d)
Q22.(b)
Q23.(c)
Q24.(c)
Q25.(c)
Q26.(b)
Q27.(d)
Q28.(a)
Q29.(a)
Q30.(c)
Q31.(a)
Q32.(a)
Q33. (c)
Q34. (d)
Q35.(b)
Q36.(d)
Q37.(b)
Q38.(a)
Q39.(c)
Q40.(a)

As Recieved from examiner
09/09/24

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Q1. Possion's ratio is defined as
(a) Longitudinal strain divided by lateral strain
(b) Lateral strain divided by longitudinal strain
(c) Longitudinal strain divided by shear strain
(d) None of the above

Q2. A contour may be defined as an imaginary line passing through
(a) Points of the longitudinal section
(b) Points of equal elevation
(c) Point of equal local ground slope
(d) Points of transverse section surveys

Q3. The simply supported beam carries a uniformly distributed load (w, kN/m) and span length is 'L'. The maximum shear force in the beam is
(a) wL/4
(b) wL/2
(c) wL
(d) 2wL

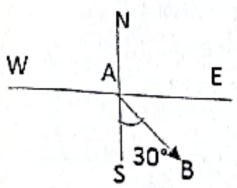
Q4. Which of the following type of treatment methods are used for municipal and industrial waste waters?
(a) Main stream
(b) Slow rate
(c) Overflow
(d) Rapid infiltration

Q5. In trusses, zero force members are provided to improve_____ of the structure
(a) Stability
(b) Ductility
(c) Malleability
(d) Toughness

Q6. If a beam is uniformly distributed throughout the span and also carries concentrated loads, then influence line diagram for bending moment consists of
(a) straight lines and parabolic curves
(b) straight lines and cubic curves
(c) parabolic curves
(d) straight lines

Q7. The bearing of line AB as shown below is represented in reduced bearing as:

(a) E60°S
(b) N150°
(c) E30°S
(d) S30°E

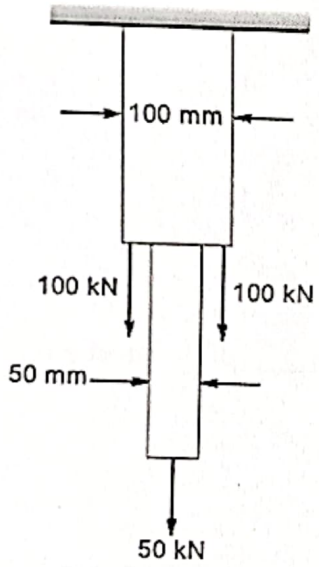


Q8. The resistance to flow of bitumen is measured by

(a) Flash and fire
(b) Viscosity
(c) Penetration test
(d) Ductility test

Q9. A hanger is made of two bars of different sizes. Each bar has a square cross-section. The hanger is loaded by three-point loads in the mid-vertical plane as shown in Figure below. Ignore the self-weight of the hanger. What is the maximum tensile stress in N/mm2 anywhere in the hanger without considering stress concentration effect?

(a) 15
(b) 25
(c) 35
(d) 45



Q10. A three span continuous beam ABCD loaded with udl of 100 kN/m on each span. Support A is fixed support and support D is hinged support while B and C are continuous supports. The degree of kinematic indeterminacy of this beam is

(a) 1
(b) 2
(c) 3
(d) 4

Q11. Factor of safety is defined as ratio of:

(a) ultimate stress to working stress
(b) working stress to ultimate stress
(c) breaking stress to ultimate stress
(d) ultimate stress to breaking stress

Q12. The flaky aggregates should not exceed

(a) 1/2 of mean dimension
(b) $3/4^{th}$ of mean dimension
(c) $1/8^{th}$ of mean dimension
(d) $3/5^{th}$ of mean dimension

Q13. During the measurement of a line by chain or tape in slopes, if the length of the line is 'l' and the height difference between the ends of the line is 'h', then the correction to the measured length is more $\frac{h^2}{2l}$ than by

(a) Zero

(b) $+\frac{h^4}{8l^3}$

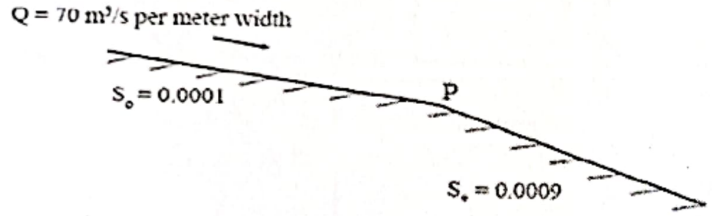
(c) $-\frac{h^3}{2l^2}$

(d) $+\frac{h^3}{4l^2}$

Q14. Creep of concrete under compression is defined as the:

(a) increase in the magnitude of strain under constant stress
(b) increase in the magnitude of stress under constant strain
(c) decrease in the magnitude of strain under constant stress
(d) decrease in the magnitude of stress under constant strain

Q15. A very wide rectangular channel carries a discharge (Q) of 70 m^3/s per meter width. Its bed slope changes from 0.0001 to 0.0009 at a point P, as shown in the figure (not to scale). The Manning's roughness coefficient of the channel is 0.01. What water surface profile(s) exist(s) near the point P?



(a) M_1 and S_2
(b) M_1 only
(c) S_2 only
(d) S_2 and hydraulic jump

Q16. In a shrinkage limit test, the volume and mass of a dry soil pat are found to be 50 cm^3 and 88 g. respectively. The specific gravity of the soil solids is 2.71 and the density of water is 1 g/cc. The shrinkage limit is

(a) 20.36
(b) 19.90
(c) 18.46
(d) 17.40

Q17. The maximum strain in the tension reinforcement in the section at failure when designed for the limit state of collapse should be _____ $\frac{0.87}{E_s} fy + 0.002$

(a) Less than, (b) greater than, (c) equals to, (d) less than equals to

Q18. With reference to the compaction test conducted on soils, which of the following is incorrect?

(a) Peak point of the compaction curve gives the maximum dry unit weight and optimum moisture content

(b) with increase in the compaction effort, the maximum dry unit weight increases

(c) With increase in the compaction effort, the optimum moisture content decreases

(d) Compaction curve crosses the zero-air-voids curve

Q19. The ultimate BOD (L_o) a wastewater sample is estimated as 87% of COD. The COD of this wastewater is 300 mg/L. Considering first order BOD reaction rate constant k (use natural log) = 2.3 per day and temperature coefficient $\theta = 1.047$, the BOD value (in mg/L, up to one decimal place) after three days of incubation at 27°C for the wastewater will be

(a) 202

(b) 261

(c) 155.2

(d) 160.2

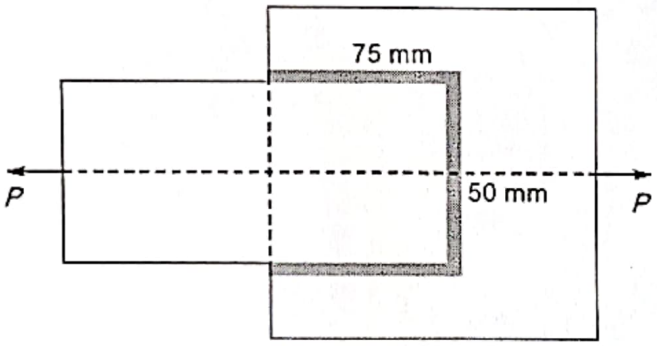
Q20. Consider the fillet-welded lap joint shown in the figure (not to scale). The length of the weld shown is the effective length. The welded surfaces meet at right angle. The weld size is 8 mm, and the permissible stress in the weld is 120 MPa. What is the safe load P (in kN, rounded off to one decimal place) that can be transmitted by this welded joint?

(a) 140 kN

(b) 144 kN

(c) 134 kN

(d) 130 kN



Q21. What is the permissible noise limit of 120 db?

(a) 30 minutes

(b) 2 minutes

(c) 1 minute

(d) 30 seconds

Q22. A two-phase signalized intersection is designed with a cycle time of 100 s. The amber and red times for each phase are 4 s and 50 s, respectively. If the total lost time per phase due to start-up and clearance is 2 s, the effective green time of each phase is _____s.

(a) 56

(b) 48

(c) 60

(d) 30

Q23. In a water sample, the concentrations of Ca^{2+}, Mg^{2+} and HCO_3 - are 100 mg/L, 36 mg/L and 122 mg/L, respectively. The atomic masses of various elements are: Ca = 40, Mg = 24, H = 1, C = 12, O = 16. The total hardness and the temporary hardness in the water sample (in mg/L as $CaCO_3$) will be

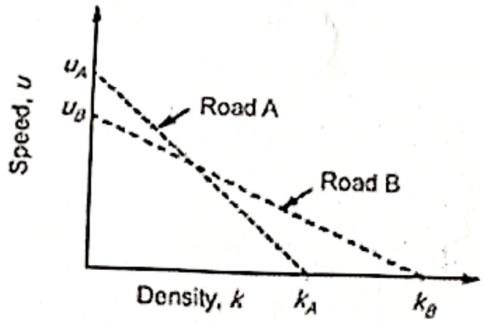
(a) 400 and 300, respectively
(b) 500 and 100, respectively
(c) 400 and 100, respectively.
(d) 800 and 200, respectively.

Q24. As per Rankine's theory of earth pressure, the inclination of failure planes is $(45 + \phi/)°$ with respect to the direction of the minor principal stress.

The above statement is correct for which one of the following options?

(a) Only the active state and not the passive state
(b) Only the passive state and not the active state
(c) Both active as well as passive states
(d) Neither active nor passive state

Q25. A plot of speed-density relationship (linear) of two roads (Road A and Road B) is shown in the figure.



If the capacity of Road A is C_A and the capacity of Road B is C_B, what is C_A/C_B?

(a) k_A/k_B
(b) u_A/u_B
(c) $k_A u_A / k_B u_B$
(d) $k_A u_B / k_B u_A$

Q26. Design of road intersections is a part of _____

(a) Harbour engineering
(b) Highway engineering
(c) Railway engineering
(d) Traffic engineering

Q27. A retaining wall with measurements 30 m x 12 m x 6 m was constructed with bricks of dimensions 8 cm x 6 cm x 6 cm If 60% of the wall consists of bricks, the number of bricks used for the construction is_____lakhs.

(a) 30
(b) 40
(c) 75
(d) 45

Q28. The speed-density relationship in a mid-block section of a highway follows the Greenshield's model. If the free flow speed is v_f and the jam density is K_j, the maximum flow observed on this section is

(a) $\frac{v_f K_j}{4}$

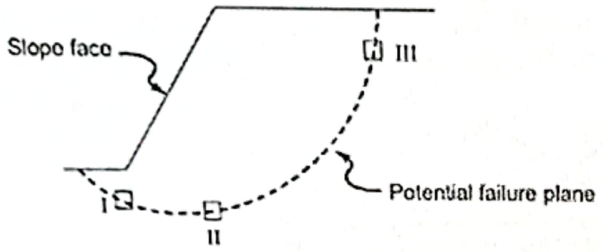
(b) $\frac{v_f K_j}{2}$

(c) $v_f K_j$

(d) $\frac{v_f K_j}{8}$

Q29. A possible slope failure is shown in the figure. Three soil samples are taken from different locations (I, II, and III) of the potential failure plane. Which is the most appropriate shear strength test for each of the samples to identify the failure mechanism? Identify the correct combination from the following options:

P: Triaxial compression test
Q: Triaxial extension test
R: Direct shear or shear box test
S: Vane shear test



(a) I-Q, II-R, III-P
(b) I-R, II-P, III-Q
(c) I-S, II-Q, III-R
(d) I-P, II-R, III-Q

Q30. If the fineness modulus of a sample of fine aggregates is 4.3, the mean size of the particles in the sample is between

(a) 300 μm and 600 μm
(b) 2.36 mm and 4.75 mm
(c) 1.18 mm and 2.36 mm
(d) 150 μm and 300 μm

Q31. Structural failures considered in the mechanistic method of bituminous pavement design are

(a) Fatigue and Rutting
(b) Fatigue and Shear
(c) Shear and Slippage
(d) Rutting and Shear

Q32. A steel column is restrained against both translation and rotation at one end and is restrained only against rotation but free to translate at the other end. Theoretical and design (IS:800-2007) values, respectively, of effective length factor of the column are

(a) 1.0 and 1.2
(b) 1.2 and 1.0
(c) 1.0 and 1.0
(d) 1.2 and 1.2

Q33. Depending upon type of contract which of the following is not a type of tender?

(a) Item Rate Tender
(b) Percentage Rate Tender
(c) Selected Tender
(d) Lum-sum Tender

Q34. In construction management, critical path method

(a) Helps in ascertaining time schedules
(b) Makes better and detailed planning possible
(c) Provides a standard method for communicating project plans schedules and to time and cost performance
(d) All of the above

Q35. Terzaghi's bearing capacity factors Nc, Nq and Nr are functions of

(a) Cohesion only
(b) Angle of internal friction only
(c) Both cohesion and angle of internal friction
(d) None of the above

Q36. A decrease in water content results in a reduction of the volume of a soil in

(a) Liquid state
(b) Plastic state
(c) Semi-solid state
(d) All of these

Q37. Pick up the correct equation from the following

(a) Run off = Surface run off - Ground water flow
(b) Run off = Surface run off + Ground water flow
(c) Run off = Surface run off / Ground water flow
(d) Run off = Surface run off × Ground water flow

Q38. The unit hydrograph due to a storm may be obtained by dividing the ordinates of the direct runoff hydrograph by

(a) direct runoff volume
(b) period of strom
(c) total rainfall
(d) none of above

Q39. The formula $V = (1/n)\, r^{2/3} \sqrt{s}$ used for determining flow velocities in sewers, is known as

(a) Kutter's formula.
(b) Bazin's formula.
(c) Manning's formula.
(d) Chezy's formula.

Q40. Which one of the following is a secondary pollutant?

(a) Ozone
(b) Carbon Monoxide
(c) Hydrocarbon
(d) Volatile Organic Carbon (VOC)