Solutions of

RPSC 2018

PRELIMINARY EXAMINATION

Assistant Engineer

Paper-II

CIVIL ENGINEERING

Date of Exam: 16-12-2018

Paper Code NEAP-81

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Rajashthan Public Service Commission Prelims Exam, 2018

Paper -II : Civil Engineering

(Assistant Engineer)

1. A prismatic bar when subjected to pure bending assumes the shape of
(1) Catenary
(2) Cubic parabola
(3) Quadratic parabola
(4) Arc of circle

Ans. (4)
A prismatic bar when subjected to pure bending assumes the shape of arc of circle.

2. Most common method of pre-stressing used for factory production is
(1) Long line method
(2) Freyssinet system
(3) Magnel-Blaton system
(4) Lee-McCall system

Ans. (1)
Most common method of prestressing used for factory production is long line method (Hoyer method).

3. The drain which is provided parallel to roadway to intercept and divert the water from hill slopes is
(1) Sloping drain (2) Catch water drain
(3) Side drain (4) Cross drain

Ans. (2)
The drain which is provided parallel to roadway to intercept and divert the water from hilly slopes is catch water drain. Its purpose is to gather water draining from higher sloping ground before it reaches the flat land.

4. A traffic rotary is justified where
(1) Number of intersecting roads is between 8 and 10
(2) Space is limited and costly
(3) When traffic volume is > 6000 vehicles/hr
(4) When traffic volume is having lowest limit of 500 vehicles/hr

Ans. (4)
A traffic rotary is justified where traffic volume ranges between 500 to 3000 vehicle per hour.

5. Contour lines can unite only in one condition, that is
(1) Cave (2) Valley
(3) Vertical cliff (4) River bed

Ans. (3)
Contour lines can unite only in the condition of vertical slift.

6. Tacheometry is adopted where
(1) Too many curves exists at the border
(2) Obstacles, undulation exists
(3) Limitation of space exists
(4) None of the above

Ans. (2)
Tacheometry is adopted where obstacles adn undulations exist on the ground.

7. 70% index of wetness means
(1) Rain excess of 30%
(2) Rain deficiency of 30%
(3) Rain deficiency of 70%
(4) None of these

Ans. (2)
Rainfall deficiency = 100 – Index of wetness
= 100 – 70 = 30%

8. Methemoglobinemia or blue baby is caused due to
(1) Chlorides (2) Fluorides
(3) Nitrates (4) Sulphides

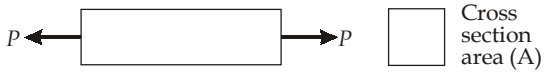
Ans. (3)
Methemoglobinemia is caused due to the excess of nitrates.

9. Lacustrine are obtained from
(1) River (2) Glaciers
(3) Sea (4) Lake beds

Ans. (4)
Lacustrine soils are obtained from lake beds.

10. A prismatic member with area of cross section 'A' is subjected to a tensile load 'P', then maximum shear stress and its inclination with the direction of load respectively are
(1) P/A and 60° (2) P/2A and 45°
(3) P/2A and 60° (4) P/A and 45°

Ans. (2)



Normal stress in direction of load = $\frac{P}{A}$

In case of uniaxial stress, maximum and minimum principle stress will be $\frac{P}{A}$ and 0 respectively.

So, Maximum shear stress = $\frac{\sigma_1 - \sigma_2}{2}$

$$= \frac{\frac{P}{A} - 0}{2} = \frac{P}{2A}$$

Plane of maximum shear stress

$$\tan 2\theta_{\tau,max} = \frac{-(\sigma_x - \sigma_y)}{2\tau_{xy}} \quad \left\{\because \tau_{xy} = 0\right\}$$

$$\tan (2\theta_{max}) = \infty$$

$$\theta\tau_{max} = 45°$$

11. The phenomenon of decreased resistance of material due to reversal of stress is called
(1) Creep (2) Fatigue
(3) Resilience (4) Plasticity

Ans. (2)
Fatigue is the weakening of material caused by repeatedly applied loads.

12. A bull nose brick is not used for
(1) Rounding off sharp corners
(2) Pillars
(3) Decoration purpose
(4) Arches

Ans. (2)
Bull nose bricks, with their smooth, rounded, outward edges, are used to soften the asthetics and add protection and visual appeal.

13. Bullet proof glass is made of thick glass sheet sandwiched by a layer of
(1) Steel (2) Stainless steel
(3) Vinyl plastic (4) Chrominium plate

Ans. (3)
Bullet proof glass is made of thick glass sheet sandwiched by layer of high test plastic i.e. vinyl plastic.

14. The most suitable equipment for compacting clayey soils is a
(1) Smooth wheeled roller
(2) Pneumatic tyred roller
(3) Sheeps foot roller
(4) Vibrator

Ans. (3)
Sheep foot rollers are used for compacting clayey soils.

15. RC - 2; MC - 2 and SC - 2 correspond to
(1) Same viscosity
(2) Viscosity in increasing order from RC-2 to SC-2
(3) Viscosity in decreasing order from RC-2 to SC-2
(4) None of the above

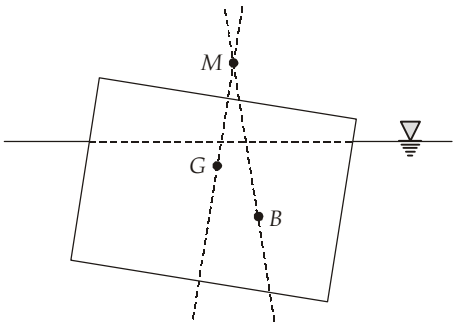
Ans. (1)
RC-2, MC-2 and SC-2 corresponds to same viscosity.

16. The shape factor of an isosceles triangle should be
(1) 1.5 (2) 1.7
(3) 2.34 (4) 2

Ans. (3)

17. For a floating body to be in stable equilibrium, its metacenter should be
(1) Below the center of gravity
(2) Below the center of buoyancy
(3) Above the center of buoyancy
(4) Above the center of gravity

Ans. (4)
In a footing body,



18. As per IS:800, the maximum bending moment of purlin is
(1) WL/6 (2) WL/8
(3) WL/4 (4) WL/10
Where-W = udl; L = Span of purlin

Ans. (4)
As per IS 800, the maximum bending moment of purlins is $\left(\frac{WL}{10}\right)$.

19. The standard meridian of India is
(1) 35° (2) 82°30′
(3) 67°30′ (4) 120°

Ans. (2)
The standard meridian of India is 82°30′.

20. The window provided on the sloping roof of a building is called
(1) Dormer window
(2) Bay window
(3) Sky light window
(4) Glazed window

Ans. (1)
The window provided on the sloping roof of building is called Dormer window.

21. A queen closer is a
(1) Brick laid with its length parallel to the face or direction of wall
(2) Brick laid with its breadth parallel to the face or direction of wall
(3) Brick having the same length and depth as the other bricks but half the breadth
(4) Brick with half the width at one end and full width at the other

Ans. (3)
When a brick is cut along its length, making it two equal halves then it is called queen closer.

22. Resins are
(1) Not soluble in water
(2) Soluble in spirit
(3) Used in Varnishes
(4) Left behind on evaporation of oil

Ans. (3)

23. Steps which are normally triangular in shape are called
(1) Angular steps (2) Radial steps
(3) Winders (4) Spiral steps

Ans. (3)
Steps which are normally triangular in shape are called windows.

24. A beam of uniform strength contains same
(1) Bending moment (2) Bending stress
(3) Deflection (4) Stiffness

Ans. (2)
A beam of uniform strength contains same bending stress.

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25. Consider the following statements:
The coefficient of permeability 'K' depends upon-
(i) Void ratio of the soil
(ii) Duration of flow
(iii) Diameter of the soil grain
(iv) Shape of the particle
Which of the above statement is correct?
(1) i, ii, iii, iv (2) ii and iii only
(3) i, iii and iv only (4) iii and iv only

Ans. (3)
According to Kozney equation,

$$\text{Permeability, } k \propto \frac{e^3}{1+e}\left(\frac{\gamma}{\mu}\right)_{\text{liquid}} \cdot d^2$$

where, e = void ratio, d = diameter of grains

26. The windblown soils are associated with-
(1) Alluvial soil (2) Lateritic coil
(3) Loess (4) Black cotton soil

Ans. (3)
Loess soils are formed by wind which contains uniformly graded soil particles.

27. The tendency of a stone is, to split along-
(1) Texture (2) Fracture
(3) Cleavage (4) Structure

Ans. (3)
The tendency of a stone is, to split along cleavage.

28. The load carrying capacity of a helically reinforced column as compared to that of a tied column is about-
(1) 5% less (2) 10% less
(3) 5%more (4) 10% more

Ans. (3)
In case of a helically reinforced column, load carrying capacity is increased by 5%.

29. The vertical member used in door frame is called-
(1) Post (2) Hanging style
(3) Sill (4) Rail

Ans. (1)
The vertical member used in door frame is called post.

30. The property of the ingredients to separate from each other while placing the concrete is called-
(1) Segregation (2) Compaction
(3) Shrinkage (4) Bulking

Ans. (1)
Segregation is the property of the ingredients to separate from each other while placing the concrete.

31. When (h) is the difference in heights between the extremities of a chain length (l) then the correction for the slope requires is-
(1) h/l (2) h^2/l
(3) $h^2/2l$ (4) $h/2l$

Ans. (3)

32. The first observation taken on turning point is
(1) Back sight
(2) Foresight
(3) Intermediate sight
(4) None of the above

Ans. (1)
The first observation taken on turning point is called back sight.

33. A survey done to understand the heavenly bodies is known as-
(1) Celestial survey
(2) Astronomical survey
(3) Photographic survey
(4) Aerial survey

Ans. (2)
A survey done to understand the heavenly bodies is known as Astronomical survey.

34. In India which technology is highly adopted for fluoride removal?
(1) Aeration
(2) Lime soda technique
(3) Nalgonda method
(4) Ozonation

Ans. (3)
Nalgonda method and Prashanti method are used for fluoride removal.

35. For pipes, turbulent flow occurs when Reynolds number is
(1) Less than 2000
(2) Between 2000 and 4000
(3) More than 4000
(4) None of the above

Ans. (3)

Type of flow in pipe	Reynolds Number
Laminar flow	< 2000
Turbulent flow	> 4000

36. An isobar is a line which connects all points below the ground surface at which
(1) The local ground elevation is same
(2) The settlement is same
(3) The vertical stress is same
(4) The ground elevation is varying

Ans. (3)
An isobar is a line which connects all points below the ground surface having same vertical stress.

37. Undisturbed tests are required for conducting
(1) Hydrometer test
(2) Shrinkage limit test
(3) Consolidation test
(4) Specific gravity test

Ans. (3)
Undisturbed tests are required for conducting shear strength test and consolidation test.

38. The earth pressure behind a bridge abutment is
(1) Active
(2) Passive
(3) At rest
(4) Constant always and everywhere

Ans. (3)
The earth pressure behind a bridge abutment is at rest.

39. Bulking of sand is maximum if moisture content is about
(1) 2% (2) 4%
(3) 5% (4) **10%**

Ans. (3)

40. The diameter of needle in Vicat apparatus for initial setting time is
(1) 0.5 mm (2) 1 mm
(3) 5 mm (4) 10 mm

Ans. (2)
The diameter of needle in vicat apparatus for intial settling time is 1 mm.

41. Tie bars in CC roads are at-
(1) Expansion joints
(2) Contraction joints
(3) Warping joints
(4) Longitudinal joints

Ans. (4)
Tie bars in cc roads at longitudinal joints.

42. It is a common practice to design a highway to accommodate traffic volume corresponding to
(1) 30^{th} hour (2) Peak hour
(3) ADT (4) 15 mm peak hour

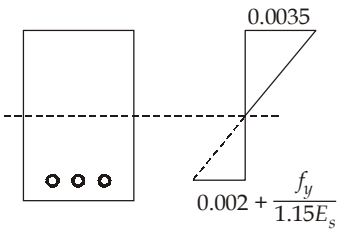
Ans. (1)
30^{th} maximum hourly volume is used for the design of highway.

43. The two main gases obtained from anaerobic decomposition are-
(1) Ammonia and CO_2
(2) CO_2 and CH_4
(3) CH_4 and Hydrogen sulphide
(4) Ammonia and CH_4

Ans. (2)
The main gases obtained from anaerobic decomposition are CO_2 & CH_4.

44. As per IS: 456 the value of f_y at outermost tension fiber is-
(1) $0.02 + (f_y/1.5E_s)$
(2) $0.0035 + (f_y/1.5E_s)$
(3) $0.002+ (f_y/1.15E_s)$
(4) $0.002+ (f_y/1.5E_s)$

Ans. (3)



Strain diagram.

45. The R.L. of the point 'A' which is on floor is 100 m and back sight reading on 'A' is 2.445 m. If the foresight reading on the point 'B' which is on ceiling is 2.745 m, the R.L. of point 'B' will be
(1) 94.80 m (2) 99.71 m
(3) 100.29 m (4) 105.20 m

Ans. (4)
Heigh of instrument = 100 + *BS* at *A*
= 100 + 2.445 = 102.445 m
RL of ceiling (at point B) = 102.445 + 2.745
= 105.20 m

46. Hydraulic lime is obtained by
(1) Fly ash
(2) Burning of kankar
(3) Red stone
(4) Calcination of pure clay

Ans. (2)
Hydraulic lime is obtained by burning of Kankar.

47. Excess of silica in the clay
(1) Makes the brick brittle and weak
(2) Changes the colour of brick from red to yellow
(3) Improves impermeability and durability of the brick
(4) Makes the brick crack and wrap on drying

Ans. (1)
Excess of silica in clay makes the brick brittle and weak.

48. Neoprene is suitable for use in
(1) Joinery work
(2) Floors of dance halls
(3) Bearing of bridge
(4) Hard duty rubber coating of floors

Ans. (3)

49. In a transit theodolite, and incidental error due to eccentricity of Verniers is primarily encountered by-
(1) Reading both the vermiers
(2) Reading different part of main scale
(3) Reading right and left faces
(4) Taking both right swing readings

Ans. (1)

50. If a radius of curvature of a simple curve is 229.2 m, then is degree of curvature is
(1) 2° (2) 3°
(3) 5° (4) 10°

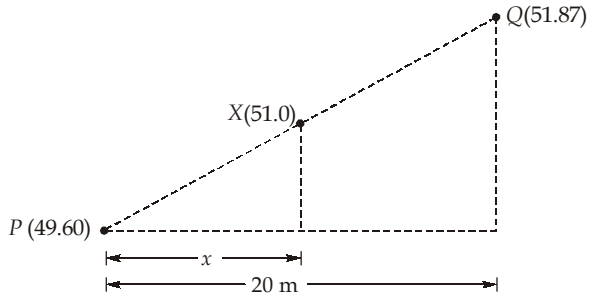
Ans. (3)

$$\text{Degree of curvature} = \frac{1145}{R} = \frac{1145}{229.2} = 5°$$

51. The Reduced Levels (RLs) of the point P and Q are +49.600 m and +51.870 m respectively. Distance PQ is 20 m. THe distance (in m from P) at which the +51.00 m contour cuts the line PQ is

(1) 15.00 m (2) 12.33 m
(3) 3.52 m (4) 2.27 m

Ans. (2)



$$\therefore \quad \frac{x}{(51-49.6)} = \frac{20}{(51.87-49.6)}$$

$$\therefore \quad x = 12.33$$

52. List I lists tools/instruments while List II lists the method of surveying. Match the tool/instrucment with the corresponding method of surveying.

List-I		List-II
P.	Alidade	**(i)** Chain surveying
Q.	Arrow	**(ii)** Levelling
R.	Bubble tube	**(iii)** Plane table surveying
S.	Stadia hair	**(iv)** Theodolite surveying

	P	Q	R	S
(1)	(iii)	(ii)	(i)	(iv)
(2)	(ii)	(iv)	(iii)	(i)
(3)	(i)	(ii)	(iv)	(iii)
(4)	(iii)	(i)	(ii)	(iv)

Ans. (4)

53. List I (Test) with List II (property) and select the correst answer-

List-I		List-II
A.	Proctor test	**(i)** Grain size analysis
B.	Vane test	**(ii)** Shear strength
C.	Penetration test	**(iii)** Bearing capacity
D.	Hydrometer test	**(iv)** Compaction

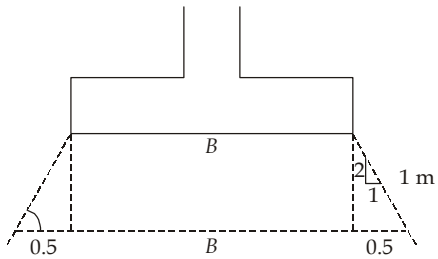
	A	B	C	D
(1)	(ii)	(iv)	(i)	(iii)
(2)	(iv)	(ii)	(i)	(iii)
(3)	(iv)	(ii)	(iii)	(i)
(4)	(ii)	(iv)	(iii)	(i)

Ans. (3)

54. A footing of 2 m × 1 m exerts a uniform pressure of 150 kN/m^2 on the soil. Assuming a load dispersion of 2 vertical to 1 horizontal, the average vertical stress (kN/m^2) at 1.0 m below the footing is-

(1) 75 (2) 80
(3) 50 (4) 100

Ans. (3)



Total load acting on footing = 2 × 1 × 150
= 300 kN

∴ Area at 1 m depth below footing
= (2 + 1) × (1 + 1) = 6 m^2

∴ Stress at 1 m depth below footing

$$= \frac{300}{6} = 50 \text{ kN/m}^2$$

55. An unsupported excavation is made to the maximum possible depth in a clay soil having γ_t = 18 kN/m^3, C = 100 kN/m^2, ϕ = 30°. The active earth pressure, according to Rankine's theory, at the base level of excavation is-

(1) 115.47 kN/m^2 (2) 54.36 kN/m^2
(3) 27.18 kN/m^2 (4) 13.25 kN/m^2

Ans. (a)

$$K_a = \frac{1-\sin\phi}{1+\sin\phi} = \frac{1}{3}$$

Depth of unsupported cut = $\dfrac{4c}{\gamma\sqrt{K_a}}$

$$= \frac{4\times 100}{18\sqrt{1/3}} = 38.49 \text{ m}$$

Active earth pressure at this depth,

$$P_a = K_a\gamma h - 2c\sqrt{K_a}$$

$$= \frac{1}{3}\times 18\times 38.49 - 2\times 100\sqrt{1/3}$$

= 115.47 kN/m^2

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56. For a given shear force across a symmetrical 'I' section, the intensity of shear stress is maximum at the-

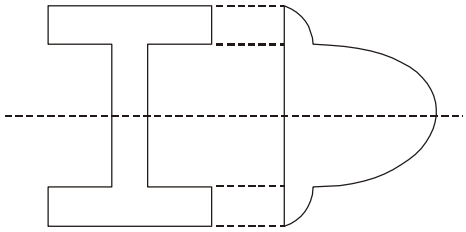
(1) junction of flange and the web, but on web

(2) junction of the flange and the web, but on the flange

(3) centroid of the section

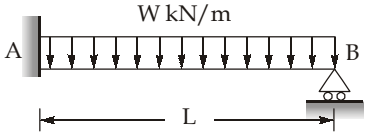
(4) extreme fibres

Ans. (3)



Beam cross-section Shear stress distribution

57. In the propped cantilever beam carrying a uniformly distributed load of kN/m, shown in the following figure, the reaction at the support B is

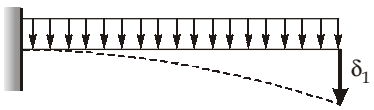


(1) $\frac{5}{8}$WL (2) $\frac{3}{8}$WL

(3) $\frac{1}{2}$WL (4) $\frac{3}{4}$WL

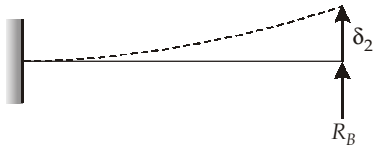
Ans. (2)

Removing support at B and allowing the beam to deflect under given loading.



$$\delta_1 = \frac{wL^4}{8EI}$$

Now, the deflection of beam when only support reaction at *B* is acting,



$$\therefore \quad \delta_2 = -\frac{R_B \times L^3}{3EI}$$

Now, as per compatibility condition deflection at point *B* should be zero,

$$\therefore \quad \delta_1 + \delta_2 = 0$$

$$\frac{wL^4}{8EI} + \frac{(-R_B)L^3}{3EI} = 0$$

$$\therefore \quad R_B = \frac{3}{8}wL$$

58. Two beams of same material have equal cross-sectional area. If one beam has square cross-section and the other has circular cross section

(1) Both the beam will be equally strong

(2) Circular section will be stronger

(3) Square section will be stronger

(4) Strength depends on loading condition

Ans. (3)

Given: $A_{circle} = A_{square}$

$$\frac{\pi}{4}D^2 = a^2$$

$$\Rightarrow \quad a = \frac{\sqrt{\pi}D}{2}$$

$$\Rightarrow \quad D = \frac{2}{\sqrt{\pi}}a$$

$$Z_{square} = \frac{a^3}{6} = 0.167a^3$$

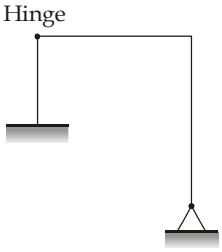
$$Z_{circle} = \frac{\pi D^3}{32} = \frac{\pi\left(\frac{2}{\sqrt{\pi}}\right)^3 a^3}{32}$$

$$= 0.141a^3$$

$$\because \quad Z_{square} > Z_{circle}$$

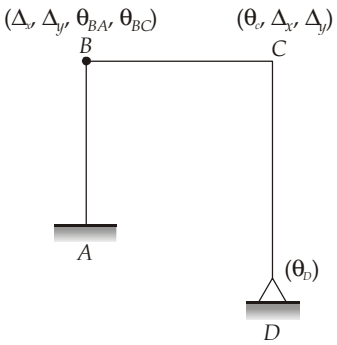
So, square section will be stronger.

59. For the plane frame as shown in the figure, the degree of kinematic indeterminacy neglecting axial deformation, is



(1) 3 (2) 5
(3) 7 (4) 9

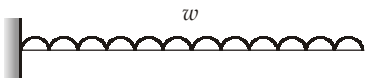
Ans. (2)



So, Total kinematic indeterminacy = 8
But members are axially rigid, D_K = 8 – Number of member
= 8 – 3 = 5

60. The intensity of u.d.l. which, when it acts over the entire span of 1 m of a cantilever beam is rectangular cross-section of width of 100 mm and depth 200 m, would produce a maximum shear stress of 1.5 N/mm^2, is
(1) 30 kN/m (2) 26.6 kN/m
(3) 20 kN/m (4) 36.6 kN/m

Ans. (3)



Let the intensity = w kN/m

$\because \quad V_{max} = wl$

$\Rightarrow \quad \tau_{avg} = \dfrac{wl}{a \cdot b}$

$\because$ For rectangular section $\tau_{avg} = \dfrac{2}{3}\tau_{max}$

$\Rightarrow \quad \tau_{max} = \dfrac{3}{2}\dfrac{wl}{ab} = 1.5$

$\therefore \quad w = \dfrac{ab}{l} = \dfrac{0.1 \times 0.2}{1} \times 10^3$

w = 20 kN/m

Note : In exam depth was given 200 m which is practically incorrect.

61. The bulk modulus of K, modulus of elasticity E and Poisson's ratio is $\dfrac{1}{m}$, then which of the following is true

(1) $E = 3K\left(1+\dfrac{2}{m}\right)$ (2) $E = 3K\left(1-\dfrac{1}{m}\right)$

(3) $E = 3K\left(1-\dfrac{2}{m}\right)$ (4) $E = 3K\left(1+\dfrac{1}{m}\right)$

Ans. (3)

$E = 3k(1 - 2\mu)$

$\therefore \quad \mu = \dfrac{1}{m}$

$\therefore \quad E = 3k\left(1-\dfrac{2}{m}\right)$

62. Consier the following statements-
I. The economic spacing of a roof truss depends on cost of purlins and cost of roof covering.
II. Purlins provided over roof trusses are designed as a continuous as per IS: 800
III. Bearing stifferers are provided in a plate girder to prevent web buckling
The correct statements are
(1) I, II and III are correct
(2) Only I and II are correct
(3) II and III are correct
(4) I and II are correct

Ans. (1)

63. A symmetrical channel section is made of a material which is equally strong in tension and compression. It is used as a simply supported beam with its web horizontal to carry vertical load. It will be
(1) Strongest if the web is used as a top face

(2) Strongest if the web is used as a bottom face
(3) Equally strong in (1) and (2)
(4) Not possible to state which of the above statement is correct

Ans. (1)

Web of the beam is horizontal and it is laterally unsupported so the permissible stress in bending compression will reduce. Therefore, it is better to use web as top face so that more area is on top face.

64. In the simplified design of angle iron purlins, which one of the following assumption would not be valid-
(1) Load component acting normal to the slope is considered
(2) Bending moment about the minor axis is considered
(3) Allowable bending stress is not reduced
(4) Slope of the roof should not exceed 30°

Ans. (2)

65. In a counterfort retaining wall, the main reinforcement is provided on the
(i) Bottom face in front counterfort
(ii) Inclined face in front counterfort
(iii) Bottom face in back counterfort
(iv) Inclined face in back counterfort
(1) (i) and (ii) (2) (ii) and (iii)
(3) (i) and (iv) (4) (iii) and (iv)

Ans. (3)

Counterforts are firmly attached to the face slab as well as the base slab. The earth pressure acting on the face slab is transferred to the counter forts which deflect as vertical cantilevers. The back of the rear counter forts comes in tension and their front face is under compression. So the inclined (back) face of rear counter forts should be provided with main reinforcement.

In the case of front counterforts the tension develops at the bottom face and it is provided with main reinforcement.

66. In a plain concrete pedestal of M35 grade, the maximum bearing pressure at the base is found to be 40 N/mm^2. Find the dept of footing, if the projection beyond the column is 300 mm.
(1) 3.1 m (2) 2.6 m
(3) 2.4 m (4) 1.9 m

Ans. (1)

$$d > 300 \times \tan\alpha$$

$$d > 300 \times 0.9\sqrt{\frac{100q}{f_{ck}} + 1}$$

$$d > 300 \times 0.9\sqrt{\frac{100 \times 40}{35} + 1}$$

$$d > 2.89 \text{ m}$$

So, $d = 3.1$ m

67. In case of two way slab, the limiting deflection of the slab is-
(1) Primarily a function of the long span
(2) Primarily a function of the short span
(3) Independent of long or short spans
(4) Dependent on both long and short spans

Ans. (2)

68. Drops are provided in flat slabs to resist
(1) thrust (2) bending moment
(3) torsion (4) shear

Ans. (4)

69. **Assertion (A):** According to IS: 456; over reinforced sections are not permitted.
Reason (R): There is ductile failure of over reinforced section.
(1) Both A and R are true and R is the correct explanation of A
(2) Both A and R are true but R is not a correct explanation of A
(3) A is true but R is false
(4) A is false but R is true

Ans. (3)

There is brittle (sudden) failure of over reinforced section.

70. The maximum diameter that a capillary tube can have to ensure that a capillary rise of atleast 6 mm is achieved when the tube is dipped into a body of liquid with surface tension = 0.08 N/m and density = 900 kg/m^3, is

(1) 3 mm (2) 6 mm
(3) 5 mm (4) 8 mm

Ans. (2)

$$h = \frac{4T\cos\alpha}{\rho g d}$$

$$\therefore 6 = \frac{4\times 0.08\times 1}{900\times 9.81\times d}\times 10^3 \qquad \{\because \alpha = 0\}$$

$$d = \frac{4\times 0.08\times 10^3}{900\times 9.81\times 6}\text{m}$$

$$d = 6.04 \text{ mm}$$

71. A horizontal water jet with a velocity of 10 m/s and cross-sectional area of 10 mm^2 strikes a flat plate held normal to the flow direction. The density of water is 1000 kg/m^3. The total force on the plate due to the jet is

(1) 100 N (2) 10 N
(3) 0.1 N (4) 1 N

Ans. (4)

$$F = \rho a v^2$$
$$= 1000 \times 10 \times 10^{-6} \times 10^2$$
$$= 1 \text{ N}$$

72. A person standing on the bank of a canal drops a stone on the water surface. He notices that the disturbances on the water surface is not travelling upstream. This is because the flow in the canal is

(1) Sub-critical (2) Super-critical
(3) Steady (4) Uniform

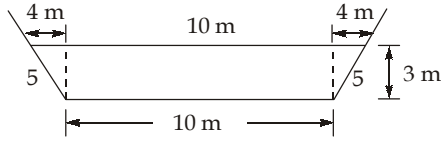
Ans. (2)

Because the water is not travelling upstream so the follow will be super-critical.

73. A trapezoidal channel is 10.0 m wide at the base and has a side slope of 4 horizontal to 3 vertical. The bed slope is 0.002. The channel is lined with smooth concrete (Manning's N = 0.012). The hydraulic radius (in m) for a depth of flow of 3 m is

(1) 20.0 (2) 3.5
(3) 3.0 (4) 2.1

Ans. (4)



$$A = \frac{1}{2}(10+18)\times 3$$

$$A = 42 \text{ m}^2$$

$$P = 10 + 10 = 20$$

$$R = \frac{A}{P} = \frac{42}{20} = 2.1 \text{ m}$$

74. A catchment area of 60 ha has a run off coefficient of 0.40. If a storm of intensity 3 cm/h and duration longer than the time of concentration occurs in the catchment, then what is the peak discharge?

(1) 2.0 m^3/s (2) 2.5 m^3/s
(3) 4.5 m^3/s (4) 2.5 m^3/s

Ans. (1)

$$Q_{peak} = \frac{1}{36}kPA \text{ (Rational formula)}$$

$$= \frac{1}{36}\times 0.4\times 3\times 60$$

$$= 2 \text{ m}^3/\text{s}$$

75. A 8 hours unit hydrograph of catchment is triangular in shape with a base width of 64 hours and peak ordinate of 20 m^3/s. The equilibrium discharge of S-curve obtained by using this 8 hours unit hydrograph is

(1) 60 m^3/s (2) 80 m^3/s
(3) 100 m^3/s (4) 800 m^3/ s

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Ans. (2)

If area of catchment is A km^2 then

$$\frac{1}{2}\times 20\times 64\times 3600 = A\times\frac{1}{100}$$

$$\Rightarrow \quad A = 230.4\ km^2$$

So, $$Q_S = 2.778\frac{A}{T_0}$$

$$= \frac{2.778\times 230.4}{8} = 80.0064\ m^3/sec = 80\ m^3/sec$$

76. Khosla's formula for assessing pressure distribution under weir floors are based on
(1) Potential flow in permeable layers just beneath the floors
(2) Boundary layer flow with pressure drop longitudinally
(3) Conformal transformation of potential flow into the W plane
(4) Simplification of 3-D flow

Ans. (3)

77. Force considered for the analysis of an elementary profile of a dam under empty reservoir condition are
(1) Uplift pressure (2) Water pressure
(3) Self-weight (4) Wave pressure

Ans. (3)

78. The following characteristics pertain to the sand filters used in the water industry:
I. Filtration rate is 1 to 4 $m^3/ (m^2$ day)
II. Typical duration of operation in one run is 24 to 72 hours
III. Operation cost is low
Which of the above characteristics pertain to slow sand filters?
(1) I, II and III (2) I and II
(3) II and III (4) I and III

Ans. (4)

Typical duration of operation for slow sand filter is 1 to 3 months.

79. Match the following:

List-I	List-II
A. Hardness	**(i)** Winkler method
B. Chlorine	**(ii)** EDTA method
C. DO	**(iii)** Orthotolidine test
D. Chloride	**(iv)** Mohr method

	A	B	C	D
(1)	(ii)	(iii)	(i)	(iv)
(2)	(ii)	(iv)	(i)	(iv)
(3)	(i)	(iii)	(ii)	(iv)
(4)	(i)	(iv)	(ii)	(iii)

Ans. (1)

80. Consider the following impurities-
(i) CO_2 and H_2S
(ii) Finely divided suspended matter
(iii) Disease causing bacteria
(iv) Excess alkalinity
The correct sequence of the removal of these impurities in a water treatment plant is
(1) (i) (ii) (iii) (iv) (2) (i) (iv) (iii) (ii)
(3) (i) (iv) (ii) (iii) (4) (iv) (i) (iii) (ii)

Ans. (3)

Correct sequence for removal of impurities in water treatment plant.
i. CO_2 and H_2S
ii. Excess alkalinity
iii. Finely alkainity
iv. Disease causing bacteria

81. A waste water sample of 2 m*l* is made upto 300 m*l* in BOD bottle with distilled water. Initial DO of the sample is 8 mg/*l* and after 5 days it is 2 mg/*l*. What is its BOD?
(1) 894 mg/*l* (2) 900 mg/*l*
(3) 300 mg/*l* (4) 1200 mg/*l*

Ans. (2)

BOD = $(DO_i - DO_f)$ × dilution factor

$$= (8-2)\times\frac{300}{2}$$

$$= 900\ mg/l$$

82. Which of the following sewage treatment method has inherent problems of odour, ponding and fly nuisance?
(1) UASB system
(2) Activated sludge process
(3) Trickling filters
(4) Stabilization ponds

Ans. (3)

83. The working conditions in Imhoff tanks are
(1) aerobic only
(2) anaerobic only
(3) aerobic in lower compartment and anaerobic in upper compartment
(4) anaerobic in lower compartment and aerobic in upper compartment

Ans. (2)
Imhoff tank is used for the clarification of sewage by simple settling and sedimentation along with anaerobic digestion of the extracted sludge.

84. For a road with camber of 3% and the design speed of 80 km/hr, the minimum radius of the curve beyond which no super-elevation is needed is
(1) 1680 m (2) 944 m
(3) 406 m (4) 280 m

Ans. (2)

$$C = \frac{V^2}{225R}\frac{V^2}{gR}$$

$$V = 80\times\frac{5}{18} = 22.22\ \text{m/s}$$

$$\therefore \quad 0.03 = \frac{(22.22\times0.75)^2}{9.81\times1^2}$$

$$R = 943.67$$

So provided radius = 944 m

85. As per IRC guidelines for designing flexible pavements by CBR method, the load parameter required is
(1) number of commercial vehicles per day
(2) cumulative standard axles in msa
(3) equivalent single axle load
(4) number of vehicles (all types) during design life

Ans. (2)

86. The general requirement in constructing a reinforced concrete road is to place a single layer of reinforcement
(1) Near the bottom of the slab
(2) Near the top of the slab
(3) At the middle
(4) Equally distributed at the top and the bottom

Ans. (3)

87. The Pensky-Martens apparatus are used for conducting the test on bitumen for testing
(1) Fire point (2) Ductility
(3) Viscosity (4) Penetration

Ans. (1)

88. The dilatancy correction in standard Penetration Test (SPT) is given by
(1) $N' = 15 + (N - 15)$
(2) $N' = 15+\frac{1}{2}(N-15)$
(3) $N' = 15+\frac{1}{2}(N-10)$
(4) $N' = 15 + (N - 10)$

Ans. (2)

$$N' = 15+\frac{(N-15)}{2}$$

89. The conditions required to be satisfied for the analysis of indeterminate structure are
(1) Equilibrium
(2) Compatibility
(3) Force-displacement relationship
(4) All of these

Ans. (4)

90. In slope deflection method, the joints are considered rigid when-
(1) no change in value of the angles between members
(2) 90° angle between the members in frame
(3) 180° angle between the members in beams
(4) all of these

Ans. (1)

91. Maxwell's reciprocal theorem in structural analysis:
(1) is true for any structure obeying Hooke's law
(2) can be applied to the rotations caused by flexure, shear or torsion
(3) is useful in analyzing indeterminate
(4) all of these

Ans. (4)

92. As per IS: 456-2000, the final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members, should not normally exceed
(1) span/250 (2) span/350
(3) 20 mm (4) both (2) and (3)

Ans. (1)

93. For the overall cost of roof trusses to be minimum, the cost of trusses should be equal to
(1) twice the cost of purlins plus the cost of roof coverings
(2) twice the cost of roof coverings plus the cost of purlins
(3) the cost of roof coverings plus the cost of purlins
(4) twice the cost of purlins plus twice the cost of roof coverings

Ans. (1)

$$t = 2p + r$$

where, t = overall cost of roof truss
p = cost of purlins
r = cost of roof covering

94. Intermediate vertical stiffeners in plate girders are used to
(1) Prevent local buckling of the web
(2) Prevent local buckling of the flange
(3) Prevent excessive deflection
(4) Increase the bearing strength of the web

Ans. (1)

95. The detention time for a water sedimentation tank using coagulated raw supplies may vary between
(1) 1 to 2 hours (2) 2 to 4 hours
(3) 4 to 8 hours (4) 16 to 24 hours

Ans. (2)
In case of plain sedimentation, detention time 4 to 8 hours.
In water sedimentation tank using coagulated raw supplies → 2 to 4 hr.

96. The overflowing sheet of water on a weir is called
(1) Head (2) Nappe
(3) Upstream (4) Crest

Ans. (2)
Nappe is the sheet of water flowing over the weir.

97. For a transition curve, the shape recommended by IRC is
(1) Spiral (2) Lemniscate
(3) Cubic parabola (4) All of these

Ans. (1)

98. Asphalt concrete is a mix comprising of-
(1) Fine aggregate, mineral filler and bitumen
(2) Fine aggregate and bitumen
(3) Coarse aggregate, fine aggregate, mineral filler and bitumen
(4) Coarse aggregate, mineral filler and bitumen

Ans. (3)

99. On a right angled road intersection with two way traffic, the total number of conflict points are

(1) 32 (2) 16

(3) 24 (4) 4

Ans. (3)

Number of conflict points in

crossing - 4

Merging - 8

Weaving - 12

Total conflict points - 24

100. The shape of the STOP sign according to IRC: 67–2001 is

(1) Circular (2) Triangular

(3) Octagonal (4) Rectangular

Ans. (3)

■■■■

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7 AIR Rohit Kumar Rajpoot
8 AIR Vijaya N. Pandey

20 in Top 20

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10 AIR Srichand Pooniya
11 AIR Ashish Gupta
12 AIR Sakshi Gupta
13 AIR Ankur Gupta
14 AIR Singh Jayshreedeepak
15 AIR Shashank Shekhar
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17 AIR Reema Agarwal
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4 AIR Amit Kumar
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7 AIR Akhil Palliwar
8 AIR Rohit Bansal

20 in Top 20

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11 AIR Prashant Kumar Singh
12 AIR Nishant Kumar
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7 AIR Tekchand Deshwal
8 AIR Manne Ravi Teja

20 in Top 20

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E&T

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8 AIR Suryash Gautam

18 in Top 20

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