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## Section – II – CIVIL ENGINEERING

1 If three forces P, Q and R keep a body in equilibrium, the angle between P & Q is  $90^\circ$  and R is acting vertically downward, then magnitude of forces R and Q respectively in terms of P will be

1)  $\frac{P}{\sqrt{2}}, \sqrt{2}P$

2)  $\sqrt{2}P, \frac{P}{\sqrt{2}}$

3)  $P, \sqrt{2}P$

4)  $\sqrt{2}P, P$

2 The algebraic sum of moments of two unlike parallel forces about any point in their plane will be

1) Zero

2) Constant

3) Always anticlockwise

4) Always clockwise

3 If the number of members (m) in a frame having joints (j) is more than that required by the equation  $m=2j-3$ , then such frames called

1) Ideal frame

2) Imperfect frame

3) Perfect frame

4) Redundant frame

4 A steel bar of 500mm length is under tensile stress of  $100 \text{ N/mm}^2$ . If the modulus of elasticity is  $2 \times 10^{11} \text{ N/m}^2$ , then the total elongation of the bar will be

1) 0.25 mm

2) 2.50 mm

3) 5.00 mm

- 4) 0.50 mm
- 5 Hoop stress for a wooden wheel with steel flat tyre in terms of outside diameter of the wheel  $D$ , inside diameter of the tyre  $d$  and Young's modulus  $E$  is
- 1)  $E(D-d)/d$
  - 2)  $E(D/d)$
  - 3)  $E(D/(D-d))$
  - 4)  $E(d/D)$
- 6 A tensile force of  $P$  is applied on a compound bar having two members  $X$  and  $Y$ . Then the load shared by the member  $X$  is
- 1)  $\frac{PA_x E_x}{A_x E_x + A_y E_y}$
  - 2)  $\frac{PA_y E_y}{A_x E_x + A_y E_y}$
  - 3)  $P/2$
  - 4)  $\frac{PE_x}{E_y}$
- 7 Relation between the elastic constants  $E$  and  $C$  for poisson's ratio of 0.25 is
- 1)  $E=10C$
  - 2)  $E=5C$
  - 3)  $E=2.5C$
  - 4)  $E=0.25C$
- 8 The radius of Mohr's circle represents
- 1) Minimum normal stress
  - 2) Maximum normal stress
  - 3) Minimum shear stress

- 4) Maximum shear stress
- 9 For an inclined plane in a rectangular block subjected to two mutually perpendicular normal stresses 1000 MPa and 400 MPa and shear stresses 400 MPa, the maximum normal stress will be
- 1) 1200 MPa
  - 2) 700 MPa
  - 3) 600 MPa
  - 4) 200 MPa
- 10 At a hinge in a beam
- 1) Shear force is zero
  - 2) Bending moment is maximum
  - 3) Bending moment is zero
  - 4) Bending moment changes sign
- 11 The bending moment for a beam with equal overhangs and carrying equal point loads each of  $P$  at the free ends, the shear force for the beam portion between the supports is
- 1) Zero
  - 2) equal to  $P$
  - 3) Linearly varying from  $-P$  to  $+P$
  - 4) Linearly varying from 0 to  $P$
- 12 Assumption made in the theory of bending is
- 1) Radius of curvature is small
  - 2) Radius of curvature is large
  - 3) Transverse sections of the beam do not remain plane after bending
  - 4) Doesn't follow Hook's law in bending

- 13 In a beam of rectangular cross section, the ratio of the maximum shear stress to the average shear stress is
- 1) 2.50
  - 2) 2.00
  - 3) 1.50
  - 4) 1.33
- 14 A simply supported beam of 10 m span is carrying a load of 4.8 kN at mid span. If Young's modulus of elasticity (E) is  $2 \times 10^8$  kN/m<sup>2</sup> and moment of inertia (I) is 20 cm<sup>4</sup>, then the maximum deflection will be
- 1) 5.00 mm
  - 2) 2.50 mm
  - 3) 0.50 mm
  - 4) 0.25 mm
- 15 The differential equation of flexure is
- 1)  $EI \frac{d^2 y}{dx^2} = -M$
  - 2)  $EI \frac{dy}{dx} = M^2$
  - 3)  $EI \frac{d^2 y}{dx^2} = M^2$
  - 4)  $M \frac{d^2 y}{dx^2} = -EI$
- 16 The slenderness ratio of free standing column of length 4 m and 40mmx40mm section is
- 1) 115.2
  - 2) 230.4
  - 3) 692.8

4) 346.8

17 Euler's crippling load for a column of length  $l$  with both ends hinged and flexural rigidity  $EI$  is given by

1)  $P = 2n^2EI/l^2$

2)  $P = n^2EI/l^2$

3)  $P = 4n^2EI/l^2$

4)  $P = n^2EI/(4l^2)$

18 For shaft in torsion

1)  $\frac{q}{r} = \frac{I}{J}$

2)  $\frac{C\theta}{l} = \frac{I}{J}$

3)  $\frac{q}{r} = \frac{C\theta}{l}$

4) All the above

19 The ratio of maximum shear stress of a solid shaft of diameter  $D$  to that of a hollow shaft having external diameter  $D$  and internal diameter  $0.5D$  is

1) 0.50

2) 1.00

3) 1.50

4) 0.94

20 Section modulus ( $Z$ ) for a rectangular cross section is

1)  $bh^3/12$

2)  $bh^3/6$

3)  $bh^2/12$

4)  $bh^2/6$

- 21 The reaction at a roller support of beam will be
- 1) Tangential to support
  - 2) Normal to support
  - 3) Unknown in direction
  - 4) Inclined to support
- 22 For a beam subjected to point loads, the shear force between point loads
- 1) is constant
  - 2) varies linearly
  - 3) has parabolic variation
  - 4) always remain zero
- 23 The Strain energy stored due to bending for a cantilever beam of span  $l$ , Modulus of elasticity  $E$ , moment of inertia  $I$  and a point load  $P$  at free end is
- 1)  $P^2 l^3 / (6EI)$
  - 2)  $P^2 l^5 / (40EI)$
  - 3)  $P^2 l^3 / (96EI)$
  - 4)  $P^2 l^5 / (240EI)$
- 24 The method in which a single equation is formed for all loads on the beam and the equation constructed in such a way that the integral constants apply to all the sections of the beam is
- 1) Moment area method
  - 2) Conjugate beam method
  - 3) Macaulay's method
  - 4) method of super position
- 25 A cantilever beam with UDL of  $w$  N/m for entire length of  $L$  will have maximum deflection equal to
- 1)  $wL^4 / (48EI)$

- 2)  $5L^4/(384EI)$
  - 3)  $wL^4/(8EI)$
  - 4)  $wL^4/(3EI)$
- 26 What is poise?
- 1) Unit of viscosity
  - 2) Dyne-sec/cm<sup>2</sup>
  - 3) 0.1 times Ns/m<sup>2</sup>
  - 4) All the above.
- 27 Surface tension has the units of
- 1) Nm
  - 2) N/m
  - 3) N/m<sup>2</sup>
  - 4) N/m<sup>3</sup>
- 28 The ratio of specific heat of a gas at constant pressure and the specific heat of the gas at constant volume
- 1) is always constant
  - 2) varies with temperature
  - 3) varies with pressure
  - 4) is not constant
- 29 A perfect gas obeys
- 1) Boyle's law only
  - 2) Charles' law only
  - 3) both Boyle's law and Charles' law
  - 4) None of the above

- 30 The thermal efficiency of an engine, which is supplied heat at the rate of 15000 Nm/s and gives an output of 4500 W is
- 1) 45%
  - 2) 50%
  - 3) 30%
  - 4) 33%
- 31 Micro-manometer is used to
- 1) determine low pressure difference
  - 2) determine higher pressure difference
  - 3) pressure measurement for gases only
  - 4) measure pressure in congested areas
- 32 Prandtl's Pitot tube measures
- 1) Stagnation head only
  - 2) Pressure head only
  - 3) Velocity head and Stagnation head
  - 4) Pressure head and Stagnation head
- 33 Based on principle of conservation of energy, the equation derived for an ideal fluid is
- 1) Bernoulli's Equation
  - 2) Newton's Law of Viscosity
  - 3) Impulse – momentum equation
  - 4) Continuity equation
- 34 Mouthpiece has increased net head when compared to small orifice due to
- 1) turbulence in the tube
  - 2) vena contracta occurred within the tube

- 3) smaller length of the tube
- 4) smooth boundary of the tube
- 35 If Velocity potential satisfies Laplace equation the flow will be
- 1) Irrotational flow
  - 2) Free vortex flow
  - 3) Continuous flow
  - 4) Forced vortex flow
- 36 The ratio of viscous forces to inertial forces is called
- 1) Mach number
  - 2) Weber number
  - 3) Reynolds number
  - 4) Froude number
- 37 If the position of meta centre remain lower than centre of gravity of the floating body, the body will remain in a state of
- 1) Stable equilibrium
  - 2) Unstable equilibrium
  - 3) Neutral equilibrium
  - 4) None of the above
- 38 The error in discharge due to error in the measurement of head over a rectangular notch is given by
- 1)  $\frac{dQ}{Q} = \frac{1}{2} \frac{dH}{H}$
  - 2)  $\frac{dQ}{Q} = \frac{3}{2} \frac{dH}{H}$
  - 3)  $\frac{dQ}{Q} = \frac{3}{4} \frac{dH}{H}$

$$4) \quad \frac{dQ}{Q} = \frac{5}{2} \frac{dH}{H}$$

39 Impulse momentum equation gives relationship between force (F), mass (m) and velocity (v) as

$$1) \quad F = v \frac{dm}{dt}$$

$$2) \quad F = \frac{1}{m} \frac{dv}{dt}$$

$$3) \quad F = \frac{d(mv)}{dt}$$

$$4) \quad F = v \frac{dv}{dt}$$

40 In turbulent flow, the loss of head is approximately proportional to

1) Velocity

2) (Velocity)<sup>1/2</sup>

3) (Velocity)<sup>3/4</sup>

4) (Velocity)<sup>2</sup>

41 A rigid pipe of length L, diameter D, wall thickness t and modulus of elasticity E is conveying water with a mean velocity of V. If mass density and bulk modulus of water are  $\rho$  and K respectively, then water hammer due to sudden closure in the pipe will cause increase in pressure equal to

$$1) \quad \rho LV/t$$

$$2) \quad V\sqrt{\rho K}$$

$$3) \quad V \sqrt{\frac{\rho}{\left(\frac{1}{K} + \frac{D}{Et}\right)}}$$

4) None of the above

- 42 The discharge from a centrifugal pump is 100 lpm and the leakage is 11 lpm. Then the volumetric efficiency of the pump is
- 1) 89%
  - 2) 90%
  - 3) 99%
  - 4) 80%
- 43 Draft tube for a reaction turbine is arranged for
- 1) Safety purpose only
  - 2) Increasing velocity head
  - 3) Converting kinetic head into pressure head
  - 4) Diverting water only
- 44 Which hydraulic turbine more efficient at part load operation?
- 1) Pelton wheel
  - 2) Francis turbine
  - 3) Propeller turbine
  - 4) Kaplan turbine
- 45 In an inward flow reaction turbine, velocity of flow at the inlet is 2 m/s. if the guide vanes make an angle of  $30^\circ$  to the tangential velocity direction of the runner, the absolute velocity of the water leaving the guide vanes is
- 1) 1 m/s
  - 2) 2 m/s
  - 3) 3 m/s
  - 4) 4 m/s

46 In a laminar boundary layer over a flat plate, the growth of the boundary layer with distance  $x$  from leading ledge is given by  $\delta/x$  is proportional to Reynolds number ( $Re_x$ ) as

- 1)  $Re_x^{1/2}$
- 2)  $Re_x^{-1/2}$
- 3)  $Re_x^{1/5}$
- 4)  $Re_x^{-1/5}$

47 The cavitation parameter  $\sigma$  is defined in terms of net positive suction head (NPSH) and net head  $H$  as

- 1)  $NPSH/vH$
- 2)  $H/NPSH$
- 3)  $H/vNPSH$
- 4)  $NPSH/H$

48 The momentum correction factor is used to account for

- 1) Change in direction of flow
- 2) Change in pressure
- 3) Non uniform distribution of velocity
- 4) Unsteady flow

49 Centre of Pressure is

- 1) Always below the centroid of the submerged plane
- 2) Always at the centroid of the submerged plane
- 3) Always above the centroid of the submerged plane
- 4) Anywhere with respect to the centroid of the submerged plane

50 What is a condition for a hydraulically efficient channel

- 1) Minimum flow rate.
- 2) Maximum wetted perimeter.

- 3) Constant velocity.
- 4) Minimum wetted perimeter.

## KEY TO Section II CIVIL ENGINEERING

Q.NO	Answer		Q.NO	Answer
1	4		26	4
2	2		27	2
3	4		28	1
4	1		29	3
5	1		30	3
6	1		31	1
7	3		32	4
8	4		33	1
9	1		34	2
10	3		35	3
11	1		36	3
12	2		37	2
13	3		38	2
14	2		39	3
15	1		40	4
16	3		41	2
17	2		42	2
18	4		43	3
19	4		44	4
20	4		45	4
21	2		46	2
22	1		47	4

23	1		48	3
24	3		49	1
25	3		50	4

## Section – III – CIVIL ENGINEERING

1. The Indian standard brick size is
  - 1) 19 cm x 9 cm x 9 cm
  - 2) 18 cm x 9 cm x 9 cm
  - 3) 20 cm x 10 cm x 10 cm
  - 4) 20 cm x 10 cm x 9 cm
2. The first class brick immersed in water for 24 hours should not absorb water (by weight) more than
  - 1) 5%
  - 2) 10%
  - 3) 15%
  - 4) 20%
3. Seasoning of timber is done for
  - 1) To reduce weight only
  - 2) To make it soft only
  - 3) To prevent shrinkage and warping
  - 4) To increase moisture content
4. IS 12269 deals with
  - 1) 53 grade Ordinary portland cement
  - 2) 43 grade Ordinary portland cement
  - 3) 33 grade Ordinary portland cement

- 4) Sleeper cements
- 5 Workability of concrete may be measured by
  - 1) Slump test
  - 2) Minimum void method
  - 3) Maximum density method
  - 4) Fineness modulus method
- 6 Ultrasonic pulse velocity measurements may be used to establish
  - 1) Homogeneity of concrete
  - 2) Presence of cracks and voids
  - 3) Quality of concrete in relation to standard requirements
  - 4) All the above
- 7 In the analyses of plane frame, the stiffness factor at a joint is taken equal to the sum of stiffness factors the members connected to the joint by using
  - 1) Principle of virtual work
  - 2) Principle of angular momentum
  - 3) Principle of super position
  - 4) Principle minimum work done
- 8 The principle of virtual work is applied to elastic system by considering virtual work done by
  - 1) Internal forces only
  - 2) External forces only
  - 3) Internal as well as external forces
  - 4) None of the above
- 9 The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in
  - 1) The direction in which the deflection is required

- 2) Vertical direction
  - 3) Horizontal direction
  - 4) Inclined direction
- 10 In the procedure of Macaulay's method, for getting the deflection equation
- 1) The differential equation of flexure is integrated for once
  - 2) The differential equation of flexure is integrated for twice
  - 3) The differential equation of flexure is integrated for thrice
  - 4) None of the above
- 11 The Castigliano's second theorem can be used compute deflections
- 1) In statically determinate structures only
  - 2) At the point under the load only
  - 3) for beams and frames only
  - 4) For any type of structure
- 12 The width of analogous column in the method of analogy is
- 1)  $2/(EI)$
  - 2)  $1/(EI)$
  - 3)  $1/2(EI)$
  - 4)  $1/4(EI)$
- 13 In slope deflection equations, the deformations are considered to be caused by
- 1) Axial force
  - 2) Shear force
  - 3) Bending moment
  - 4) All the above

- 14 As per IS-800, the minimum pitch of bolts in a row of bolts is recommended as the diameter of the bolt times
- 1) 2.0
  - 2) 2.5
  - 3) 3.0
  - 4) 4.0
- 15 In a fillet weld, the weakest section is the
- 1) smaller side of the fillet
  - 2) throat of the fillet
  - 3) side perpendicular to force
  - 4) side parallel to force
- 16 In rolled steel beams, major part of bending moment is resisted by
- 1) Flanges
  - 2) Web
  - 3) Flanges and web
  - 4) Flanges, web and fillets
- 17 Load on connection is not eccentric for
- 1) Lap joint
  - 2) Single cover butt joint
  - 3) Double cover butt joint
  - 4) All the above
- 18 A steel column in a structure carries a load of 125 kN. It is built up of 2 ISMC 350 channels connected by lacing. The lacing carries a load of
- 1) 125 kN
  - 2) 12.5 kN
  - 3) 3.125 kN
  - 4) Zero

- 19 The section in which concrete is not fully stressed to its maximum permissible value while stress in steel reaches its maximum value, is called
- 1) Under reinforced section
  - 2) Critical section
  - 3) Over reinforced section
  - 4) Balanced section
- 20 The centre to centre spacing of vertical stirrups, in a rectangular reinforced concrete beam is
- 1) increased towards the centre of the span of the beam.
  - 2) decreased towards the centre of the span of the beam.
  - 3) increased at the ends
  - 4) maintained nonuniformly.
- 21 Maximum reinforcement in an RCC beam of dimension  $b \times D$  shall not exceed
- 1)  $0.06 bD$
  - 2)  $0.04bD$
  - 3)  $0.02 bD$
  - 4)  $0.08bD$
- 22 The diameter of longitudinal bars in a column should not be less than
- 1) 4 mm
  - 2) 8 mm
  - 3) 12 mm
  - 4) 16 mm
- 23 The profile of the prestressing steel in prestressed concrete member follows
- 1) Axial force diagram
  - 2) Shear force diagram
  - 3) Bending moment diagram
  - 4) None of the above

- 24 The technique for establishing and maintaining priorities among various jobs of a project, is known
- 1) Event flow scheduling technique
  - 2) short interval scheduling
  - 3) Critical ratio scheduling
  - 4) Slotting technique for scheduling
- 25 The performance of a specific task in CPM, is known
- 1) Dummy
  - 2) Event
  - 3) Contract
  - 4) Activity
- 26 If  $a$  is the optimistic time,  $b$  is the pessimistic time and  $m$  is most likely time of an activity, the expected time of the activity, is
- 1)  $(a+m+b)/6$
  - 2)  $(a+2m+b)/6$
  - 3)  $(a+4m+b)/6$
  - 4)  $(a+5m+b)/6$
- 27 The field capacity of a soil is 25%, its permanent wilting point is 15% and specific dry unity weight is 1.5, if the depth of root zone of a crop, is 80 cm, the storage capacity of the soil, is
- 1) 8 cm
  - 2) 10 cm
  - 3) 12 cm
  - 4) 14 cm
- 28 One of the basic assumptions made in unit hydrograph theory is
- 1) Rainfall is uniform all over the catchment

- 2) Base flow is considered
  - 3) Rainfall varies with time
  - 4) All the above
- 29 A process determining outflow pattern from reservoirs for any given pattern of inflow, storage and tail-water condition is known as
- 1) Hydrograph
  - 2) Flood discharge
  - 3) Runoff estimate
  - 4) Flood routing
- 30 The recording type rain-guage gives
- 1) Mass curve of rainfall
  - 2) Hydrograph
  - 3) Total rainfall of 24 hours period
  - 4) Monthly rainfall
- 31 Lacey's regime width (W) for a channel having flood discharge of Q is given by
- 1)  $W = 1.35(Q)^{1/2}$
  - 2)  $W = 4.75(Q)^{1/2}$
  - 3)  $W = 1.35(Q)^{1/3}$
  - 4)  $W = 4.75(Q)^{1/3}$
- 32 The solid roller bucket is arranged at the end of a spillway to
- 1) measure the discharge
  - 2) provide stability to the spillway
  - 3) trap silt from flowing water
  - 4) dissipate energy through hydraulic jump

- 33 To avoid gravity dam failure by crushing for the dam material of allowable stress 300 t/sq.m and specific gravity 2.4, the limiting height is equal to
- 1) 88.23 m
  - 2) 125.25 m
  - 3) 214.29 m
  - 4) >214.29 m
- 34 The recommended maximum water supply needs as per CPHEEO guidelines for metropolitan and mega cities where sewerage system is existing or contemplated in litres per capita per day (lpcd)
- 1) 45
  - 2) 70
  - 3) 136
  - 4) 150
- 35 Dental caries, a disease caused by drinking water due to
- 1) Excess fluorine
  - 2) Absence of fluorine
  - 3) Excess of nitrates
  - 4) Presence of lead
- 36 If the BOD of a diluted sample in 1:100 ratio is 11 ppm in the beginning and 8 PPM at the end of 5 days, then BOD of the sample is
- 1) 300 PPM
  - 2) 950 PPM
  - 3) 137.5 PPM
  - 4) 73 PPM

- 37 The peak factor suggested by CPHEEO for computing carrying capacity in the design of sewers for the contributory population of 20,000 is
- 1) 2.00
  - 2) 2.25
  - 3) 2.50
  - 4) 3.00
- 38 The tolerance limit of pH for industrial effluents discharged into inland surface waters
- 1) Less than 5.5
  - 2) 5.5 to 9.0
  - 3) Above 9.0
  - 4) Must be 7 only
- 39 Relationship involving voids ratio ( $e$ ), degree of saturation ( $S$ ), water content ( $w$ ) and specific gravity of soil solids ( $G$ ) is given by
- 1)  $wSe=G$
  - 2)  $we=SG$
  - 3)  $wS=Ge$
  - 4)  $wG=Se$
- 40 A clay soil sample has unconfined compression strengths in the undisturbed state and remoulded state are 200 kN/sq.m and 60 kN/sq.m respectively. Then its sensitivity is
- 1) 260
  - 2) 140
  - 3) 0.3
  - 4) 3.33

- 41 The core-cutter method for determining in-situ unit weight is suitable for
- 1) Soils containing gravel particles
  - 2) Stiff clays
  - 3) Soft cohesive soils
  - 4) Sandy soils
- 42 The average permeability for flow perpendicular to bedding planes when compared to the average permeability for the flow parallel to the bedding planes
- 1) Always less
  - 2) Always greater
  - 3) Always equal
  - 4) Lesser or greater
- 43 The earth pressure theory that is used for the design of cantilever retaining wall is
- 1) Meyerhof's theory
  - 2) Rankine's theory
  - 3) Terzaghi's theory
  - 4) Skempton's theory
- 44 California bearing ratio (CBR) is a
- 1) measure of soil strength
  - 2) procedure for designing flexible pavements
  - 3) method of soil identification
  - 4) measure to indicate the relative strengths of paving materials
- 45 Correct length of a 100 m tape, weighing 24 N when pull of 200 N is applied at the ends is freely suspended is
- 1) 100.12 m
  - 2) 100.06 m

- 3) 99.88 m
- 4) 99.94 m
- 46 If the radius of a circular is 100 m and deflection angle is  $90^\circ$ , then the length of backward tangent is
- 1) 141.4 m
- 2) 70.7 m
- 3) 100 m
- 4) 50 m
- 47 Northing, easting and elevation are obtained in
- 1) Chain surveying
- 2) Compass surveying
- 3) Auto Level surveying
- 4) Total station surveying
- 48 The type of Bitumen for which the viscosity has been decreased by a volatile dilutant is known as
- 1) Super Bitumen
- 2) Cutback Bitumen
- 3) Lighter Bitumen
- 4) Fast Bitumen
- 49 Benkelman beam deflection method is used for design of
- 1) Rigid overlay on rigid pavement
- 2) Flexible overlay on flexible pavement
- 3) Flexible overlay on rigid pavement
- 4) Rigid overlay on flexible pavement

- 50 The absolute minimum radius for a horizontal curve designed for a speed of 80 KMPH, given the permissible values of super elevation and coefficient of friction are 0.04 and 0.16
- 1) 458 m
  - 2) 252 m
  - 3) 150 m
  - 4) 105 m

KEY TO SECTION III CIVIL ENGINEERING

Q.NO	Answer		Q.NO	Answer
1	1		26	3
2	4		27	3
3	3		28	1
4	1		29	4
5	1		30	1
6	4		31	2
7	3		32	4
8	3		33	1
9	1		34	4
10	2		35	2
11	4		36	1
12	2		37	4
13	3		38	2
14	2		39	4
15	2		40	4
16	1		41	3
17	3		42	1
18	3		43	2

19	1		44	1
20	1		45	4
21	2		46	3
22	3		47	4
23	3		48	2
24	3		49	2
25	4		50	2

