OPSC-2020

ODISHA PUBLIC SERVICE COMMISSION

Assistant Executive Engineer

Civil Engineering
Preliminary Exam
held on 29-11-2020

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Questions and Answer Keys

Q.1 The radius of Mohr's circle for two equal unlike principal stresses of magnitude p is :

(A) p (B) $\dfrac{p}{2}$

(C) Zero   (D) None of these

Ans. (A)

Q.2 Rate of change in Bending Moment is equal to :
(A) Shear force   (B) Deflection
(C) Slope   (D) Rate of loading

Ans. (A)

Q.3 The maximum compressive stress at the top of a beam is 1,600 kg/cm^2 and the corresponding tensile stress at the bottom of the beam is 400 kg/cm^2. If the depth of the beam is 10 cm, the neutral axis from the top is at :
(A) 2 cm   (B) 4 cm
(C) 6 cm   (D) 8 cm

Ans. (D)

Q.4 If the depth of a simply supported beam carrying an isolated load at its centre, is doubled, the deflection of the beam at its centre will be changed by a factor of :

(A) 2   (B) $\dfrac{1}{2}$

(C) 8   (D) $\dfrac{1}{8}$

Ans. (D)

Q.5 For a given material Young's modulus is 200 GN/m^2 and modulus of rigidity is 80 GN/m^2. The value of Poisson's ratio is :
(A) 0.15   (B) 0.20
(C) 0.25   (D) 0.40

Ans. (C)

Q.6 If the dynamic viscosity of a fluid is 0.5 poise and specific gravity is 0.5, then the kinematic viscosity of that fluid in stokes is :
(A) 0.25   (B) 0.5
(C) 0.75   (D) 1.0

Ans. (D)

Q.7 Centre of buoyancy always :
(A) Coincide with the Centre of Gravity
(B) Coincide with the centroid of the volume of liquid displaced
(C) Remains above the Centre of Gravity
(D) Remains below the Centre of Gravity

Ans. (B)

Q.8 A rectangular block 2 meters long, 1 meter wide and 1 meter deep floats in water, the depth of immersion being 0.5 meter. If the water weighs 10 kN/m^3, then the weight of the block is :
(A) 5 kN   (B) 10 kN
(C) 15 kN   (D) 20 kN

Ans. (B)

Q.9 The distance from pipe boundary, at which the 'turbulent shear stress' is one-third the 'wall shear stress', is :

(A) $\dfrac{1}{3}r$ (B) $\dfrac{1}{2}r$

(C) $\dfrac{2}{3}r$ (D) $\dfrac{3}{4}r$

Ans. (C)

Q.10 In series-pipe problems :
(A) The head loss is same through pipe.
(B) The discharge is same through each pipe.
(C) A trial solution is not necessary.
(D) The discharge through each pipe is added to obtain discharge.

Ans. (B)

Q.11 The best hydraulic channel cross section is the one which has a :
(A) Minimum roughness coefficient
(B) Least cost
(C) Maximum area for a given flow
(D) Minimum wetted perimeter

Ans. (D)

Q.12 For maximum discharge in a circular channel section, the ratio of depth of flow to that of the diameter of the channel is :
(A) 0.95   (B) 0.81
(C) 0.50   (D) 0.30

Ans. (A)

Q.13 If the conjugate depths before and after the jump are 0.5 m and 2.5 m respectively, then the loss of energy in the hydraulic jump will be :
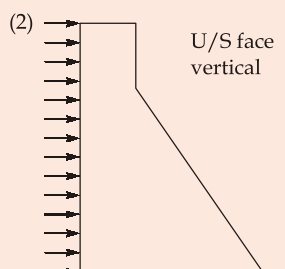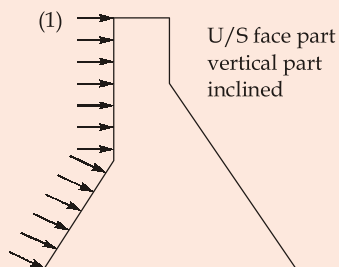(A) 0.8 m   (B) 1.6 m
(C) 3.2 m   (D) 6.4 m

Ans. (B)

Q.14 Hydraulic pressure on a dam depends upon its :
(A) Length   (B) Depth
(C) Shape   (D) Shape and depth

Ans. (D)
Hydraulic pressure is the normal pressure exerted by water on the dam body. It obviously depends on the depth of water stored but apart from that, it also depends on shape of dam body.

Example:

(1) U/S face part vertical part inclined

(2) U/S face vertical

However, it doesn't depend on length of dam.

Q.15 Manometers are used to measure :
(A) Pressure in water channels, pipes etc.
(B) Difference in pressure at two points
(C) Atmospheric pressure.
(D) Very low pressure.

Ans. (B)

Q.16 The normal annual precipitation of stations A, B, C and D are 700 mm, 1,000 mm, 900 mm and 800 mm respectively. If the storm precipitation at three stations B, C and D were 100 mm, 90 mm and 80 mm respectively, then the storm precipitation for station A will be :
(A) 70 mm   (B) 80 mm
(C) 90 mm   (D) 105 mm

Ans. (A)

Q.17 S-hydrograph is used to obtain hydrograph of :
(A) Shorter duration from longer duration
(B) Longer duration from shorter duration
(C) Both (A) and (B)
(D) None of these

Ans. (C)

Q.18 A major resistive force in a dam is :
(A) Water pressure
(B) Self weight of dam
(C) Wave pressure
(D) Uplift pressure

Ans. (B)

Q.19 Aqueduct or super passage type of works are used when :
(A) High flood drainage discharge is small
(B) High flood drainage discharge is large and short lived
(C) High flood drainage discharge is large and continues for a long time
(D) None of these

Ans. (C)

Q.20 Hydrograph is the graphical representation of :
(A) Rainfall and time
(B) Surface run off and time
(C) Ground water flow and time
(D) Run off and time

Ans. (D)

Q.21 Infiltration rate is always :
(A) More than the infiltration capacity
(B) Equal to or less than the infiltration capacity
(C) Less than the infiltration capacity
(D) Equal to or more than the infiltration capacity

Ans. (B)

Q.22 Seepage through embankment in an earthen dam is controlled by :
(A) Drain Trenches
(B) Drainage filters
(C) Relief Wells
(D) Provision of downstream berms

Ans. (B)

Q.23 Which of the following is least suited for an earthen dam?
(A) Ogee spillway
(B) Chute spillway
(C) Side channel spillway
(D) Shaft spillway

Ans. (D)

Q.24 The main function of a divide wall is to :
(A) Control the silt entry into the canal
(B) Prevent river floods from entering into the canal
(C) Separate the under sluices from weir proper
(D) Provide smooth flow at sufficiently low velocity

Ans. (C)

Q.25 A divide wall is provided :
(A) Parallel to the axis of weir and up stream of it
(B) At right angles to the axis of weir
(C) Parallel to the axis of weir and downstream of it
(D) At an inclination to the axis of weir

Ans. (B)

Q.26 For water bound macadam roads in localities of heavy rainfall, the recommended value of camber is :
(A) 1 in 30   (B) 1 in 36
(C) 1 in 48   (D) 1 in 60

Ans. (*)

Q.27 If the stopping distance is 60 meters, then the minimum stopping sight distance for two lane, two way traffic is :
(A) 180 m   (B) 120 m
(C) 30 m   (D) 60 m

Ans. (D)

Q.28 If the average centre to centre spacing of vehicles is 20 meters, then the basic capacity of traffic lane at a speed of 50 kmph is :
(A) 2,500 vehicles per day
(B) 2,000 vehicles per hour
(C) 2,500 vehicles per hour
(D) 1,000 vehicles per hour

Ans. (C)

Q.29 The background colour of informatory sign board is :
(A) Red   (B) Yellow
(C) Green   (D) White

Ans. (C)

Q.30 The ductility value of bitumen for suitability in road construction should not be less than :
(A) 50 cm   (B) 60 cm
(C) 40 cm   (D) 30 cm

Ans. (*)

Q.31 Bitumen grade 80/100 means :
(A) Its penetration value is 8 mm.
(B) Its penetration value is 10 mm.
(C) Its penetration value is 8 to 10 mm.
(D) Its penetration value is 8 to 10 cm.

Ans. (C)

Q.32 If V is the speed of a moving vehicle, r is the radius of the curve, g is the acceleration due to gravity, W is the width of the carriage way, the super elevation is :

(A) $\dfrac{WV}{gr}$ (B) $\dfrac{W^2V}{gr}$

(C) $\dfrac{WV}{gr^2}$ (D) $\dfrac{WV^2}{gr}$

Ans. (D)

Q.33 Reinforcement in cement concrete slab of road pavements is placed :
(A) In the form of welded mesh
(B) Longitudinally
(C) Transversally
(D) Longitudinally and transversally

Ans. (D)

Q.34 Minimum thickness of a layer of fine sand required to cut off the capillary rise of water completely should be :
(A) 40 cm　　(B) 52 cm
(C) 64 cm　　(D) 76 cm

Ans. (D)

Q.35 The suitable gradient within which an engineer must endeavour to design the road is called :
(A) Limiting gradient
(B) Ruling gradient
(C) Average gradient
(D) Exceptional gradient

Ans. (B)

Q.36 The ranging of the line between two stations across the raised ground is called :
(A) Direct ranging
(B) Indirect ranging
(C) Random line ranging
(D) None of these

Ans. (B)

Q.37 The correct sequencing of setting up a plane table at a working station is :
(A) Levelling, Centering, Orienting
(B) Centering, Orienting, Levelling
(C) Orienting, Levelling, Centering
(D) Levelling, Orienting, Centering

Ans. (A)

Q.38 Which of the following scale is the largest one?
(A) 1 cm = 50 m　　(B) 1 : 42000
(C) RF = $\frac{1}{300000}$　　(D) 1 cm = 50 km

Ans. (A)

Q.39 The length of a chain is measured from :
(A) Centre of one handle to centre of other handle
(B) Outside of one handle to outside of other handle
(C) Outside of one handle to inside of other handle
(D) Inside of one handle to inside of other handle

Ans. (B)

Q.40 The horizontal angle between the true meridian and magnetic meridian is called :
(A) Azimuth　　(B) Declination
(C) Local attraction (D) Magnetic bearing

Ans. (B)

Q.41 A series of closely spaced contour lines represent a :
(A) Steep slope　(B) Gentle slope
(C) Uniform slope　(D) Plane surface

Ans. (A)

Q.42 If the intercept on a vertical staff is observed as 0.75 m from a tacheometer, the horizontal distance between the tacheometer and staff station is :
(A) 7.5 m　　(B) 25 m
(C) 50 m　　(D) 75 m

Ans. (D)

Q.43 If the fore bearing of a line is 36°15′, its back bearing will be :
(A) 36° 15′　　(B) 126° 15′
(C) 143° 15′　　(D) 216° 15′

Ans. (D)

Q.44 The theodolite is an instrument used for measuring very accurately :
(A) Horizontal angles only
(B) Vertical angles only
(C) Horizontal and vertical angles
(D) Linear measurement

Ans. (C)

Q.45 The horizontal distance between any two consecutive contours is called :

(A) Vertical equivalent
(B) Horizontal equivalent
(C) Contour interval
(D) Contour gradient

Ans. (B)

Q.46 The maximum frictional force which comes into play when a body just beginning to slide over the surface of another body is known as :
(A) Static friction
(B) Dynamic friction
(C) Limiting friction
(D) Coefficient of friction

Ans. (C)

Q.47 Two balls of equal mass and of perfectly elastic material are lying on the floor. One of the balls with velocity v is made to strike the second ball. Both the balls after impact will move with a velocity :

(A) v (B) $\dfrac{v}{2}$

(C) $\dfrac{v}{4}$ (D) $\dfrac{v}{8}$

Ans. (B)

Q.48 The angular velocity (in radians/second) of a body rotating at N RPM is :

(A) $\dfrac{\pi N}{60}$ (B) $\dfrac{\pi N}{180}$

(C) $\dfrac{2\pi N}{60}$ (D) $\dfrac{2\pi N}{180}$

Ans. (C)

Q.49 The velocity ratio of a differential pulley block with D and d as diameter of larger and smaller pulley is :

(A) $\dfrac{D}{(D-d)}$ (B) $\dfrac{D}{(D+d)}$

(C) $\dfrac{2D}{(D-d)}$ (D) $\dfrac{2D}{(D+d)}$

Ans. (C)

Q.50 A rubber ball is dropped from a height of 2 meters. If there is no loss of velocity after rebounding, the ball will rise to a height of :
(A) 1 meter   (B) 2 meters
(C) 3 meters   (D) 4 meters

Ans. (B)

Q.51 The law of motion involved in recoil of a gun is :
(A) Newton's First Law of Motion
(B) Newton's Second Law of Motion
(C) Newton's Third Law of Motion
(D) None of these

Ans. (C)

Q.52 The moment of inertia of circular section about it's diameter (d) is :

(A) $\dfrac{\pi d^3}{16}$ (B) $\dfrac{\pi d^3}{32}$

(C) $\dfrac{\pi d^4}{32}$ (D) $\dfrac{\pi d^4}{64}$

Ans. (D)

Q.53 Two forces are acting at angle of 120°. The bigger force is 40 Newton and the resultant is perpendicular to the smaller force. The smaller force is
(A) 20 N   (B) 40 N
(C) 80 N   (D) None of these

Ans. (A)

Q.54 The acceleration of a particle moving with simple harmonic motion, at any instant is given by:
(A) $\omega \cdot y$ (B) $\omega^2 \cdot y$

(C) $\dfrac{\omega^2}{y}$ (D) $\omega^3 \cdot y$

where ω is the angular velocity of the particle in rad/sec and y is the displacement of the particle from mean position.

Ans. (B)

Q.55 The moment of inertia of a rectangular section, 3 cm wide and 4 cm deep, about the X-X axis is:
(A) 9 cm^4 (B) 12 cm^4
(C) 16 cm^4 (D) 20 cm^4

Ans. (C)

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Q.56 The water content of soil is defined as the ratio of:
(A) Volume of water to volume of given soil
(B) Volume of water to volume of voids in soil
(C) Weight of water to weight of air in voids
(D) Weight of water to weight of solids of given mass of soil

Ans. (D)

Q.57 The minimum size of grains of silt is about:
(A) 0.0002 mm   (B) 0.002 mm
(C) 0.02 mm   (D) 0.2 mm

Ans. (B)

Q.58 Gravel and sand are:
(A) Cohesive coarse grained soil
(B) Cohesive fine grained soil
(C) Non-cohesive coarse grained soil
(D) Non-cohesive fine grained soil

Ans. (C)

Q.59 The ratio of settlement at any time 't' to the final settlement, is known as:
(A) Coefficient of consolidation
(B) Degree of consolidation
(C) Consolidation index
(D) Consolidation of undisturbed soil

Ans. (B)

Q.60 According to Terzaghi, the net ultimate bearing capacity of Clay is given by:
(A) $c\,N_q$ (B) $c\,N_\gamma$
(C) $c\,N_c$ (D) $1.3\,c\,N_c$

Ans. (C)

Q.61 If w is the water content and γ is the unit weight of soil mass, then the unit weight of dry soil (γ_d) is equal to:

(A) $\left(\dfrac{w}{\gamma}\right)+1$ (B) $\left(\dfrac{\gamma}{w}\right)+1$

(C) $\dfrac{\gamma}{(1+w)}$ (D) $\dfrac{(1+w)}{\gamma}$

Ans. (C)

Q.62 The relation between void ratio(e) and porosity ratio(n) is:

(A) $n=\dfrac{(1+e)}{(1-e)}$ (B) $e=\dfrac{(1+n)}{(1-e)}$

(C) $n=\dfrac{e}{(1-e)}$ (D) $e=n\,(1+e)$

Ans. (D)

Q.63 A soil has bulk density of 2.30 g/cm³ and water content 15 percent, the dry density of the sample is:
(A) 1.0 g/cm²   (B) 1.5 g/cm³
(C) 2.0 g/cm³   (D) 2.5 g/cm³

Ans. (C)

Q.64 The plasticity index is the numerical difference between:
(A) Liquid limit and plastic limit
(B) Plastic limit and shrinkage limit
(C) Liquid limit and shrinkage limit
(D) None of these

Ans. (A)

Q.65 Mechanical stabilization of soil is done with the help of:
(A) Cement   (B) Lime
(C) Bitumen   (D) Proper Grading

Ans. (D)

Q.66 A load 'W' is moving from left to right supported on a simply supported beam of span 'L'. The maximum bending moment at 0.4 L from the left support is:
(A) 0.16 WL (B) 0.20 WL
(C) 0.24 WL (D) 0.25 WL

Ans. (C)

Q.67 In Moment Distribution Method, the sum of distribution factors of all the members meeting at any joint is always:
(A) Zero   (B) Less than 1
(C) 1   (D) Greater than

Ans. (C)

Q.68 When a uniformly distributed load, longer than the span of the girder moves from left to right, then maximum bending moment a mid section occurs when the uniformly distributed load occupies:
(A) Less than the left half span
(B) Whole of the left half span
(C) More than the left half span
(D) Whole span

Ans. (D)

Q.69 Degree of static indeterminacy of a rigid-jointed plane frame having 15 members, 3 reaction components and 14 joints is:
(A) 2 (B) 3
(C) 6 (D) 8

Ans. (C)

Q.70 Two bars of different material and same size are subjected to the same tensile force. If the bars have unit elongation in the ratio of 2 : 5, then the ratio of the modulus of elasticity of the two materials will be:
(A) 2 : 5 (B) 5 : 2
(C) 4 : 3 (D) 3 : 4

Ans. (B)

Q.71 The shear force diagram for a cantilever beam of length l and carrying a gradually varying load from zero at the free end and W per unit length at the fixed end is a:
(A) Horizontal straight line
(B) Vertical straight line
(C) Inclined line
(D) Parabolic curve

Ans. (D)

Q.72 A simply supported beam carries a varying load from zero at one end and ω at the other end. If the length of beam is α, the maximum bending moment is:

(A) $\dfrac{\omega\alpha}{27}$ (B) $\dfrac{\omega\alpha^2}{27}$

(C) $\dfrac{\omega^2\alpha}{\sqrt{27}}$ (D) $\dfrac{\omega\alpha^2}{9\sqrt{3}}$

Ans. (D)

Q.73 The equivalent length of a column of length L, having one end fixed and the other end free, is;
(A) $2L$ (B) L

(C) $\dfrac{L}{2}$ (D) $\dfrac{L}{\sqrt{2}}$

Ans. (A)

Q.74 The single rolling load of 8 kN rolls along a girder of 15 m span. The absolute maximum bending moment will be:
(A) 8 kN.m (B) 15 kN.m
(C) 30 kN.m (D) 60 kN.m

Ans. (C)

Q.75 For a single point load W moving on a symmetrical three hinged parabolic arch of span L, the maximum sagging moment occurs at a distance x from the ends. The value of x is:
(A) 0.211 L (B) 0.25 L
(C) 0.234 L (D) 0.5 L

Ans. (A)

Q.76 If the length of a wall on either side of a lintel opening is at least half of its effective span L, the load W carried by the lintel is equivalent to the weight of brickwork contained in an equilateral triangle, producing a maximum bending moment:

(A) $\dfrac{WL}{2}$ (B) $\dfrac{WL}{4}$

(C) $\dfrac{WL}{6}$ (D) $\dfrac{WL}{8}$

Ans. (C)

Q.77 The length of the lap in a compression member is kept greater than bar diameter × (Permissible stress in bar/ Five times the bond stress) or:
(A) 12 bar diameters
(B) 18 bar diameters
(C) 24 bar diameters
(D) 30 bar diameters

Ans. (C)

Q.78 If H is the overall height of a retaining wall retaining a surcharge, the width of the base slab usually provided, is:
(A) 0.3 H (B) 0.4 H
(C) 0.6 H (D) 0.7 H

Ans. (C, D)
As per IS 14458.1.1998 (1), Table (2)
Base slab width may vary between 0.5H to 0.8H and the value that can be used depend on designer.

Q.79 Workability of concrete is inversely proportional to:
(A) The time of transit
(B) The water-cement ratio
(C) The air in the mix
(D) The size of aggregate

Ans. (A)

Q.80 If diameter of a reinforcement bar is d, the anchorage value of the hook is
(A) 4d   (B) 8d
(C) 12d   (D) 16d

Ans. (D)

Q.81 According to Indian Standards, the pozzolana content in Portland Pozzolana Cement is:
(A) 10% to 25%   (B) 25% to 35%
(C) 35% to 50%   (D) More than 50%

Ans. (A)

Q.82 For longitudinal reinforcing bars in a column, the cover should not be less than:
(A) 10 mm   (B) 20 mm
(C) 30 mm   (D) 40 mm

Ans. (D)

Q.83 For the design of retaining walls, the minimum factor of safety against overturning is taken as:
(A) 1.5   (B) 2.0
(C) 2.5   (D) 3.0

Ans. (B)
As per IS 14458 Part 2 : 1997 (page 3)
Retaining walls and breast wall shall be designed as rigid wall using following criteria.

Factor of safety against overturning	> 2.0 (static loads) >1.5 (with earthquake force)

Q.84 For deflection of a simply supported beam to be within permissible limits, the ratio of span to effective depth as per IS 456-1978 should not exceed:
(A) 7   (B) 20
(C) 26   (D) 35

Ans. (B)

Q.85 The live load to be considered for an inaccessible roof, is:
(A) Nil   (B) 75 kg/m^2
(C) 150 kg/m^2 (D) 200 kg/m^2

Ans. (B)

Q.86 For rivet diameter up to 24 mm, the diameter of the rivet hole is larger than the diameter of the rivet by:
(A) 1.0 mm   (B) 1.5 mm
(C) 2.0 mm   (D) 2.5 mm

Ans. (B)

Q.87 The effective length of a fillet weld is taken as:
(A) The actual length plus twice the size of weld.
(B) The actual length minus twice the size of weld.
(C) The actual length plus thrice the size of weld.
(D) The actual length minus thrice the size of weld.

Ans. (B)

Q.88 The average shear stress for rolled beams is calculated by dividing the shear force at the cross section by the:
(A) Gross section of the web
(B) Depth of the beam
(C) Web thickness
(D) Width of flange

Ans. (A)

Q.89 The diameter of cold driven rivets range from:
(A) 6 to 12 mm   (B) 12 to 22 mm
(C) 22 to 32 mm   (D) 32 to 42 mm

Ans. (B)

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Q.90 The longitudinal space between the effective length of intermittent butt welds is taken not more than:
(A) Four times the thickness of the thicker part joined.
(B) Four times the thickness of the thinner part joined.
(C) Sixteen times the thickness of the thicker part joined.
(D) Sixteen times the thickness of the thinner part joined.

Ans. (D)

Q.91 Maximum permissible slenderness ratio of a member carrying loads resulting from wind is:
(A) 180   (B) 250
(C) 300   (D) 350

Ans. (B)

Q.92 Allowable working stress for rolled steel beam section compression members may be assumed as:
(A) 60 N/mm^2 (B) 80 N/mm^2
(C) 100 N/mm^2 (D) 120 N/mm^2

Ans. (C)

Q.93 The net cross sectional area of a tension member is equal to:
(A) Gross sectional area
(B) Gross sectional area minus the maximum deduction for rivet holes
(C) Gross cross sectional area plus the maximum deduction for rivet holes
(D) Two times the gross sectional area

Ans. (B)

Q.94 The stress in the wall of a thin cylinder subjected to internal pressure is:
(A) Hoop tension
(B) Shear
(C) Hoop compression
(D) Torsional shear

Ans. (A)

Q.95 Stiffeners are used in plate girders to:
(A) Reduce the compressive stress
(B) Reduce shear stress
(C) Take bearing stress
(D) Avoid buckling of web plate

Ans. (D)

Q.96 When a body is subjected to two equal and opposite forces, acting tangentially across the resisting section, as a result of which, the body tends to shear off across the section, the stress and strain induced is:
(A) Tensile stress, tensile strain
(B) Compressive stress, compressive strain
(C) Shear stress, tensile strain
(D) Shear stress, shear strain

Ans. (D)

Q.97 Hook's law holds good up to:
(A) Yield point   (B) Elastic limit
(C) Plastic limit   (D) Breaking point

Ans. (B)

Q.98 The Poisson's ratio of steel varies from:
(A) 0.23 to 0.27   (B) 0.25 to 0.33
(C) 0.31 to 0.34   (D) 0.32 to 0.42

Ans. (B)

Q.99 In a simply supported beam, carrying a uniformly distributed load w per unit length, the point of contraflexure:
(A) Lies in the centre of the beam
(B) Lies in the end of the beam
(C) Depends on the length of the beam
(D) Does not exist

Ans. (D)

Q.100 A rectangular beam A has length l, width b and depth d. Another beam B has the same length and width but depth is $2d$. The elastic strength of beam B will be:
(A) Same   (B) Double
(C) Four times   (D) Six times

Ans. (C)

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