# GATE SOLVED PAPER - CE

2008

Q. 1 The shape of the cross-section, which has the largest shape factor, is
(A) rectangular (B) I-section
(C) Diamond (D) Solid circular

Q. 2 Rivets and bolts subjected to both shear stress ($\tau_{vf,\text{cal}}$) and axial tensile stress ($\sigma_{tf,\text{cal}}$) shall be so proportioned that the stresses do not exceed the respective allowable stresses τ_{vf} and σ_{tf} and the value of $\left(\frac{\tau_{vt,\text{cal}}}{\tau_{vf}} + \frac{\sigma_{tf,\text{cal}}}{\sigma_{tf}}\right)$ does not exceed

(A) 1.0 (B) 1.2
(C) 1.4 (D) 1.8

Q. 3 A continuous beam is loaded as shown in the figure below. Assuming a plastic moment capacity equal to M_P, the minimum load at which the beam would collapse is
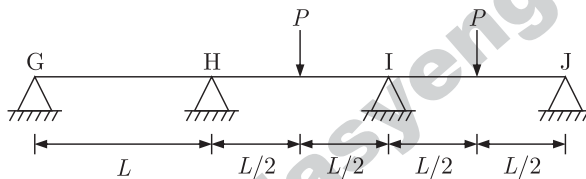
(A) $\dfrac{4M_P}{L}$ (B) $\dfrac{6M_P}{L}$

(C) $\dfrac{8M_P}{L}$ (D) $\dfrac{10M_P}{L}$

Q. 4 The product of matrices $(PQ)^{-1}P$ is
(A) P^{-1} (B) Q^{-1}
(C) $P^{-1}Q^{-1}P$ (D) PQP^{-1}

Q. 5 The general solution of $\dfrac{d^2 y}{dx^2} + y = 0$ is
(A) $y = P\cos x + Q\sin x$ (B) $y = P\cos x$
(C) $y = P\sin x$ (D) $y = P\sin^2 x$

Q. 6 The equation $k_x\dfrac{\partial^2 h}{\partial x^2} + k_z\dfrac{\partial^2 h}{\partial z^2} = 0$ can be transformed to $\dfrac{\partial^2 h}{\partial x_t^2} + \dfrac{\partial^2 h}{z^2} = 0$ by substituting

(A) $X_t = X\dfrac{k_z}{k_x}$ (B) $X_t = X\dfrac{k_x}{k_z}$

(C) $X_t = x\sqrt{\dfrac{k_x}{k_z}}$ (D) $X_t = x\sqrt{\dfrac{k_z}{k_x}}$

Q. 7 The value of $\displaystyle\int_0^{3x}\int_0 (6 - x - y)\,dxdy$ is
(A) 13.5 (B) 27.0
(C) 40.5 (D) 54.0

Q. 8   Three values of x and y are to be fitted in a straight line in the form $y = a + bx$ by the method of least squares. Given $\Sigma x = 6, \Sigma y = 21, \Sigma x^2 = 14$ and $\Sigma xy = 46$, the values of a and b are respectively
(A) 2 and 3   (B) 1 and 2
(C) 2 and 1   (D) 3 and 2

Q. 9   Solution of $\dfrac{dy}{dx} = -\dfrac{x}{y}$ at $x = 1$ and $y = \sqrt{3}$ is
(A) $x - y^2 = -2$ (B) $x + y^2 = 4$
(C) $x^2 - y^2 = -2$ (D) $x^2 + y^2 = 4$

Q. 10   If probability density function of random variable X is
$$f(x) = x^2 \text{ for } -1 \le x \le 1, \text{ and}$$
$$= 0 \text{ for any other value of } x$$
then, the percentage probability $P\left(-\dfrac{1}{3} \le x \le \dfrac{1}{3}\right)$ is
(A) 0.247   (B) 2.47
(C) 24.7   (D) 247

Q. 11   The Eigen values of the matrix $[P] = \begin{bmatrix} 4 & 5 \\ 2 & -5 \end{bmatrix}$ are
(A) – 7 and 8   (B) – 6 and 5
(C) 3 and 4   (D) 1 and 2

Q. 12   A person on a trip has a choice between private car and public transport. The probability of using a private car is 0.45. While using the public transport, further choices available are bus and metro, out of which the probability of commuting by a bus is 0.55. In such a situation, the probability (rounded up to two decimals) of using a car, bus and metro, respectively would be
(A) 0.45, 0.30 and 0.25   (B) 0.45, 0.25 and 0.30
(C) 0.45, 0.55 and 0.00   (D) 0.45, 0.35 and 0.20

Q. 13   The following simultaneous equations
$$x + y + z = 3 \qquad x + 2y + 3z = 4$$
$$x + 4y + kz = 6$$
will NOT have a unique solution for k equal to
(A) 0   (B) 5
(C) 6   (D) 7

Q. 14   The inner (dot) product of two vectors $\vec{P}$ and $\vec{Q}$ is zero. The angle (degrees) between the two vectors is
(A) 0   (B) 30
(C) 90   (D) 120

Q. 15   Two primary air pollutants are
(A) sulphar oxide and ozone
(B) nitrogen oxide and peroxyacetylnitrate
(C) sulphur oxide and hydrocarbon
(D) ozone and peroxyacetylnitrate

Q. 16   Two biodegradable components of municipal solid waste are
         (A) plastics and wood   (B) cardboard and glass
         (C) leather and tin cans   (D) food wastes and garden trimmings

Q. 17   A wastewater sample contains $10^{-5.6}$ mmol/L of OH^- ions at $25°C$ The pH of this
         sample is
         (A) 8.6   (B) 8.4
         (C) 5.6   (D) 5.4

Q. 18   Match List-I (Estimation method) with List-II (Corresponding indicator) and
         select the correct answer using the codes given below the lists :

	List-I		List-II
a.	Azide modified Winkler method for dissolved oxygen	1.	Eriochrome Black T
b.	Dichromate method for chemical oxygen demand	2.	Ferroin
c.	EDTA titrimetric method for hardness	3.	Potassium chromate
d.	Mohr or Argentometric method for chlorides	4.	Starch

Codes :

	a	b	c	d
(A)	3	2	1	4
(B)	4	2	1	3
(C)	4	1	2	3
(D)	4	2	3	1

Q. 19   Determine the correctness or otherwise of the following Assertion [A] and the
         Reason [R] :
         Assertion :The crown of the outgoing larger diameter sewer is always matched
         with the crown of incoming smaller diameter sewer.
         Reason : It eliminates backing up of sewage in the incoming smaller diameter
         sewer.
         (A) Both [A] and [R] are true and [R] is the correct reason for [A]
         (B) Both [A] and [R] are true but [R] is not the correct reason for [A]
         (C) Both [A] and [R] are false
         (D) [A] is true but [R] is false

Q. 20   The 5-day BOD of a wastewater sample is obtained as 190 mg/L (with $k = 0.01h^{-1}$
). The ultimate oxygen demand (mg/L) of the sample will be
         (A) 3800   (B) 475
         (C) 271   (D) 190

Q. 21   A water treatment plant is required to process 28800 m^3/d of raw water
         (density=1000 kg/m^3, kinematic viscosity= 10^{-6} m^2/s). The rapid mixing tank
         imparts a velocity gradient of $900s^{-1}$ to blend 35 mg/L of alum with the flow for
         a detention time of 2 minutes. The power input (W) required for rapid mixing is
         (A) 32.4   (B) 36
         (C) 324   (D) 32400

Q. 22   Match List-I (Terminology) with List-II (Definition/ Brief Description) select the correct answer using the codes given below the lists :

	List-I		List-II
a.	Primary treatment	1.	Contaminant removal by physical forces
b.	Secondary treatment	2.	Involving biological and or chemical reaction
c.	Unit operation	3.	Conversion of soluble organic matter to biomass
d.	Unit process	4.	Removal of solid material from incoming wastewater

Codes :

	a	b	c	d
(A)	4	3	1	2
(B)	4	3	2	1
(C)	3	4	2	1
(D)	1	2	3	4

Q. 23   A person standing on the bank of a canal drops a stone on the water surface. He notices that the disturbance on the water surface is not travelling upstream. This is because the flow in the canal is

(A) sub-critical   (B) super-critical

(C) steady   (D) uniform

Q. 24   The flow of water (mass density $= 100$ kg/m^3 and kinematic viscosity $= 10^{-6}$ m^2/s) in a commercial pipe, having equivalent roughness k_s as 0.12 mm, yields an average shear stress at the pipe boundary $= 600$ N/m^2. The value of k_s/δ' (δ' being the thickness of laminar sub-layer) for this pipe is

(A) 0.25   (B) 0.50

(C) 6.0   (D) 8.0

Q. 25   A river reach of 2.0 km long with maximum flood discharge of 10000m^3/s is to be physically modeled in the laboratory where maximum available discharge is 0.20 m^3/s. For a geometrically similar model based on equally of Froude number, the length of the river reach (m) in the model is

(A) 26.4   (B) 25.0

(C) 20.5   (D) 18.0

Common Data For Questions. 26, 27 and 28 :

A rectangular channel 6.0 m wide carries a discharge of 16.0 m^3/s under uniform flow condition with normal depth of 1.60 m. Minning's 'n' is 0.015.

Q. 26   The longitudinal slope of the channel is

(A) 0.000585

(B) 0.000485

(C) 0.000385

(D) 0.000285

Q. 27   A hump is to be provided on the channel bed. The maximum height of the hump without affecting the upstream flow condition is
(A) 0.50 m   (B) 0.40 m
(C) 0.30 m   (D) 0.20 m

Q. 28   The channel width is to be contracted. The minimum width to which the channel can be contracted without affecting the upstream flow condition is
(A) 3.0 m   (B) 3.8 m
(C) 4.1 m   (D) 4.5 m
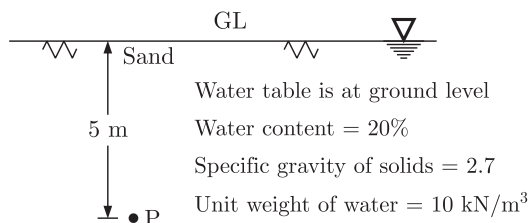
Statement For Linked Answer Q. 29 and 30 :

An automobile with projected area 2.6 m^2 is running on a road with a speed of 120 km per hour. The mass density and the kinematic viscosity of air are 1.2 kg/m^3 and 1.5×10^{-5} m^2/s, respectively. The drag coefficient is 0.30.

Q. 29   The drag force on the automobile is
(A) 620 N   (B) 600 N
(C) 580 N   (D) 520 N

Q. 30   The metric horse power required to overcome the drag force is
(A) 33.23   (B) 31.23
(C) 23.23   (D) 20.23

Q. 31   Group symbols assigned to silty sand and clayey sand are respectively
(A) SS and CS (B) SM and CS
(C) SM and SC (D) MS and CS

Q. 32   When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as
(A) passive earth pressure   (B) swelling pressure
(C) pore pressure   (D) active earth pressure

Q. 33   Compaction by vibratory roller is the best method of compaction i case of
(A) moist silty sand
(B) well graded dry sand
(C) clay of medium compressibility
(D) silt of high compressibility

Q. 34   The liquid limit (LL), plastic limit (PL) and shrinkage limit (SL) of a cohesive soil satisfy the relation
(A) $LL > PL < SL$ (B) $LL > PL > SL$
(C) $LL < PL < SL$ (D) $LL < PL > SL$

Q. 35   A footing 2 m $\times$ 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
(A) 50   (B) 75
(C) 80   (D) 100

Q. 36   A direct shear test was conducted on a cohesion less soil ($C = 0$) specimen under a normal stress of 200 kN/m^2. The specimen failed at a shear stress of 100 kN/m^2. The angle of internal friction of the soil (degree) is
(A) 26.6   (B) 29.5
(C) 30.0   (D) 32.6

Q. 37   A pile of 0.50 m diameter and of length 10 m is embedded in a deposit of clay. The undrained strength parameters of the clay are cohesion= 60 kN/m^2 and the angle of internal friction= 0. The skin friction capacity (kN) of the pile for an adhesion factor of 0.6, is
(A) 671   (B) 565
(C) 283   (D) 106

Q. 38   A saturated clay stratum draining both at the top and bottom undergoes 50 per cent consolidation in 16 year under an applied load. If an additional drainage layer were present at the middle of the clay stratum, 50 per cent consolidation would occur in
(A) 2 years   (B) 4 years
(C) 8 years   (D) 16 years

Q. 39   A test plate 30 m × 30 m cm resting on a sand deposit settles by 10 mm under a certain intensity. A footing 150 cm × 200 cm resting on the same sand deposit and loaded to the same load intensity settles by
(A) 2.0 mm   (B) 27.8 mm
(C) 30.2 mm   (D) 50.0 mm

Q. 40   A volume of 3.0×10^6 m^3 of groundwater was pumped form an unconfined aquifer uniformly from an area of 5 km^2. The pumping lowered the water table form initial level of 102 m to 99 m. The specific yield of the aquifer is
(A) 0.20   (B) 0.30
(C) 0.40   (D) 0.50

Statement For Linked Answer Q. 41 and 42 :

The ground conditions at a site are shown in the figure below.

Q. 41   The saturated unit weight of the sand (kN/m^3) is
(A) 15
(B) 18
(C) 21
(D) 24

Q. 42   The total stress, pore water pressure and effective stress (kN/m^2) at the point P
         are, respectively
         (A) 75, 50 and 25   (B) 90, 50 and 40
         (C) 105, 50 and 55   (D) 120, 50 and 70

Statement For Linked Answer Q. 43 and 44 :

         A column is supported on a footing as shown in the figure below. The water table
   is at a depth of 10 m below the base of the footing.
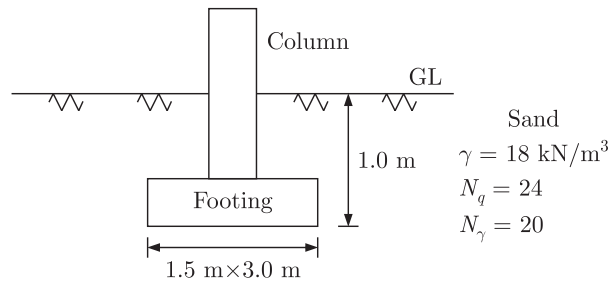
Q. 43   The net ultimate bearing capacity (kN/m^2) of the footing based on Terzaghi's
         bearing capacity equation is
         (A) 216   (B) 432
         (C) 630   (D) 846

Q. 44   The safe load (kN) that the footing can carry with a factor of safety 3 is
         (A) 282   (B) 648
         (C) 945   (D) 1269

Q. 45   The specific gravity of paving bitumen as per IS:73-1992 lies between
         (A) 1.10 and 1.06   (B) 1.06 and 1.02
         (C) 1.02 and 0.97   (D) 0.97 and 0.92

Q. 46   A combined value of flakiness and elongation index is to be determined for a
         sample of aggregates. The sequence in which the two tests are conducted is
         (A) elongation index test followed by flakiness index test on the whole sample

         (B) flakiness index test followed by elongation index test on the whole sample

         (C) flakiness index test followed by elongation index test on the non-flaky
             aggregates

         (D) elongation index test followed by flakiness index test on non-elongated
             aggregates

Q. 47   The capacities of " One-way 1.5 m wide sidewalk (persons per hour)" and "
         One-way 2 lane urban road (PCU per hour, with no frontage access, no standing
         vehicles and very little cross traffic)" are respectively
         (A) 1200 and 2400   (B) 1800 and 2000
         (C) 1200 and 1500   (D) 2000 and 1200

Q. 48   The shape of the STOP sign according to IRC:67-2001 is
         (A) circular surveying   (B) triangular
         (C) octagonal   (D) rectangular

Q. 49   The type of surveying in which the curvature of the earth is taken into account
         is called
         (A) Geodetic surveying
         (B) Plane surveying
         (C) Preliminary surveying
         (D) Topographical surveying

Q. 50   A roundabout is provided with an average entry with of 8.4 m, width of weaving
         section as 14 m, and length of the weaving section between channelizing islands
         as 35 m. The crossing traffic and total on the weaving section are 1000 and 2000
         PCU per hour respectively. The nearest rounded capacity of the roundabout (in
         PCU per hour) is
         (A) 3300
         (B) 3700
         (C) 4500
         (D) 5200

Q. 51   Design parameters for a signalized intersection are shown in the figure below. The
         green time calculated for major and minor roads are 34 and 18 s, respectively.
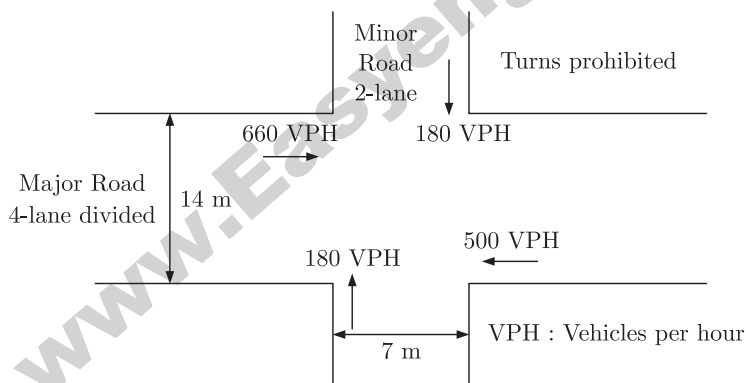
         The critical lane volume on the major road changes to 440 vehicles per hour per
         lane and the critical lane volume on the minor road remains unchanged. The
         green time will
         (A) increase for the major road and remain same for the minor road.
         (B) increase for the major road and decrease for the minor road.
         (C) decrease for both the roads.
         (D) remain unchanged for both the roads.

Q. 52   It is proposed to widen and strength and existing 2-lane NH section as a divided
         highway. The existing traffic in one direction is 2500 commercial vehicles (CV)
         per day. The construction will take 1 year. The design CBR of soil subgrade is
         found to be 5 per cent. Given : traffic growth rate for CV = 8 per cent, vehicle
         damage factor = 3.5 (standard axles per CV), design life = 10 years and traffic
         distribution factor = 0.75. The cumulative standard axles (msa) computed are
         (A) 35   (B) 37
         (C) 65   (D) 70

Q. 53   A linear relationship is observed between speed and density on a certain section of a highway. The free flow is speed is observed to be 80 km per hour and the jam density is estimated as 100 vehicles per km length. Based on the above relationship, the maximum flow expected on this section and the speed at the maximum flow will respected be
(A) 8000 vehicles per hour and 80 km per hour
(B) 8000 vehicles per hour and 25 km per hour
(C) 2000 vehicles per hour and 80 km per hour
(D) 2000 vehicles per hour and 40 km per hour

Q. 54   The plan of a survey plotted to a scale of 10 m to 1 cm ie reduced in such a way that a line originally 10 cm long now measures 9 cm. The area os the reduced plan is measured as 81 cm^2. The actual area (m^2) of the survey is
(A) 10000   (B) 6561
(C) 1000   (D) 656

Q. 55   The lengths and bearing of a closed traverse PQRSP are given below.

| Line	Length (m)	Bearing (WCB)
PQ	200	0°
QR	1000	45°
RS	907	180°
SP	?	?

The missing length and bearing, respectively of the line SP are
(A) 207 m and 270°   (B) 707 m and 270°
(C) 707 m and 180°   (D) 907 m and 270°

Q. 56   The focal length of the object glass of a tacheometer is 200 mm, the distance between the vertical axis of the tacheometer and the optical centre of the object glass is 100 mm and the spacing between the upper and lower line of the diagram axis is 4 mm. With the line of collimation perfectly horizontal, the staff intercepts are 1 m (top), 2m (middle), and 3 m (bottom). The horizontal distance (m) between the staff and the instrument station is
(A) 100.3   (B) 103.0
(C) 150.0   (D) 153.0

Q. 57   A road is provided with a horizontal circular curve having deflection angle of 55° and centre line radius of 250 m. A transition curve is to be provided at each end of the circular curve of such a length that the rate of gain of radial acceleration is 0.3 m/s^3 at a speed of 50 km per hour. Length of the transition curve required at each of the ends is
(A) 2.57 m   (B) 33.33 m
(C) 35.73 m   (D) 1666.67 m

Q. 58   A light house of 120 m height is just visible above the horizon from a ship. The correct distance (m) between the ship and the light house considering combined correction for curvature and refraction, is
(A) 39.098   (B) 42.226
(C) 39098   (D) 42226

Statement For Linked Answer Q. 59 and 60 :

A horizontal curvature curve with a centre line radius of 200 m is provided on a 2-lane, 2-way SH section. The width of the 2-lane road is 7.0 m. Design speed for this section is 80 km per hour. The brake reaction time is 2.4 s, and the coefficients of friction in longitudinal and lateral directions are 0.355 and 0.15, respectively.

Q. 59 The safe stopping sight distance on the section is
(A) 221 m　　　　　　　　　　　　(B) 195 m
(C) 125 m　　　　　　　　　　　　(D) 65 m

Q. 60 The set-back distance from the centre line of the inner lane is
(A) 7.93 m　　　　　　　　　　　　(B) 8.10 m
(C) 9.60 m　　　　　　　　　　　　(D) 9.77 m

Q. 61 A flood wave with a known inflow hydrograph is routed through a large reservoir. The outflow hydrograph will have
(A) attenuated peak with reduced time-base

(B) attenuated peak with increased time-base

(C) increased peak with increased time-base

(D) increased peak with reduced time-base

Q. 62 A stable channel is to be designed for a discharge of Q m^3/s with silt factor f as per Lacey's method. The mean flow velocity (m/s) in the channel is obtained by

(A) $\left[\dfrac{Qf^2}{140}\right]^{1/6}$　　　　　　(B) $\left[\dfrac{Qf}{140}\right]^{1/3}$

(C) $\left[\dfrac{Q^2f^2}{140}\right]^{1/6}$　　　　　　(D) $0.48 \times \left[\dfrac{Q}{f}\right]^{1/3}$

Q. 63 The base width of an elementary profile of a gravity dam of height H is b. The specific gravity of the material of the dam is G and uplift pressure coefficient is K. The correct relationship for no tension at the heel is given by

(A) $\dfrac{b}{H} = \dfrac{1}{\sqrt{G-K}}$　　　　　　(B) $\dfrac{b}{H} = \sqrt{G-K}$

(C) $\dfrac{b}{H} = \dfrac{1}{G-K}$　　　　　　(D) $\dfrac{b}{H} = \dfrac{1}{K\sqrt{G-K}}$

Q. 64 A weir on a permeable foundation with downstream sheet pile is shown in the figure below. The exit gradient as per Khosla's method is
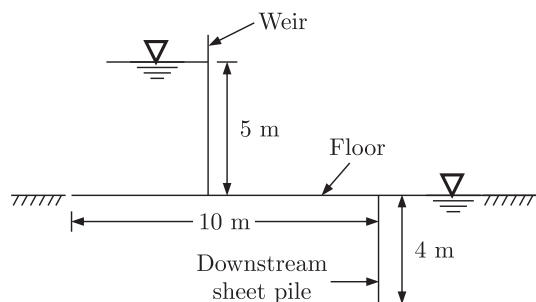
(A) 1 in 6.0　　　　　　　　　　　(B) 1 in 5.0
(C) 1 in 3.4　　　　　　　　　　　(D) 1 in 2.5

Q. 65 Water emerges from an ogee spilway with velocity $=$ 13.72 m/s and depth $=$ 0.3 m at it toe. The tail water depth required to form a hydraulic jump at the toe is
(A) 6.48 m   (B) 5.24 m
(C) 3.24 m   (D) 2.24 m

Q. 66 An outlet irrigates an area of 20 ha. The discharge (L/s) required at this outlet to meet the evapotranspiration requirement of 20 mm occurring unifromly in 20 days neglecting other field losses is
(A) 2.52   (B) 2.31
(C) 2.01   (D) 1.52

Q. 67 A reinforced concrete structure has to be constructed along a sea coast. The minimum grade of concrete to be used as per IS : 456-2000 is
(A) M 15   (B) M 20
(C) M 25   (D) M 30

Q. 68 In the design of a reinforced concrete beam the requirement for bond is not getting satisfied. The economical option to satisfy the required for bond is by
(A) bounding of bars
(B) providing smaller diameter bars more in number
(C) providing larger diameter bars less in number
(D) providing same diameter bars more in number

Q. 69 Un-factored maximum bending moment at a section of a reinforced concrete beam resulting form a frame analysis are 50, 80, 120 and 180 kNm under dead, live wind and earthquake loads respectively. The design moment (kNm) as per IS : 456-2000 for the limit state of collapse (flexure) is
(A) 195   (B) 250
(C) 345   (D) 372

Q. 70 A reinforced concrete column contains longitudinal steel equal to 1 per cent of net cross-section are of the column. Assume modular ratio as 10. The loads carried (using the elastic theory) by the longitudinal steel and the net area of concrete, are P_s and P_c respectively. The ratio P_s/P_c expressed as per cent is
(A) 0.1   (B) 1
(C) 1.1   (D) 10

Q. 71 A pre-tensioned concrete member of section 200 mm $\times$ 250 mm contains tendons of area 500 mm^2 at centre of gravity of the section. The prestress in the tendons is 1000 N/mm^2. Assuming modular ratio as 10, the stress (N/mm^2) is concrete is
(A) 11   (B) 9
(C) 7   (D) 5

Common Data For Questions. 72 and 73 :

A reinforced concrete beam of rectangular cross section of breadth 230 mm and effective depth 400 mm is subjected to a maximum factored shear force of 120 kN. The grades of concrete, main steel provided, the design shear strength τ_c as per IS : 456-2000 is 0.48 N/mm^2. The beam is designed for collapse limit state.

Q. 72   The spacing (mm) of 2-legged 8 mm stirrups to be provided is
(A) 40   (B) 115
(C) 250   (D) 400

Q. 73   In addition, the beam is subjected to a torque whose factored value is 10.90 kNm.
The stirrups have to be provided to carry a shear (kN) equal to
(A) 50.42   (B) 130.56
(C) 151.67   (D) 200.23

Q. 74   A mild steel specimen is under uniaxial tensile stress. Young's modulus and yield
stress for mild steel are 2×10^5 MPa and 250 MPa respectively. The maximum
amount of strain energy per unit volume that can be stored in this specimen
without permanent set is
(A) 156 Nmm/mm^3

(B) 15.6 Nmm/mm^3

(C) 1.56 Nmm/mm^3

(D) 0.156 Nmm/mm^3

Q. 75   Cross-section of a column consisting to two steel strips, each of thickness t and
width b is shown in the figure below. The critical loads of the column with perfect
bond and without bond between the strips are P and P_0 respectively. The ratio
P/P_0 is
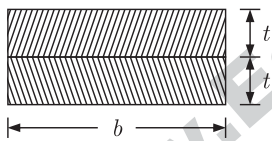
(A) 2   (B) 4
(C) 6   (D) 8

Q. 76   A rigid bar GH of length L is supported by a hinge and a spring of stiffness K as
shown in the figure below. The buckling load, P_{cr}, for the bar will be
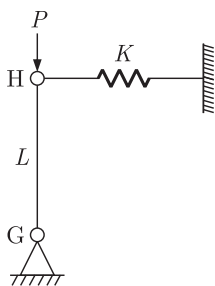
(A) $0.5KL$ (B) $0.8KL$
(C) $1.0KL$ (D) $1.2KL$

Q. 77   The maximum shear stress in a solid shaft of circular cross-section having diameter
d subjected to a subject to a torque T is τ. If the torque is increased by four
times and the diameter of the shaft is increased by two times, the maximum shear
stress in the shaft will be
(A) 2τ (B) τ
(C) $\tau/2$ (D) $\tau/4$

Q. 78   A vertical rod PQ of length L is fixed at its top end P and has a flange fixed to the bottom end Q. A weight W is dropped vertically from a height $h(< L)$ on to the flange. The axial stress in the rod can be reduced by

(A) increasing the length of the rod

(B) decreasing the length of the rod

(C) decreasing the area of cross-section of the rod

(D) increasing the modulus of elasticity of the material

Q. 79   The maximum tensile stress at the section X-X shown in the figure below is
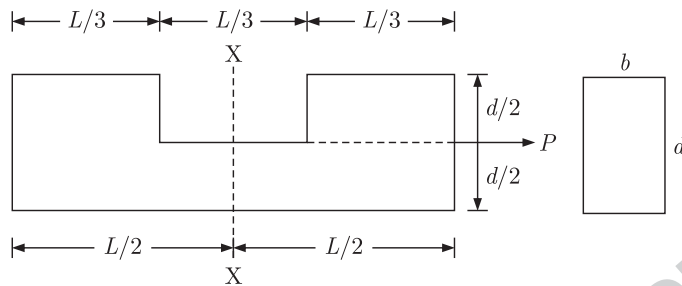
(A) $\dfrac{8P}{bd}$ (B) $\dfrac{6P}{bd}$

(C) $\dfrac{4P}{bd}$ (D) $\dfrac{2P}{bd}$

Q. 80   The stepped cantilever is subjected to moments, M as shown in the figure below. The vertical deflection at the free end (neglecting the self weight) is
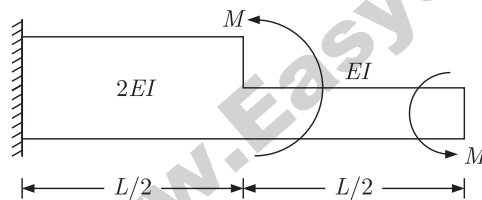

(A) $\dfrac{ML^2}{8EI}$ (B) $\dfrac{ML^2}{4EI}$

(C) $\dfrac{ML^2}{EI}$ (D) Zero

Statement For Linked Answer Q. 81 & 82 :

Beam GHI is supported by three pontoons as shown in the figure below. The horizontal cross-sectional area of each pontoon is 8 m^2, the flexural rigidity of the beam is 10000 kNm^2 and the unit weight of water is 10 kNm^3
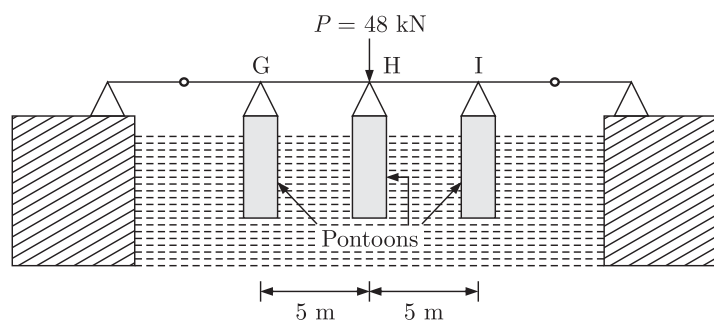
Q. 81   When the middle pontoon is removed, the deflection at *H* will be
(A) 0.2 m   (B) 0.4 m
(C) 0.6 m   (D) 0.8 m

Q. 82   When the middle pontoon is brought back to its position as shown in the figure above, the reaction at *H* will be
(A) 8.6 kN   (B) 15.7 kN
(C) 19.2 kN   (D) 24.2 kN

Q. 83   The degree of static indeterminacy of the rigid frame having two internal hinges as shown in the figure below, is
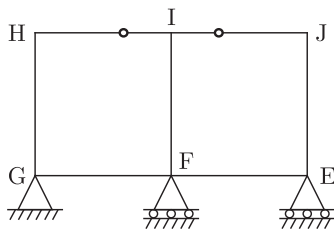
(A) 8   (B) 7
(C) 6   (D) 5

Q. 84   The members EJ and IJ of a steel truss shown in the figure below, are subjected to a temperature rise to 30°C. The coefficient of thermal expansion of steel is 0.000012 per °C per unit length. The displacement (mm) of joint E relative to joint H along the direction HE of the truss, is
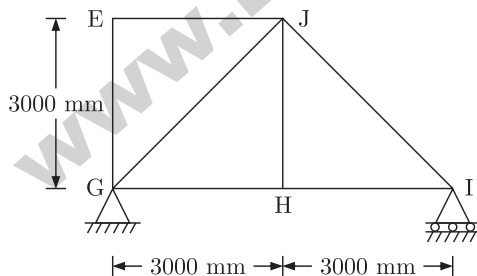
(A) 0.255   (B) 0.589
(C) 0.764   (D) 1.026

Q. 85   The span(s) to be loaded uniformly for maximum positive (upward) reaction at support P, as shown in the figure below, is (are)
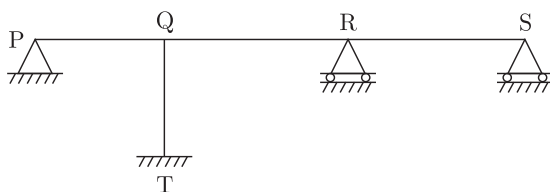
(A) PQ only   (B) PQ and QR
(C) QR and RS   (D) PQ and RS

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ANSWER KEY

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1	2	3	4	5	6	7	8	9	10
(C)	(C)	(B)	(B)	(A)	(D)	(A)	(*)	(D)	(B)
11	12	13	14	15	16	17	18	19	20
(B)	(*)	(D)	(C)	(C)	(*)	(D)	(B)	(A)	(C)
21	22	23	24	25	26	27	28	29	30
(D)	(*)	(B)	(D)	(*)	(A)	(B)	(C)	(D)	(C)
31	32	33	34	35	36	37	38	39	40
(C)	(A)	(B)	(B)	(A)	(A)	(B)	(B)	(B)	(A)
41	42	43	44	45	46	47	48	49	50
(C)	(C)	(C)	(C)	(C)	(*)	(A)	(C)	(A)	(B)
51	52	53	54	55	56	57	58	59	60
(*)	(B)	(D)	(A)	(B)	(A)	(C)	(D)	(C)	(C)
61	62	63	64	65	66	67	68	69	70
(*)	(A)	(A)	(C)	(C)	(B)	(D)	(*)	(D)	(D)
71	72	73	74	75	76	77	78	79	80
(B)	(B)	(C)	(D)	(B)	(*)	(C)	(A)	(A)	(C)
81	82	83	84	85					
(*)	(*)	(D)	(C)	(D)					