Competitive Questions

Reinforced Concrete

Q1: the two chief numerical characteristics that determine the character of bar reinforcement are its……..

a. diameter
b. yield point and modulus of elasticity
c. development length
d. depth

Q2: Since concrete is used mostly in compressive, ...curve is of primary interest.

a. Load- deflection
b. Age- strain
c. Stress- strain
d. Yield point

Q3: One of the most important assumptions relating to flexure and flexural shear is:

a. A cross-section that was plane before loading remains plane under load.
b. Bending stress at any point depends on the strain at that point in a manner given by a stress-strain diagram of the material.
c. The distribution of the shear stress over the depth of the section depends on the shape of the cross-section and of the stress-strain diagram.
d. All above mentioned.

Q4: ……. through crushing of concrete is sudden, of an almost explosive nature, and occurs without warning.

a. Compression failure
b. Tension failure
c. Combined failure
d. Plastic failure

Q5: An approximate nominal flexural strength of rectangular concrete beam having the following properties: b = 250 mm, d = 600 mm, A_s = 1530 mm^2, f_c = 28 MPa, f_y = 420 MPa, is:

a. 300 kN.m
b. 400 kN.m
c. 450 kN.m
d. 350 kN.m

Q6: The ACI Code defines a tension controlled member as one with a net tensile strain greater than or equal to ……

a. 0.005
b. 0.004
c. 0.003
d. 0.002

Q7: It is specified that the minimum clear distance between adjacent bars in beams not be less than ……..

a. The one half diameter bar, or 25 mm
b. The nominal diameter bars, or 25 mm
c. the twice diameter bar, or 20 mm
d. none of the above.

Q8: A rectangular concrete beam considered as doubly reinforced beam if ……

a. Tensile reinforcement ratio is equal to maximum reinforcement ratio.
b. Tensile reinforcement ratio is lesser than maximum reinforcement ratio
c. Tensile reinforcement ratio is greater than maximum reinforcement ratio
d. none of the above

Q9: The web-shear cracks can be expe`cted to form when the diagonal tension stress in the vicinity of the neutral axis becomes ..... the tensile strength of the concrete.

a. equal to
b. less than
c. Zero
d. None of the above

Q10: According to the ACI-Code, web reinforcement does not required wherever the shear force less than ……..

a. φ Vc
b. Vc
c. φ Vc/2
d. None of the above

Q11: For simply supported beam with a clear span of 12 m, the minimum thickness required in accordance to the ACI Code is:

a. 400 mm
b. 550 mm
c. 600 mm
d. 750 mm

Q12: The cracking torque of the solid reinforced concrete member having the following properties: b = 200 mm, h = 250 mm, f_c= 25 MPa, f_y = 414 MPa, is……

(hint: $T_{cr} = 0.33 \sqrt{f_c}\ (A^2_{cp}/P_{cp})$

a. 4.6 kN.m
b. 13.8 kN.m
c. 7.33 kN.m
d. 3.34 kN.m

Q13: A better approach, providing the basis for practical design of concrete columns, is to construct a ……. defining failure load and failure moment for a full range of eccentricities.

a. Load – deflection curve.
b. Strength interaction diagram.
c. Stress – strain curve.
d. Eccentricity curve.

Q14: The point on the interaction diagram is the dividing point between compression failure and tension failure is called …….

a. interaction point
b. steel yield point
c. limit stain state
d. Balanced failure mode

Q15: The curvature shape of the one-way slab under distributed loading and simply supported along its two opposite long edges and free along the two opposite short edges is ……..

a. Linear
b. Cylindrical
c. Irregular
d. None of the above

Q16: The minimum reinforcement required for the one-way slab having 150 mm thickness is:

a. 270 mm^2
b. 300 mm^2
c. 250 mm^2
d. 400 mm^2

Q17: The I-section concrete beam having the following properties: d = 450 mm, b_w = 200 mm, f_y = 420 Mpa and f_c = 28 MPa. If the ultimate shear force = 210 kN, the spacing for φ 10 mm web reinforcement required is: (hint: $V_c = (0.17.\ \lambda.\ \sqrt{f_c}\ .b_w.\ d)$).

a. 200 mm
b. 150 mm
c. 100 mm
d. 75 mm

Q18: For the column having the following properties: Dimension: 300 × 500 mm, d' = 63 mm, As= 4φ22 mm, *fc* = 24 MPa and *fy* = 350 MPa

The nominal axial load strength for zero eccentricity column was calculated to be:

a. 4120 kN
b. 3602 kN
c. 2412 kN
d. 3000 kN

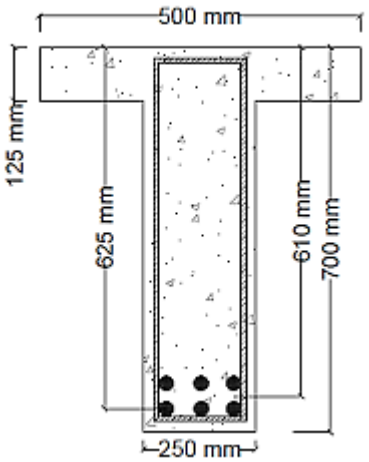
Q19: At any section where tensile reinforcement (with f_y = 420 MPa) is required by analysis, the steel reinforcement ratio provided must not be less than:

a. 0.0033
b. 0.002
c. 0.0018
d. 0.0035

Q20: The design strength of the T-beam shown is:

As = 6 φ 22

f_c = 21 MPa, f_y = 420 MPa



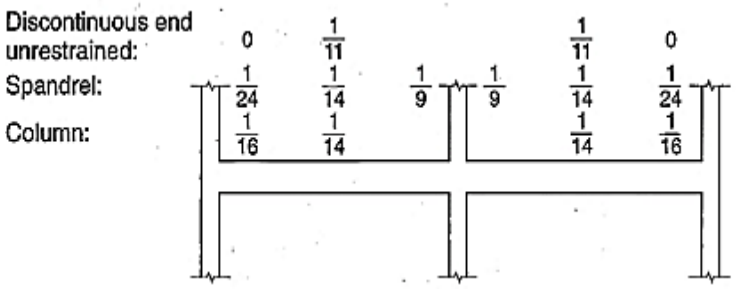
a. 532 kN.m
b. 473 kN.m
c. 610 kN.m
d. 390 kN.m

Q21: Consideration of maximum material economy often leads to proportions with effective depth *d* in the range from about..... times the width *b*.

a .. 1.0 to 1.5
b .. 1.5 to 2
c. 2 to 3
d. 3 to 4

Q22: According to the ACI coefficients shown below, the exterior negative moment for one-way slab with two adjacent 7.5 m span resting on brick wall and carry an ultimate factored load of 50 kN.m will be:

a. 117.187 kN.m
b. 175.78 kN.m
c. 200.9 kN.m
d. 0.0 kN.m



Q23: The nominal torsional strength for a concrete member is given by the equation: $T_n = (2A_o\ A_t\ f_{yt}/s)\cot\theta$. According to that, the nominal torsional strength of beam having the following properties will be:

(b = 200 mm, h = 200 mm, stirrups φ 10@ 125 mm, f_y = 400 MPa, clear cover 20 mm).

a. 10.25 kN.m
b. 9.6 kN.m
c. 8.22 kN.m
d. 11.4 kN.m

Q24: One of the main division of columns is: slender column, for which the strength may be significantly reduced by:

a. Strength of the material
b. Geometry of the cross-section
c. Lateral deflection
d. None of the above.

Q25: The modular ration used in transformed concrete section for a concrete beam having properties of f_c = 28 MPa and f_y = 414 MPa is:

a. 8.0
b. 8.5
c. 9.0
d. 9.5

Q26: If the area of steel reinforcement required for one-way slab is 620 mm^2, the φ 10 mm steel bars will distribute over each meter as:

a. φ 10 @ 200 mm
b. φ 10 @ 125 mm
c. φ 10 @ 150 mm
d. φ 10 @ 100 mm

Q27: The axially loaded circular column having the following properties: Column diameter = 500 mm, fc = 30 MPa, fy = 400 MPa, α = 0.7, As = 10 φ 28 mm
Use the equ. Pu = α φ [0.85fc (Ag – Ast) + Ast fy]
The ultimate axial load can be carried is about:

a. 6400 kN
b. 5000 kN
c. 4300 kN
d. 2000 kN

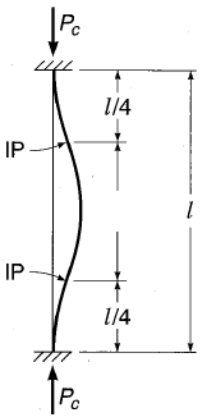
Q28: For simply supported beam, spacing of stirrups at mid-span is:

a. Maximum
b. Minimum
c. between maximum and minimum
d. None of the above.

Q29: The strength of concentrically loaded columns decreases with increasing…..

a. Reinforcement ratio
b. Compressive strength
c. Spacing of stirrups
d. Slenderness ratio

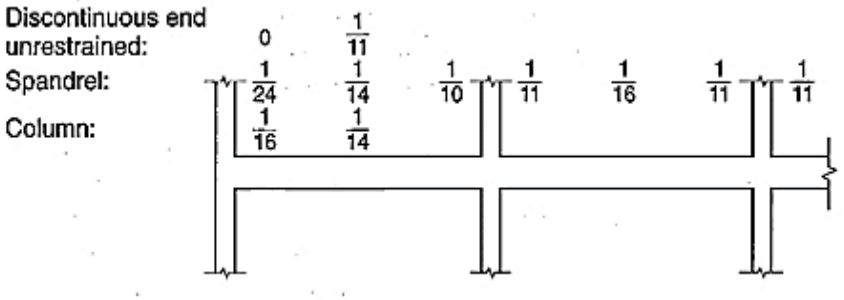
Q30: For the two fixed ended column shown below: the effective length factor (k) is equal to:



a. 1.0
b. 2.0
c. 0.5
d. 0.5 < k < 1.0

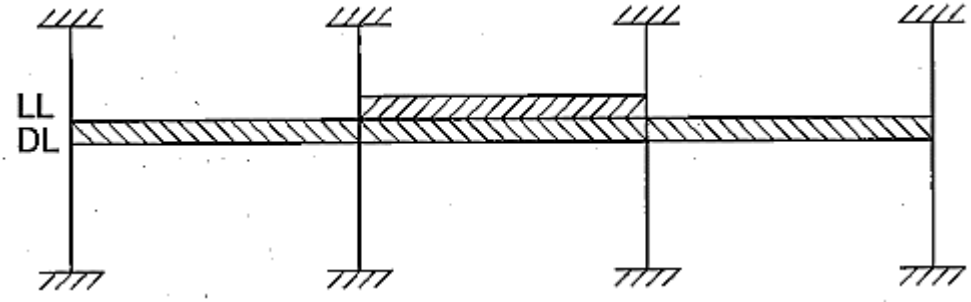
Concrete Design

Q1: For the ACI coefficients shown below, if the ultimate load applied on exterior beam of 8 m span is 40 kN/m, and the beam rest on brick wall, then the positive bending moment will be:



a. 232. 7 kN.m
b. 182.85 kN.m
c. 106.67 kN.m
d. zero

Q2: As require by the ACI Code, the loading case shown below is for:



a. Maximum positive moment in the exterior spans, the minimum positive moment in the centre span.
b. Maximum positive moment in the centre span and minimum positive moments in the exterior spans.
c. Maximum negative moment at both faces of the interior column.
d. None of the above.

Q3: The approximate thickness required for the 2-way concrete slab of (5.6 × 7.3 m) is:

a. 145 mm
b. 175 mm
c. 125 mm
d. 100 mm

Q4: In reinforced concrete slab, when the ratio of long to short direction taken to be 2,..... of the load applied on slab will be distributed on the short direction.

a. 75%
b. 50%
c. 96%
d. 82%

Q5: The coefficients method used to calculate the moments in two-way slabs supported by edges beams also called by:

a. Moment distribution method
b. Direct design method
c. Equivalent frame method
d. ACI Method 3

Q6: In direct design method, the negative moment at the face of support will take ….... of the total static moment

a. 35%
b. 65%
c. 50%
d. 75%

Q7: Which of the following is the limit of the direct design method:

a. There must be three continuous spans in each direction.
b. Panel should be rectangular, with the ratio of longer to shorter dimensions, is lesser or equal to 2.
c. Column offset shall not exceed 10% of the span in the direction of offset from either axis between center lines of successive columns
d. All the above mentioned

Q8: In shear design of flat plates, the critical section is an area taken at a distance …..... from all face of the support.

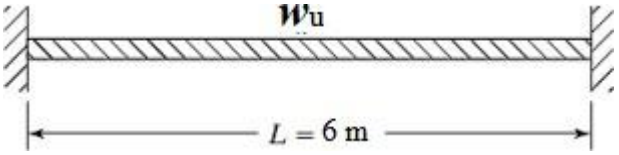
a. d
b. 1.5 d
c. 0.5 d
d. 2d

Q9: ACI Code requires the column capital should be oriented no greater than …..... to the axis of the column.

a. 45º
b. 35º
c. 30º
d. 55º

Q10: Using plastic theory, for the beam shown below, the collapse load (w_u) will be:

a. (4/9) Mp
b. (4/3) Mp
c. 3 Mp
d. (4/3) Mp



Q11: When the load increases further on slab, the line where the cracking concentrates (across which the steel reinforcement has yielded) will increase until a collapse mechanism is formed. These lines are called……..

a. Deformation lines
b. Yield lines
c. Influence lines
d. All the above

Q12: A square slab is simply supported along all sides and it's to be isotopically reinforced. What will be the resisting moment (m) per linear meter required just to sustain a uniformly distributed collapse load (w) kN/m^2

a. m = wl/8
b. m = wl^2/12
c. m = wl^2/8
d. m =wl^2/24

Q13: Which of the following is the disadvantage of the ribbed slab?

a. Not suitable where the live loads are huge as heavy manufacturing buildings, warehouses.
b. Sometimes difficult to install the electric equipment.
c. Formwork cost is high.
d. All the above

Q14: Two-way Ribbed Slab System is known as ……

a. Flat slab
b. Edge slab
c. Waffle slab
d. Continuous slab

Q15: The loss of prestress force may be attributed to the:

a. Loading change
b. Temperature change
c. Relaxation
d. Support condition

Q16: A simply supported prestressed beam will be used on a 12.0 m simple span. it has the following properties:

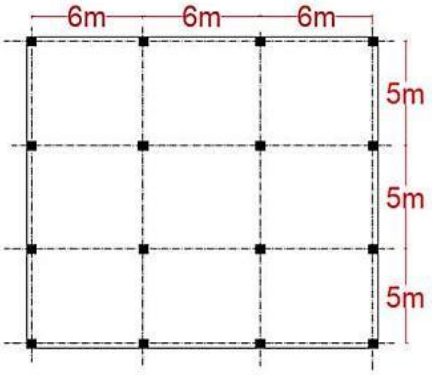
$I = 5 \times 10^9$ mm^4, $A = 114 \times 10^3$ mm^2, e = 130 mm, $y_{top} = y_{bot} = 305$ mm

Pi = 750 kN, Moment due to self-weight = 48.6 kN.m

The top stress at transfer stage is:

a. – 3.6 MPa
b. – 9.5 MPa
c. – 6.5 Mpa
d. – 4.6 MPa

Q17: For the flat slab shown below:



Ultimate load = 9 kN/m^2

Column size = 0.4 × 0.4 m

Using direct design method, the total static moment in long direction will be:

(Hint use DDM equation ($M_o = w_u.l^2_n.l_2/8$))

a. 176.4 kN.m
b. 157.5 kN.m
c. 202.5 kN.m
d. 168.75 kN.m

Q18: In punching shear design of flat slab, shear reinforcement can be provided by:

a. Slab thickness
b. Column size
c. Shear studs
d. Slab span

Q19.....is the projection of slab provided at the vicinity of column to minimize punching shear demand.

a. An integrated beam
b. A shear studs
c. A stirrup
d. A drop panel

Q20: A two-way slab continuous over all four edges having the following properties: Dimensions = 6m × 5.4 m, Ultimate load = 15 kN/m^2

The Negative Moment at short direction is:

Table 1 - Coefficients for Negative Moments in Slabs

$M_a^- = C_{a,neg} w_u l_a^2$
$M_b^- = C_{b,neg} w_u l_b^2$
where w_u = total factored uniform load (DL + LL)

Ratio $m = \frac{l_a}{l_b}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	$C_{a,neg}$	-	0.045	0.076	0.050	0.075	0.071	0.071	0.033	0.061
	$C_{b,neg}$		0.045		0.050				0.061	0.033
0.95	$C_{a,neg}$	-	0.050	0.072	0.055	0.079	0.075	0.067	0.038	0.065
	$C_{b,neg}$		0.041		0.045				0.056	0.029
0.90	$C_{a,neg}$	-	0.055	0.070	0.060	0.080	0.079	0.062	0.043	0.068
	$C_{b,neg}$		0.037		0.040				0.052	0.025

a. 21.87 kN.m
b. 14.71 kN.m
c. 31.185 kN.m
d. 19.89 kN.m

Q21: When the tendons are tensioned after the concrete is placed and has gained its strength, the construction named:

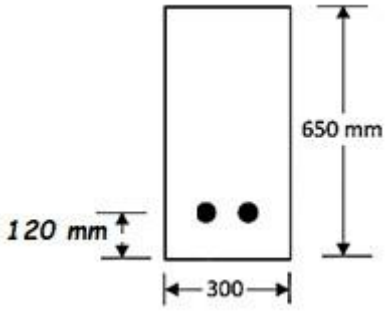
a. Pre-tensioned construction
b. Monolithic construction
c. Post-tensioned construction
d. All above mentioned

Q22 .....is a procedure for the analysis and design of two-way slabs limited to slab systems subjected to uniformly distributed loads and supported on equally or nearly equally spaced columns.

a. Virtual work method
b. Direct design method
c. Method 3
d. ACI coefficients method

Q23: For the prestressed section shown below, the section having the following properties: Aps = 1000 mm^2, fps = 1200 MPa, f_c = 36 MPa. The nominal strength will be equal to:

a. 415.6 kN.m
b. 500.3 kN.m
c. 557.6 kN.m
d. 630.3 kN.m



Q24: For a simply supported square slab with uniform loading, where do the yield lines typically form?

a. Along the diagonals
b. Parallel to the shorter edges
c. Parallel to the longer edges
d. Randomly distributes

Q25: The reinforcement in the short direction of two-way slab should be placed ……. the reinforcement in the long direction.

a. With
b. Over
c. Below
d. None of the above

Q26: In Analysis and design of statically indeterminate beams, which of the following limitations the ACI moment coefficients are applicable?

a. There are two or more spans
b. Members are prismatic
c. Loads uniformly distributed.
d. All of the above mentioned.

Q27: The yield line analysis of concrete slabs focuses entirely on the …….. of the slab.

a. Shear capacity
b. Vertical deflection
c. Support condition
d. Flexural capacity

Q28: The main disadvantage of using prestressed concrete beams is:

a. Increase the shear capacity
b. Increase the stiffness
c. Higher cost
d. Smaller section used

Q29: The term "one-way slab" refers to a slab that:

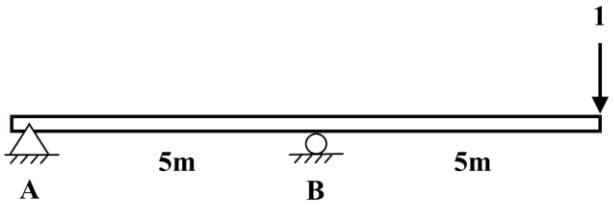
a. Transfer load in one-direction
b. Has equal reinforcement in both directions
c. Supported on all four sides
d. None of the above.

Q30: The minimum diameter of bars used in slab reinforcement is:

a. 6 mm
b. 8 mm
c. 10 mm
d. 12 mm

Structures

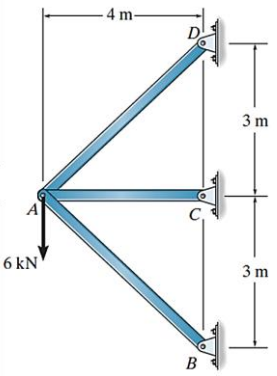
Q1: For the beam shown, what is the value of the influence line of the reaction at A when the unit load located at the free end?



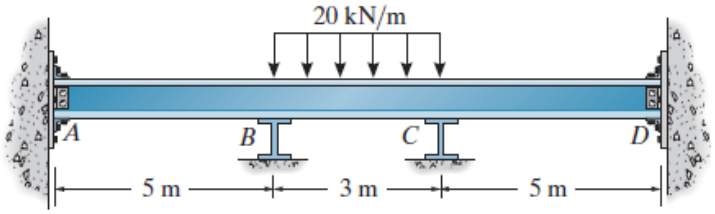
A. Zero kN
B. -2 kN
C. 1 kN
D. -1 kN

Q2: For the truss shown, by inspection, the force in member **AC** is …...?

A. Zero
B. 6 kN (C)
C. 3.6 kN (C)
D. 4.8 kN (C)



Q3: For the beam shown, if A and D are hinges, B and C are rollers, then the beam can statically classified as ….?

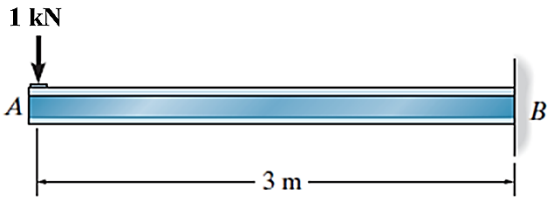


A. Stable and statically determinate
B. unstable and statically determinate
C. Stable and statically indeterminate to the 3rd degree
D. Stable and statically indeterminate to the 5th degree

Q4: For the cantilever beam shown, the deflection at the free end is ……?

A. $\frac{3}{EL}$ B. $\frac{9}{EL}$

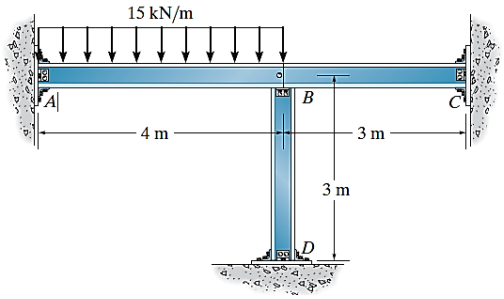
C. $\frac{18}{EL}$ D. $\frac{27}{EL}$



Q5: For the frame shown, if A and C are hinge, D is fixed, what is the degree of freedom ….?

A. 1 B. 2

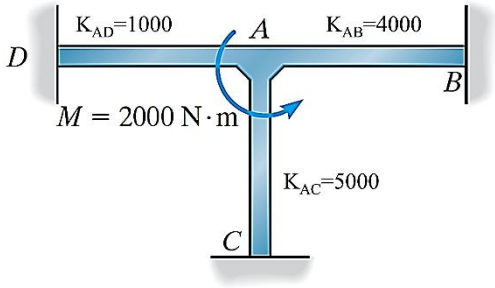
C. 3 D. 5



Q6: For the frame shown, If M = 2000 N.m acts at joint A, the equilibrium moments exerted by the member AD on the joint, is:

A. 200 kN.m B. 400 kN.m

C. 800 kN.m D. 1000 kN.m

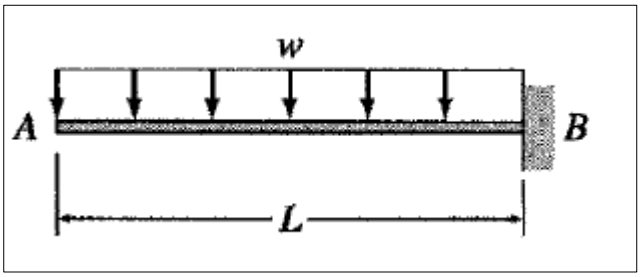


Q7: In moment distribution method, K is

A- Stiffness Factor B- Joint Stiffness Factor

C- Member Stiffness Factor Total Stiffness Factor

Q8: Use the virtual work method. Determine m and M. EI is constant. w= 5 kN/m **(2 marks)**



A- m= -1 kN.m M= -5 kN.m B- m= -x kN.m M= -5 x^2 kN.m

C- m= -x kN.m M= -2.5 x kN.m D- m= -x kN.m M= -2.5 x^2 kN.m

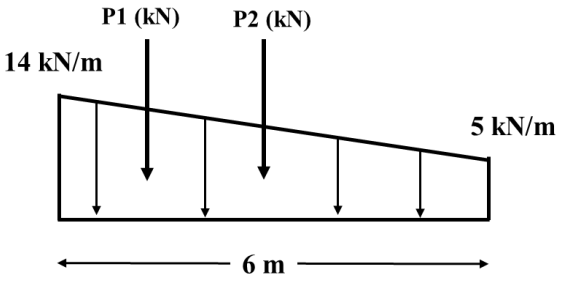
Q9: For the distributed load shown, the values of P_1 (kN) and P_2 (kN), respectively are:

A. P_1= 30 kN, P_2= 27 kN

B. P_1= 27 kN, P_2= 30 kN

C. P_1= 42 kN, P_2= 30 kN

D. P_1= 30 kN, P_2= 42 kN



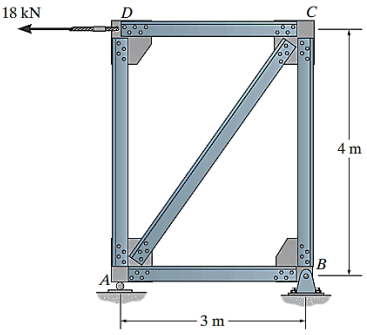
Q10: For the truss shown, the forces in member CD and DA, and the vertical reaction at B, respectively, are:

A. F_{CD} = 18 kN (T), F_{DA} = 0, B_y = 24 kN (↓)

B. F_{CD} = 18 kN (C), F_{DA} = zero, B_y = 24 kN (↑)

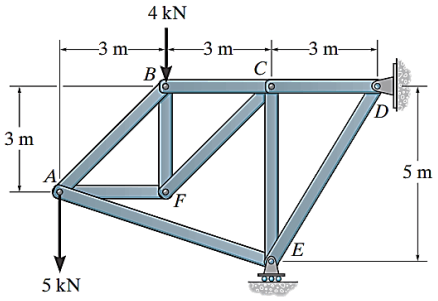
C. F_{CD} = 18 kN (T), F_{DA} = 24 kN (C), B_y = 0

D. F_{CD} = 24 kN (T), F_{DA} = 0, B_y = 18 kN (↑)



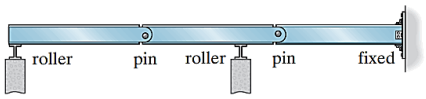
Q11: The truss shown is:

A. Statically indeterminate to the 2nd degree, externally stable, internally unstable
B. Statically determinate, externally unstable, internally stable
C. Statically determinate, externally unstable, internally unstable
D. Statically determinate, externally stable, internally stable



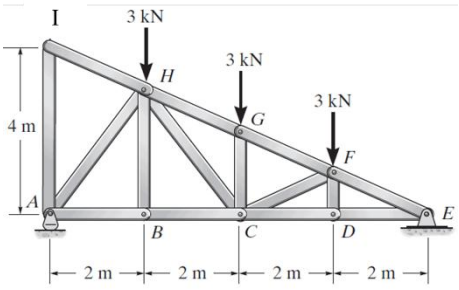
Q12: The frame shown is:

A. Statically indeterminate to the 1st degree, stable
B. Statically determinate, unstable
C. Statically determinate, stable
D. Statically indeterminate to the 1st degree, unstable



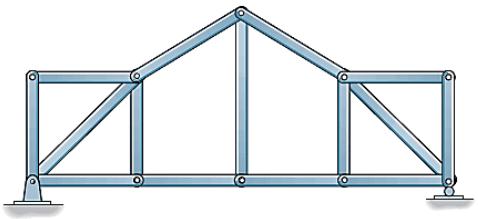
Q13: For the truss shown, the zero force members are:

A. AI,
B. AI, HI, BH
C. AI, HI, BH, DF
D. AI, HI, BH, DF, CG



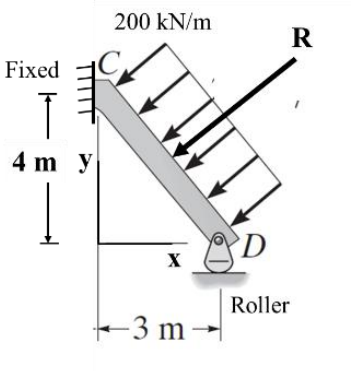
Q14: The truss shown is (assume any type of loading):

A. Unstable
B. Statically determinate, externally stable, internally unstable
C. Statically indeterminate to the 2nd degree, externally stable, internally stable
D. Statically indeterminate to the 2nd degree, externally stable, internally unstable



Q15: For the figure shown, the value of R_x and R_y, respectively are:

A. R_x = 600 kN (→), Ry = 800 kN (↑)
B. R_x = 600 kN (←), Ry = 800 kN (↓)
C. R_x = 800 kN (→), Ry = 600 kN (↑)
D. R_x = 800 kN (←), Ry = 600 kN (↓)



Q16: One of the following structures its members carry only axial loads:

A. Truss
B. Frame
C. Cable
D. A and C

Q17: Frame members can carry:

A. Axial load
B. Shear load
C. Flexural load
D. A, B and C

Q18: The following loads can be considered as a live load:

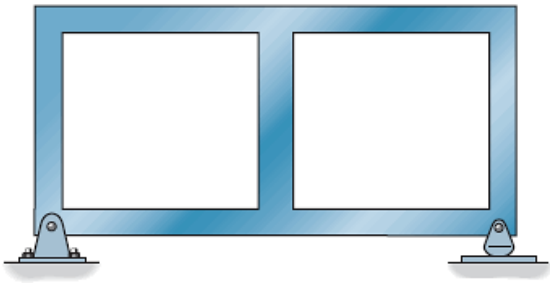
A. Moving load
B. Objects temporarily placed on a structure
C. Occupiers
D. A, B and C

Q19: The frame shown is:

A. Statically determinate, unstable
B. Statically indeterminate to the 1st degree, stable
C. Statically indeterminate to the 1st , unstable
D. Unstable

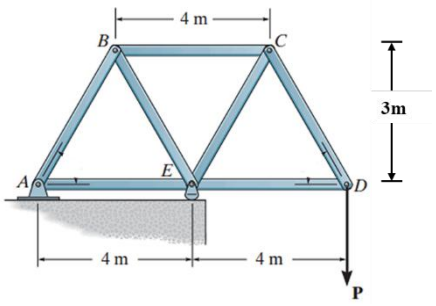
Q20: The following frame is:

A. Statically indeterminate to the 2nd degree, stable
B. Statically indeterminate to the 4nd degree, stable
C. Statically indeterminate to the 6nd degree, stable
D. Statically indeterminate to the 8nd degree, stable



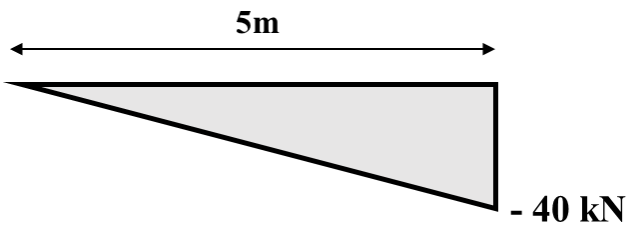
Q21: For the truss shown if **P = 10.5 kN**, the force in member F_{BC} equal to :

A. F_{BC} = 10.5 kN(T)
B. F_{BC} = 10.5 kN(C)
C. F_{BC} = 14 kN(T)
D. F_{BC} = 14 kN(C)



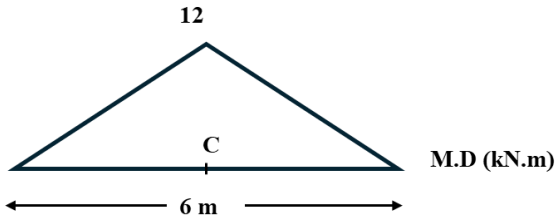
Q22: The value of load (w) that caused the shear diagram shown below is:

A. w = 8 kN/m (↑)
B. w = 8 kN/m (↓)
C. w = 8 kN (↓)
D. w = 8 kN/m (↑)



Q23: For a beam having the moment diagram shown, the corresponding value at C in the shear diagram is equal to:

A. Zero
B. 18 kN
C. 36 kN
D. 72 kN



Q24: The compound truss can be analyzed by applying:

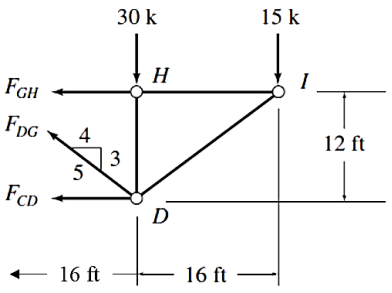
A. Method of joints only
B. Method of sections only
C. both the method of joints and the method of sections
D. None of the above

Q25: In the shear diagram of a beam, the point of zero shear represents:

A. Maximum Moment
B. Minimum moment
C. Zero Moment
D. Inflection point

Q26: For the truss section shown , the force in member GH equal to:

A. F_{GH} = 80 k (T)
B. F_{GH} = 80 k (C)
C. F_{GH} = 20 k (C)
D. F_{GH} = 20 k (T)



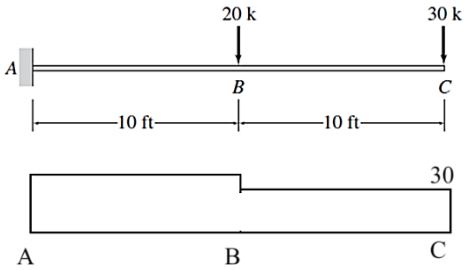
Q27: For the beam shown , the value of shear at B is equal to:

A. 10 k

B. 20 k

C. 30 k

D. 50 k



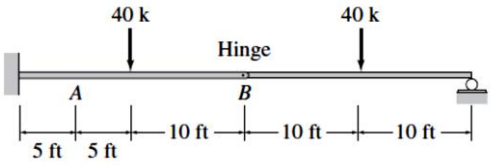
Q28: For the beam shown, the shear and moment at point B respectively equal to:

A. 20 k, Zero

B. 20 k, 400 k.ft

C. 40 k, Zero

D. 40 k, 400 k.ft



Q29: For a simply supported beam with a point load at the center, the bending moment diagram will be

A. Constant

B. Rectangular

C. Triangular

D. parabolic

Q30: For a cantilever beam of length (L) and carrying a uniformly distributed load, the value of maximum moment is located at ?

A. The fixed end

B. The free end

C. The mid-span

D. The one third from the fixed end

Q31: In the moment diagram, the sudden change (vertical line) is caused by?

A. A uniform distributed load

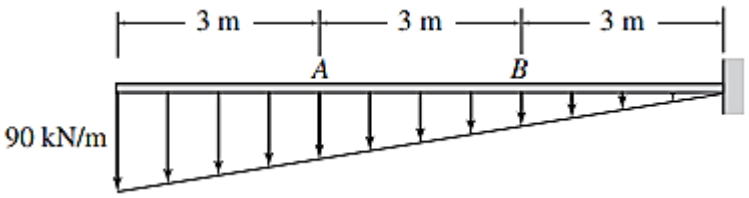
B. A concentrated moment.

C. A concentrated load

D. A uniformly varying load

Q32: For the cantilever beam shown, the shape of moment diagram, and the value of at the moment at the fixed end, respectively is:

A. Parabolic, 1215 kN.m
B. Parabolic, 2430 kN.m
C. Cubic, 1215 kN.m
D. Cubic, 2430 kN.m

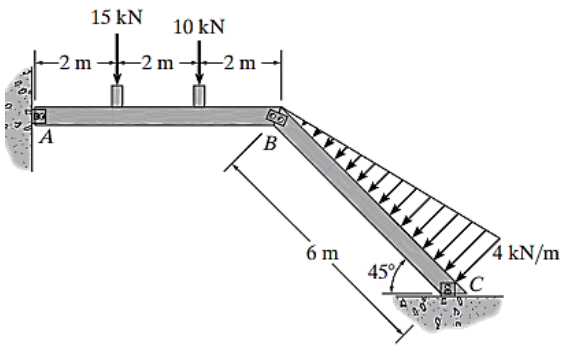


Q33: For an internal hinge in a frame member, when drawing the moment diagram, the value of bending moment at that hinge is?

A. Maximum
B. Minimum
C. Zero
D. Inflection point

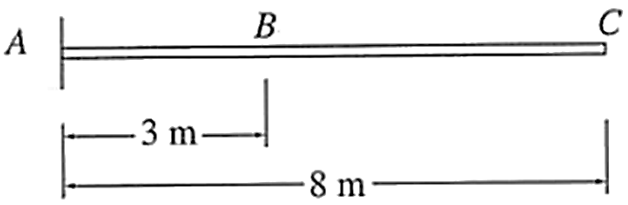
Q34: For the frame show, the shape of moment diagram of member BC is:

A. Rectangular
B. Linear
C. Parabolic
D. Cubic



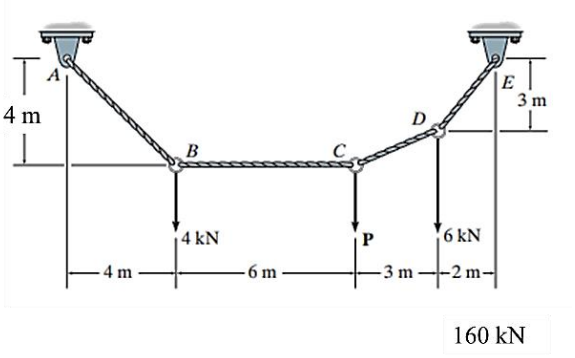
Q35: If A is fixed, the maximum shear that can be developed at point B due to a moving load of 10 kN is.

A. 5 kN
B. 10 kN
C. 50 kN
D. 80 kN



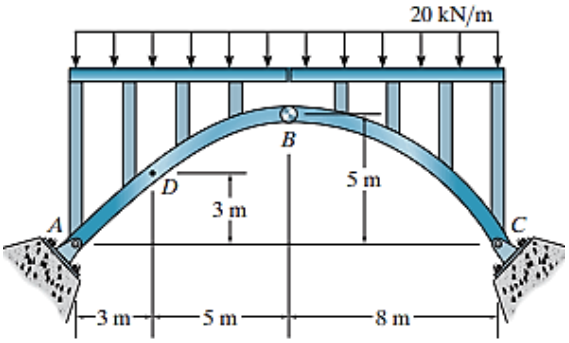
Q36: For the cable system, the value of P is equal to?

A. P = 1.32 kN
B. P = 2.32 kN
C. P = 4 kN
D. None of the above



Q37: For the arch shown, if By = 0, then the value of Bx is equal to:

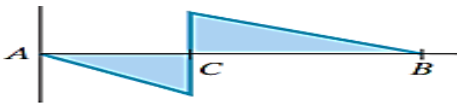
A. Bx = zero
B. Bx = 64 kN
C. Bx = 128 kN
D. Bx = 256 kN

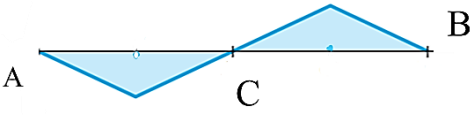


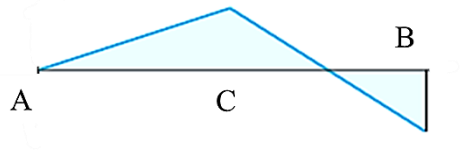
Q38: For the beam shown, the shape of the influence line for the reaction at the support A is:

A. Rectangular
B. Right angle triangular
C. Equal angle triangular
D. Equal sides triangular

Q39: For the beam shown , the shape of the influence line for the shear at C is:

A. 

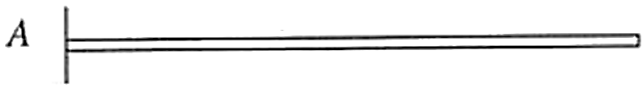
B. 

C. 

D. None of the above

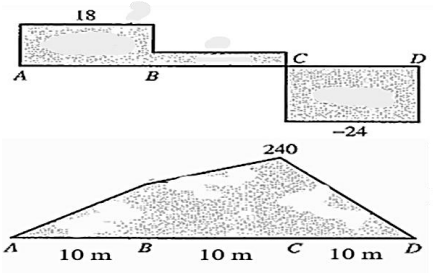
Q40: For the beam shown, if the support at A is fixed, then, the shape of the influence of the vertical reaction at A is:

A. Triangular
B. Rectangular
C. Equal sides triangular
D. None of the above



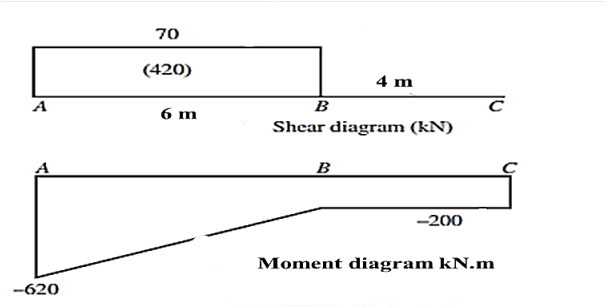
Q41: For the shear and moment diagram of a member in a frame. The values of shear at B and moment at C are respectively equal to:

A. 6 kN, 180 kN.m
B. 30 kN, 180 kN.m
C. 30 kN, 18 kN.m
D. 60 kN, 18 kN.m



Q42: For the shear and moment diagram of a member in a frame. The value of – 200 kN.m is due to?

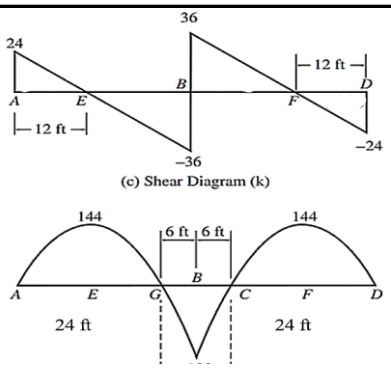
A. Concentrated load of 200 kN (↓)
B. Concentrated load of 200 kN (↑)
C. Clockwise moment of 200 kN.m
D. Counterclockwise moment of 200 kN.m



Q43: For the shear and moment diagram of a frame member, the value of moment at point B is equal to:

A. 180 kN.m
B. – 180 kN.m
C. 36 kN.m

D. – 144 kN.m



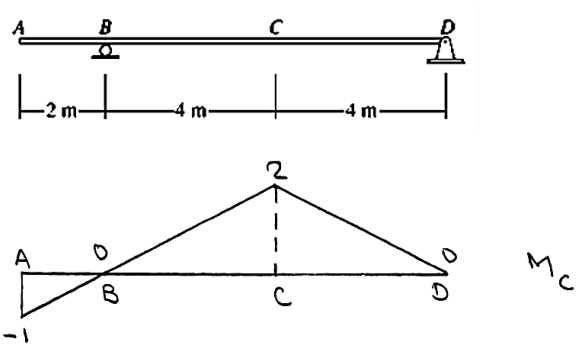
Q44: For the beam shown, the maximum positive bending moment at point C due to a concentrated live load of 100 kN, a uniformly distributed live load of 50 kN/m is:

A. 475 kN.m

B. 500 kN.m

C. 550 kN.m

D. 600 kN.m



Q45: A simply supported beam of length (L) carrying a uniform distributed load of (w N/m), the value of shear at mid-span is:

A. Maximum

B. Minimum

C. Zero

D. A and B

Q46: The shape of moment diagram of a simply supported beam carrying a uniform distributed load of (w N/m), is:

A. Linear

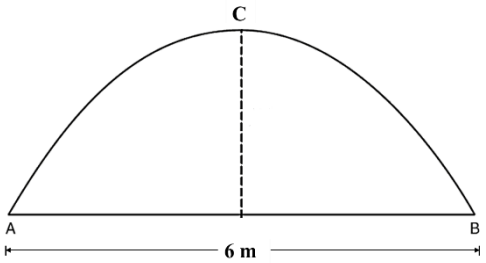
B. Parabolic

C. Cubic

D. Horizontal

Q47: For the moment diagram shown, if the applied uniform distributed load is (10 kN/m), the value of moment at C is equal to:

A. 15 kN.m
B. 30 kN.m
C. 45 kN.m
D. 60 kN.m



Q48: The primary internal forces that developed in a beam through any section is:

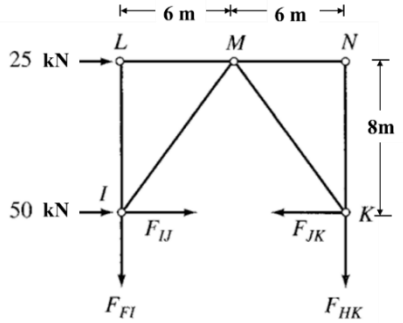
A. Axial force
B. Shear force
C. Moment
D. All of the above

Q49: The value of the moment at the internal hinge of a beam is:

A. Zero Moment
B. Minimum moment
C. Maximum Moment
D. Inflection point

Q50: For the truss section shown , the force in member **HK** equal to:

A. F_{HK} = 13.34 kN (C)
B. F_{HK} = 16.67 kN (C)
C. F_{HK} = 21.67 kN (C)
D. F_{HK} = 25.34 kN (C)



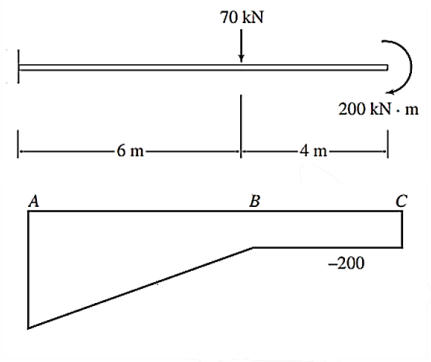
Q51: For the moment diagram of the beam shown , the value of moment at A is equal to:

A. - 70 kN.m

B. - 220 kN.m

C. - 420 kN.m

D. - 620 kN.m



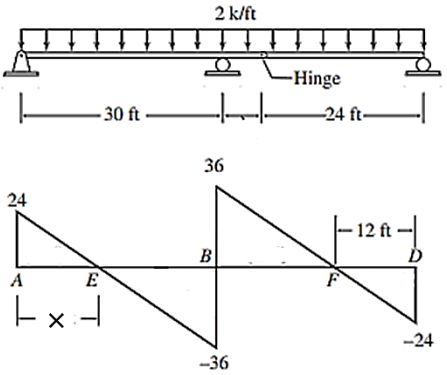
Q52: For the shear diagram of the beam shown, the value of × is equal to:

A. 12 ft

B. 15 ft

C. 20 ft

D. 24 ft



Q53: For a simply supported beam with a concentrated load at the center, the shear is equal to zero at:

A. Right support

B. Left support

C. Mid-span

D. None of the above

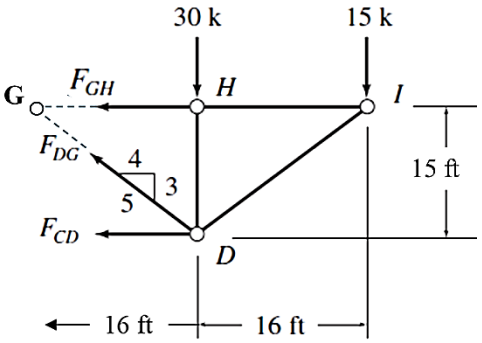
Q54: For a truss section shown, the value of the force in member **CD** is equal to?

A. 32 kN (T)

B. 32 kN (C)

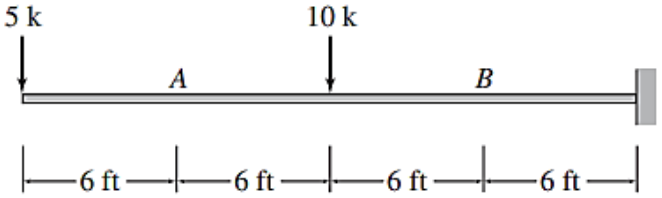
C. 62 kN (T)

D. 62 kN (C)



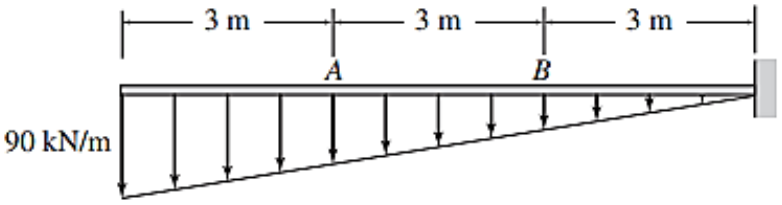
Q55: For the beam shown, the shear value at the free end is equal to?

A. 5 kN
B. -5 kN
C. 15 kN
D. -15 kN



Q56: For the cantilever beam shown, the shape of shear diagram, and the value of the moment at the fixed end, respectively, are:

A. 2nd degree, 40.5 kN
B. 2nd degree, 121.5 kN
C. 3rd degree, 243 kN
D. None of the above



Q57: A symmetrical frame has a joint that connect two vertical members with stiffness 3EI/L each and a horizontal beam with stiffness 4EI/L. What is the distribution factor for one of the vertical members at the top joint?

A. 0.1
B. 0.2
C. 0.3
D. 0.4
E. 0.5

Q58: A moment of 5000 N.m is distributed at a joint, and the carry-over factor is 0.5. What is the moment carried over to the far fixed end?

A. 1000 N.m

B. 1500 N.m

C. 2000 N.m

D. 2500 N.m

E. 3000 N.m

Q59: A beam has a moment of 8000 N.m applied at joint B. If the distribution factor for member BA is 0.4 and for BC is 0.6, what moment is distributed to span BA?

A. 2400 N.m

B. 3200 N.m

C. 4800 N.m

D. 6400 N.m

E. 8000 N.m

Q60: A two-span continuous beam with identical spans and EI values is analyzed using the moment distribution method. If the stiffness of each span is 4EI/L, what is the total joint stiffness at the middle support?

A. EI/L

B. 2EI/L

C. 4EI/L

D. 6EI/L

E. 8EI/L

Q61: A continuous beam has two spans, each with a length of 6 m. If both spans have the same flexural rigidity (EI) and are fixed at both ends, what is the distribution factor for each span at the middle joint?

A. 0.25

B. 0.5

C. 1

D. 1.5

E. 2

Q62: Which of the following best describes a distribution factor?

A. The total joint stiffness

B. The proportion of moment carried over to the next support
C. The ratio of carry-over moment to the initial moment
D. The moment applied at a joint
E. The ratio of a member's stiffness to the total joint stiffness

Q63: In the moment distribution method, what happens if a beam has an overhanging span?

A. The moment at the overhang is distributed equally
B. The carry-over factor becomes negative
C. The overhang reduces the stiffness of the entire beam
D. The distribution factor for the overhang is zero
E. The distribution factor for the overhang is equal to one

Q64: If a beam is pin-supported at its far end, then the value of carry-over factor is equal to?

A. 1
B. 0.5
C. zero
D. The distribution factor
E. Double

Q65: What is the stiffness factor for a beam with a fixed far end?

A. 4EI/L
B. 3EI/L
C. 2EI/l
D. EI/L
E. zero

Q66: For the frame shown below, the equation of Mcb is?

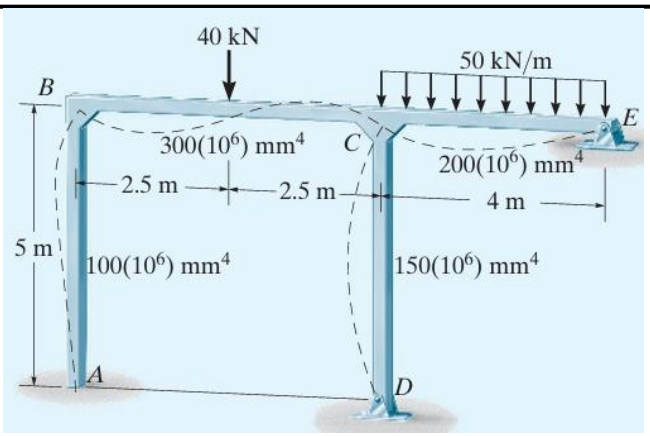
A. Mcb=18000 θc

B. Mcp=20000 θc

C. Mcp=24000 θc

D. Mcp=28000 θc

E. Mcp=30000 θc



Q67: For the table of calculations shown for a frame solved by the moment distribution method, the value of X is

Joint	A	B		C		D	
Member	AB	BA	BC	CB	CD	DC	2
DF	0	0.5	0.5	0.4	0.6	0	3
FEM			−240	240	−250	250	4
Dist.		120	120	X	6		5

A. 5

B. 6

C. 4

D. -96

E. 96

Q68: For the frame shown, if A is hinge, B and C is fixed. Then degree of freedom is:

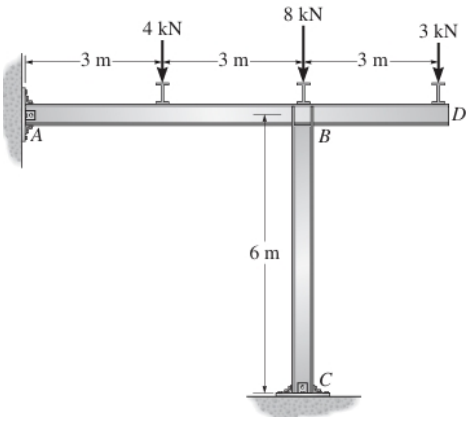
A. θA, θB, θC and ΔD

B. θB, θC and ΔD

C. θA, θB, θC, θD and ΔD

D. θA, θB, θD and ΔD

E. θA, θB, and θD



For the frame shown, if A, and C is fixed. The number of redundant forces and the degree of freedom, respectively are:

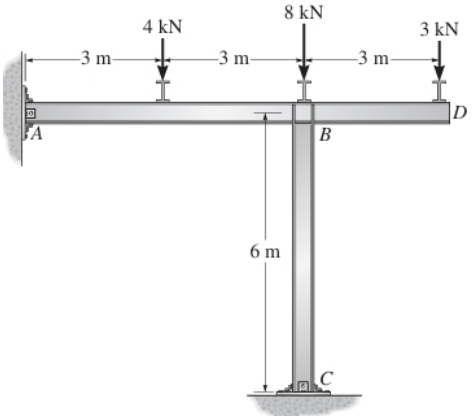
A. 3, 1

B. 1, 3

C. 3, 3

D. 4, 2

E. 3, 4



Q69: For the frame shown, The FEM for member BD is:

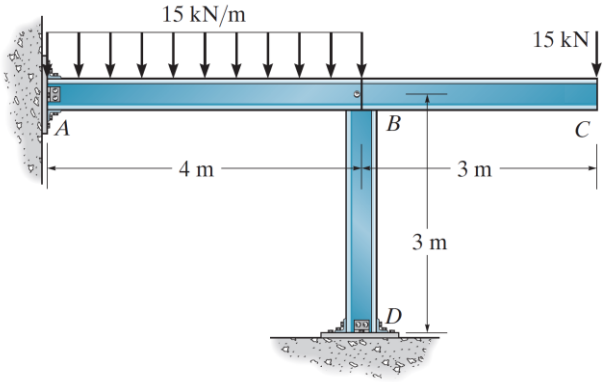
F. WL^2/8

G. 45 kN m

H. -45 kN m

I. Zero

J. WL^2/12



Q70: For the beam shown, the number of redundant forces and the degree of freedom, respectively are:

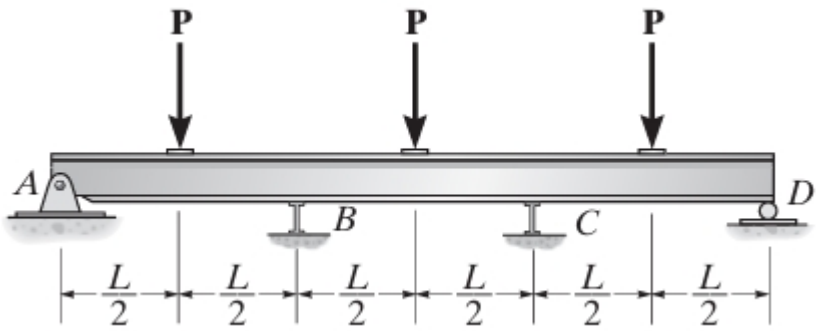
A. 1, 2

B. 2, 1

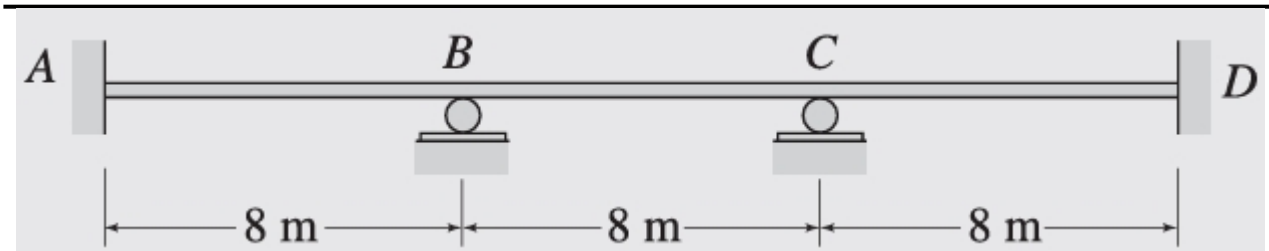
C. 2, 2

D. 2, 3

E. 2, 4



Q71: For the beam shown, if support B stalled of 20mm, then the spans rotation are?



A. ΨAB = 20 mm, ΨBC = -20 mm, ΨCD = 0

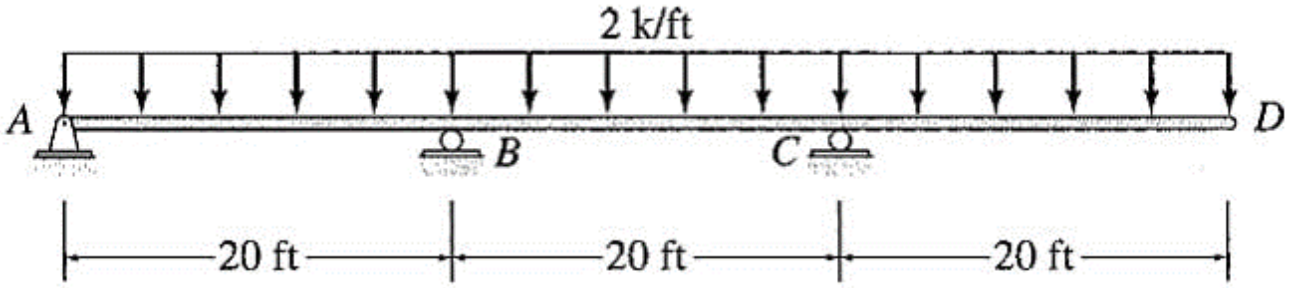
B. ΨAB = -20 mm, ΨBC = 20 mm, ΨCD = 0

C. ΨAB = -0.0025 mm, ΨBC = -0.0025 mm, ΨCD = 20mm

D. ΨAB = 0.0025 mm, ΨBC = -0.0025 mm, ΨCD = 0

E. ΨAB = -0.0025 mm, ΨBC = -0.0025 mm, ΨCD = 0mm

Q72: For the beam shown, which of the following equilibrium equation at point C is correct?



A. $M_{CB}+M_{CD}=400$ k.ft

B. $M_{CB}= 400$ k.ft

C. $M_{CB}+M_{CD}+M_{BC}=0$

D. $M_{BC}+M_{CB}=-400$ k.ft

E. A and B

Q73: The virtual work method is based on the principle of:

A. Conservation of energy

B. Conservation of momentum

C. Conservation of mass

D. conservation of angular momentum

E. None of the above

Q74: Using the virtual method to calculate deflection, $\boldsymbol{\Delta} = \int mM/EI\ dx$, M represents:

A. Internal virtual moment due to unit couple moment (kN.m)

B. External Moment due to actual loads

C. External virtual moment due to virtual unit load (kN)

D. External Shear Force due to real loads

E. Internal moment due to actual loads

Q75: The assumed positive sign of the fixed end moment and Ψ in the slop-deflection method respectively, are?

A. clockwise, counterclockwise

B. counterclockwise, counterclockwise

C. counterclockwise, counterclockwise

D. clockwise, clockwise

E. depend on load direction

Q76: For the frame shown, assume support D is fixed. The moment (M_{DB}) is:-

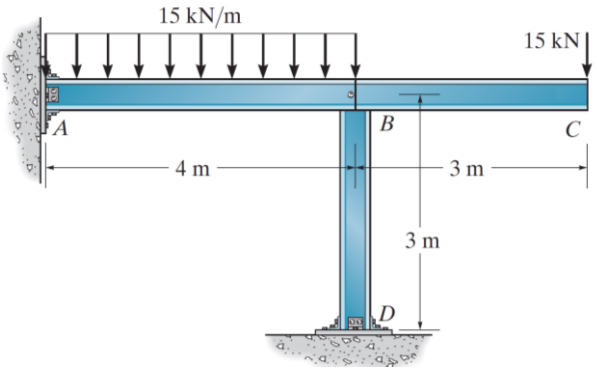
A. $M_{DB}=2EK\ (\theta_B)$

B. $M_{DB}=2EK(2\theta_D+\theta_B)$

C. $M_{DB}=3EK(2\theta_D+\theta_B)$

D. $M_{DB}=3EK\ (2\theta_D)$

E. $M_{DB}=3EK(\theta_D)$



Q77: For the beam shown, The FEM for member AB at Point B is:

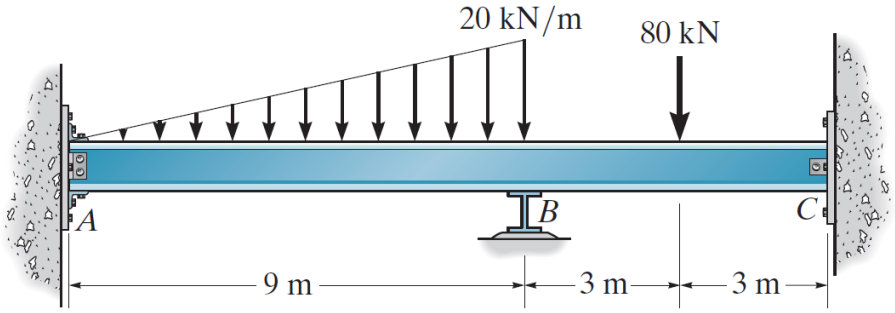
A. WL2/20

B. WL2/30

C. WL2/15

D. WL2/12

E. WL2/8



Q78: For the frame shown, which of the following equilibrium equation is correct at point C?

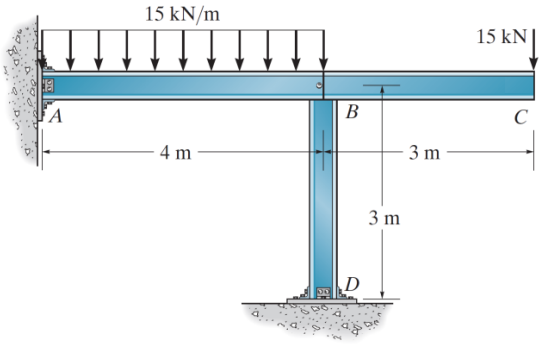
A. MBC+MBA+MBD=45 kN.m

B. MBA+MBD=45 kN.m

C. MBC+MBA=0

D. MBC+MBA=45 kN.m

E. MBC+MBD=0



Q79: For the frame shown below using the force method, Which redundant can be removed?

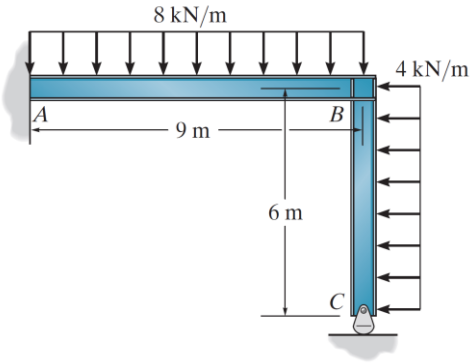
A. Vertical Reaction at C

B. Vertical Reaction at A

C. Moment Reaction at A

D. Horizontal Reaction at A

E. A and C



Q80: For the beam shown in Figure EI is constant, $M=wx^2/2$ and m= -x, the vertical reaction at the B is:

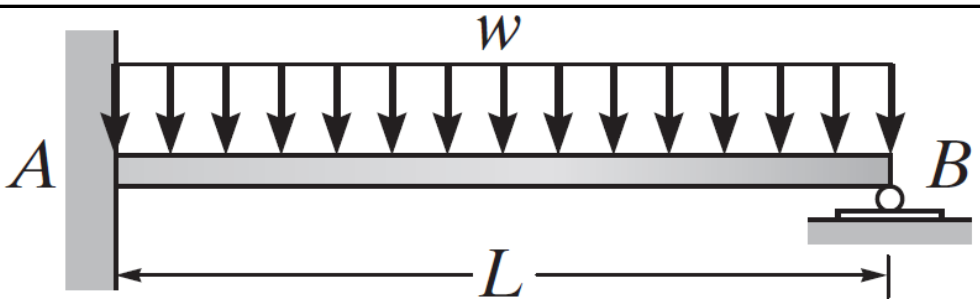
A. 5WL/8

B. 3WL/8

C. WL/2

D. WL/3

E. WL/6



Q81: For the shown frame, the vertical deflection at point C is:-

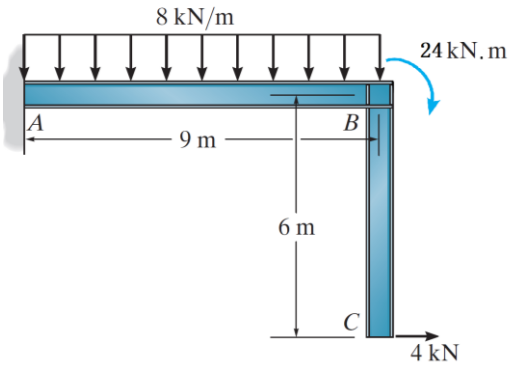
A. 6500/EI

B. 6561/EI

C. 7500/EI

D. 6550/EI

E. 384/EI



Q82: For the frame shown below using the force method, if the EI of the member of the BC were doubled, the value of the reaction at C will be:

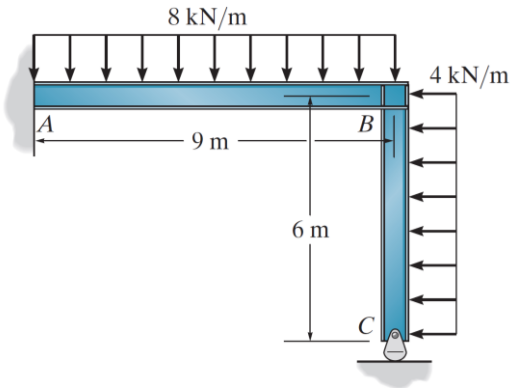
A. Quartered

B. Half

C. Double

D. Triple

E. Not changed



Q83: To determine the vertical displacement of joint B. Using the method of virtual work, the value of n and N in member DB, respectively are?

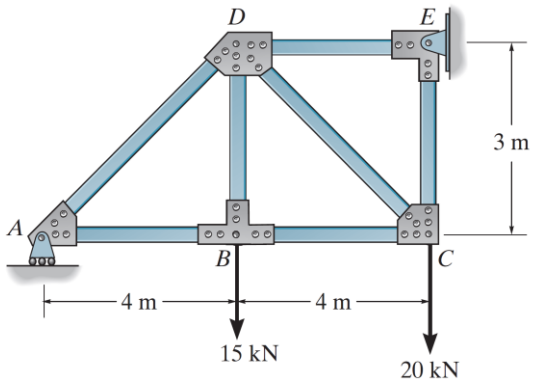
A. 0 kN, 0 kN

B. 1 kN, 15 kN

C. 0.5 kN, 20 kN

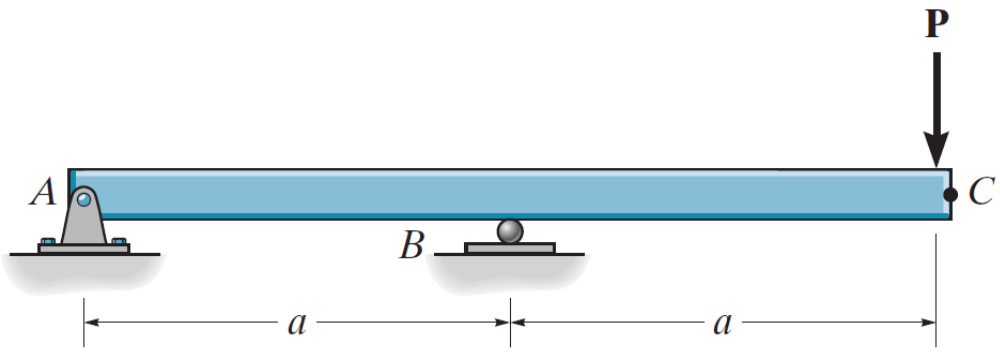
D. 0.667 kN, 15 kN

E. 0.5 kN, 15 kN



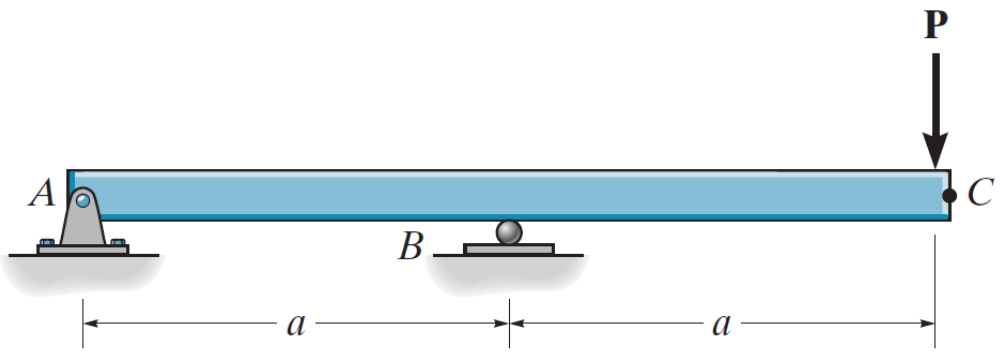
Q84: For the rectangular cross-section beam shown, if the deflection at C is 5mm. Using virtual work method, what will the deflection at C if the depth (h) of the beam was reduced by half?

A. 5 mm
B. 15 mm
C. 20 mm
D. 30 mm
E. 40 mm



Q85: For the beam shown, if the deflection at C is 5mm. Using virtual load method, what is deflection at C if the modulus of elasticity was reduced by half?

A. 2.5mm
B. 5mm
C. 7.5mm
D. 10mm
E. 12.5mm



Q86: In the force method for analysis of statically indeterminate structures, when removing the redundant force, the resulted structure should be?

A. Statically determinate
B. Statically indeterminate
C. Stable
D. A and C
E. B and C

Q87: In the force method, the flexibility coefficient (fCB) represents?

A. The deflection at C due to applied unit force at C
B. The deflection at B due to applied unit force at C
C. The deflection at C due to applied unit force at B
D. The deflection at B due to applied unit force at B
E. The deflection at A due to applied unit force at C

Q88: In the force method, the removed unknown force from a structure to make it statically determinate is called?

A. Degree of freedom
B. Redundant Force
C. Distribution factor
D. Carry over factor
E. Flexibility coefficient

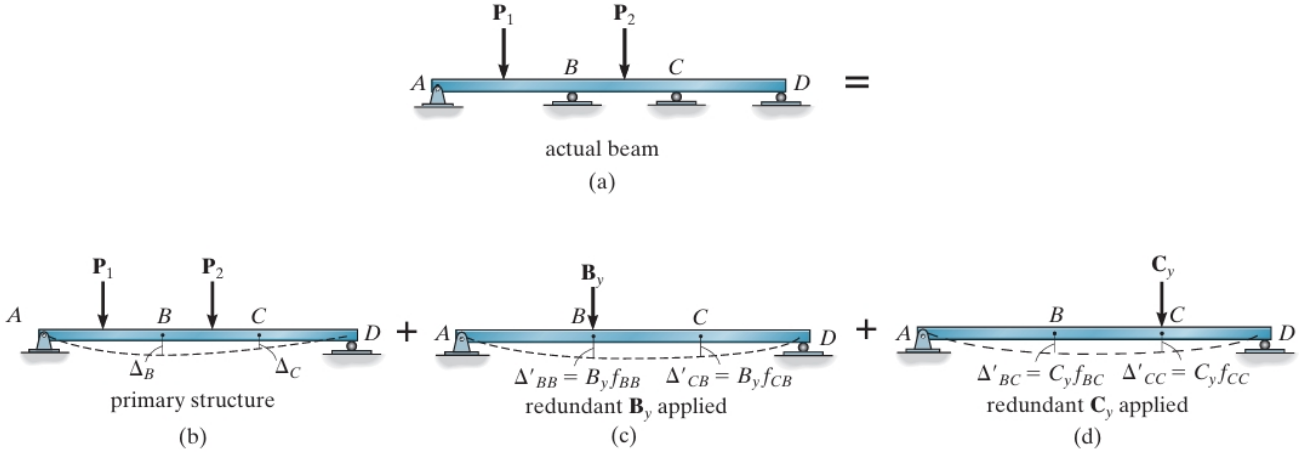
Q89: Which formula can be used to determine a joint displacement of a truss due to load using virtual work method?

A. $1 \cdot \Delta = \Sigma n \alpha \delta T L$
B. $1 \cdot \Delta = \Sigma n \delta L$
C. $\Delta = \sum N \left(\frac{\partial N}{\partial P}\right) \frac{L}{AE}$
D. $1 \cdot \Delta = \sum \frac{nNL}{AE}$
E. $1 \cdot \theta = \int_0^L \frac{m_\theta M}{EI} dx$

Q90: The Virtual work can be used to determine the deflection in?

A. Trusess	
B. Beams	
C. Frames	
D. B and C	
E. A, B, and C	

Q91: The compatibility equations for the deflection at B and C of the beam shown below, respectively are:



A. 0 = ΔB + Cy fBB + By fBC and 0 = Δc + Cy fcB + By fcc

B. 0 = ΔB + By fBB + By fBC and 0 = Δc + Cy fcB + Cy fcc

C. 0 = ΔB + By fBB + Cy fBC and 0 = ΔB + By fcB + Cy fcc

D. 0 = ΔB + By fBB + Cy fBC and 0 = Δc + By fcB + Cy fcc

E. 0 = Δc + By fBB + Cy fBC and 0 = Δc + By fcB + Cy fcc

Q92: In the compatibility equation shown, the term fBB refers to:

A. Flexibility coefficient

B. Angular flexibility

C. Stiffness factor

D. Rigidity factor

E. modulus of elasticity

$$0 = -\Delta_B + B_y f_{BB}$$

Q93: In the equation of virtual-work method for a beam or frame shown below, mθ is:

$$1 \cdot \theta = \int_0^L \frac{m_\theta M}{EI} dx$$

A. Internal virtual moment in the beam or frame, caused by external virtual unit load
B. Internal virtual moment in the beam or frame, caused by external unit couple moment
C. Internal virtual moment in the beam or frame, caused by external real load
D. Internal virtual moment in the beam or frame, caused by external real couple moment
E. Internal virtual load in the beam or frame, caused by external real load

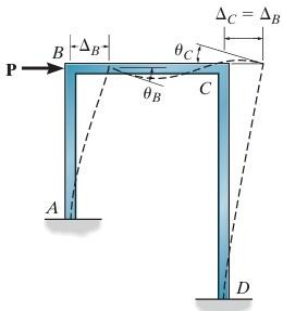
Q94: In the equation of virtual-work for the truss, n represents:

$$1 \cdot \Delta = \sum \frac{nNL}{AE}$$

A. Internal virtual force in a frame member caused by the external virtual unit load
B. Internal virtual force in a truss member caused by the external real load
C. Internal virtual force in a truss member caused by the internal virtual unit load
D. External virtual force in a truss member caused by the external virtual unit load
E. Internal virtual force in a truss member caused by the external virtual unit load

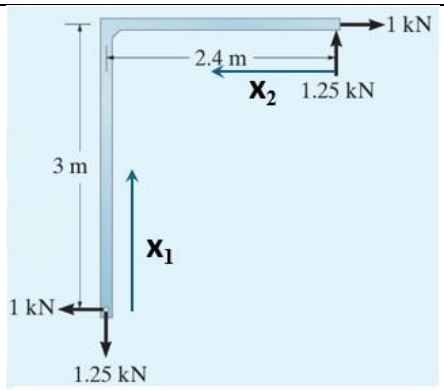
Q95: For the frame shown, the degree of freedom is:

A. 1
B. 2
C. 3
D. 4
E. 5

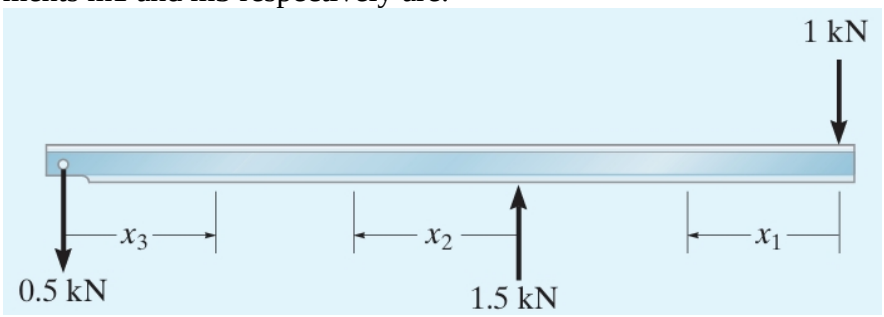


Q96: The consistent deformation method is also called?
A. Stiffness Method
B. Slop-Deflection equations method
C. Moment distribution method
D. Virtual work method
E. Force method

Q97: For the virtual frame shown, if the positive direction of the moment is to be clockwise. Then the internal virtual moments m_1 and m_2, respectively are:

A. m1= -1.25(x1), m2= 1.25 (x_2)	
B. m_1= 1(x_1), m_2= -1.25 (x_2)	
C. m_1= -1(x_1), m_2= -1.25 (x_2)	
D. m_1= 1(x_1), m_2= 1.25 (x_2)	
E. m_1= 1.25(x_1), m_2= 1 (x_2)	

Q98: For the virtual beam shown, if the positive direction of the moment is to produce a concave up. Then the internal virtual moments m1 and m3 respectively are:



A. m1= -1x1 and m3= -0.5 x3

B. m1= 1x1 and m3= -0.5 x3

C. m1= -1x1 and m3= 0.5 x3

D. m1= 1x1 and m3= 0.5 x3

E. m1= -1x2 and m3= -0.5 x3

Q99: To determine the rotation at any point in a beam using virtual work method, it is required to:

A. Apply external virtual unit couple moment (kN.m) at this point.

B. Apply external virtual unit load (kN) at this point.

C. Remove the redundant supports

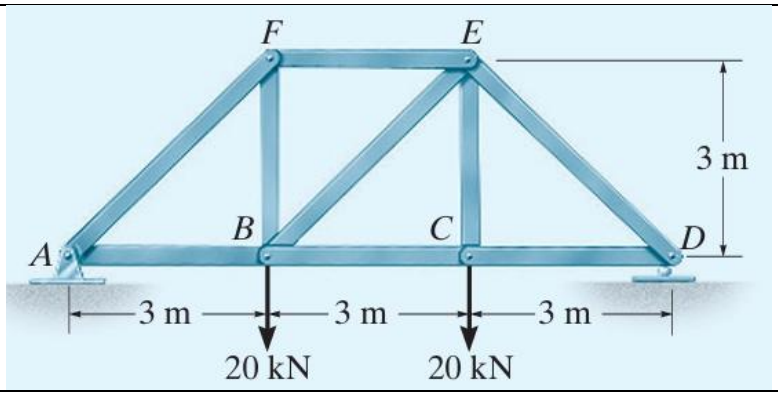
D. Determine the number of redundant force

E. Calculate the member stiffness Factor

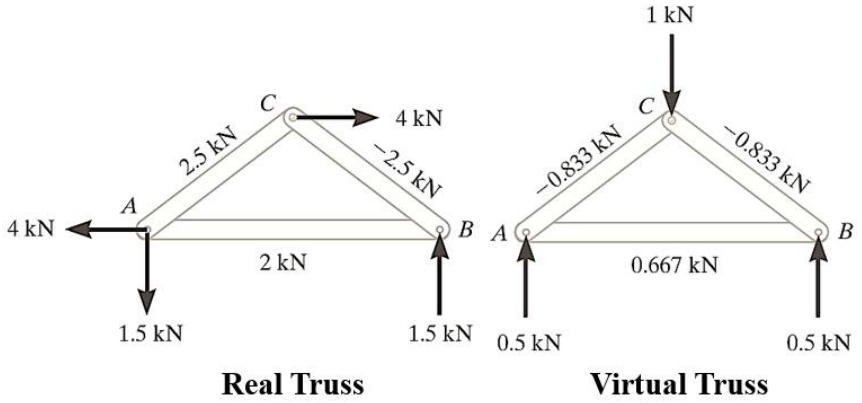
Q100: A symmetrical frame has a joint that connect two vertical members with stiffness 3EI/L each and a horizontal beam with stiffness 4EI/L. What is the distribution factor for one of the vertical members at the top joint?

A. 0.1	
B. 0.2	
C. 0.3	
D. 0.4	
E. 0.5	

Q101: For the truss shown, to determine the vertical displacement at joint C, a virtual external unit load of 1kN (upward) was applied at joint C. The sum of product nNL= -369.7 kN².m; A = 300 mm² and E = 200 GPa. Then the value of displacement at C is equal to:

A. 0.16 mm (upward)	
B. 0.16 mm (Downward)	
C. 6.16 mm (upward)	
D. 6.16 mm (downward)	
E. zero	

Q102: For the truss shown, if A= 400 mm² and E= 200 GPa, then the vertical displacement at C is equal to:



A. -0.133 mm

B. 0.133 mm

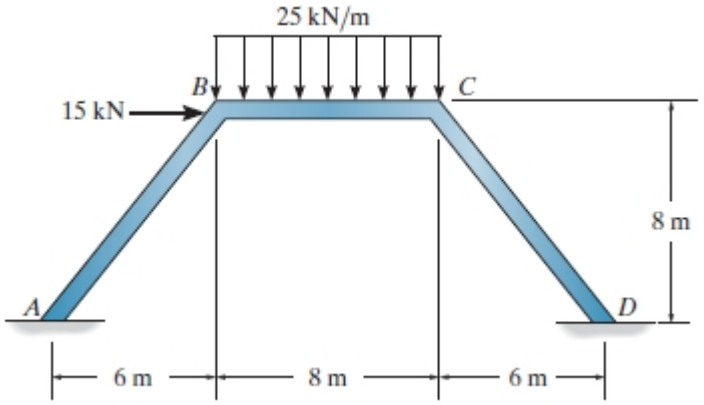
C. 1.33 mm

D. -1.33 mm

E. 0.133 m

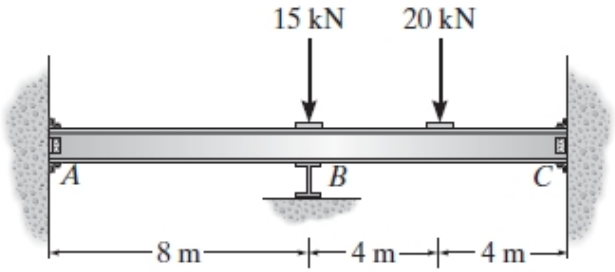
Q103: The degree of freedom for the frame shown in figure is .....

A. 1
B. 2
C. 3
D. 4
E. 5



Q104: For the beam shown, the degree of freedom is

A. 1
B. 2
C. 3
D. 4
E. 5



Q105: In the equation of virtual, the strain energy caused by temperature; the symbol δTm means:

A. uniform temperature change
B. temperature difference between top and bottom face of the beam
C. temperature difference between the mean temperature and the temperature at the top or bottom of the beam
D. temperature difference between the beam center line and the top beam face
E. internal force difference between the top and bottom face of the beam face

Q106: When a structure is loaded, specified points on it, called ..... will undergo unknown displacements.

A. Hinges
B. Nodes
C. Supports
D. Joints
E. None of the above

Q107: Determine the reaction Cy (chosen as a redundant) of the shown frame using force method . EI is constant. Given: member AB: M = -0.25 x2 , m = x , member BC M=0, m= 0

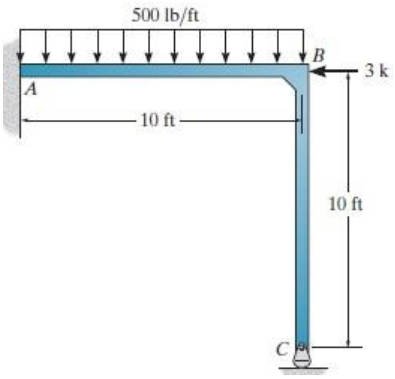
A. Cy = 3 k

B. Cy = 1.87 k

C. Cy = 2.5 k

D. Cy = 4.1 k

E. Cy= 3.07 k



Q108: Determine the reaction Ay (Cy is chosen as a redundant) of the shown frame using force method . EI is constant. Given: member AB: M = -0.25 x2 , m = x , member BC M=0, m= 0

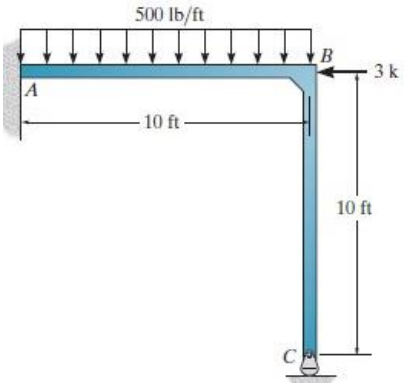
A. Ay = 3 k

B. Ay = 1.87 k

C. Ay = 3.125 k

D. Ay = 4.1 k

E. Ay=3.07 k



Q109: Determine the reactions at the supports B (By) (which chosen as a redundant), Assume B and C are rollers and A is pinned, using force method The support at B settles downward 0.25 ft . Assume Δ ' B = 1.544 in (down) and Fbb = 0.03432 in/k (up)

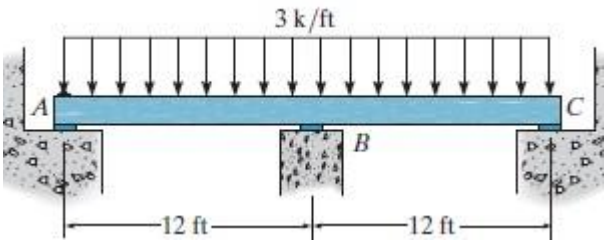
A. By = 18.07 k

B. By = 21.77 k

C. By = 23.02 k

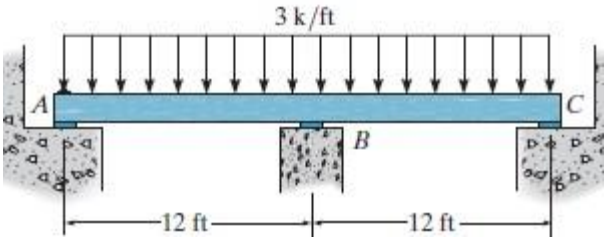
D. By = 37.7 k

E. By=45.8 k



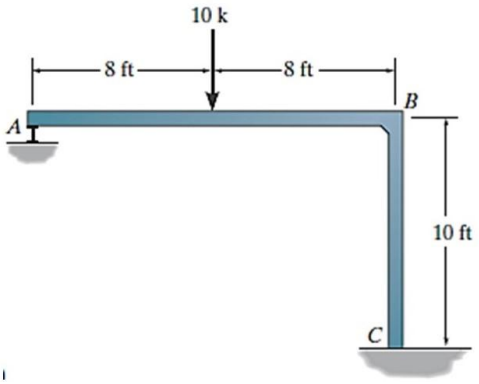
Q110: Determine the reactions at the supports A (Ay) (By is chosen as a redundant), Assume B and C are rollers and A is pinned, using force method The support at B settles downward 0.25 ft . Assume Δ ' B = 1.544 in (down) and FBB = 0.03432 in/k (up). (Hint: first find By from compatibility equation then find Ay from equilibrium equation)

A. Ay = 17.1 k
B. Ay = 21.77 k
C. Ay = 23.02 k
D. Ay = 37.7 k
E. Ay=45.8 k



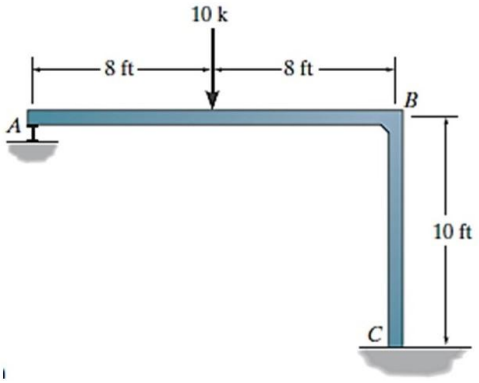
Q111: Determine the reactions at the supports A (Ay) (which chosen as a redundant), Assume A is roller and C is fixed, using force method. Assume ΔA = -17066.67/EI and FAA= 3925.33/EI

A. Ay = 9.23 k
B. Ay = 21.77 k
C. Ay = 12.56 k
D. Ay = 15.2 k
E. Ay=4.35 k

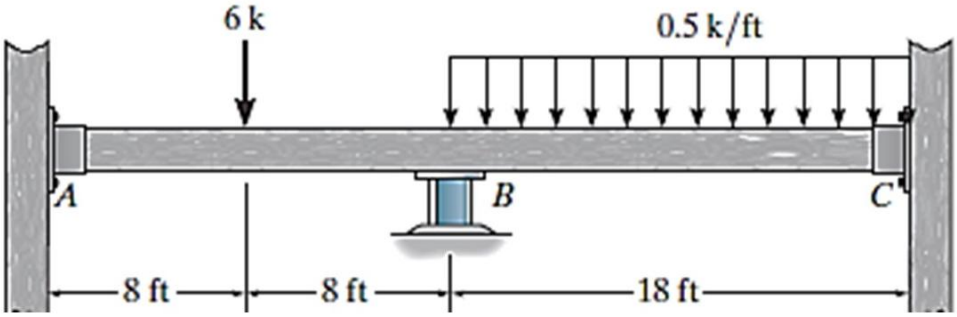


Q112: Determine the reactions at the supports C (Cy) (Ay is chosen as a redundant), Assume A is roller and C is fixed, using force method. Assume ΔA = -17066.67/EI and FAA= 3925.33/EI

A. Cy = 3.2 k
B. Cy = 7.5 k
C. Cy = 2.51 k
D. Cy = 5.65 k
E. Cy= 3.07 k



Q113: For the beam shown in Figure and using the slope-deflection method, the MBC is equal to ..... Given: (FEM)BC = -13.5 k.ft , (FEM)CB = 13.5 k.ft , A and C is fixed and B is roller.



A. MBC = (2EI/18) (θB) -13.5

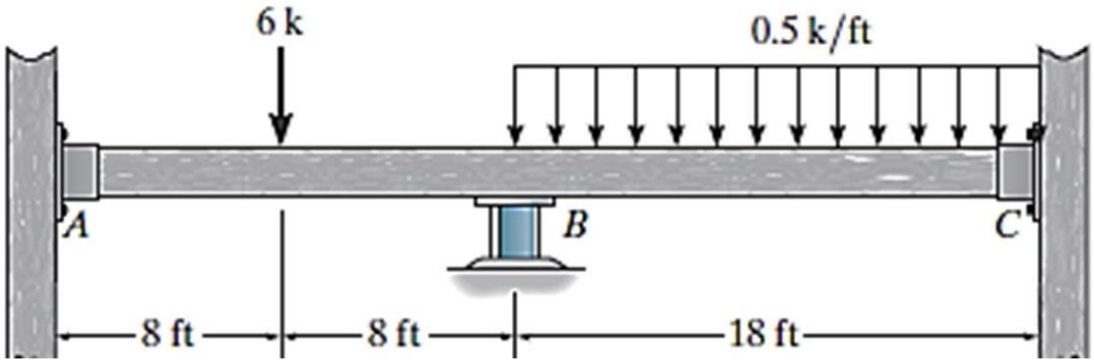
B. MBC = (3EI/18) (θB) +13.5

C. MBC = (4EI/18) (θB) -13.5

D. MBC = (2EI/18) (2θB) -13.5

E. MBC = 3EI/18 (θB)

Q114: For the beam shown in Figure and using the slope-deflection method, the MCB is equal to ..... Given: (FEM)BC = -13.5 k.ft , (FEM)CB = 13.5 k.ft , A and C is fixed and B is roller



A. MCB =(2EI/18) (θB) -13.5

B. MCB = (3EI/18) (θB) +13.5

C. MCB = (4EI/18) (θB) -13.5

D. MCB = (3EI/18) (θB)

E. MCB = (EI/9) (θB) +13.5

.

Q115: For the frame shown in Figure, using the slope-deflection method, the MBA is equal to ..... .Given: (FEM)BC = – 30 k.ft , A and C are pinned and B and D are fixed

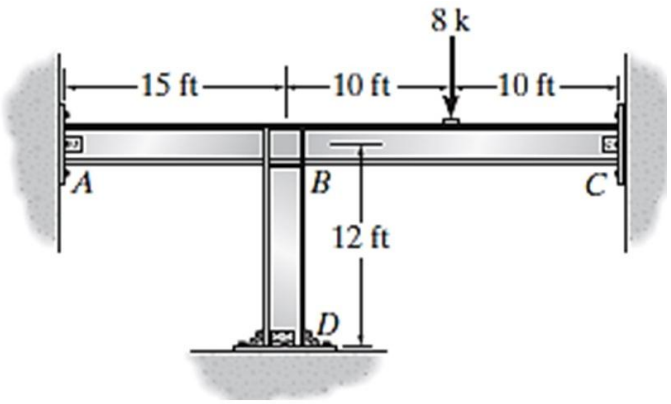
A. MBA = 0.2 EI θB -30

B. MBA = 0.2 EI θB +30

C. MBA = (2/15) EI θB +30

D. MBA = 0.2 EI θB

E. MBA = (2/15) EI θB



Q116: What will be the value of Ue if material is linear elastic? Moment is increased from 0 to m gradually.

A. 1⁄4 M θ

B. 1⁄3 M θ

C. 1⁄2 M θ

D. M θ

Q117: The shown structure has ..... D.O F

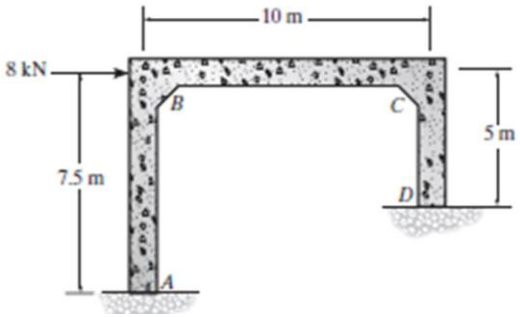
A. 1

B. 2

C. 3

D. 4

E. 5



Q118: The distribution factor of member OB of the shown structure is ..... (supports conditions are A :roller B: hinge and and C is fixed)

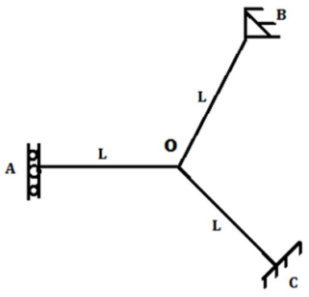
A. 2/3

B. 1/2

C. 3/8

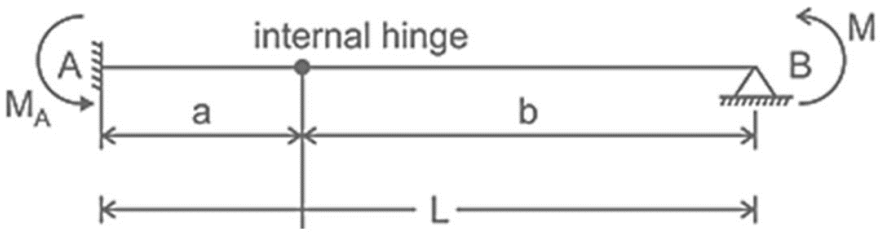
D. 1/8

E. 1/3



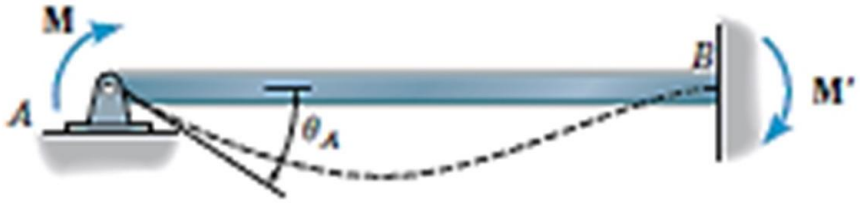
Q119: The carry-over factor CBA of the shown beam is .....

A. a/b
B. b/L
C. L/b
D. b/a
E. a/ (2b)



Q120: For the shown beam, when use the moment distribution method used for statically indeterminate structures, If M = 4000 N.m (applied in A), then the fraction of M carried over to Joint B (M') will equal to .....

A. 4000 N.m
B. 8000 N.m
C. 12000 N.m
D. 2000 N.m
E. 3000 N.m



Q121: When use the compatibility equation to analyze a structure, the term f can measured by .....

A. rad / m
B. N.m /rad
C. rad/ N . m
D. rad
E. m/n

Q122: When use the compatibility equation to analyze a structure, the term α can measured by:

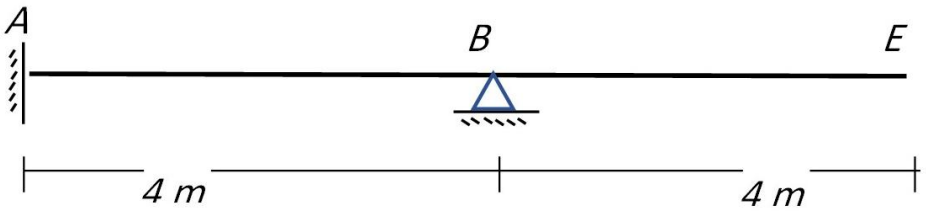
A. rad / m
B. N.m /rad
C. rad/ N . m
D. rad
E. n/m

Q123: For a continuous beam ABC, the stiffness factor for BA is (EI) and for BC is (1.5 EI) , the distribution factor for BA will be .....

A. 2
B. 0.3
C. 0.8
D. 0.4
E. 1

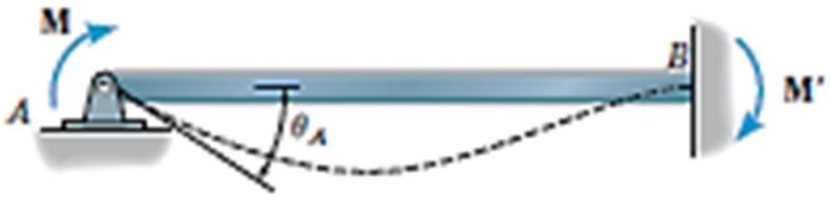
Q124: For the shown beam of uniform cross section, A: Fixed , B hinged and E is free, at joint B the stiffness factor from span BE will be .....

A. 0.5 EI
B. 0.75 EI
C. EI
D. 2 EI
E. zero



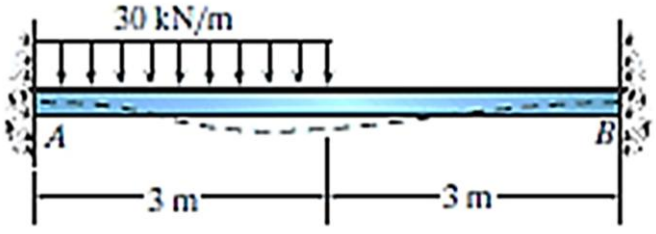
Q125: For the shown beam, when use the moment distribution method used for statically indeterminate structures, and if M = 3000 N.m (applied in A), then the fraction of M carried over to Joint B (M') will equal to .....

A. 3000 N.m
B. 6000 N.m
C. 12000 N.m
D. 2250 N.m
E. 1500 N.m



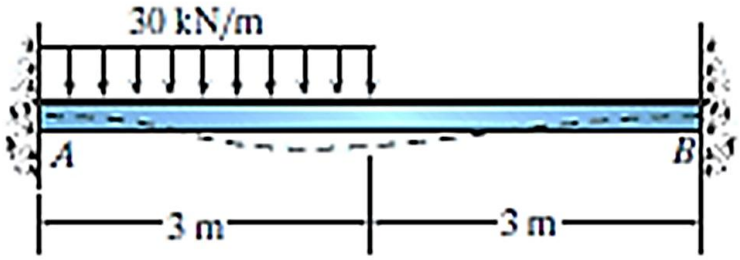
Q126: When using the force method to analyze the shown beam, the compatibility equation for the redundant moment at point A is .....

A. 0= θA + MAαAA + MB αAB
B. 0 = θB+ MAαAA + MB αAB
C. 0= θA + MA αBA + MB αAA
D. 0= θB + MA αAB + MB αBB
E. 0= θA+ MA αAA + MB αBA



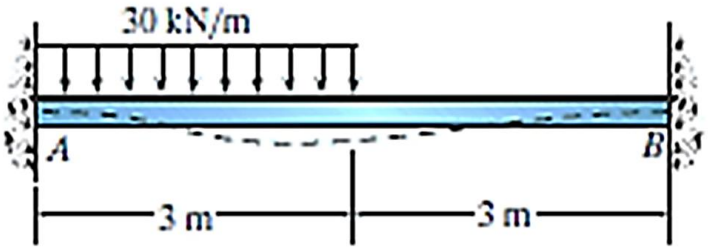
Q127: For the shown beam, when the force method is used to find the reactions and if the MB and MA will considered as a redundant , the moment at B (MB) will equal to ....., Given : θA = 151.9/EI , θB = 118.1/EI , αAA = 2/EI , αBB = 2/EI , αAB = 1/EI

A. MB = - 61.9 kN.m
B. MB = - 64.06 kN.m
C. MB = - 106.1 kN.m
D. MB = - 93.07 kN.m
E. MB = - 28.1 kN.m



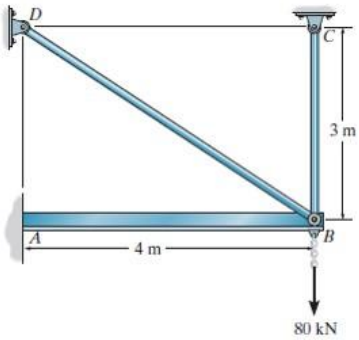
Q128: When using the force method to analyze the shown beam, the compatibility equation for the redundant moment at point B is .....

A. 0= θA + MAαAA + MB αAB
B. 0 = θB+ MAαAA + MB αAB
C. 0= θB + MA αBA + MB αBB
D. 0= θB + MA αAB + MB αBB
E. 0= θB + MA αBA + MB αBA



Q129: For the truss shown, the number of compatibility equation required to analyze the truss is .....

A. 1
B. 2
C. 3
D. 4
E. 5

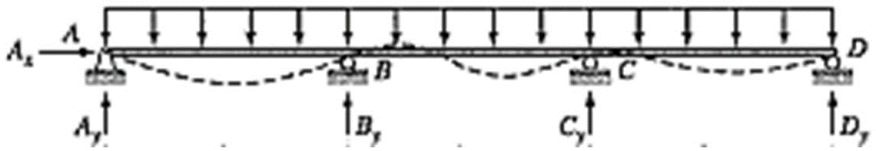


For the shown beam with two fixed ends, the number of compatibility equation required to find the unknown reactions is .....

A. 1
B. 2
C. 3

D. 4

E. 5



Q130: For the shown beam with two fixed ends, the number of compatibility equation required to find the unknown reactions is .....

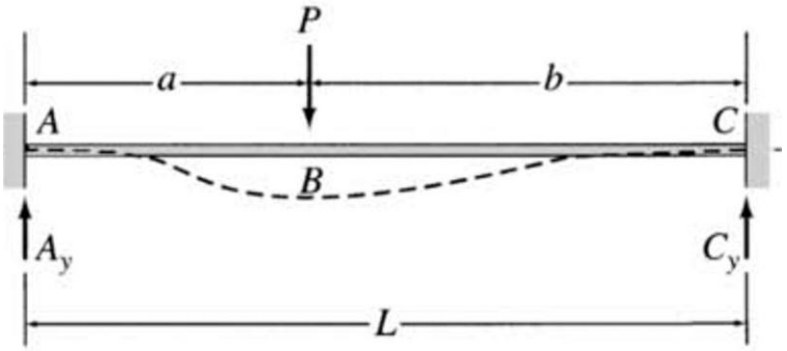
A. 1

B. 2

C. 3

D. 4

E. 5



Q131: When use the compatibility equation to analyze a truss, the term fACBC means

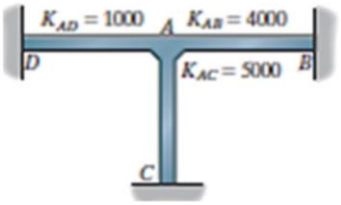
A. flexibility coefficient, refers to the relative displacement at member BC, caused by a real load at AC.
B. relative displacement, refers to the relative displacement at member BC, caused by a real load at AC
C. flexibility coefficient, refers to the relative displacement at member BC, caused by unit load at AC
D. relative displacement, refers to the relative displacement at member AC, caused by a unit load at BC
E. flexibility coefficient, refers to the relative displacement at member AC, caused by a unit load at BC

Q132: When use the compatibility equation to analyze a structure, the term αBC means

A. flexibility coefficient , as the deflection at B caused by a unit couple moment applied to AC
B. flexibility coefficient ,as the angular deflection at C caused by a unit couple moment applied to B
C. flexibility coefficient ,as the angular displacement at C caused by a unit couple moment applied to B
D. flexibility coefficient , as the angular displacement at B caused by a unit load applied to C
E. flexibility coefficient ,as the angular displacement at B caused by a unit couple moment applied to C

Q133: In the moment distribution method for the statically indeterminate frame shown in Figure, the distribution factor for the member AB (DFAB) is equal to ----------

A. 1000
B. 4000
C. 0.1
D. 10 000
E. 0.4



Q134: If the member has a circular cross-sectional area _____ out of the plane of its cross section will occur when it is loaded

A. no warping or distortion
B. Maximum warping or distortion
C. Minimum warping or distortion
D. depend on the loading value
E. Flexural-warping

Q135: When use the compatibility equation to analyze a structure, the term fBC means

A. flexibility coefficient, refers to the deflection at B, caused by a real load at C
B. flexibility coefficient, refers to the deflection at C, caused by a unit load at B
C. deflection at B, caused by a unit load at C
D. deflection at C, caused by a unit load at B
E. flexibility coefficient, refers to the deflection at B, caused by a unit load at C

Q136: In virtual-work equation 1. $\theta = \int (m\theta\ M)/EI\ dx$, the term "1" represent .....

A. internal virtual unit force acting on beam or frame
B. external virtual unit force acting on truss
C. external virtual unit moment acting on beam or frame
D. the internal virtual moment acting on beam or frame
E. external virtual unit vertical force acting on beam or frame

Q137: In virtual-work equation 1. $\Delta=\int mM/EI\, dx$, the term "1" represents .....

A. the internal virtual unit load acting on a beam or frame
B. the external virtual unit load acting on a truss
C. the external virtual unit load acting on beam or frame
D. the internal virtual moment acting on beam or frame
E. the external virtual unit moment acting on beam or frame

Q138: In virtual-work equation 1. $\Delta =\sum nNL/AE$, the N is symbol refer to .....

A. the internal virtual moments due to real applied loads
B. the external virtual unit load
C. the internal virtual loads caused by real loads
D. the external applied load
E. internal normal force caused by real loads

Q139: The $m\theta$ symbol in the virtual work equation is .....

A. Internal virtual moment in the beam or frame, caused by external virtual coupled load or virtual moment
B. External virtual moment in the beam or frame, caused by the external virtual coupled load or virtual moment
C. Internal virtual moment in the beam or frame, caused by the external virtual load
D. External virtual moment in the beam or frame, caused by the external virtual
E. None of the above

Q140: Carry over Moment is defined as .....

A. The moment applied at one end to cause unit slope at the support
B. The additional moment applied at one end to completely resist the rotation caused due to external loading
C. The moment developed or induced at one end due to a moment at another end
D. The moment applied at one end to cause unit slope at another end
E. None of the above

Q141: The ratio of a moment produced at a joint to the applied moment at the other joint, without displacing it is known as .....

A. Moment factor
B. Distribution factor
C. Displacement factor
D. Carry over factor
E. Rigidity factor

Q142: The sum of Distribution Factor at a joint is always .....

A. one
B. zero
C. Depends on total Member
D. EI/L
E. 2EI/L

Q143: In moment distribution method, stiffness factor K at A (for member AB) can be defined as .....

A. The amount of force V required to rotate the end A of the beam θA = 1 rad
B. The amount of moment M required to rotate the end A of the beam θA = 1 rad
C. The amount of force V required to make a displacement the end A of the beam θ = 1 unit
D. The amount of moment M required to rotate the far end B of the beam θB = 1 rad
E. The amount of moment M required to rotate the end A end B and of the beam θA and θB "1 rad"

Q144: Analysis of statically indeterminate structures by the force method can be applied for .....

A. Trusses only
B. Beams and Frames
C. Trusses and beams
D. Frames only
E. Trusses, Beams and Frames

Q145: The beams and frames can resist the following forces .....

A. Axial forces
B. Shear forces
C. Shear and moment forces
D. Axial, shear and moment forces
E. Torsion

Q146: The truss structures can resist the following force .....

A. Shear forces
B. Shear and moment forces
C. Axial forces
D. Torsional forces
E. None of the above

Q147: The unit load method is also called .....

A. Euler's Method
B. Virtual work method
C. Real method
D. Castigliano's method
E. Conjugate Beam method

Q148: The Virtual work refers to .....

A. Virtual work done by virtual forces
B. Actual work done by actual forces
C. Actual work done by virtual forces
D. Virtual work done by actual forces
E. Energy in structure due to virtual forces

Q149: The principle of virtual work states that, for a body to be in equilibrium, the virtual work should be .....

A. Any value between zero and one
B. Zero
C. Maximum
D. Minimum
E. Half of the applied external load

Q150: In the moment distribution method, K is:

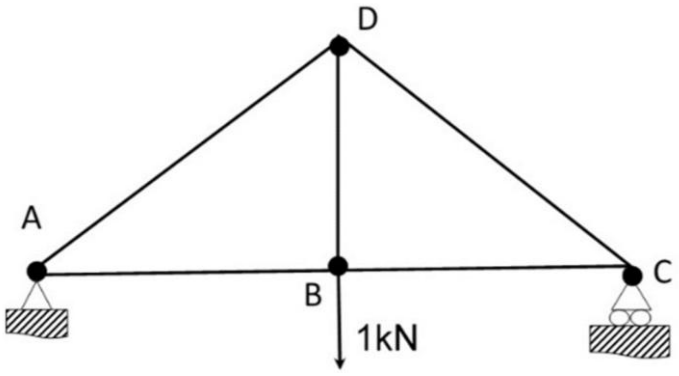
A. Joint Stiffness Factor
B. Total Stiffness Factor
C. Member Degree of Freedom
D. Joint rigidity
E. Member Stiffness Factor

Q151: In the virtual-work equation 1. $\Delta = \sum nNL/AE$, n is refer to .....

A. The internal applied virtual moment
B. The applied external virtual unit load
C. The internal virtual load caused by external virtual unit load
D. The external applied load
E. The support reaction

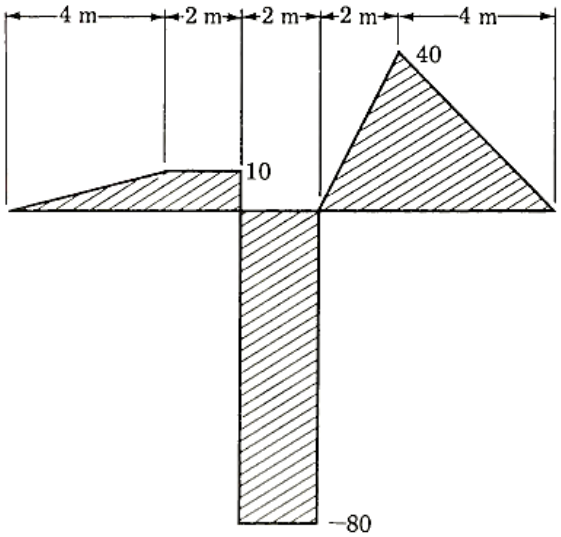
Q152: The truss shown in Figure could be the virtual truss system to find .....

A. The rotation at B
B. The horizontal displacement at B
C. The vertical displacement at B
D. The vertical displacement at D
E. The torsion strain energy at truss



Strength of Materials

Q1: For the shear diagram shown, the maximum negative bending moment is:



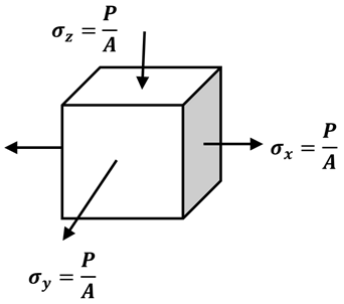
E. - 40 kN.m
F. - 80 kN.m
G. - 120 kN.m
H. - 160 kN.m

Q2: A solid steel shaft has a length of 3m. If the polar moment of inertia J = 3.10×10^{6} mm^4, the modulus of rigidity is G = 83×10^{9} N/m^2 and the angle of twisting is 1.6 °. What is the value of applied torque.

E. 1.2 kN.m
F. 2.4 kN.m
G. 4.2 kN.m
H. 4.4 kN.m

Q3: The element shown is subjected to a triaxial stress. The formula to calculate the strain in y-direction (ε_y) is:

E. $\varepsilon_y = \frac{1}{E}[\sigma_y - \mu\sigma_x + \mu\sigma_z]$
F. $\varepsilon_y = \frac{1}{E}[\sigma_y + \mu\sigma_y + \mu\sigma_z]$
G. $\varepsilon_y = \frac{1}{E}[-\sigma_y - \mu\sigma_x - \mu\sigma_z]$
H. $\varepsilon_y = \frac{1}{E}[\sigma_y - \mu\sigma_x - \mu\sigma_z]$

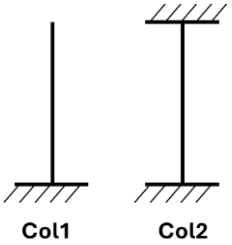


Q4: The area moment method is used to calculate ?

E. The flexural stress
F. The deflection
G. The axial deformation
H. The shear stress

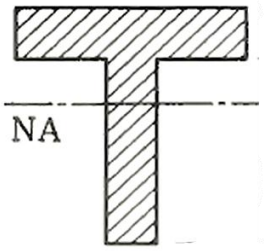
Q5: The two columns shown have the same dimensions and properties. The critical load (P_{cr}) of col1 is --------- times less than the critical load (P_{cr}) of the col2:

E. 4
F. 8
G. 12
H. 16



Q6: For the beam section shown, the maximum shear stress occur at ……..

E. The top fiber
F. The bottom fiber
G. The neutral axial
H. The junction between web and flange

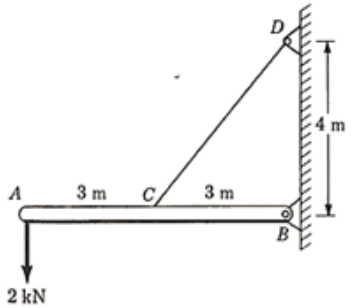


Q7: The maximum deflection in a simply supported beam occur when ……

A- The slop zero
B- The slop is minimum
C- The slop is maximum
D- The shear is zero

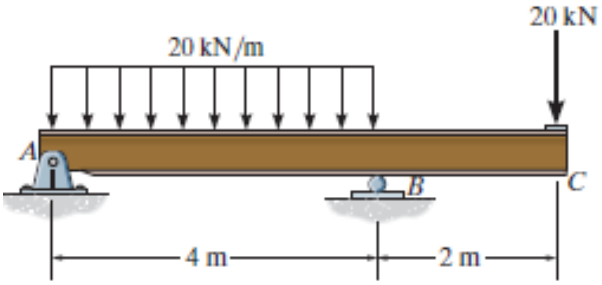
Q8: A homogeneous bar AB of 150-kg weight carried a 2- kN load. The bar is supported by a pin at B and a 10-mm dimeter cable CD. What is the stress in the cable CD:-

A- 26.2 MPa
B- 261.2 MPa
C- 36.2 MPa
D- 361.2 MPa



Q9: For the beam shown, What is the value of maximum positive bending moment:

A- 2.25 kN.m
B- 12.5 kN.m
C- 22.5 kN.m
D- 32.5 kN.m



Q10: A 40 mm in diameter steel bar and 5m length is subjected to an axial load of 60 kN. If the modulus of elasticity is E_{st} = 200 GPa. What is the value of the axial deformation (δ)?

A- 1.19 mm
B- 2.19 mm
C- 11.9 mm
D- 21.9 mm

Q11: A beam of 100-mm wide and 200-mm high in cross section and 8m length, carried a uniformly distributed load of 6 kN/m. What is the value of the maximum flexural stress?

A- 50.8 MPa
B- 62 MPa
C- 68.5 MPa
D- 72 MPa

Q12: A hollow steel shaft with a length of 3m is subjected to a torque of T= 4 kN.m. If the polar moment of inertia J = 3.10×10^6 mm^4 and the modulus of rigidity is G = 83×10^9 N/m^2. What is the angle of twist (θ) in degree?

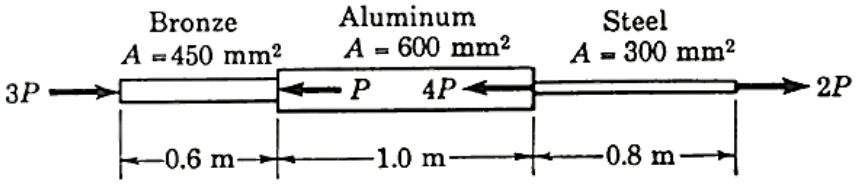
A- 1.22 °
B- 2.31°
C- 2.67 °
D- 4.66 °

Q13: If the critical load (P_{cr}) of two-fixed ends column is 400 kN. What is the corresponding value of P_{cr} if the column is fixed-free ends with the same length and cross section:

A- 25 kN
B- 50 kN
C- 75 kN
D- 100 kN

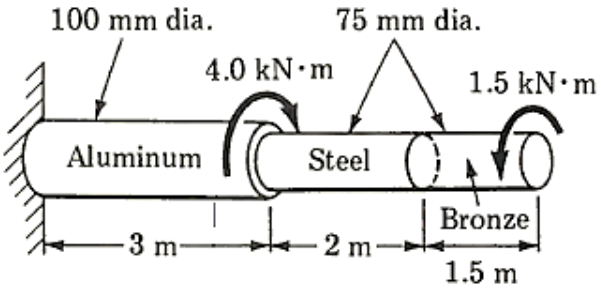
Q14: For the assembly shown, if P = 50 kN, what is the axial deformation (δ) developed in the aluminum bar. Use Ea = 70 GPa.

A. 23.8 mm (lengthening)
B. 2.38 mm (shortening)
C. 2.38 mm (lengthening)
D. 23.8 mm (shortening)



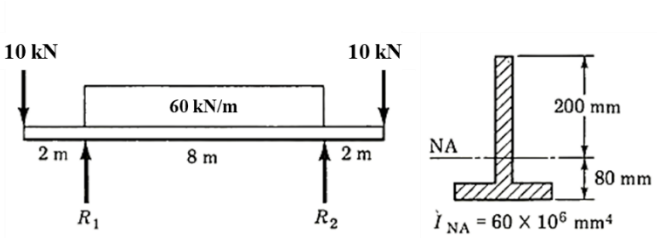
Q15: Determine the maximum shearing stress developed in the aluminum rod. Use Ga= 28 GPa.

A. 12.73 MPa
B. 14.33 MPa
C. 17.73 MPa
D. 19.33 MPa



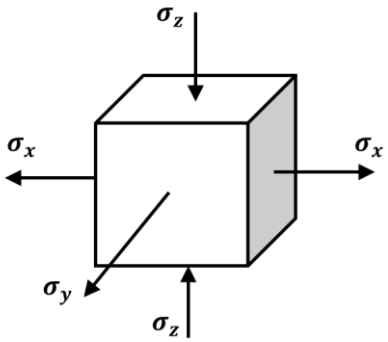
Q16: Determine the maximum compressive stress developed in the beam shown at the section of maximum moment.

A. 1033.3 MPa
B. 1133.3 MPa
C. 1333.3 MPa
D. 1533.3 MPa



Q17: The element shown is subjected to three perpendicular normal stress σ_x, σ_y *and* σ_z, then the strain in the x-direction can be calculated from:

A. $\varepsilon_x = \frac{1}{E}\left[\sigma_x - v\,(\sigma_y - \sigma_z)\right]$
B. $\varepsilon_x = \frac{1}{E}\left[\sigma_x + v\,(\sigma_y + \sigma_z)\right]$
C. $\varepsilon_x = \frac{1}{E}\left[\sigma_x - v\,(\sigma_y + \sigma_z)\right]$
D. $\varepsilon_x = \frac{1}{E}\left[\sigma_x + v\,(\sigma_y - \sigma_z)\right]$



Q18: In Moher's circle, the radius of the circle (R) represents:

A. Maximum tensile stress
B. Maximum compressive stress
C. Maximum shear stress
D. Maximum bearing stress

Q19: Two columns have the same geometry and properties but with different ends support. One with two hinged-ended and the other with two fixed- ended. The critical load (Pcr) of the two hinged- ended is ---------- times than the critical load (Pcr) of the two fixed- ended:

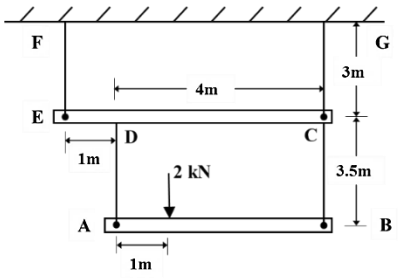
A. 0.25 times
B. 0.5 times
C. 2 times
D. 4 times

Q20: If the pressure in a thin walled cylinder tank is raised to the bursting point, then the failure in the cylinder will occur due to:

A. Shear stress
B. Longitudinal stress
C. Bearing stress
D. Hoop stress

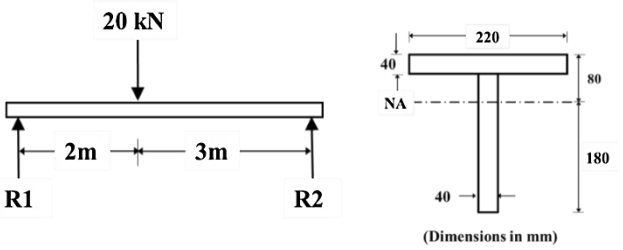
Q21: If the diameter of rod EF is 12 mm, what is the stress developed in that rod ?

A- 6.61 MPa
B- 8.61 MPa
C- 10.61 MPa
D- 12.61 MPa



Q22: For the loaded beam shown in Fig. below, if I_{NA} = 15.6 mm^4 , what is the value of maximum tensile stress developed in the beam?

A- 0.14 MPa
B- 0.22 MPa
C- 0.24 MPa
D- 0.32 MPa



Q.23: To calculate the critical load for the two-hinged ends columns, the used formula is $P_{cr} = \frac{n^2\pi^2 EI}{L^2}$

Where n = 1, what is the value of n for the case of one-end fixed (flange) columns?

A- 0.25

B- 0.50

C- 0.75

D- None of the above

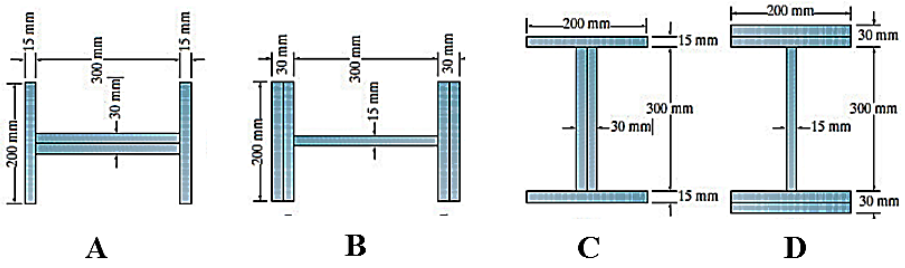
Q.24: Which of the following sections can support a higher bending moment?

A

B

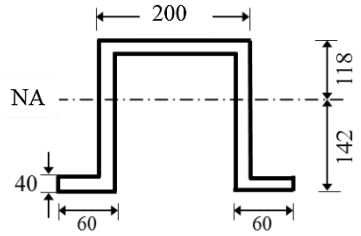
C

D



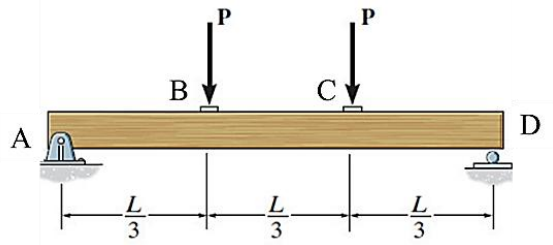
Q25. For the beam section shown, the maximum value of the shearing stress is located at:

A. The top fiber
B. The centroide
C. The junction between the web and flage
D. The bottom fiber



Q26. For the loaded beam shown, the maximum value of deflection is located at:

A. point B
B. Point C
C. Mid-Span
D. point D



Q28: A 40 mm in diameter steel bar and 5m length is subjected to an axial load of 60 kN. If the modulus of elasticity is Est = 200 GPa. What is the value of the axial deformation (δ)?

A. 1.19 mm
B. 2.19 mm
C. 11.9 mm
D. 21.9 mm

Q29: A beam of 100-mm wide and 200-mm high in cross section and 8m length, carried a uniformly distributed load of 6 kN/m. What is the value of the maximum flexural stress?

A. 50.8 MPa
B. 62 MPa
C. 68.5 MPa
D. 72 MPa

Q30: A hollow steel shaft with a length of 3m is subjected to a torque of T= 4 kN.m. If the polar moment of inertia J = 3.10 × 106 mm4 and the modulus of rigidity is G = 83 × 109 N/m2. What is the angle of twist (θ) in degree?

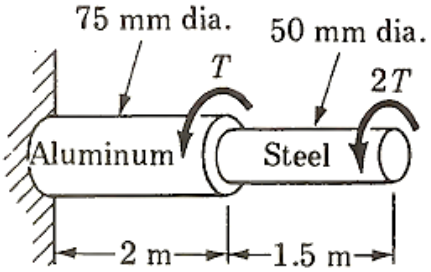
A. 1.22^0
B. 2.31^0
C. 2.67^0
D. 4.66^0

Q31: If the critical load (Pcr) of two-fixed ends column is 400 kN. What is the corresponding value of Pcr if the column is fixed-free ends with the same length and cross section: (1 mark)

A. 25 kN
B. 50 kN
C. 75 kN
D. 100 kN

Q32: If T= 4 kN/m, determine the angle of rotation in degree of the free end with respect to the fixed end. Use G_a = 28 GPa and G_s = 83 GPa and $J_a = 3.10\times10^{-6}$ m^4, $J_s = 6.13\times10^{-7}$ m^4.

A- 6.43 ^{0}
B- 6.63 ^{0}
C- 6.83 ^{0}
D- 6.93 ^{0}



Q.33: A beam of 5 m length and 100×200 mm rectangular cross section, carrying a uniformly distributed load of 80kN/m, what is the maximum value of bending stress?

A- 150 MPa
B- 210 MPa
C- 318 MPa
D- 375 MPa

Q.34: If the critical load of a fixed-free ends column is (P_{cr}), what is the corresponding value of the critical load for a two fixed ends column?

A- $4P_{cr}$ B- $8P_{cr}$

C- $12P_{cr}$ D- $16P_{cr}$

Q.35: A cylindrical tank with diameter of ***D mm*** and thickness ***t mm*** is subjected to a pressure of ***p MPa***, the hoop stress is calculated using:

A- $\sigma_h = \frac{PD}{t}$ B- $\sigma_h = \frac{PD}{2t}$

C- $\sigma_h = \frac{PD}{3t}$ D- $\sigma_h = \frac{PD}{4t}$

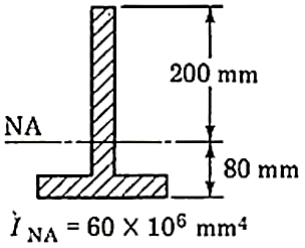
Q.36: For the beam section shown, the maximum value of the shearing stress is located at:

A- Neutral axis

B- Top fiber

C- Bottom fiber

D- Junction between the flange and the web



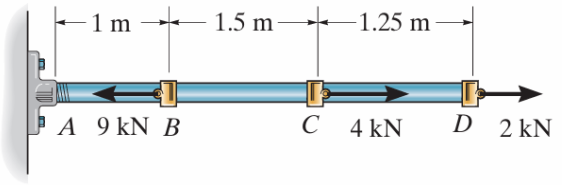
Q.37: The steel rod is subjected to the loading shown. If the cross-sectional area of the rod is 50 mm^2 and E= 200 GPa, determine the total displacement of its end D.

A- 8.50 mm (Shortening)

B- 8.50 mm (Lengthening)

C- 0.850 mm (Shortening)

D- 0.850 mm (Lengthening)



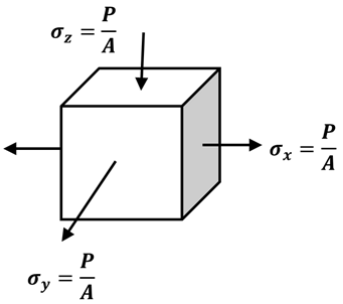
Q38: The element shown is subjected to a triaxial stress. The formula to calculate the strain in y-direction (ε_z) is:

A- $\varepsilon_z = \frac{1}{E}[\sigma_z - \mu\sigma_x + \mu\sigma_y]$

B- $\varepsilon_z = \frac{1}{E}[\sigma_z + \mu\sigma_x + \mu\sigma_y]$

C- $\varepsilon_z = \frac{1}{E}[-\sigma_z - \mu\sigma_x - \mu\sigma_y]$

D- $\varepsilon_z = \frac{1}{E}[\sigma_{yz} + \mu\sigma_x + \mu\sigma_y]$



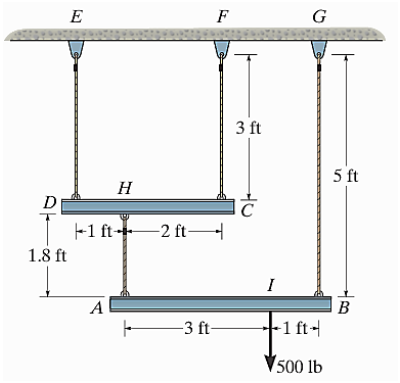
Q39: The element shown is subjected to a triaxial stress. The formula to calculate the strain in y-direction (ε_z) is:

A- F_{DE} = 183.33 lb

B- F_{DE} = 283.33 lb

C- F_{DE} = 383.33 lb

D- F_{DE} = 833.33 lb



Q40: For the state of stress at a point, if $\sigma_{max} = 150\ MPa\ and\ \sigma_{min} = 50\ MPa$. What is the maximum shearing stress.

A- $\tau_{max} = 50\ MPa$

B- $\tau_{max} = 100\ MPa$

C- $\tau_{max} = 150\ MPa$

D- $\tau_{max} = 200\ MPa$

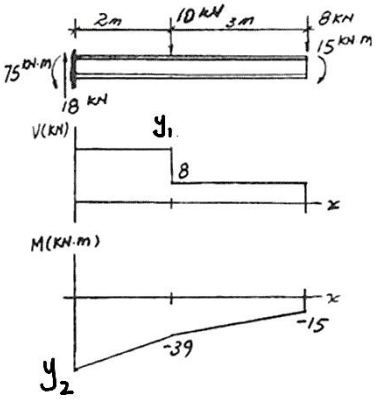
Q41: For the load, shear and moment diagram, what the value of shear (y_1) and the value of the moment (y_2), respectively.

A- y_1 = - 12 kN and y_2 = 0 kN.m

B- y_1 = - 12 kN and y_2 = 18 kN.m

C- y_1 = 18 kN and y_2 = -18 kN.m

D- y_1 = - 18 kN and y_2 = -75 kN.m



Foundation Engineering

1. In designing a subsoil exploration program for a tall structure, the depth of boring should typically extend to a depth where:

A) Hard strata is encountered
B) Groundwater table is found
C) Increase in stress due to foundation load becomes negligible
D) First cohesive layer is detected

2. Which of the following field tests gives a direct measure of undrained shear strength in soft clays without requiring sample retrieval?

A) Standard Penetration Test (SPT)
B) Cone Penetration Test (CPT)
C) Vane Shear Test
D) Pressuremeter Test

3. The most significant source of error in the interpretation of SPT N-values arises from:

A) Energy loss due to rod length and hammer type
B) Equipment cost variability
C) Soil disturbance during sampling
D) Inability to penetrate gravel

4. What is the main reason for reduced bearing capacity when a water table is located near the base of the footing?

A) Increase in overburden pressure
B) Reduction in soil strength due to reduced effective stress
C) Increased skin friction
D) Higher load distribution efficiency

5. Which of the following modifies the Terzaghi bearing capacity factors for use in Skempton's bearing capacity equation?

A) Water table correction factors
B) Shape factors
C) Cohesion-only conditions (for clay)
D) Load inclination factors

6. The bearing capacity of a shallow footing decreases when:

A) The soil compressibility increases
B) The footing width increases
C) The water table drops
D) The unit weight of soil increases

7. For a footing under eccentric loading, what is the effect on bearing capacity?

A) No change if the load is concentric
B) Increased bearing pressure
C) Effective footing area decreases, reducing bearing capacity
D) Shape factor becomes irrelevant

8. In case of inclined loading on a footing, the bearing capacity is adjusted using:

A) Shape factors only
B) Depth factors only
C) Inclination factors that reduce Nq and Nγ
D) Skempton's cohesion factor

9. In Terzaghi's bearing capacity equation, which of the following is a limitation?

A) It includes the effect of eccentric loading
B) It accounts for inclined load effects
C) It allows for water table fluctuation above footing
D) It assumes general shear failure in homogeneous soils

10. Immediate settlement primarily occurs due to:

A) Reorientation of clay particles
B) Expulsion of pore water under long-term loading
C) Elastic deformation of dry or saturated soils without drainage
D) Chemical weathering of soil minerals

11. Schmertmann's method (1978) is mainly applicable to:

A) Sands and overconsolidated silts
B) Cohesive saturated clays
C) Collapsible loess soils
D) Peat and organic soils

12. Bjerrum's correction method accounts for:

A) Immediate settlement only
B) Overestimation in settlement due to rigid footing assumption
C) Secondary compression effects
D) Layered soils' effect on primary settlement

13. Primary consolidation settlement is driven by:

A) Air expulsion from voids
B) Elastic strain recovery
C) Dissipation of excess pore water pressure
D) External temperature fluctuations

14. The coefficient of secondary compression (Cα) relates to:

A) Increase in pore pressure
B) Settlement after 90% consolidation
C) Rate of elastic settlement
D) Time-dependent settlement under constant load

15. For normally consolidated clays, primary consolidation is:

A) Negligible
B) Significant and time-dependent
C) Nonexistent in saturated soils
D) Linear with time

16. Which of the following best describes the primary load transfer mechanism in point-bearing piles?

A) Frictional resistance along the shaft
B) Skin resistance in cohesive soils
C) End-bearing resistance at the pile tip
D) Load sharing with adjacent piles

17. According to Meyerhof's method, the ultimate end-bearing capacity (Qp) depends primarily on:

A) Pile length and groundwater table
B) Effective overburden pressure and soil type
C) Cone resistance and pile spacing
D) Modulus of subgrade reaction

18. Which pile material is most suitable in aggressive chemical environments like marine conditions?

A) Timber
B) Concrete
C) Steel
D) Fiber-reinforced polymer

19. The major difference between friction piles and point bearing piles lies in:

A) Pile diameter
B) Type of pile cap used
C) Load transfer mechanism
D) Installation technique

20. Negative skin friction on piles occurs when:

A) The surrounding soil settles more than the pile
B) The pile is loaded beyond its elastic limit
C) Groundwater rises above the pile base
D) Lateral soil movement is restrained

21. Group efficiency for closely spaced piles in clay is generally:

A) Equal to 1
B) Less than 1 due to overlapping stress zones
C) Greater than 1 due to end bearing overlap
D) Unaffected by pile spacing

22. Elastic settlement of a group of piles depends most on:

A) Soil cohesion and pile shape
B) Pile diameter and pile cap stiffness
C) Modulus of elasticity of soil and pile spacing
D) Type of pile head connection

23. Which of the following assumptions is NOT part of Rankine's active earth pressure theory?

A) Soil is dry, homogeneous, and cohesionless
B) Wall yields sufficiently to mobilize active pressure
C) Wall-soil friction is considered
D) Backfill surface is planar

24. Coulomb's earth pressure theory differs from Rankine's by:

A) Considering wall friction and wall inclination
B) Assuming purely cohesive soil
C) Ignoring wall-soil friction
D) Assuming the wall remains completely vertical

25. The factor of safety against sliding for a retaining wall is calculated using:

A) Total vertical load / resisting moment
B) Shear strength of soil / active pressure
C) Passive pressure / wall height
D) Resisting force / driving force

26. A gravity retaining wall resists earth pressure primarily by:

A) Structural reinforcement
B) Wall curvature
C) Its own weight
D) Anchor bolts

27. What is the fundamental assumption in the analysis of cantilever sheet pile walls in sandy soils using the free earth support method?

A) The passive pressure acts only at the bottom
B) The moment at the base is zero
C) Active and passive pressures are equal
D) Soil pressure distribution is linear

28. In sandy soils, the depth of embedment for a cantilever sheet pile wall is determined by:

A) Considering both cohesion and friction angle
B) Ensuring equal moments of active and passive earth pressures
C) Equating active pressure and surcharge
D) Neglecting soil unit weight

29. In clay soils, what is the primary failure mode of cantilever sheet pile walls if not properly designed?

A) Tensile cracking
B) Local crushing
C) Hydraulic uplift
D) Rotational slip failure

30. In sandy soils, increasing the friction angle (ϕ) will generally:

A) Decrease passive resistance
B) Increase active pressure
C) Reduce required embedment depth
D) Have no effect

Steel Structures Design

1) **Beams behavior at compression zone depending on:**
   a) Applied dead and live loads.
   b) Their lateral bracing situation.
   c) Cross sectional area.
   d) Yielding stress of steel used.
2) **Block shear failure in a tension member typically involves:**
   a) Shear along the longitudinal section and tension along the transverse section.
   b) Tension along the longitudinal section and shear along the transverse section.
   c) Tension along both the longitudinal and transverse sections.
   d) Shear along both the longitudinal and transverse sections.
3) **What end condition must a column satisfy for Euler's buckling load equation to apply?**
   a) Ends must be fixed and not rotate.
   b) Ends must be free to rotate but not translate laterally.
   c) Ends must be free to rotate and translate laterally.
   d) Ends must be rigidly fixed.
4) **The spacing distance value (L_p) is dependent on:**
   a) The beam cross sectional area.
   b) Yield stress of steel used in beam manufacturing.
   c) The dimensions of the beam cross section and on its yield stress.
   d) The applied load and moment.
5) **Which of the following is a lateral load?**
   a) Dead load.
   b) Live load.
   c) Wind load.
   d) Gravity load.
6) **Elastic critical moment is:**
   a) Bending moment at which beam do not fail by lateral buckling.
   b) Bending moment at which beam fails by lateral buckling.
   c) Shear force at which beam do not fail by lateral buckling.
   d) Shear force at which beam fails by lateral buckling.

7) A beam of W shape turned on its side when subjected to gravity loads may be

a) Stronger than one in the upright position.
b) Buckled laterally when all section points reach yielding.
c) Lateral-torsional buckling is not applicable.
d) Complies with zone 3.

8) A beam that is wholly encased in concrete or that has its compression flange incorporated in a concrete slab is.

a) Considered in zone1.
b) Considered in zone2.
c) Considered in zone3.
d) None of above.

9) The lateral-torsional buckling modification factor for nonuniform moment diagrams C_b is affected by:

a) The end restraint.
b) Loading conditions of the member.
c) The end restraint and loading conditions of the member.
d) Cross section properties and type of steel used in beam manufacturing.

10) A compact section is a section that:

a) developing a inelastically stress distribution before buckling locally
b) developing a fully elastic stress distribution before buckling locally
c) developing a fully plastic stress distribution before buckling locally
d) developing a partially plastic stress distribution before buckling locally

11) In which of the following cases shear does not govern design of beam?

a) when web thickness is large in plate girders
b) when depth of beam section is small and loaded uniformly
c) when large concentrated loads are placed near support
d) when two members are rigidly connected together with their webs lying in same plane

12) When a steel member is simultaneously subjected to axial loads and bending moments, it experiences:

a) Torsion
b) Shear
c) Flexure-torsion interaction
d) Pure axial deformation

13) Secondary forces in members subjected to bending and axial loads are developed because:

a) The members are not connected with frictionless pins.
b) The members' centers of gravity do not exactly coincide at the joints.
c) The connector's centers of gravity do not exactly coincide at the joints.
d) All the above.

14) Which of the following steel cross-sectional shapes is generally preferred for resisting combined bending and axial loads due to its efficiency?

a) Rectangular
b) Circular
c) I-shaped (wide flange)
d) T-shaped

15) The second-order moment is:

a) An external moment applied along unbraced length of member.
b) Equal to the axial compression load times the lateral displacement or eccentricity.
c) The moment produced due to sidesway.
d) Equal to the moment due to lateral displacement and sidesway.

16) In the AISC specifications, what is the approximate method used for?

a) Analysis of beams only
b) Analysis of columns only
c) Analysis of steel members subjected to combined bending and axial loads
d) Analysis of tension members only

17) In the AISC code, what is the typical limit state that is checked for members subjected to combined axial loads and bending moments?

a) Yielding
b) Buckling
c) Deflection
d) Fatigue

18) What is required for the analysis of built-up compression members?

a) Knowledge of cross-sectional properties and component connections.
b) Only the material properties of the components.
c) Calculations of lateral forces acting on the member.
d) Determination of buckling modes without connection details.

19) What is the significance of the term "compact section" in AISC when analyzing steel members under axial loads and bending?

a) Section is not prone to lateral-torsional buckling
b) Section has a slender and flexible profile
c) Section has a sufficient level of compactness to resist buckling
d) Section is immune to axial loads
e) Adjust the column dimensions

20) When considering unbraced frames, where do the maximum primary moments typically occur?

a) Beam midpoints
b) Column ends
c) Bracing locations
d) Diaphragm connections

21) Where do the maximum sidesway moments occur in unbraced frames?

a) At the mid-span of beams
b) At the column ends
c) At the mid-height of columns
d) At the joints of members

22) What does the equivalent axial load method involve in beam-column design?

a) Replacing axial load with a fictitious concentric load
b) Increasing the axial load to maximize strength
c) Ignoring bending moments for simplicity
d) Applying trial sections directly without adjustments

23) What is a distinguishing characteristic of high-strength bolts compared to unfinished bolts?

a) Smaller tolerances
b) Larger design strengths
c) Made from carbon steels
d) Heat-treated steel with higher tensile strengths

24) How is slip-resistance defined in the context of bolted connections?

a) When the shearing load exceeds the frictional resistance
b) When the connection is tightened using a calibrated wrench
c) When the members slip on each other and shear off the bolts
d) When the clamping force is equal to the coefficient of friction

25) In a butt joint, why are the bolts said to be in double shear?
a) Because there are two bolts used in the joint
b) Because the members are arranged in a symmetrical manner
c) Because the shearing force is distributed across two planes
d) Because the bolts are subjected to bending and shearing forces

26) In what situation are threads almost always excluded from the shear plane for normal bolt and member sizes?
a) When using oversized holes
b) When using short-slotted holes
c) When using standard hole sizes
d) When using long-slotted holes

27) How are the reduced eccentricity values computed for two fastener arrangements?
a) By analyzing the deformation of the bolts
b) By using the Crawford-Kulak formula
c) By computing the eccentric moment
d) By determining the location of the instantaneous center

28) Why welded structures are considered more rigid?
a) Because they use thicker materials
b) Because connections are made through intermediate plates
c) Because members are often welded directly to each other
d) Because they undergo less deformation under load

29) Why is the angle of the fillet weld with respect to the pieces being welded mentioned as important?
a) It affects the length of the weld
b) It influences the theoretical throat dimension
c) It impacts the strength of the weld
d) It determines the type of metal used

30) Which type of weld is commonly used for column splices and beam flange connections?
a) Butt weld
b) Seam weld
c) Groove weld
d) Fillet weld

Concrete Technology

1: The following table represents the sieve analysis of fine aggregate symbol :

النسبة المئوية المجمعة المحجوزة على كل منخل %	مقاس المنخل
2	4.75 mm
15	2.36 mm
40	1.18 mm
55	0.6 mm
77	0.3 mm
97	0.15 mm

Thus, the fineness modulus (F.M) of fine aggregate is :

A- 2.86 B- 3.15

C- 5.5 D- 0 %

2: If the Cylinder compressive strength of concrete is 20 MPa, the equivalent cube compressive strength is:

A- 17-16 MPa B- 20 MPa C- 19 MPa D- 24-25 MPa

3: The chemical reaction that occurs during the manufacturing process of concrete is due to :

A -adding the water to the mixes of materials of materials B- Burning the mixes

C- adding the gypsum (calcium sulphate) the clinker D-all of theme

4: The standard situation of aggregate in concrete mix design of American Concrete Institute (ACI) mix design method is:

A- Oven Dry B- Air Dry

C- Wet Moist D- Saturated Surface Dry SSD

5: The concrete Modulus of Elasticity (E) that adopted in calculation of concrete design and analysis is:

A- Initial Tangent modulus B- Secant Modulus

C- Tangent Modulus D- Not of them

6: The adding of gypsum (calcium sulphate) to the clinker is to :

A- to prevent the sudden settingB- to increase cement strength

C- to increase cement fineness D- to decrease cement heat

7. The critical factor influencing "Creep" in concrete is:

a) Aggregate type

b) Sustained load duration

c) Water-cement ratio

d) Ambient temperature

8. The primary role of gypsum in cement is to:

a) Increase strength

b) Control setting time

c) Reduce cost

d) Improve workability

9. Segregation in concrete is caused by:

a) Excessive vibration or high slump

b) Low water-cement ratio

c) Use of air-entraining agents

d) High cement content

10. The air content of fresh concrete is 4%. If the theoretical density is 2400 kg/m³, the actual density is:

a) 2304 kg/m³

b) 2352 kg/m³

c) 2400 kg/m³

d) 2448 kg/m³

11. The primary role of sand in concrete is to:

a) Provide strength

b) Fill voids between coarse aggregates

c) Reduce cost

d) Accelerate hydration

12. M25 concrete implies:

a) 25 MPa at 7 days

b) 25 MPa at 28 days

c) 25% cement content

d) 25 mm max aggregate size

13. The primary role of C_3S in cement is to:

a) Provide early strength

b) Control setting time

c) Resist sulfate attack

d) Reduce heat generation

14. The primary objective of ACI 211 mix design is to:

a) Maximize cement content

b) Achieve required strength & workability at minimum cost

c) Use the largest possible aggregates

d) Eliminate admixtures

15. In ACI 211, the water-cement ratio is determined based on:

a) Aggregate shape

b) Target compressive strength and exposure conditions

c) Cement brand

d) Mixer capacity

16. In British Mix Design method, the free water-cement ratio is determined from:

a) Strength vs. w/c ratio curves

b) Aggregate absorption

c) Cement fineness

d) Ambient temperature

17. The early strength of concrete depend mainly on:

a) C4AF

b) C3A

c) C3S

d) $CaSO_2$

18. In ready-mixed concrete, the permissible time for concrete components to remain mixed according to Iraqi specifications is :

A- 60 minutes B- 60 minutes

C- 120 minutes D- 150 minutes

19. The modulus of elasticity of a concrete specimen having a strength of (34)MPa, and a density of(2350) kg/m^3 is :

A- 28.2 MPa B- 25.7 MPa
C- 31.9 MPa D- 32.5 MPa

20- The ACI-211method for concrete mix design method consider the aggregate moisture condition state in design is:

A- Saturated Surface Dry B- moist condition (saturated wet surface)

C- Air Dry D- Oven dry

21- The British Standard method for concrete mix design method consider the aggregate moisture condition state in design is:

1- Saturated Surface Dry 2- moist condition (saturated wet surface)

3- Air Dry 4- Oven dry

22- "Vicat apparatus" is used to measure :

A- fineness of cement B- Concrete porosity

C- Cement initial setting Time D- Cement Initial and Final setting Time

23- The following cement type is preferred to use in mass concrete

A- Rapid hardening Portland Cement B- Low Hydration Heat Cement

C- Sulphate resisting Cement D- Masonry Cement

24- The "Blaine" testing method is used (in ASTM and Iraqi Standard test method) to measure:

1- Cement setting time 2- Cement surface area

3- Cement Porosity 4- Cement Voids Rario

25- If the cube compressive strength of concrete is 30 MPa, the equivalent cylinder compressive strength is:

A- 15 MPa B- 20 MPa

C- 24 MPa D- 35 MPa

26- The Concrete Absolute Density can be define as:

A- The mass per unit volume of a material excluding pores or voids

B- The mass per unit volume of a material including pores, voids, and air gaps.

C- The ratio of a concrete density to the density of water.

D- Mass per unit volume without moisture

27 – The Concrete specimen of the following slump value is considered successful:

A- 160 mm B- 10 mm C- 175 mm D- 75 mm

28- According to British standard "CP" , the elastic modulus of elasticity "E" of concrete is related to:

A- Concrete strength B- root of concrete strength

C - Cubic root of concrete strength D- square of concrete compressive strength

29- Which cement type is most suitable for marine structures?

A- Ordinary Portland Cement (OPC) B- Rapid Hardening Cement

C- Sulphate Resistant Cement (SRC) D- White Cement

30- he water-cement ratio (w/c) for normal concrete typically ranges between:

A- 0.1 – 0.2 B- 0.3 – 0.5 C- 0.6 – 0.8 D- 0.9 – 1.2

تكنولوجيا الخرسانة

1. **ما هو العامل الأساسي الذي يؤثر على جودة الخرسانة في الموقع؟**
   أ- جودة الأسمنت فقط
   ب- نوعية الركام فقط
   ت- مهارة العاملين وتنفيذ العمليات بشكل صحيح
   ث- درجة حرارة الجو فقط

2. **ما هو السبب الرئيسي لاستخدام الحديد مع الخرسانة في المنشآت؟**
   أ- زيادة الوزن
   ب- تقليل التكلفة
   ت- مقاومة قوى الشد
   ث- تحسين المظهر الجمالي

3. **ما هو المقصود بمصطلح "الانفصال" في الخرسانة؟**
   أ- تفاعل كيميائي بين الأسمنت والماء
   ب- فصل مكونات الخرسانة غير المتجانسة
   ت- زيادة مقاومة الخرسانة للضغط
   ث- تقليل نسبة الماء في الخلطة

4. **ما هي النسبة التقريبية لمقاومة الشد مقارنة بمقاومة الضغط في الخرسانة؟**
   أ- 10%
   ب- 25%
   ت- 50%
   ث- 75%

5. **ما هو الاختبار المستخدم لقياس مقاومة الخرسانة للانحناء؟**
   أ- اختبار الضغط
   ب- اختبار الشد
   ت- اختبار الانحناء
   ث- اختبار القص

6. **وجود مواد ضارة في الركام قد يؤدي إلى:**
   أ- زيادة المقاومة
   ب- تحسين التشغيلية
   ت- تقليل الديمومة
   ث- زيادة الدمك

7. ما الهدف الرئيسي من التحليل المنخلي(Sieve Analysis) ؟

أ- تحديد التركيب الكيميائي
ب- الكشف عن المواد الضارة
ت- تقدير محتوى الرطوبة
ث- تحديد توزيع حجم الحبيبات

8. الحجم الأقصى للركام المستخدم في الخرسانة يتحدد بناءً على:

أ- لون الأسمنت
ب- نوع الإضافات الكيميائية
ت- سُمك العنصر الإنشائي
ث- نسبة الماء إلى الأسمنت

9. وجود شوائب عضوية في الركام يمكن أن يؤدي إلى:

أ- زيادة زمن التصلب
ب- تحسين نعومة السطح
ت- تقوية الترابط مع الأسمنت
ث- زيادة مقاومة الضغط

10.من أكثر المواد الضارة في الركام تأثيرًا:

أ- الطين والغرين
ب- أكاسيد الحديد
ت- الحجر الجيري
ث- الحصى

11.ما المقصود بـ "قابلية التشغيل" في الخرسانة الطازجة؟

أ- مدى صلابة الخرسانة بعد التصلب
ب- مقاومة الخرسانة للانضغاط
ت- سهولة خلط ونقل وصب ودمك الخرسانة دون حدوث انفصال أو نزف
ث- كمية الإسمنت المستخدمة في الخلطة

12.أي العوامل التالية تؤثر في قابلية التشغيل للخرسانة؟

أ- درجة الحرارة فقط
ب- نسبة الماء إلى الإسمنت، شكل الركام، ودرجة الحرارة
ت- لون الإسمنت
ث- نوع الفولاذ المستخدم في التسليح

13.ما هو "الانفصال" في الخرسانة الطازجة؟

أ- تفاعل كيميائي داخلي يؤدي لتصلب الخرسانة
ب- فصل مكونات الخرسانة عن بعضها أثناء النقل أو الصب
ت- انهيار القالب المستخدم في الصب
ث- زيادة مقاومة الخرسانة

14.كيف يمكن تقليل ظاهرة "النزف (Bleeding) "في الخرسانة؟

أ- بزيادة نسبة الماء إلى الإسمنت
ب- باستخدام ركام خشن أكثر
ت- بإضافة مواد حابسة للهواء أو تقليل الماء المستخدم
ث- باستخدام رمل أكثر نعومة

15.ما الهدف من خلط الخرسانة جيدًا؟

أ- توزيع المواد بشكل متجانس للحصول على خرسانة متماسكة ومتينة
ب- زيادة زمن التصلب
ت- تقليل كمية المواد المضافة
ث- منع الشقوق بعد التصلب

16.ما هو أكثر أنواع مقاومة الخرسانة استخدامًا في التقييم الإنشائي؟

أ- مقاومة الشد
ب- مقاومة القص
ت- مقاومة الانضغاط
ث- مقاومة التآكل

17.ما تأثير زيادة نسبة الماء إلى الأسمنت في الخلطة الخرسانية؟

أ- زيادة مقاومة الانضغاط
ب- تقليل مقاومة الانضغاط
ت- عدم تأثير على المقاومة
ث- تحسين مقاومة الشد فقط

18.من اختبارات الخرسانة المتصلدة لاختبار مقاومة الانضغاط هو اختبار:

أ- المخروط الناقص
ب- المكعب أو الأسطوانة
ت- الانسيابية
ث- الانكماش

19.يستخدم اختبار الشد غير المباشر (اختبار الانشطار) لتحديد:

أ- مقاومة الانضغاط
ب- مقاومة التآكل
ت- مقاومة الشد
ث- مقاومة القص

20.في اختبار مقاومة الانضغاط، تؤخذ عينات الخرسانة عادةً على شكل:

أ- مكعبات أو أسطوانات
ب- منشور أو متوازي مستطيلات
ت- أقراص مسطحة
ث- مكعبات فقط

21. **ما المقصود بمعامل المرونة (Modulus of Elasticity) في الخرسانة؟**

أ. النسبة بين الإجهاد والانفعال في مرحلة الفشل الكامل
ب. النسبة بين الإجهاد والانفعال ضمن حدود المرونة
ت. كمية التمدد الحراري في الخرسانة
ث. النسبة بين مقاومة الشد ومقاومة الانضغاط

22.**أي من العوامل التالية لا تؤثر بشكل مباشر على معامل المرونة للخرسانة؟**

أ. نوع الركام المستخدم
ب. نسبة الماء إلى الاسمنت
ت. سرعة الخلط
ث. عمر الخرسانة

23.**من أنواع الانكماش في الخرسانة:**

أ. الانكماش الحراري فقط
ب. الانكماش البلاستيكي فقط
تج. الانكماش الجاف والانكماش البلاستيكي والانكماش الذاتي
ث. الانكماش الناتج عن الفشل الإنشائي فقط

24.**الزحف (Creep) في الخرسانة يُعرف بأنه:**

أ. تغير في مقاومة الخرسانة بفعل العوامل الجوية
ب. تشوه مستمر ناتج عن حمل ثابت يُطبق لفترة طويلة

ت. حدوث تشققات بعد تصلب الخرسانة
ث. تغير لون سطح الخرسانة

25. **ما العلاقة بين الزحف والانكماش في الخرسانة؟**
أ. كلاهما يحدث نتيجة زيادة الأحمال
ب. كلاهما يؤثر في تشوه الخرسانة بمرور الزمن
ت. الزحف ناتج عن تغيرات حرارية فقط والانكماش عن رطوبة
ث. لا توجد علاقة بينهما

26. **أي من الطرق التالية تُعد من الطرق الشائعة لتصميم الخلطات الخرسانية؟**
أ. طريقة الوزن الحجمي فقط
ب. الطريقة البريطانية، الطريقة الأمريكية، والطريقة الهندية
ت. الطريقة الإيطالية فقط
ث. الطريقة اليدوية البسيطة

27. **عند تصميم خلطة خرسانية لمقاومة ضغط معينة، فإن الاختبارات المستخدمة** للتحقق من التصميم تشمل:
أ. اختبار الانكماش فقط
ب. اختبار مقاومة الشد فقط
ت. اختبار الهطول واختبار مقاومة الضغط بعد 28 يومًا
ث. اختبار الكثافة فقط

28. **ما هو تأثير زيادة نسبة الماء في الخلطة الخرسانية؟**
أ. زيادة مقاومة الخرسانة
ب. تقليل قابلية التشغيل
ت. زيادة قابلية التشغيل ولكن تقليل المقاومة والمتانة
ث. تقليل زمن الشك الابتدائي

29. **ما الهدف من استخدام المضافات الكيميائية في تصميم الخلطات الخرسانية؟**
أ. تقليل استخدام الركام الناعم
ب. تحسين خصائص الخرسانة الطازجة أو المتصلدة
ت. تقليل نسبة الأسمنت المستخدم فقط
ث. استبدال الماء بشكل كامل

30. **في طريقة التصميم الأمريكية(ACI) ، ما هو العامل الرئيسي الذي يتم تحديده أولاً؟**
أ. نسبة الرمل إلى الحصى
ب. محتوى الأسمنت

ت. مقاومة الضغط المطلوبة للخرسانة
ث. زمن الشك النهائي

(Engineering Analysis)

1- Which of the following is a **first-order** differential equation?

A. $\frac{d^2y}{dx^2} + y = 0$

B. $\frac{dy}{dx} + y = 0$

C. $\frac{d^3y}{dx^3} = x$

D. $\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

2- Which method is used to solve a first-order **linear** ODE?

A. Laplace Transform

B. Separation of Variables

C. Integrating Factor

D. Euler's Method

3- Solve $\frac{dy}{dx} = xy \quad with \quad y(0) = 1$

A. $y = e^x$

B. $y = e^{x^2}$

C. $y = e^{x^2/2}$

D. $y = x^2 + 1$

4- Which of the following is the **integrating factor** for the equation $\frac{dy}{dx} + 3y = 6x$?

A. e^x

$B.\ e^{3x}$
$C.\ 3e^{x}$
$D.\ e^{x}$

5- If DE contains $xdx + ydy$, Then the trying of Integration Factor is:

A. $(x^2 + y^2)\ as\ \ a\ multiplier$

B. $(x^2 - y^2)\ as\ \ a\ multiplier$

C. $(\frac{1}{x^2} + \frac{1}{y^2})\ as\ \ a\ multiplier$

D. $(x^2y^2)\ as\ \ a\ multiplier$

6- Given the differential equation: $(2xy + y^2)dx + (x^2 + 2xy) = 0$ Is this an exact equation?

A. Yes

B. No

C. Only when $x = y$

D. Cannot be determined

7- The auxiliary equation of $y'' + 4y = 0$ is:

A. $m^2 + 4 = 0$

B. $m^2 - 4 = 0$

C. $m^2 + 2m + 4 = 0$

D. $m^2 - 2m + 4 = 0$

8- The general solution of $y'' + y = 0$ is:

A. $y = Ae^x + Be^{-x}$

B. $y = Acos(x) + Bsin\ (x)$

C. $y = Ae^{ix} + Be^{-ix}$

D. $y = Acosh(x) + Bsinh\ (x)$

9- For the equation $y'' - 2y' + 5y = 0$, the nature of the roots is:

A. Real and distinct

B. Real and repeated

C. Complex conjugate

D. Pure imaginary

10- Find the particular solution of $y'' - y' = e^x$

A. $y_p = A\ e^x$

B. $y_p = A\ xe^x$

C. $y_p = A\ x^2e^x$

D. $y_p = A\ e^{-x}$

11- The general solution of the differential equation $y'' + 4y' = \sin(2x)$

A. $y = C_1\cos(2x) + C_2\sin(2x) + Ax\cos(2x)$
B. $y = C_1\cos(2x) + C_2\sin(2x) + Ax\sin(2x)$
C. $y = C_1\cos(2x) + C_2\sin(2x) + Ax\cos(x)$
D. $y = C_1\cos(2x) + C_2\sin(2x) + Ax\sin(x)$

12- Given $y'' + y = \cos(x)$, find a particular solution.

A. $y_p = A\cos(x)$

B. $y_p = A\sin(x)$

C. $y_p = Ax\cos(x) + Bx\sin(x)$

D. No particular solution exists.

13- The Fourier series of a periodic function *f(x)* with period 2π is given by: $f(x) = a_o + \sum_{n=1}^{\infty}(a_n \cos n\pi + b_n \sin n\pi)$, What is the formula for the coefficient a_0?

A. $\frac{1}{2\pi}\int_{-\pi}^{\pi} f(x)dx$

B. $\int_{0}^{\pi} f(x)dx$

C. $\frac{1}{\pi}\int_{-\pi}^{\pi} f(x)dx$

D. $\frac{1}{\pi}\int_{0}^{\pi} f(x)dx$

14- Which of the following statements is **true** regarding the Fourier series of an **even function**?

A. Only sine terms are present

B. Only cosine terms are present

C. Both sine and cosine terms are present

D. No Fourier series exists for even functions

15- What is the Fourier series of the function $f(x)=x$, defined on the interval $(-\pi, \pi)$, and extended periodically?

A. Contains only cosine terms

B. Contains only sine terms

C. Contains both sine and cosine terms

D. Zero for all terms

16- Which coefficient represents the **amplitude** of the n^{th} sine term in a Fourier series?

A. a_n

B. b_n

C. a_0

D. n

17- What is the Fourier series expansion of $f(x) = |x|$ on $(-\pi, \pi)$?

A. Contains only sine terms

B. Contains both sine and cosine terms

C. Contains only cosine terms

D. Is zero

18- What is the Fourier sine series of $f(x) = x$ defined on $(0, \pi)$?

A. $\sum_{n=1}^{\infty} \frac{2(-1)^{n+1}}{n} \sin nx$

B. $\sum_{n=1}^{\infty} \frac{2}{n} \sin nx$

C. $\sum_{n=1}^{\infty} \frac{2(-1)^{n}}{n} \sin nx$

D. $\sum_{n=1}^{\infty} \frac{(-1)^{n}}{n} \sin nx$

19- What is the Fourier cosine series for $f(x) = x$, defined on $(0, \pi)$?

A. $\frac{\pi}{2} - \sum_{n=1}^{\infty} \frac{4}{\pi n^2} \cos nx$

B. $\sum_{n=1}^{\infty} \frac{4\,(-1)^n}{n^2} \cos nx$

C. $\sum_{n=1}^{\infty} \frac{2}{\pi n^2} \cos nx$

D. $\frac{\pi}{2} - \sum_{n=1}^{\infty} \frac{4\,(-1)^n}{n^2} \cos nx$

20- What is the Laplace transform of the unit step function $f(t)$=1?

A. $\frac{1}{S}$

B. $\frac{1}{S^2}$

C. $\frac{1}{S^3}$

D. $\frac{1}{S^4}$

21- What is the Laplace transform of t^2?

A. $\frac{2}{S^3}$

B. $\frac{2}{S^2}$

C. $\frac{2}{S}$

D. $\frac{2}{S^4}$

22- What is the Laplace transform of e^{at}?

A. $\frac{1}{S-a}$

B. $\frac{1}{S+a}$

C. $\frac{1}{S^2-a^2}$

D. $\frac{1}{S^2+a^2}$

23- What is the Laplace transform of *cosh (at)*?

A. $\frac{S}{S^2-a^2}$

B. $\frac{S}{S^2+a^2}$

C. $\frac{a}{S^2-a^2}$

D. $\frac{a}{S^2+a^2}$

24- What is the Laplace transform of t^n?

A. $\frac{n!}{S^{n+1}}$

B. $\frac{1}{S^{n+1}}$

C. $\frac{n!}{S^n}$

D. $\frac{1}{S^n}$

25- Which of the following is a second-order linear partial differential equation?

A. $\frac{\partial u}{\partial x} + u = 0$

B. $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

C. $\frac{\partial u}{\partial x} \cdot \frac{\partial u}{\partial y} = 0$

D. $u \cdot \frac{\partial^2 u}{\partial x^2} = 0$

26- The general solution of the PDE $\frac{\partial u}{\partial x} = 0$ is:

$A.\quad u = f(y)$
$B.\quad u = f(x)$
$C.\quad u = f(x+y)$
$D.\quad u = f(x-y)$

27- Which of the following PDEs is classified as hyperbolic?

$A.\quad \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

$B.\quad \frac{\partial^2 u}{\partial t^2} - C^2 \frac{\partial^2 u}{\partial x^2} = 0$

$C.\quad \frac{\partial u}{\partial t} - D\frac{\partial^2 u}{\partial x^2} = 0$

$D.\quad \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x,y)$

28- **The method of separation of variables is applicable to PDEs that are:**

A. Nonlinear and homogeneous

B. Linear and homogeneous

C. Nonlinear and nonhomogeneous

D. Linear and nonhomogeneous

29- The solution of $\frac{d^4 y}{dx^4} = y$ is:

$A.\quad y = Ae^x + Be^{-x} + C\cos x + D\sin x$

$B.\quad y = Ae^x + Bxe^x + C\cos x + D\sin x$

$C.\quad y = Ae^{-x} + Bxe^{-x} + C\cos x + D\sin x$

$D.\quad y = Axe^x + Bxe^{-x} + C\cos x + D\sin x$

30- If $M(x,y)dx + N(x,y)dy = 0$ *is exact, Then*:

A. $\int_a^x M(x,y)dx + \int_b^y N(a,y)dy = 0$

B. $\int_a^x M(x,y)dx + \int_b^y N(x,y)dy = 0$

C. $\int_a^x M(x,y)dx + \int_b^y N(a,y)dy = c$

D. $\int_a^x M(x,y)dx + \int_b^y N(x,y)dy = c$

SOIL MECHANICS

Q1: Weathering process involves breaking down rocks by:

A- Mechanical process
B- Chemical process
C- Mechanical Chemical processes

Q2: The type of soil that transported by running water and deposited along streams is:

A- Alluvial soil
B- Marine soil
C- Aeolian soil
D- Glacial soil

Q3: The maximum size of sand according to MIT classification is:

A- 1.75 mm
B- 2.0 mm
C- 3.0 mm
D- 4.75 mm

Q4: The tetrahedron units consist of oxygen atoms surrounding a silicon atom. The number of oxygen atoms are:

A- 2
B- 3
C- 4
D- 6

Q5: The flocculated structure of clay is characterized by:

A- Higher compressibility
B- Higher permeability
C- Lower strength
D- Lower permeability

Q6: The void ratio of soil equal to:

A- $e = \frac{v_v}{v}$

B- $e = \frac{v_s}{v}$

C- $e = \frac{v_s}{v_v}$

D- $e = \frac{v_v}{v_s}$

Q7: The relationship between void ratio and porosity is given by the equation:

A- $n = \frac{e}{1+e}$

B- $n = \frac{1+e}{e}$

C- $n = \frac{e}{1-e}$

D- $n = \frac{1-e}{e}$

Q8: The dry unit weight of soil is given by the relationship:

A- $\gamma_d = \frac{w}{v}$

B- $\gamma_d = \frac{w_s}{v_s}$

C- $\gamma_d = \gamma_t\,(1 + w)$

D- $\gamma_d = \frac{G_s\,\gamma_w}{1+e}$

Q9: A soil sample has a total unit weight of 16.97 kN/m^3, void ratio of 0.84 and specific gravity of 2.7. The moisture content of the sample is:

A- 17%

B- 18%

C- 19%

D- 20%

Q10: If the soil sample has the following properties (γ_t = 16.5 kN/m^3, w = 15%, G_s= 2.7). The porosity of soil is:

A- 0.42

B- 0.44

C- 0.46

D- 0.48

Q11: When the uniformity coefficient is equal to 5, the sand soil is classified as:

A- SP
B- SW
C- SW-SC
D- SW-SM

Q12: If the liquid limit of clay soil is 52% and lies above A- line , the soil is classified as:

A- CL-ML
B- CL
C- MH
D- CH

Q13: When the coefficient of gradation of gravel soil is 2.9 and the uniformity coefficient is 4.5, the gravel soil is classified as:

A- GP
B- GP-GC
C- GW
D- GW-GC

Q14: The results of the sieve analysis of a soil is tabulated below. the soil is classified according to unified soil classification systems (USCS) as:

Diameter (mm	20	4.75	2.0	0.85	0.425	0.150	0.05	0.075	D_{10}	D_{30}	D_{60}
% Passing	64	39	24	14	9	3	1.5	1	0.47	4.1	16

A- GW
B- SW
C- GP
D- SP

Q15: The results of the sieve analysis of a soil is tabulated below. the soil is classified according to AASHTO classification system as:

Diameter (mm	4.75	2.0	0.85	0.425	0.150	0.075	LL	PL
% Passing	100	93	85	80	70	55	50	18

$$GI = (F_{200} - 35)[0.2 + 0.005(LL - 40)] + 0.01(F_{200} - 15)(PI - 10)$$

A- A-7-6 (13)
B- A-7-6 (14)
C- A-7-6 (15)
D- A-7-6 (16)

Q16: Quick condition in soil take place when the effective stress equal to:

A- Less than zero
B- More than zero
C- Zero

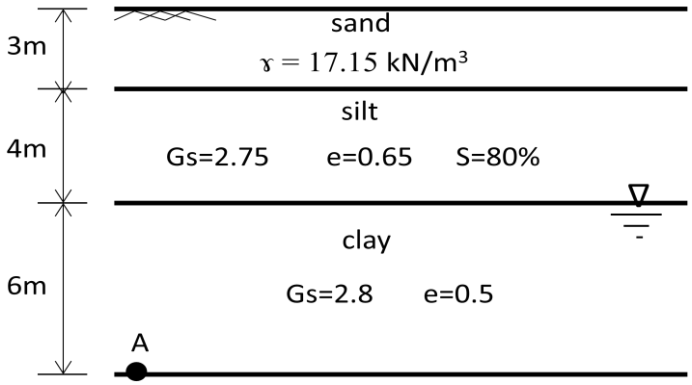
Q17: In most soils, the average critical hydraulic gradient approximately equal to:

A- Zero
B- Less than 1
C- More than 1
D- 1

Q18: The water table is lowered from a depth of 3 m to a depth of 6 m below ground surface in a deposit of silt. The silt is saturated even after the water table is lowered, its water content is 26%, assume Gs= 2.7. The increase in the effective stress at the depth of 10 m due to lower the water table is:

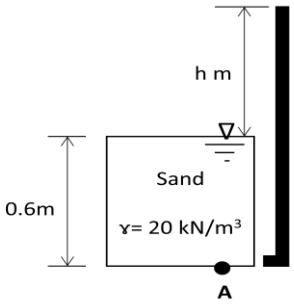
A- 19.23 kPa
B- 19.63 kPa
C- 20.23 kPa
D- 20.63 kPa

Q19: For the soil profile shown in figure below, the vertical effective stresses at points A is:



A- 199.35 kPa
B- 198.35 kPa
C- 197.55 kPa
D- 196.55 kPa

Q20: For the figure shown below, the value of (h) at which the sand would be expected to be quick is:



A- 0.42 m
B- 0.48 m
C- 0.56 m
D- 0.62 m

Q21: Elastic settlement caused by elastic deformation take place in:

A- Dry soil
B- Saturated soil
C- Dry and saturated soil

Q22: The over consolidated ratio for normally consolidated clay soil is:

A- Less than 1
B- More than 1
C- Zero
D- 1

Q23: A 12 m depth of sand layer has a dry unit weight of 18 kN/m^3 and submerged unit weight of 11 kN/m^3 overlies a 7 m layer of normally consolidated clay below which is an impermeable stratum. The properties of clay layer are (Gs= 2.76, *w*=40.5%, L.L= 48%). The water table was 5 m below natural ground surface. The average increase in pressure at the center of the clay layer is 120 kN/m^2 due to the weight of a building that constructed on ground surface. The expected total primary consolidation settlement is:

A- 22.3 cm
B- 23.3 cm
C- 23.6 cm
D- 23.9 cm

Q24: A 6 m thick clay layer is subjected to an average change of excess pore water pressure of 60 kPa. Sand seams with drainage outlet exist above and below the layer. The coefficient of permeability of the clay is 0.03 m/year and the consolidation settlement of the clay is 0.3 m. What is the coefficient of consolidation (c_v).:

A- 3.68 m^2/sec
B- 3.98 m^2/sec
C- 4.68 m^2/sec
D- 4.98 m^2/sec

Q25: A normally consolidated clay layer extends from the ground surface down to a depth of 8 m, below the clay layer is a sand stratum. The coefficient of consolidation (c_v)is equal to (1x10^{-2} cm^2/sec). The water table is at ground surface and the ground surface is loaded with uniformly 100 kN/m^2 make the upper surface impervious. The time required for ultimate consolidation settlement is:

A- 1.63 year
B- 1.82 year
C- 2.03 year
D- 2.33 year

Q26: In unconfined compression test, the stress (σ_3) has a value equal to:

A- $\sigma_3 = \sigma_1$ B- $\sigma_3 < \sigma_1$

C- $\sigma_3 > \sigma_1$ D- Zero

Q27: When drainage is prevented during triaxial test, the test is:

A- consolidated drained test B- Consolidated undrained test

C- Quick test D- Slow test

Q28: A sand layer has the following properties (Ø= 35°, γ_d = 17 kN/m^3, G_s= 2.7), the water table is at depth of 2.5 m below the ground surface. The shear strength along horizontal plane at a depth of 4.0 m is:

A- 41 kPa B- 45 kPa

C- 51 kPa D- 56 kPa

Q29: A saturated specimen of cohesionless soil was tested under drained condition in triaxial test. The sample failed at deviator stress of 352 kN/m^2 and θ= 60°. Find the magnitude of major principal stress at failure:

A- 518 kPa B- 528 kPa

C- 538 kPa D- 558 kPa

Q30: A consolidated drained triaxial test was conducted on a normally consolidated clay. At failure, the confining pressure is (262 kN/m^2) and the deviator stress is (262 kN/m^2). The angle of internal friction is:

A- 18.27° B- 18.87°

C- 19.17° D- 19.47°

Fluid Mechanics

1. **When pressure is measured concerning absolute zero pressure, it is known as**

(A) Atmospheric pressure
(B) Absolute Pressure
(C) Gauge Pressure
(D) Vacuum Pressure

2. **In a static liquid, the vertical distance from the datum line to the free surface of the liquid is known as**

(A) head
(B) pressure head
(C) depth
(D) pressure depth

3. **For a liquid with a mass of 2000 kg and a volume of 2.5 m^3. Calculate mass density.**

(A) 0.00125 kg/m3
(B) 0.00125 kN/m2
(C) 800 kg/m3
(D) 800 kg/m2

4. **A simple manometer containing mercury is used to measure the pressure of oil (specific gravity 0.8) flowing in a pipe, as shown below. The Mercury level in an open tube is 150 mm higher than that on the left limb. If the oil height in the left limb is 90 mm, determine the pressure in terms of the head of water in a pipe.**

(A) 19.306 kN/m3
(B) 19.306N/m3
(C) 19.306 kN/cm3
(D) 19.306 N/cm3

5. **A swimming pool, 10 m long on one side, is filled with water up to a depth of 3.6 m. Find the total pressure on the wall of the pool**

(A) 63.57 kN/m
(B) 63.57 kN
(C) 635.70 kN
(D) 635.70 kN/m

6. _____is an Instrument to determine the velocity of flow at the required point in a pipe or a stream.

(A) Venturi meter
(B) orifice meter
(C) Pitot tube
(D) Venturiflume

7. Head loss due to fitting in the pipe.

(A) h = 0.5 V12/2g
(B) h = Kb V2/2g
(C) h = (V2 – V3)2/2g
(D) h = Kf V2/2g

8. A pipeline is 6 km long and has a 20 cm diameter connecting two reservoirs, 'A' and 'B'. The rate of discharge in the pipe is 30 litres/sec. Find out the difference in reservoir levels if friction factor f = 0.0008.

(A) 4.5 mm
(B) 4.5 cm
(C) 4.5 m
(D) 4.5

9. _____is defined as the fluid's weight ratio to its volume.

(A) Density
(B) Specific weight
(C) Specific gravity
(D) Surface tension

10. _____is defined as the ratio of the weight density (or density) of a fluid to the weight density (or density) of a standard fluid.

(A) Density
(B) Specific weight
(C) Specific gravity
(D) Surface tension

11. Tensile force acting on the free surface of a liquid per unit length is called _____.

(A) Density
(B) Specific weight
(C) Specific gravity
(D) Surface tension

12. Attraction between the molecules of liquids to another body is called _____.

(A) Cohesion
(B) Adhesion
(C) Dynamic Viscosity
(D) Kinetic Viscosity

13. A rectangular plate of 2 m x 3 m height is immersed vertically in water with a top edge parallel to and at a depth of 3 m below the free surface. Calculate total water pressure.

(A) 264.87 kN
(B) 264.87 N
(C) 176.58 N
(D) 176.58 kN

14. An inverted triangular plate has a base parallel to the water surface, with a width of 1.6 m and a height of 2.10 m. It is submerged in water so that its base is 1.0 m below the free surface. Find total pressure.

(A) 28.01 N
(B) 28.01 kN
(C) 16.48 kN
(D) 16.48 N

15. The type of flow in which the velocity at any given time changes concerning space is known as

(A) steady flow
(B) unsteady flow
(C) uniform flow
(D) non-uniform flow

16. The type of flow in which the fluid characteristics like velocity, pressure, density, etc., at a point change with time is known as

(A) steady flow
(B) unsteady flow
(C) uniform flow
(D) non-uniform flow

17. The diameters of a pipe at sections 1 and 2 are 10 cm and 15 cm, respectively. Find the discharge through the pipe if the velocity of water flowing at section 1 is 5 m/s.

(A) 0.00393 m3/sec
(B) 0.0393 m3/sec
(C) 0.393 m3/sec
(D) 3.93 m3/sec

18. The liquid is flowing through a 200 mm diameter tube with a mean velocity of 2 m/s. If the density of the liquid is 912 kg/m3 and viscosity is 0.38 N.S/m2, find flow type.

(A) Laminar flow
(B) Transition flow
(C) Turbulent flow
(D) None of the above

19. The diameters of a pipe at sections 1 and 2 are 10 cm and 15 cm, respectively. The velocity of water flowing through the pipe at section 1 is 5 m/s. Determine the velocity in section 2.

(A) 0.22 m/sec
(B) 0.45 m/sec
(C) 2.22 m/sec
(D) 4.40 m/sec

20. The bed and sides are smooth and regular in artificial channels.

(A) true
(B) false
(C) all
(D) none

21. In a pipe flow, the minor losses are those

(A) Which depends on the length of the pipeline
(B) Caused by friction and are thus also called friction losses.
(C) Which have a small magnitude
(D) These are caused by total disturbance produced by such fittings as valves, bends, etc.

22. The maximum velocity in a circular pipe when flow is laminar occurs at

(A) The top of the pipe
(B) The bottom of the pipe
(C) The centre of the pipe
(D) Not necessarily at the centre.

23. If the capillary rise of water in a 2 mm diameter tube is 1.5 cm, the height of capillary rise in a 0.5 mm diameter tube, in cm, will be

(a) 10.0 (b) 1.5 (c) 6.0 (d) 24.0

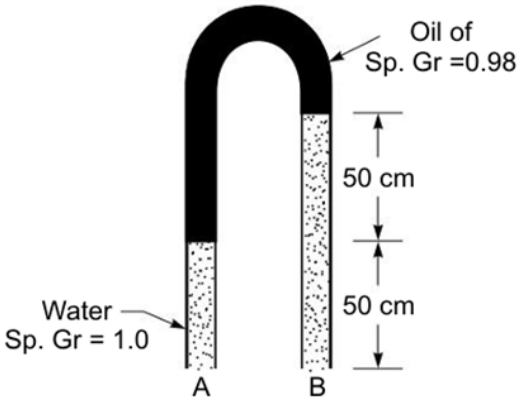
24. In the setup shown in Fig., assuming the specific weight of water as 10 kN/m³, the pressure difference between the two points A and B will be:

(a) 10 N/m³

(b) –10 N/m³

(c) 20 N/m³

(d) –20 N/m³



25. A cylindrical tank of 2 m diameter is laid with its axis horizontal and is filled with water just to its top. The force on one of its end plates in kN, is

(a) 123.0
(c) 30.76
(b) 61.51
(d) 19.58

26. A rectangular plate 0.75 m * 2.4 m is immersed in a liquid of relative density 0.85 with its 0.75 m side horizontal and just at the water surface. If the plane of the plate makes an angle of 60° with the horizontal, the pressure force on one side of the plate, in kN, is

(a) 15.6
(b) 7.8
(c) 24.0
(d) 18.0

27. A circular annular plate bounded by two concentric circles of diameter 1.2 m and 0.8 m is immersed in water with its plane making an angle of 45° with the horizontal. If the centre of the circles is 1.625 m below the free surface, the total pressure force on one side of the plate in kN is

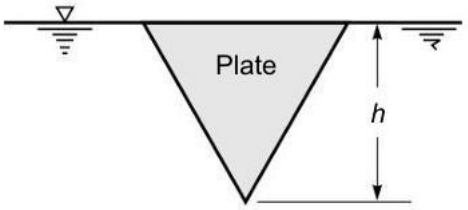
(a) 7.07 (c) 14.14 (b) 10.0 (d) 18.0 2.32

28. A rectangular plate, 30 cm * 50 cm, is immersed vertically in water with its longer side vertical. The total force on one side of the plate is estimated at 17.6 kN. If the plate is turned in the vertical plane at its centre of gravity by 90° and if all other factors remain the same, the total force on one side of the plate would now be

(a) 8.8 Kn (b) 15.6 Kn (c) 17.6 kN (d) 19.6 kN

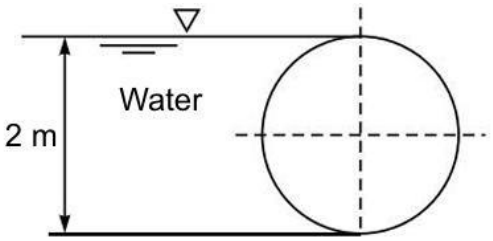
29. An equilateral triangular plate immersed in water. the centre of pressure below the water surface is at a depth of

a. 3h/4
b. h/3
c. 2h/3
d. h/2



30. A cylindrical gate of 2.0 m diameter is holding water on one side, as shown in Fig. 2.103. The resultant vertical component of the force of water per meter with of gate------ is in kN/m

(a) 15.71
(b) 31.42
(c) 20.0
(d) zero



Hydraulic Structure

[1] When the total horizontal force acting on the dam is greater than the total verticle force, then the dam may fail by _

a) Overturning
b) Sliding
c) Overstressing
d) Cracking

[2] If 'H' is the depth of water on the upstream side of the weir and 'L' is the creep length, then the Bligh's creep coefficient will be

a) H/L
b) L/H
c) HL
d) None

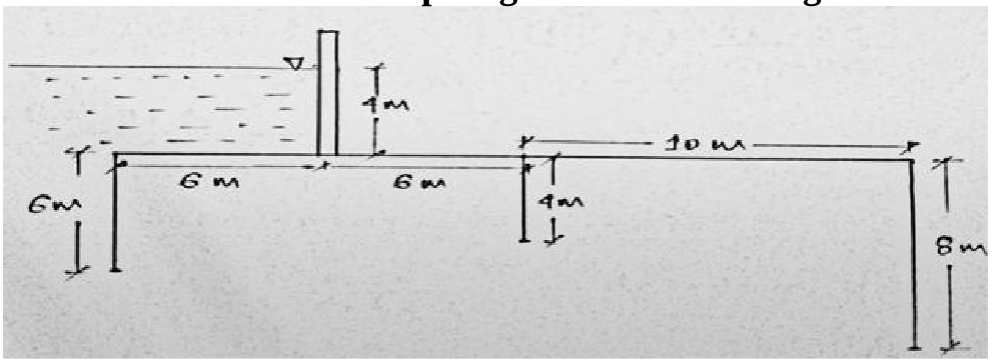
[3] What are the two leading causes of the failure of hydraulic structures on the previous foundation?

a) Seepage and Over-turning
b) Undermining and Uplift
c) Over-turning and Piping
d) Overturning and Uplifting

[4] If the value of Bligh's coefficient for a particular soil is equal to 12, then what is the safe hydraulic gradient for that soil?

a) 1/12
b) 1/9
c) 1/15
d) 1/5

[5] Calculate the value of creep length for the following.



a) 50 m
b) 26 m
c) 58 m
d) 36 m

[6] In Lane's weighted creep theory, he suggested a weightage factor _____

a) 1/3 for horizontal creep and 1.0 for vertical creep
b) 1/3 for vertical creep and 1.0 for horizontal creep
c) 2/3 for horizontal creep and 1/3 for horizontal creep
d) 2/3 for vertical creep and 1/3 for horizontal creep

[7] The blanket in earth dam is provided _____

a) at the ground level on the u/s side
b) at the ground level on the d/s side
c) at the ground level of the D/s side of the dam
d) on the D/s slope

[8] Which type of dam is suitable for shallow pervious foundations?

a) Zoned embankment type
b) Homogenous embankment type
c) Both Non-homogenous type and homogenous type
d) Diaphragm type

[9] A phreatic line in seepage analysis is defined as the line on which pressure is _____

a) equal to the atmosphere
b) greater than atmosphere
c) lower than atmosphere
d) varying

[10] Which of the following lines acts as a dividing line between dry (or moist) and submerged lines?

a) Equipotential line
b) Path line
c) Seepage line
d) Streak line

[11] Which one of the following at the entrance of culverts controls the flow capacity of the culvert?

a- Depth of headwater
b- Cross-sectional area
c- Inlet edge configuration

[12] When energy loss in culverts or waterways need to be minimized, then

a- Only the inlet must be streamlined to avoid losses at the inlet
b- Both the inlet and outlet must be streamlined to avoid significant form losses
c- Using the steep slope
d- None of the above

[13] According to US Army Corps, the u/s profile of ogee spillway extends up to ___ _____

a- x = 1.27 Hd
b- x = -1.27 Hd
c- x = 0.431 Hd
d- x = -0.431 Hd

[14] The spillway which can be adopted with ease on gravity as well as earthen da ms is _____

a- ogee spillway
b- chute spillway
c- both ogee and chute spillway
d- straight drop spillway

[15] A very steady and stable hydraulic jump is usually formed in the flows involvi ng the approaching Froude number in the range of _____

a) less than 2.5
b) b) 2.5 to 4.5
c) c) 4.5 to 9.0
d) d) more than 9.0

[16] Standard USBR stilling basin II is helpful for energy dissipation at the bottom of the overflow structure if the approaching Froude number is _____

a) less than 4.5
b) more than 4.5
c) less than 2.5
d) more than 2.5

[17] Which of the following stilling basins applies to only rectangular cross-secti ons?

a) U.S.B.R stilling basin-II
b) U.S.B.R stilling basin-IV
c) U.S.B.R stilling basin-I
d) U.S.B.R stilling basinIII

[18] The Froude number of a hydraulic jump is 5.5. The jump can be classified as _____

a) a weak jump
b) an oscillating jump
c) a rough and choppy jump
d) a steady jump

[19] A standard stilling basin is provided at the toe of a dam spillway for energy dissipation andis usually provided with auxiliary devices like chute blocks and dentated sills for the basic purpose of reducing the length of the stilling basin from about _____

a) 6 y2 to 4 y2
b) 4 y2 to 2 y2
c) 6 y2 to 2 y2
d) 3 y2 to y2

[20] In which case is the hydraulic jump not possible?
a) Initial speed > critical speed
b) Initial speed < critical speed
c) Initial speed = critical speed
d) Independent

[21] Fluid speed before the hydraulic jump is _____
a) Critical
b) Supercritical
c) Subcritical
d) Dynamic.

[22] Fluid height after the hydraulic jump is _____
a) Normal
b) Low
c) High
d) Zero

[23] The maximum permissible eccentricity for no tension at the base of a gravity dam is
A) B/2
B) B/3
C) B/4
D) B/6

[24] Uplift pressure is considered in the analysis of gravity dam
(a) only when there is a drainage gallery in the dam
(b) only when there is a tail water
(c) only when the reservoir is empty
(d) in all situations with water in the reservoir.

[25] Which type of dam cannot be constructed even on the rock foundations which are not sufficiently strong enough?

a) Gravity dam
b) Arch dam
c) Geotechnical dam
d) Embankment dam

[26] Presence of tailwater in a gravity dam

i) increases the principal stress
ii) decreases the principal stress
iii) increases the shear stress
iv) decreases the shear stress
The correct answer is

A. (i) and (iii)
B. (i)and(iv)
C. (ii) and (iii)
D. (ii) and (iv)

[27] For safety against overturning in a gravity dam, the resultant of all the forces acting on a dam must pass

A. Middle third of the base
B. Outside the base
C. Just at the extreme edge of the base
D. First third of the base
E. Within 10% of the extreme edge

[28] The forces that are considered for the analysis of an elementary profile of a gravity dam under empty reservoir conditions are

i) Water pressure
ii) Self weight
iii) Uplift
iv) Pressure due to earthquake
The correct answer is

A. Only (ii)
B. (i), (ii) and (iii)
C. (i), (ii), and (iv)
D. (i), (ii), (iii) and (iv)

[29] The discharge passing over an ogee spillway is given by (where L is the effective length of the spillway crest and H is the total head over the spillway crest, including velocity head.)

A. CLH3/2
B. CHL3/2
C. CLH5/2
D. CLH1/2

[30] The uplift pressure on a dam can be controlled by
i) constructing cutoff under upstream face
ii) constructing drainage channels bet-ween the dam and its foundation
iii) by pressure grouting in foundation
The corret answer is

A. only (i)
B. both (i) and (ii)
C. both (i) and (iii)
D. (i), (ii) and (iii)

[31] The uplift pressure on the face of a drainage gallery in a dam is taken as

A. hydrostatic pressure at toe
B. average of hydrostatic pressure at toe and heel
C. two-third of hydrostatic pressure at toe plus one-third of hydrostatic pressure at heel
D. none of the above

إدارة المشاريع

1. احسب الوقت المتوقع (TE) والانحراف المعياري باستخدام طريقة(PERT) لاحد الأنشطة له التقديرات التالية:

- الوقت المتفائل (Optimistic) = 4 أيام
- الوقت الأكثر احتمالًا (Most Likely) = 6 أيام
- الوقت المتشائم (Pessimistic) = 10 أيام

2. باستخدام طريقة(PERT) إذا كان الزمن المتوقع للمشروع 40 يومًا والانحراف المعياري للمسار الحرج 2 يوم، ما هي احتمالية إكمال المشروع خلال 44 يومًا؟
3. باستخدام طريقة(PERT) الزمن المتوقع لمشروع إنشائي = 30 يومًا الانحراف المعياري للمسار الحرج = 3 أيام ما احتمال إكمال المشروع خلال 33 يومًا.
4. باستخدام طريقة(PERT) إذا أردت أن تكون احتمال إنجاز المشروع 95%، وللمشروع مسارين حرجين . الانحراف المعياري للمسار الاول = 4 أيام والانحراف المعياري للمسار الثاني = 3 ايام ، والزمن المتوقع = 60 يومًا ما هو الزمن الذي يجب تحديده لإعطاء هذه الفرصة.
5. اوجد الانحراف المعياري لمشروع مكون من 5 أنشطة ، كل منها له انحراف معياري كالآتي:

أ: النشاط A $\sigma = 2$: حرجة .
ب: النشاط B $\sigma = 3$ غير حرجة
ج: النشاط N $\sigma = 3$ حرجة
د: النشاط C σ =2 غير حرجة
هـ. النشاط D σ =2.5 حرجة

6. باستخدام طريقة خط التوازن اذا كان الزمن لإنجاز النشاط Z هو (14) ساعة وان مجموع العمال لإنجاز الفعالية (Q) هو (6) عمال وعدد ساعات العمل باليوم (7) ساعات اوجد (M) عامل –ساعة.
7. مشروع مكون من اربع فعاليات اوجد عدد العمال الكلي المطلوب لإنجاز الفعالية A اذا علمت ان الطريقة المستخدمة في التخطيط هي طريقة خط التوازن وان عدد الوحدات المطلوب تنفيذها (50) وحدة وان معدل الانجاز (2) وحدة بالأسبوع وان عدد ساعات العمل اليومية (8) ساعات عمل وستة ايام عمل في الاسبوع .اذا علمت ان الفعالية Aتسبق جميع الفعاليات عدا الفعالية D وان الفعالية D لاحقة لجميع الفعاليات عدا الفعالية A .

الفعالية	عامل –ساعة (M)	مجموع العمال لكل وحدة (Q)
A	215	6
B	310	5
C	125	7
D	360	4

8. على ضوء معلومات السؤال السابع اوجد زمن انجاز الوحدة الواحدة للفعالية B
9. على ضوء معلومات السؤال السابع اوجد معدل الانجاز المعدل للفعالية D

10. على ضوء معلومات السؤال السابع اوجد زمن انجاز الفعالية A للمشروع

11. في تحديث المخطط السهمي، تم اكتشاف أن نشاطًا في المسار الحرج قد تأخر 4 أيام. ما هو التصرف الصحيح لتحديث المخطط؟

12. فيما يلي جدول لتنفيذ مشروع بناءً على جدول الأنشطة باستخدام طريقة تمثيل الفعاليات على الاسهم اوجد ما هو المسار الحرج في هذا المشروع؟

Activity	Preceded By	uration(day)
A	--	4
B	A	3
C	A	2
D	B,C	5
E	C	4
F	D,E	3

13. بالاستفادة من معلومات السؤال 12 اوجد زمن المشروع
14. بالاستفادة من معلومات السؤال 12 (إذا تأخر النشاط C يومين، ولم يتم تعديل أي نشاط آخر، فهل يتغير زمن المشروع)
15. بالاستفادة من معلومات السؤال 12 (إذا تمت زيادة مدة النشاط D من 5 إلى 7 أيام، فماذا يحدث لزمن المشروع)
16. بالاستفادة من معلومات السؤال 12 (إذا تمت زيادة مدة النشاط D من 5 إلى 7 أيام، فماذا يحدث لزمن المشروع).

17. بالاستفادة من معلومات السؤال 12 احسب الوقت المبكر (Early Start & Early Finish) للنشاط:D
18. بالاستفادة من معلومات السؤال 12 ما مقدار السماحية الكلية (Total Float) للنشاطE ؟
19. بالاستفادة من معلومات السؤال 12 ما مقدار السماحية الحرة للفعالية C
20. عند تطبيق تسوية الموارد على مشروع يحتوي على أنشطة متداخلة، فإن أكثر النتائج شيوعًا هي
21. ما هو الهدف الأساسي من تطبيق تقنية الـ **Crashing** في المشروع
22. في تقنية الـCrashing ، يتم اختيار الأنشطة حسب
23. في حالة وجود أكثر من مسار حرج بعد تطبيق بعض التعديلات، يجب تطبيق الـ Crashing على
24. للجدول المبين ادناه وان الفعاليات تنفذ تتابعيا اوجد باستخدام طريقة البرنامج الفوري أقل تكلفة إضافية لتقليل زمن المشروع بمقدار **يوم.**

ctivity	Time (day)	cost (£)	C.Time (day)	C.cost (£)
		00		00
		0		00
		00		00

25. بالاستفادة من جدول سؤال 24 اوجد باستخدام طريقة البرنامج الفوري أقل تكلفة إضافية لتقليل زمن المشروع بمقدار يومين.

26.باستخدام طريقة الاسبقيات وللجدول ادناه اوجد متى تنتهي الفعالية D

Activity	Preceded By	Relationships	Duration(day)
A	--	-----	4
B	A	F.S=2	3
C	A	F.F=6	2
D	B C	S.F=7 F.S=3	5
E	C	S.S=3	4
F	D E	F.S=6 F.S=3	3

27.بالاعتماد على معلومات السؤال 26 اوجد السماحية الكلية للفعالية B
28.بالاعتماد على معلومات السؤال 26 امجد زمن انجاز المشروع
29.بالاعتماد على معلومات السؤال 26اوجد زمن انجاز الفعالية E
30.بالاعتماد على معلومات السؤال 26 اوجد المسار الحرج

الجيولوجيا الهندسية

السؤال 1 : عينة من حجر المرمر الوزن الجاف (155 غم) والوزن الرطب (165غم) والكثافة الجافة(1,79 غم/سم3) , حجم العينة ؟

أ) 85.2 سم3
ب) 86.19 سم3
ج) 86.1 سم3
د) 86.2 غم

السؤال 2 : ما هو المفهوم المبسط للهندسة الجيولوجية؟

أ) دراسة الطقس والمناخ
ب) تصميم الجسور والطرق
ج) تطبيق مباشر للعلوم الجيولوجية في الأعمال الهندسية
د) تحليل مكونات التربة كيميائيًا فقط

السؤال 3: ما هو تعريف النسيج (Texture) في الصخور النارية؟

أ) عدد الفجوات في الصخر
ب) حجم وترتيب البلورات المكونة للصخر
ج) لون الصخر ومصدره
د) نسبة المعادن في الصخر

السؤال 4 : أي من الخصائص التالية تُعد من الخصائص الفيزيائية للمعادن؟

أ) درجة انكسار الضوء
ب) درجة الحرارة المحيطة
ج) اللون والبريق والشفافية
د) الكثافة السكانية

السؤال 5:ما هي الخاصية التي تعبّر عن قدرة الصخور على مرور السوائل من خلالها؟

أ) المسامية
ب) الكثافة
ج) النفاذية
د) الانفعال

السؤال 6: ما هي المنطقة التي تكون فيها الفجوات بين الصخور غير مملوءة بالماء تمامًا؟

أ) منطقة التشبع
ب) منطقة التهوية
ج) منطقة المياه العميقة
د) منطقة الصهارة

السؤال 7 : عينة من حجر الماس , حجمها (3.4سم3) والوزن النوعي الحقيقي لها (2.92) وكثافتها الجافة (14,71 غم/سم3) , الوزن النوعي الظاهري للعينة ؟

أ) 2.6
ب) 2.8
ج) 2.8 غم/سم3
د) 2.5 غم

السؤال 8: أي من المواد التالية تُعتبر "هشة" بحسب الخواص الميكانيكية؟

أ) المادة التي تستعيد شكلها بعد إزالة الإجهاد
ب) المادة التي تتشوه دون كسر
ج) المادة التي تتكسر عند تعرضها لإجهاد بسيط
د) المادة المطاوعة

السؤال 9: ما هي الوسيلة التي تنتقل بها المياه من سطح الأرض إلى باطنها؟

أ) التبخر
ب) التسرب
ج) الغليان
د) التكثيف

السؤال 10 : ما العامل الذي تعتمد عليه سرعة النهر بشكل رئيسي؟

أ) كمية الرواسب
ب) درجة ملوحة المياه
ج) شكل القناة وخشونة القاع
د) درجة حرارة الجو

السؤال 11 : أي من المهام التالية لا تعتبر من مهام الهندسة الجيولوجية؟

أ) دراسة الصخور والظواهر الجيولوجية
ب) تصميم الأساسات الخرسانية
ج) تقييم استقرار المنشآت الهندسية
د) تحديد صلاحية الصخور للاستخدامات المختلفة

السؤال 12: ما هو المصدر الرئيسي للمياه الجوفية في الصخور الرسوبية؟
أ) مياه الصهارة
ب) مياه المحيطات
ج) مياه الأمطار والثلوج
د) مياه الرياح

السؤال 13: التربة الجبسية في العراق، تغطي مساحات واسعة في العراق، وتشكل حوالي ؟

أ) 40 % من المساحة الكلية
ب) 20% من المساحة الكلية
ج).30% من المساحة الكلية
د) 50% من المساحة الكلية

السؤال 14: ما اسم المرحلة التي يسير فيها النهر بمجارٍ غير مستقيمة ويبدأ بالالتواء؟

أ) مرحلة الشباب
ب) مرحلة البلوغ
ج) مرحلة الشيخوخة
د) مرحلة الانحلال

السؤال 15: من مهام المهندس الجيولوجي؟

أ) إعداد الخرائط المعمارية
ب) فحص المواقع ميدانياً وتقييم التضاريس
ج) تحليل سلوك المنشآت تحت الأحمال
د) حفر الآبار النفطية

السؤال 16: ما هو تعريف معامل يونك (معامل المرونة)؟

أ) النسبة بين الوزن والكتلة
ب) نسبة الانفعال إلى التشويه
ج) العلاقة بين الانفعال والإجهاد
د) الفرق بين الوزن الجاف والمغمور

السؤال 17: ما هو المقصود بالحمل المعلق في الأنهار؟

أ) المواد التي تنقل بالدحرجة فقط
ب) الجزيئات الصلبة العالقة في المياه وتتطلب قوة لمنع سقوطها
ج) الأملاح الذائبة في المياه
د) الرواسب الثقيلة القاعية

السؤال 18 : ما هو المكون الأساسي للتربة الصلصالية من الناحية المعدنية؟

أ) سيليكات الألمنيوم المائية
ب) الكربونات العضوية
ج) أكاسيد الحديد
د) الأملاح الفوسفاتية

السؤال 19 :أي من الفروع التالية يُعد من فروع الهندسة الجيولوجية؟

أ) الهندسة الكهربائية
ب) الهندسة الجيوفيزيائية
ج) الهندسة الجيولوجية الفضائية
د) الهندسة الكيميائية

السؤال 20 :ما اسم العملية التي تتحول بها الرواسب إلى صخور رسوبية صلبة؟

أ) التبلور
ب) التحول
ج) التجوية
د) التحجر

السؤال 21 : أي من الآتي يُستخدم لحساب الوزن النوعي الظاهري للصخر؟

أ) وزن الماء في الفجوات فقط
ب) وزن الصخر الجاف مقسوماً على وزن الماء المزاح
ج) الوزن الكلي للعينة بعد الغمر
د) فرق الوزن بين الصخر والمعدن

السؤال 22: ***التربة الجبسية*** هي التربة الحاوية على اكثر من ؟

أ) 40 % من الجبس
ب) 30% من الجبس
ج).20% من الجبس
د) 10 % من الجبس

السؤال 23 : عينة من حجر البازلت , وزنها وهي جافة (50 غم) وحجمها (3.4سم3) , اذا كانت نسبة الامتصاص (14%) الكثافة المشبعة للعينة ؟

أ) 16.76
ب) 15.8سم3
ج) 16.50 غم/سم3
د) 16.76 غم/سم3

السؤال 24 : ما هو تعريف المعدن في علم الجيولوجيا؟

أ) مادة مصنّعة لها خصائص كهربائية
ب) مادة طبيعية عضوية ذات تركيب غير منتظم
ج) مادة غير عضوية طبيعية لها تركيب كيميائي وبناء بلوري منتظم
د) صخر مكون من مجموعة معادن متجانسة

السؤال 25: التربة تتكون من ؟

أ) ثلاث مكونات
ب) مكونان اثنان
ج) مكون واحد
د) اربع مكونات

السؤال 26: ما المقصود بـ "المسامية" في الصخور؟

أ) كمية المعادن الثقيلة الموجودة
ب) نسبة حجم الفراغات إلى الحجم الكلي للعينة
ج) الوزن النوعي للصخر
د) درجة مقاومة الصخر للحرارة

السؤال 27: أي من الخصائص التالية تُعد من صفات المعادن الصلصالية؟

أ) التمدد الحراري العالي
ب) قوة الانضغاط فقط
ج) الانتفاخ وقابلية الانضغاط
د) الشفافية واللمعان

السؤال 28 : ما هو العامل الأساسي الذي يؤثر على اختلاف التربة في العراق من منطقة لأخرى؟

أ) نسبة الأوكسجين في الهواء
ب) نوع الصخور النارية
ج) العلاقة الوراثية بين مكونات التربة والصخور الأصلية
د) كمية الكائنات الحية الدقيقة

السؤال 29: ما المقصود بالمادة اللابلورية؟

أ) مادة ذات تركيب معدني نقي
ب) مادة صلبة لا تتوزع فيها الذرات وفق نظام بلوري منتظم
ج) مادة تحتوي فقط على السيليكات
د) مادة تتكون من بلورات كبيرة متماسكة

السؤال 30: أي من التالي يُعد من شروط تكوّن الدلتا؟

أ) وجود بحر ذو تيارات قوية
ب) شاطئ حاد الميل
ج) ملوحة قليلة تمنع التجلط
د) درجة ملوحة عالية تؤدي إلى تجلط جزيئات الصلصال