BSCE QUARANTINE REVIEWER DIAGNOSTIC EXAMS
MATHEMATICS, SURVEYING AND TRANSPORTATION ENGINEERING

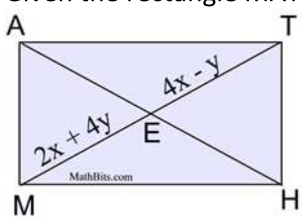
1. The number of COVID 19 Cases in a livable planet of Mars has 15,000 5 days back to 17,250 as of present. Determine the expected number of COVID 19 Cases 20 days later.

   a. 245,270 b. 245,499 c. 249,455 d. 299,405

2. These are lines which are used for overtaking from both directions of the road and all crossing movements are disallowed.
   a. Single unbroken white lines b. Single unbroken yellow lines
   c. Double unbroken yellow lines d. Double unbroken yellow lines

3. How many minutes after 2 PM will coincide the hands of the clock to each other?
   a. 30.154 b. 19.909 c. 10.909 d. 15.151

4. Given the rectangle MATH as shown in the figure, the diagonals are 36 inches. Determine the value of y.



   a. 0 b. 2 c. 5 d. 4

5. A roadway is to be designed on a level terrain. This roadway is 150 meters in length. Four cross sections have been selected, one at 0 meters, one at 50 meters, one at 100 meters, and one at 150 meters. The cross sections, respectively, have areas of 40 square meters, 42 square meters, 19 square meters, and 34 square meters. What is the volume of earthwork needed along this road?
   a. 4,900 m^3 b. 4,700 c. 5,900 d. 4,600

6. A deposit of P 1,000 is placed into a savings fund at the beginning of every month for 10 years. The fund earns 9% annual interest, compounded monthly, and paid at the end of the month. How much is in the account right after the last deposit?
   a. P 195,327.15 b. P 190,300.18 c. P 193,514.27 d. P 194,217.51

7. Suppose f(x) is a linear equation such that f(-1/2) = -7 and f(1) = -3, find the slope the line.
   a. 8/3 b. -8/3 c. 3/8 d. -3/8

8. How many four digit numbers can be formed with ten digits if zero should be the last digit without repititions?

   a. 5040 b. 504 c. 18440 d. 540

9. The speed of the train is reduced uniformly from 15 m/s to 7.0 m/s while traveling at the distance of 90 m. Compute the acceleration.
   a. -0.98 m/s b. 0.98 c. -0.89 d. 0.89

10. Find the discount if P 15,250 is discounted for 5 months at 5% simple discount.
    a. 371.17 b. 311.71 c. 317.71 d. 377.71

11. This diffraction method in waves is used when the length of an island or the width of the entrance of a bay is at least ten times the wavelength of the incident waves, there will not be a large difference between the wave height estimate by the direct diffraction calculation and the estimate using the amount of directional wave energy that arrives directly at the point of interest behind the island or in the bay.
    a. Directional Spreading b. Hydraulic Model Experiment
    c. Diffraction Coefficient d. Treatment of Oblique Incident

12. Find the length of curve and the station at PT if the degree of curve is 5º and the central angle is 72º 30' . Use arc basis.
    a. 290 m b. 350 c. 400 d. 550

13. A cone frustum shaped dalgona coffee glass has a height of 10 cm. with lower base of 2 cm radius and 5 cm at the upper base. The client is wished to have 10% of the height has pure dalgona liquid. Determine the volume of the dalgona liquid assuming that the milk is poured.
    a. 77.921 cm^3 b. 79.227 c. 73.922 d. 77.329

14. Determine the latus rectum of the parabola y^2 = 24x.
    a. 6 b. 12 c. 16 d. 20

15. Land use, transportation and road network plans are ___________
    a. None of them b. Both of them c. Intralinked d. Interlinked

16. Mary is 24 years old. Mary is twice as old as Anna was when Mary was as old as Anna is now. How old is Anna now?
    a. 24 b. 12 c. 20 d. 18

17. A line was measured with a steel rape which was exactly 30 m at 18ºC and a pull of 50 N and the measured length was 459.242 m. Temperature during measurement was 28ºC and the pull applied was 100 N. The tape was uniformly supported during the measurement. Find the true length of the line if the cross-sectional area of the tape was 0.02 cm2, the coefficient of expansion per ºC = 0.0000117 and the modulus of elasticity = 21 x 106 N per cm2.
    a. 459.314 m b. 459.038 c. 459.305 d. 459.350

18. The total interior angles of a perigon is :
    a. 540 b. 360 c. 450 d. 300

19. You have a retirement account with P 2000 in it. The account earns 6.2% interest, compounded monthly, and you deposit P 50 every month for the next 20 years. How much will be in the account at the end of those 20 years?
    a. P 30,546.62 b. P 35,662.03 c. P 36,203.65 d. P 32,662.05

20. Determine the derivative of arc tan (x/6).
    a. 6/(x^2 +36) b. -6/(x^2+36) c. 36/(x^2+36) d. -36(x^2/36)

21. Giannis has an average of hitting 4 of 5 five goals in a quarter. Tonight, he had 4 attempts. Determine the probability that he will miss at least three shots?
    a. 0.0227 b. 0.0272 c. 0.0222 d. 0.0327

22. These are frequently used at intersections of undivided highways to alert drivers that they are approaching an intersection and to control traffic at the intersection. They also can be used effectively to control left turns at skewed intersections.
a. Divisional Islands b. Refuge Islands c. Channelized Islands d. Curbed Islands

23. A compound curve laid on their tangents have the following data: $I1 = 31^{\circ}$, $D1 = 3^{\circ}$ and $D2 = 5^{\circ}$. Find the length of the common tangent passing through the PCC.
a. 115 m b. 120 c. 160 d. 180

24. You and your friends are doing physics experiments on a frozen pond that serves as a frictionless, horizontal surface. Sam, with mass 80.0 kg, is given a push and slides eastward. Abigail, with mass 50.0 kg, is sent sliding northward. They collide, and after the collision Sam is moving at 37º north of east with a speed of 6 m/s and Abigail is moving 23º at south of east with a speed of 9 m/s. Determine the speed of Sam before collision.
a. 4.79 m/s b. 8.28 c. 9.97 d. 3.52

25. A length of the roof of a warehouse using 100 m steel tape was actually 17 cm too short. The area of the roof recorded is at 7,200 sq m. What is the true area of the roof?
a. 7715.154 b. 7175.541 c. 7554.177 d. 7751.715

26. On a standard scoring, The Bucks scored 142 which having three standard deviations (σ = three pointer) from their scoring average. Determine the average offense.
a. 133 b. 142 c. 145 d. 136

27. Determine the eccentricity of the ellipse (x-4)^2 / 25 and (y-5)^2 / 144 = 1 .
a. 0.909 b. 0.991 c. 0.415 d. 1.126

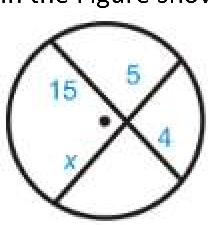
28. An Oppo smartphone has been bought at P 15,000. After a decade , the phone valued at P 4,500. Determine the value of the phone at year 6 using Sum of years digit method.
a. P 6,551.54 b. P 5,544.45 c. P 5,444.45 d. P 5,454.55

29. The standard length of rail for broad gauge is
a. 15 m b. 11 c. 13 d. 12

30. Find the radius of curvature of y^2 – 4x = 0 at (4,4).
a. 22.36 b. 25.78 c. 20.33 d. 15.42

31. A is in joint variation with B and square of C. When A = 144, B = 4 and C = 3. Then what is the value of A when B = 6 and C = 4?
a. 12 b. 18 c. 24 d. 144

32. In the Figure shown, determine the value of x.



a. 9 b. 12 c. 20 d. 37.5
SOLUTION:

33. In the spherical triangle ABC, A = 116˚19', B = 55˚30' and C = 80˚37'. Find the value of a.
a. 175.15º b. 115.57º c. 118.54 d. 154.51º

34. TP1 has an elevation of 116.18 m and foresight taken is at 0.65 m. If the BS taken at BM is at 1.53 m, determine the elevation at BM.
a. 114 m b. 110 c. 116 d. 118

35. Determine the sum of the coefficients of the term (2x+3y)^9.
a. 45 b. 54 c. 1,953,125 d. 110

36. Equipment was acquired on January 1, 2013, at a cost of $75,000. The equipment was originally estimated to have a salvage value of $5,000 and an estimated life of 10 years. Depreciation has been recorded through December 31, 2016, using the straight-line method. On January 1, 2017, the estimated salvage value was revised to $7,000 and the useful life was revised to a total of 8 years. Calculate the book value at the time of the revision.
a. $ 52,000 b. $ 60,000 c. $47,000 d. $ 34,000

37. Determine the real zeros of the function 4x^3 – 3x^2 + 5x + 6 = 0.
a. None b. Three c. Two d. One

38. A rock made up of hydrous aluminum oxides; the most common aluminum ore.
a. Graphite b. Carbon c. Basalt d. Bauxite

39. Evaluate the following limit:

$$\lim_{x \to 4} \left(\frac{4 - x}{x^2 - 16} \right)$$

a. -1/4 b. ¼ c. 1/8 d. -1/8

40. Determine the sum of the infinite geometric series of 5, 2.5, 0.125…
a. 5 b. -5 c. -10 d. 10

41. A spherical balloon is being inflated at a rate of 100 cm^3/sec. How fast is the radius of the balloon increasing when the diameter is 50 cm?
a. 1/25π cm/sec b. 1/π c. 25/π d. 5/π

42. What is the future worth of P6,500 deposited at the end of every month for 4 years if the interest is 24% compounded semi-monthly?
a. P 3,452,103.25 b. P 3,258,330.10 c. P 3,412,833.40 d. P 3,304,258.01

43. There are three MVP teams among the eight teams that have reached the quarter-finals of the PBA Playoffs. What is the probability that the three MVP teams will avoid each other in the draw if the teams are paired randomly?
a. 1/4 b. 4/7 c. 5/7 d. 1/7

44. One diagonal of a rhombus makes an angle of 29° with a side of the rhombus. If each side has a length of 7.2 inches, find the length of the longer diagonal.
a. 15.96 b. 13.80 c. 11.72 d. 12.60

45. Usually refers to magnitude measurements made from digital images by deriving the flux that would have been recorded within a circular aperture large enough to enclose the star's seeing disk.
a. Apperture Photometry b. Objective Grating
c. X Ray Pulsars d. Charge Multiplet

46. The angles of elevation of the top of a tower were observed from points A and B which lie on a horizontal line passing through the foot of the tower. B is 5 m. away from the tower. A and B are 8 m. apart. The angle at B is twice as much as that at A. How high is the tower?
a. 5.14 b. 7.85 c. 6.24 d. 6.68

47. Given five observed velocities (60 km/hr, 35 km/hr, 45 km/hr, 20 km/hr, and 50 km/hr), what is the time-mean speed and space-mean speed?
a. 42 and 36.37 b. 44 and 38.15 c. 49 and 33.15 d. 36 and 44.18

48. After applying a test vaccine called SARS CoV Vaccine, the population of a virus is reduced by fifteen percent every day. Predict how large the culture will be at the start of day 14 if it measures 12,500 units at the day initially tested positive for COVID 19.
a. 1512 b. 1388 c. 1680 d. 2044

49. A line 150 m long was paced by a surveyor for six times but one of the data is missing. The following data as recorded: x, 220,205,215,222 and 218. The pace factor is 0.700. Determine the missing data of the pace.
a. 215.7724 b. 205.7142 c. 227.4715 d. 241.0555

50. Luka signed a contract with the Ginebra worth P 500k. Due to supermax condition, he is qualified for a 5 year contract at 6% compounded continuously. What is his matured player value?
a. P 647,118.64 b. P 622,994.18 c. P 674,929.40 d. P 692,407.26

51. A fan takes 2.00 s to reach its operating angular speed of 10.0 rev/s. What is the average angular acceleration?
a. 33.7 rad/s^2 b. 30.7 c. 31.4 d. 35.6

52. A transit with a stadia constant equal to 0.33 is used to determine the horizontal distance between points B and C, with a stadia intercept reading of 1.79 m. The distance BC is equal to 186.26 m. Compute the stadia interval factor of the instrument.
a. 107.881 b. 100.975 c. 106.203 d. 103.872

53. Convert the following into polar form: $x^2 + y^2 - 2y = 0$
a. $r + 2\sin\theta = 0$ b. $r - 2\sin\theta = 0$ c. $r + \sin\theta = 0$ d. $r - \sin\theta = 0$

54. Evaluate into rectangular form: (2 cis 45)(3 cis 135)
a. -6 b. 6 c. 0 d. infinite

55. It is the sum of the first cost and the present worth of all costs or replacement, operation and maintenance.
a. Total cost b. Capitlized cost c. Initial cost d. Variable cost

56. Let $y = x^5 - 6x$. Determine the slope at (0, 1).
a. 5 b. -5 c. 6 d. -6

57. In a portable hospital, in how many ways that 12 COVID positive patients containing 7 and 5 asymptomatic patients respectively?

a. 5040 b. 792 c. 1040 d. 504

58. The perimeter of a triangle is 130 cm. One side is twice as long as the second side. The third side is 30 cm longer than the second side. Find the length of the third side.
a. 60 cm b. 50 c. 35 d. 55

59. A symmetrical parabolic curve passes through the point A whose elevation is 23.23 m at a distance of 54 m from the PC. The elevation of the PC at station 4 + 100 is 22.56 m. The grade of the back tangent is +2% and the length of the curve is 120 meters. Compute the grade of the forward tangent.
a. 0.9 % b. 1.77 % c. -1.4% d. -0.6%

60. Suppose you go to work for a company that pays one penny on the first day, 2 cents on the second day, 4 cents on the third day and so on. If the daily wage keeps doubling, what will be your total income be for working 31 days?
a. P 21,553,807.44 b. P 20,216,195.93 c. P 21,918,222.40 d. P 21,474,836.47

61. A bereaved family of a COVID 19 casualty expects to take P 1M according to Bayanihan Law in 5 years. How much is that money worth now considering interest at 8% compounded annually?
a. P 661,917.50 b. P 685,217.25 c. P 674,113.58 d. P 680,583.20

62. An isosceles triangle has two sides whose lengths are 17 and 22 m, respectively. Determine the greatest possible perimeter of the triangle.
a. 58 m b. 61 c. 55 d. 49

63. Compute the dot product A · B given the vectors A = 2i – 3j + 3k and B = I + 2j + 8k.
a. 40 b. 64 c. 36 d. 48

64. Three flags are to be displayed on a vertical flagpole in order to transmit a message from one boat to another by a prearranged code. If three flags can be selected from them, determine the number of messages can be transmitted?
a. 1000 b. 90 c. 720 d. 10

65. Determine the number of diagonals of a heptagon.
a. 14 b. 28 c. 56 d. 7

66. The Department of Public Works and Highways (DPWH) is considering the construction of a new highway through a scenic rural area. The road is expected to cost P50 million with annual use estimated at P400, 000. The improved accessibility is expected to result in additional income from tourists of P7 million per year. The road is expected to have a useful life of 25 years. If the rate of interest is 15%, Compute the benefit cost ratio assuming the project is not feasible.
a. 0.7829 b. 0.6592 c. 0.8533 c. 0.9116

67. Determine the value of (2 – 5i)^2.
a. -20 – 21i b. -21 – 20i c. 20 + 21i d. 21+20i

68. A 15 degree simple curve is to be designed for a maximum speed of 100 kph. The coefficient of friction between the tires and pavement is 0.50. Determine the percentage of super elevation.
a. 0.6219 b. 0.5307 c. 0.5519 d. 0.6422

69. Determine the equivalent of cot x/csc x.

a. csc x b. cot x c. sin x d. cos x

SOLUTION:

70. If the simple interest is P 6,500 with the rate of 9% for 6 years, find the principal.
a. P 11,904.03 b. P 12,037.04 c. P 13,400.12 d. P 10,730.40

71. Determine the thickness of a rigid pavement with a wheel load capacity of 60 kN , if the allowable tensile stress of concrete is 1.55 MPa. (Dowels are neglected.)
a. 316.841 mm b. 332.912 c. 340.777 d. 350.216

72. An archer standing on a cliff 48 meters above the level field below shoots an arrow at an angle of 30° above horizontal with a speed of 80 m/s. How far from the base of the cliff will the arrow land? (Use g = 9.8)
a. 560 m b. 582 c. 579 d. 602

73. A manufacturer sells of each of his TV Sets for $ 85. The cost C of manufacturing and selling x tv sets per week is C = 1500 + 10x + 0.005x^2. Determine the number of sets should be manufacture to maximize the profit?
a. 7500 b. 6000 c. 5500 d. 10,000

74. Find what length of canvas 0.75 m. wide is required to make a conical tent 8m in diameter and 3m high.
a. 88.72 b. 90.16 c. 83.54 d. 79.22

75. Determine the normal pull tension of 30-m tape if the unit weight of tape is 0.14 N/m. The tape is supported at only two points. The properties of the tape are: standard tension of 50N, x-section area is 1.8 mm2 and the Young's modulus is 200 x 10^9 Pa.
a. 88.2 N b. 83.7 c. 81.9 d. 85.8

BSCE QUARANTINE REVIEWER DIAGNOSTIC EXAMS
HYDRAULICS AND GEOTECHNICAL ENGINEERING

1. In its natural condition a soil sample has a mass of 2360 g and a volume of 1.20 x 10^-3 m^3. After being completely dried in an oven the mass of the sample is 2120 g. Determine the water content using soil's specific gravity of 2.68.
   a. 0.1690 b. 0.1812 c. 0.1253 d. 0.1070

2. The following reasons caused by water hammer, NOT LIMITED to:
   a. Pipe Rupture b. Damage pipe fixtures
   c. Damage to pumps and valves d. Dirty of water being drawn

3. Pick the lone statement that is TRUE statement.
   a. Platy structure on the surface of the soil is desirable.
   b. Organic matter is not particularly beneficial to the physical condition of the soil.
   c. Air is not an important part of soil.
   d. Clay holds more water than sand.

4. In Figure 1, a 50 mm pipeline leads downhill from a reservoir and discharges into air. If the loss of head between A and B is 44.2 m, compute the discharge.
   a. 10.65 L/s b. 11.31 c. 15.57 d. 12.96

5. A pipe 1 m diameter and 15 km long transmits water of velocity of 1 m/sec. The friction coefficient of pipe is 0.005. Calculate the head loss.
   a. 16.52 m b. 15.29 c. 16.55 d. 12.56

6. A soil profile shown in Figure 2 has a zone of capillary rise in the sand overlying the clay. In this zone, the average degree of saturation is 60% with a moist unit weight of 17.6 kN/m^3. Compute the effective stress at C.
   a. 99.14 kPa b. 84.15 c. 92.31 d. 81.95

7. These are retaining walls constructed to retain earth, water or any other fill material. These walls are thinner in section as compared to masonry walls.
   a. Sheet pile walls b. Brace Cuts
   c. Retaining walls d. Pile Cuts

8. The flow rate in a pipe is determined by the use of Venturi meter shown in Figure 3. Using the information given and h = 4 cm, determine the flow rate assuming uniform flow and no losses.
   a. 0.00815 m^3/s b. 0.00742 c. 0.00953 d. 0.00527

9. It is a sudden or perceptible change in a river's margin, such as a change in course or loss of banks due to flooding.
   a. alluvion b. filtration c. sedimentation d. alvusion

10. In a triaxial shear test of a cohesionless test , the solid cylinder was subjected to a liquid pressure of 20 kPa inside the chamber. It was observed that failure of the sample in shear occurred when the axial compressive stresses reached 44 kPa. Determine the angle of internal friction.
   a. 25.02° b. 18.77° c. 22.02° d. 24.74

11. Calculate Reynolds number, if a fluid having viscosity of 0.4 Ns/m2 and relative density of 900 Kg/m3 through a pipe of 20mm with a velocity of 2.5 m.

    a. 115.0 b. 118.4 c. 112.5 d. 105.7

12. A retaining wall 6m. high is supporting a horizontal back fill having a dry unit weight of 1630 kg/m^3 The cohesion less soil has an angle of friction of 27°. Compute the Rankine active force on the wall.

    a. 108.078 kN b. 115.394 c. 172.216 d. 106.339

13. Find the position of center of buoyancy for a wooden block of width 3.5 m and depth 1 m, when it floats horizontally in water. The density of wooden block id 850 kg/m^3 and its length 7.0 m.

    a. 0.95 b. 0.85 c. 1.05 d. 1.65

14. Benzene flows a 150 mm Φ pipe at a mean velocity of 4 m/s. Determine the flow rate in liters per second.

    a. 471.239 L/s b. 405.392 c. 294.472 d. 331.705

SITUATION 1: Refer to the soil stress in Figure 4. Use γ_w = 10 kN/m^3

15. Determine the total stress of the soil.

    a. 230.3 kPa b. 160.3 c. 90.3 d. 70

16. Determine the pore water pressure.

    a. 230.3 kPa b. 160.3 c. 90.3 d. 70

17. Determine the effective stress.

    a. 230.3 kPa b. 160.3 c. 90.3 d. 70

SITUATION 2: Identify the terms as stated in the following questions.

18. This is a part of the precipitation which is temporarily stored en route to or in the stream system, during or shortly after rainfall

    a. Salination b. detention storage c. invertion d. infiltration

19. It refers to water with salinity greater than that of seawater.

    a. Saltwater b. Freshwater c. Saline d. Brine

20. This refers to rise in sea or estuary water level caused by the passage of a low pressure area.

    a. storm surge b. tsunami c. gale d. seiche

SITUATION 3: A strip footing in Figure 5 of width 3 m is founded at a depth of 2 m below the ground surface in a (c - φ) soil having a cohesion c = 30 kN/m^2 and angle of shearing resistance φ = 35°. The water table is at depth of 5 m below ground level. The moist weight of soil above the water table is 17.25 kN/m^3. Use general shear failure theory of Tenzaghi.

21. Determine the ultimate bearing capacity of the soil.

    a. 4259 kPa b. 1408 c. 4272 d. 4225

22. Determine the net bearing capacity.

    a. 4259 kPa b. 1408 c. 4272 d. 4225

23. Determine the allowable bearing pressure using 3 as FS.

a. 4259 kPa　　b. 1408　　c. 4272　　d. 4225

SITUATION 4: A rectangular pontoon 10 m by 4 m in plan, weighs 280 kN and floats in sea water of density 1025 kg /m^3. A steel tube weighing 34 kN is placed longitudinally on the deck. When the tube is in a central position, the center of gravity for the combined mass is on the vertical axis of symmetry 0.25 m above the water surface. Use γ = 9.8.

24. Determine the center of gravity.
    a. 1.112 m　　b. 1.067　　c. 1.108　　d. 0.985

25. Determine the draught to the seawater displaced.
    a. 0.916 m　　b. 0.781　　c. 0.579　　d. 0.618

26. Determine the maximum distance the tube may be rolled laterally across the deck if the angle of heel is not exceed 5° .
    a. 0.860 m　　b. 0.792　　c. 0.616　　d. 0.724

SITUATION 5: A 400mm high open cylinder and 150mm in diameter is filled with water and rotated about its vertical axis at an angular speed of 33.5 rad/s.

27. Determine the volume of water remained.
    a. 5.218 L　　b. 4.079　　c. 4.242　　d. 6.219

28. Determine the depth of water at rest.
    a. 0.24 m　　b. 0.19　　c. 0.42　　d. 0.28

29. Determine the volume of water remained in the cylinder if the speed is doubled.
    a. 1.157 L　　b. 2.048　　c. 0.912　　d. 1.050

SITUATION 6: The soil has 20% gravel, 10% sand, 30% silt and 40% clay.

30. Determine the sand size percentage.
    a. 12.5%　　b. 50.5%　　c. 37.5%　　d. 40%

31. Determine the silt size percentage.
    a. 12.5%　　b. 50.5%　　c. 37.5%　　d. 40%

32. Classify the soil using triangle classification system.
    a. sand　　b. loamy sand　　c. loam　　d. clay

SITUATION 7: In the figure shown at Figure 6, the elevation of hydraulic grade line at B is 15.24 m and the Pipes BC and BD are arranged so that the flow from B divides equally, all pipes have f = 0.02. Cv = 0.953 and Cc = 0.670 for the orifice.

33. Compute the discharge of the pipeline from B to reservoir C.
    a. 0.0565 m^3/s　　b. 0.0113　　c. 0.0650　　d. 0.1675

34. Determine the elevation of the end of the pipe at D?
    a. 4.51 m　　b. 7.73　　c. 6.24　　d. 25.87

35. What is the head that will be maintained on the 125 mm φ orifice at E?
    a. 2.44 m   b. 2.83   c. 3.74   d. 2.65

SITUATION 8: In the figure shown at Figure 7, the soil has a unit weight of 16.63 kN/m^3 and undrained shear strength cu = 18.57 kN/m^2. The slope makes an angle of 50° with the horizontal. Assume stability number m = 0.164.

36. Determine the stability factor.
    a. 6.10   b. 5.70   c. 6.24   d. 5.69
37. Determine the maximum depth up to which the cut could be made.
    a. 5.953 m   b. 6.809   c. 5.517   d. 6.214
38. Compute the angle that the failure plane makes with the horizontal if BC = 9 m.
    a. 23.04°   b. 24.83°   c. 22.03   d. 23.61°

SITUATION 9: The following data for soils A and B are as follows:

Sieve Size	Diam.	Soil A % finer	Soil B % finer
No. 4	4.760	99	23
No. 10	2.000	96	19
No. 40	0.420	89	8
No. 100	0.149	79	5
No. 200	0.074	70	4
Liquid limit		49	-
Plastic limit		24	-
From the Grain Size Curve, the following were also obtained.			
D_{10}		-	0.50 mm
D_{30}		0.023	5.50 mm
D_{60}		0.032	27.50 mm

Provide your Unified Soil Classification table. Classify the soils using UCS.

39. What is the classification of soil A?
    a. CL   b. GM   c. CL   d. ML
40. What is the classification of soil B?
    a. OL   b. GW   c. ML   d. GP
41. What is the coefficient of uniformity of soil B?
    a. 70   b. 45   c. 55   d. 60

SITUATION 10: For the system show in Figure 8:

42. Find the primary consolidation settlement at σ'c = 100 kPa.
    a. 162 mm   b. 98   c. 50.4   d. 6

43. Find the primary consolidation settlement at σ'c = 150 kPa.
    a. 162 mm   b. 98   c. 50.4   d. 6

44. Find the primary consolidation settlement at σ'c = 250 kPa.
    a. 162 mm   b. 98   c. 50.4   d. 6
    SOLUTION 42-44:

SITUATION 11: A drum 700 mm and filled with water has a vertical pipe, 20 mm in diameter, attached to the top as shown in Figure 9.

45. Determine the pressure head.
    a. 1.221 m   <u>b. 1.723</u>   c. 1.516   d. 1.822

46. How much is the weight of water must be poured into the pipe to exert a force of 6500 N on the top of the drum?
    <u>a. 5.31 N</u>   b. 5.65   c. 4.78   d. 6.81

47. The energy input to the hydrological cycle is by:
    a. Wind   b. Water   <u>c. Sun</u>   d. Moon

SITUATION 12: A square plate having one of its side equal to 3 m is immersed in a water surface in a vertical position such that the two edges of the square would be horizontal in order that the center of pressure shall be 8 cm from the center of gravity.

48. How far below the water surface should the upper plate be submerged?
    a. 8.000 m   b. 6.525   c. 4.955   <u>d. 7.875</u>

49. Determine the distance of center of pressure from the water surface.
    <u>a. 9.455 m</u>   b. 4.588   c. 7.875   d. 10.216

50. Find the hydrostatic force on the plate.
    <u>a. 827.72 kN</u>   b. 794.45   c. 768.23   d. 1012.19

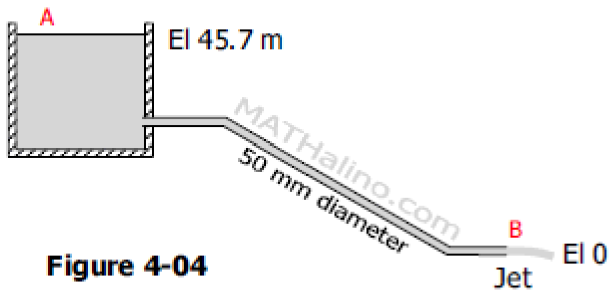


Figure 1

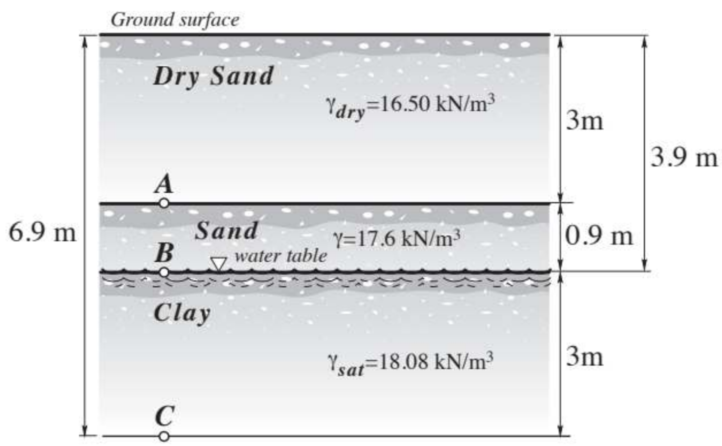


Figure 2

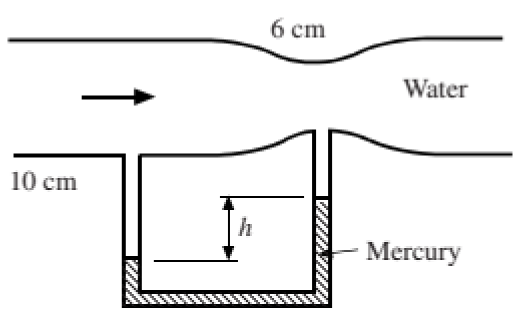


Figure 3

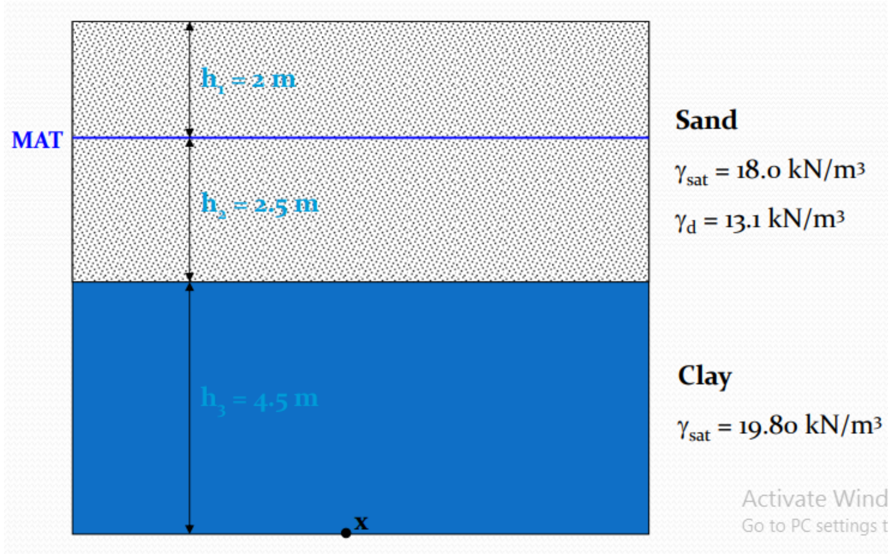


Figure 4

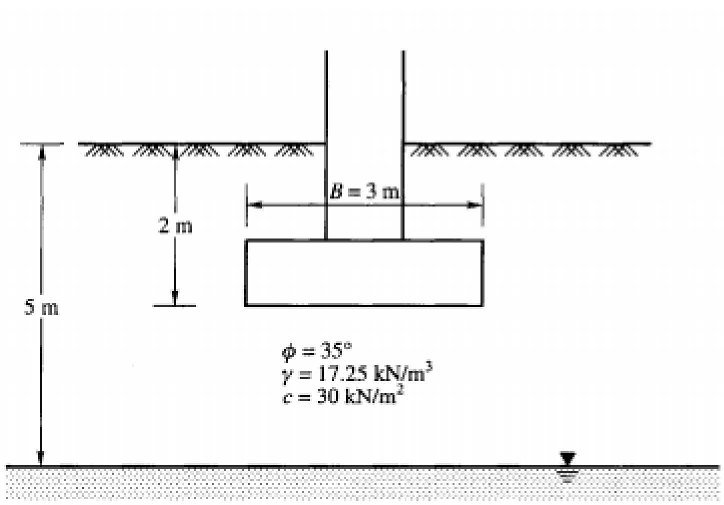


Figure 5

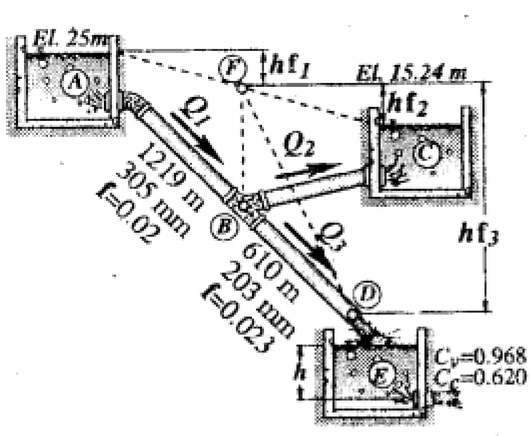


Figure 6

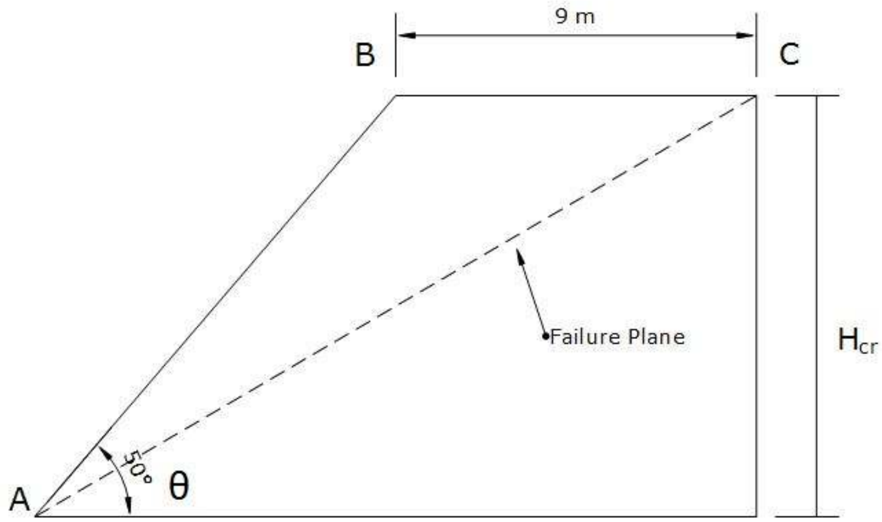


Figure 7

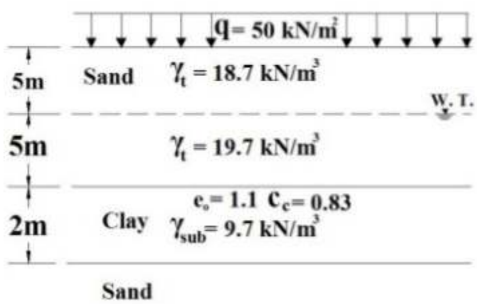


Figure 8

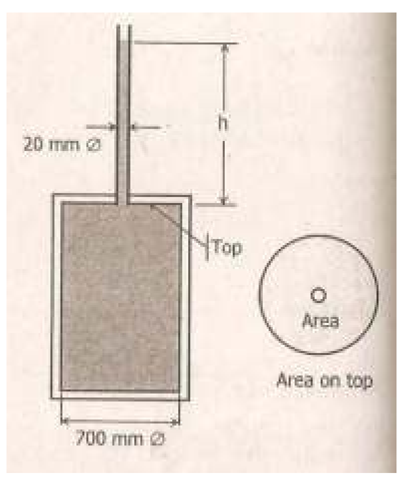


Figure 9

BSCE QUARANTINE REVIEWER DIAGNOSTIC EXAMS
STRUCTURAL ENGINEERING AND CONSTRUCTION

SITUATION 1 : The section of a concrete beam is shown in Figure 1. The beam is simply supported over a span of 5.6 m. Unit weight of the concrete is 23.6 kN/m^3. Concrete compressive strength f'c = 23.6 MPa and concrete tensile strength f'ct = 2.6 MPa. The value of b1 = 200 mm, b2 = 375 mm, h = 550 mm and D = 140 mm.

1. Determine the cracking moment of the beam.
   a. 52.181 kN m b. 49.315 c. 47.618 c. 55.818
2. Calculate the compressive stresses in the beam due to cracking moment.
   a. 4.106 MPa b. 4.251 c. 4.812 d. 4.499
3. What additional weight can the beam support without cracking?
   a. 36.110 kN/m b. 34.413 c. 38.976 d. 42.613

SITUATION 2: On the force system shown in Figure 2,

4. Determine the resultant.
   a. 544.68 lb b. 564.19 c. 588.23 d. 502.27

5. Determine the angle of the magnitude.
   a. 28.25° b. 26.44 c. 44.17 d. 21.01

6. Determine the moment of the force system.
   a. 1779.19 ft-lb b. 1443.36 c. 1699.85 d. 2031.14

7. What must be the length of a 5mm φ aluminium wine so that it can be twisted through 1 complete revolution without exceeding a shear of 42N/mm2. Take, G=27 GPa.
   a. 12.16 m b. 11.88 c. 10.09 d. 13.27
   SOLUTION:

8. It is a metal box installed at various locations along utility easements that contain electrical, telephone, or cable television switches and connections.
   a. Flashing b. Drain c. Pedestal d. Beam

SITUATION 3: For the given truss on Figure 3, it is made up of a wood 160 x 125 mm. It is subjected to a vertical load of 12.5 kN acting at C.

Allowable stress of wooden section:
Shear parallel to the grain = 1.23 MPa
Shear longitudinal for joints = 1.66 MPa
Compression parallel to the grain = 12.6 MPa
Compression perpendicular to the grain = 4.6 MPa

9. Compute the minimum length of x.
   a. 65 mm b. 89 c. 70 d. 54
10. Compute the minimum length of y.
    a. 10 b. 9 c. 11 d. 18
11. Compute the axial stress of member AC.
    a. 0.751 MPa b. 1.422 c. 1.244 d. 0.921

SITUATION 4: In Figure 4, a loading car is at rest on an inclined track. The gross weight of the car and its load is 25 kN, and it is applied at G. The cart is held in position by the cable.

12. Determine the reaction along the upper wheel.
    a. 22.7 kN b. 2.5 c. 22.65 d. 8

13. Determine the reaction along the lower wheel.
    a. 22.7 kN b. 2.5 c. 22.65 d. 8

14. Determine the tension in the cable.
    a. 22.7 kN b. 2.5 c. 22.65 d. 8

15. In Figure 5, determine the determinacy of the structure.
    a. 1° Indeterminate b. Determinate c. 2° Indeterminate d. Unstable

16. According to Section 305 of National Building Code, A building permit issued under the provisions of this Code shall expire and become null and void if the building or work authorized therein is not commenced within a period of one year from the date of such permit, or if the building or work so authorized is suspended or abandoned at any time after it has been commenced, for a period of:
    a. 90 days b. 120 days c. 6 months d. 1 year

17. A high strength steel band saw, 20 mm wide by 0.80 mm thick, runs over pulleys 600 mm in diameter. What maximum flexural stress is developed? Assume E = 200 GPa.
    a. 210.00 b. 250 c. 333.67 d. 266.67

SITUATION 5: A simply supported beam spans 7.5 m and supports a superimposed distributed load of 18.5 kN/m Beam properties are as follows
A = 10260 mm^2 , bf = 177 mm , tf = 16 mm , tw = 15 mm ,
d = 445 mm , Ix = 430 x 10^6 mm^4, Iy = 26 x 10^6 mm^4

Consider bending about x-axis.

18. Compute the maximum bending stress.
    a. 72.918 MPa b. 56.314 c. 67.308 d. 91.331
19. Compute the maximum web shear stress.
    a. 8.216 MPa b. 6.216 c. 9.711 d. 10.393

SITUATION 6: Given the following parameters P = 325 kN , Allowable weld stress Fvw = 90 MPa as shown in Figure 6.

20. Calculate the average vertical force per unit length of weld (N/mm) assuming that a = 0.
    a. 750 N/mm b. 650 c. 325 d. 375
21. Calculate the resultant force per unit length of weld (N/mm) due to eccentric load as shown in Figure 6.
    a. 1082 N/mm b. 845 c. 1015 d. 865.46
22. Calculate the thickness of the weld is 732.5 N/mm.
    a. 12 mm b. 24 c. 9 d. 18

SITUATION 7: A truck and trailer combination crossing a 12-m span has axle loads of 10, 20, and 30 kN separated respectively by distances of 3 and 5 m.

23. Determine the location of the Resultant.
    a. 4.25 m b. 5.00 c. 6.00 d. 5.50

24. Determine the maximum shear.
    a. 60 kN b. 30 c. 45 d. 20

25. Determine the maximum moment
    a. 61.25 kN m b. 95 c. 104.17 d. 180

SITUATION 8: For the beam and influence diagram shown in Figure 7,

26. Determine the maximum upward reaction at support C due to a 50 kN concentrated load.
    a. 50 kN b. 60 c. 85 d. 70

27. Determine the maximum downward reaction at support C due to a 50 kN concentrated load.
    a. 45 kN b. 20 c. 15 d. 60

SITUATION 9: A 76 x 76 x 6 mm angular section is welded to a gusset plate having a thickness of 12 mm as shown in Figure 8. The length L1 = 125 mm and L2 = 65 mm. The angular section has a cross sectional area of 929 mm^2 , Fy = 350 MPa and Fu = 460 MPa.

Allowable stresses:
Gross area tensile = 0.6Fy
Net area tensile = 0.5Fu
Shear stress = 0.3Fu

28. Determine the tensile force P based on gross area.
    a. 181.62 kN b. 524.40 c. 195.09 d. 376.71
29. Determine the value of tensile force P based on net area if the tensile strength reduction coefficient is 0.85.
    a. 181.62 kN b. 524.40 c. 195.09 d. 376.71
30. Determine the value of the tensile force P based on block shear in gusset plate along the weld.
    a. 181.62 kN b. 524.40 c. 195.09 d. 376.71

SITUATION 10: A 150 kg plate as shown in Figure 9, is supported by three cables and is in equilibrium.

31. Determine the tension at cable B
    a. 0 N b. 858 c. 1716 d. 1472
32. Determine the tension at cable C
    a. 0 N b. 858 c. 1716 d. 1472
33. Determine the tension at cable D
    a. 0 N b. 858 c. 1716 d. 1472

34. A short post constructed from a hollow circular tube of aluminum supports a compressive load of 250 kN . The inner and outer diameters of the tube are 9cm and =13cm, respectively, and its length is 100 cm. The shortening of the post due to the load is measured as 0.5 mm. Determine the strain in the post.
    a. 0.0008 b. 0.001 c. 0.0005 d. 0.01
    SOLUTION:

35. Find the critical time on a critical path shown in Figure 10 .
    a. 47 units b. 45 c. 43 d. 41

SITUATION 11: In the stress element diagram shown in Figure 11 ,

36. Determine the average stress.
    a. 15 MPa b. 30 c. 52.3 d. 67.3

37. Determine the maximum shear stress.
    a. 15 MPa b. 30 c. 52.3 d. 67.3

38. Determine the principal direction. Use Mohr's Circle.
    a. 48° b. 55° c. 50° d. 53°
    SOLUTION:

SITUATION 12: In accordance with the provisions of the 2010 NSCP, the required strength U shall be at least to the effects of the factored loads below the where the effects of the one or more loads not acting simultaneously shall be investigated:

U = 1.4D
U = 1.2D + 1.6L
U = 1.2D + 1.6L + 0.8W
U = 1.2D + 1.0(E+L)
U = 0.9D + 1.6W

Result from elastic analysis of a concrete beam yields the following values of the service moments:
D = 50 kN m , L = 80 , W = 60 , E = 100 ,.

Steel protective covering is 75 mm to the centroid of the steel group. f'c = 28 MPa , fy = 415 MPa. Assume bars are to be placed in one layer only.

39. Determine the value of the factored moment that will be used in designing the member.
    a. 141 kN m b. 188 c. 236 d. 240

40. Determine the designed dimensions using maximum allowable reinforcement ratio for tension control.
    a. 300 x 450 mm b. 275 x 475 c. 200 x 500 d. 250 x 400

41. Calculate the number of 28 mm Ø to be used.
    a. 2 b. 3 c. 4 d. 5

SITUATION 13: A propped beam AB is 9 m long is fixed at A and simply supported at B. Assuming EI is constant throughout the beam. If a concentrated load is 120 kN is acting vertically at 6m from the fixed end of the beam.

E = 150000 MPa and I = 300 x 10^6 mm^4.

42. Find the reaction at B.
    a. 62.22 kN b. 120 c. 75.22 d. 112.7

43. Determine the moment at the fixed end at A.
    a. -154.19 b. -160.02 c. -95.11 d. -88.12

44. Find the angle of rotation at B.

a. 6.11° b. 4.58° c. 3.11 d. 7.57

45. In the composite section shown in Figure 12 , determine the product of moment of inertia using parallel axis theorem.
a. 1.96 x 10^6 mm^4 b. 1.24 x 10^6 c. 5.16 x 10^6 d. 3.20 x 10^6

SITUATION 14: Light grade steel channel was used as a purlin of a truss. The top chord is inclined 1 V: 6 H and distance between trusses is equal to 5.5 meters. The purlin has a weight of 75 N/m and spaced at 1050 mm on the centers. The dead load including the roof materials is 700 Pa, live load of 1100 Pa and wind load of 1260 Pa. Coefficient of pressure at leeward and windward are 0.6 and 0.2 respectively. Assume all loads passes through the centroid of the section.

Properties of C Channel
Sx = 6.00 x 10^4 mm^3 , Sy = 1.10 x 10^4 mm^3 W = 75 N/mm
Allowable bending stresses Fbx and Fby = 210 Mpa

46. Calculate the bending stress , fbx for dead load and live load combination (D + L).
a. 103.95 MPa b. 83.265 c. 122.151 d. 111.02
47. Calculate the bending stress , fby for dead load the live load combination (D +L)
a. 103.95 MPa b. 83.265 c. 122.151 d. 111.02
48. Calculate the maximum ratio of actual to the allowable bending stress for load combination 0.75 (D + L + W) at the windward side.
a. 1.0237 b. 0.9782 c. 1.1103 d. 0.8915

49. This refers to the tendency of a solid material to slowly move or deform permanently under the influence of stresses.
a. Shrinkage b. Creep c. Hardness d. Elasticity

50. The point where the energy is released during the earthquake is called
a. Epicenter b. Hypocenter c. Metacenter d. Hypercenter

SITUATION 15: In Figure 13 shown,

51. Determine the reaction acting on the wall.
a. 3871 N b. 2500 c. 3750 d. 6970

52. Determine the reaction acting on the 500 kg block.
a. 3871 N b. 2500 c. 3750 d. 6970

53. Determine the force P in order to move the block.
a. 3871 N b. 2500 c. 3750 d. 6970

54. They are well burnt residue obtained from furnaces using coal as fuel and are used for making lime concrete.
a. Coarse Aggregates b. Sand
c. Cinder Aggregates d. Gravel

SITUATION 16: In the system of cables shown in Figure 14 , neglect the self weight of the cables.

55. Determine the sag yb .
a. 1.677 m b. 1.022 c. 1.315 d. 1.798

56. Determine the sag yd.
    a. 1.528 m b. 1.347 c. 1.001 d. 1.744

57. Determine the tension at AB.
    a. 48.789 kN b. 44.60 c. 45.05 d. 47.636

58. A concrete mix has a ratio 1:2:5 by mass. The specific gravities of the materials are as follows:

    Cement = 3.33 , Sand = 2.70 , Gravel = 2.66
    Cement weighted 40 kg per bag. Use 20 liters of water.
    Find the volume of cement solids per bag of cement.

    a. 0.015 m^3 b. 0.0030 c. 0.012 d. 0.126

SITUATION 17: A rectangular concrete beam of cross section 30 cm deep and 20 cm wide is prestressed by means of 15 wires of 5 mm diameter located 65 mm from the bottom and 3 wires of 5 mm diameter 25 mm from the top. Assuming the prestress in the steel is at 840 N/mm^2. Using the beam is supporting its own weight over a span of 6 m. and a live load of 6 kN/m ,

59. Determine the direct bending stress due to prestress.
    a. 10 MPa b. 5 c. 11.16 d. 9

60. Determine the bending stress due to prestress.
    a. 10 MPa b. 5 c. 11.16 d. 9

61. Determine the maximum working stress of concrete.
    a. 10 MPa b. 5 c. 11.16 d. 9

SITUATION 18: A reinforced concrete beam having a width of 300 mm and an overall depth of 600 m has a spacing of 2.5 m on centers supports a slab 100 mm in thickness. The superimposed dead load = 3 kPa , live load = 4.8 kPa , Columns E and H are omitted such that the girder BEHK support beams DEF at E and GHI at H as shown in Figure 15.

62. Compute the ultimate load (kN) at E induced by beam DEF. (Use NSCP 2010)
    a. 264.51 kN b. 220 c. 279.92 d. 237
63. Compute the ultimate load (kN) at H induced by beam GHI.
    a. 264.51 kN b. 220 c. 279.92 d. 237
64. Compute the maximum positive moment of girder BK assuming full fixity at B and K . Use FEM = Pab^2/L^2.
    a. 592.5 b. 395 c. 197.5 kN d. 237

SITUATION 19: A spiral column having a diameter of 550 mm is reinforced with 8 – 25 mm Ø vertical bars. With f'c = 28 MPa and fy = 400 MPa.

65. Determine the steel ratio in percent.
    a. 0.01 b. 0.02 c. 0.03 d. 0.04
66. Determine the ratio of eccentricity to the diameter of the column (e = 187.5 mm)
    a. 0.2477 b. 0.2617 c. 0.3409 d. 0.4107
67. Determine the value of the eccentric load Pn having the value of θPn/Ag = 7.5 as eccentricity factor and θ = 0.703.
    a. 2354.67 kN b. 2210.44 c. 2919.33 d. 3090.55

SITUATION 20: A rectangular footing supports a square footing column concentrically. (Use NSCP 2010)
Given:

Footing dimensions = 2.0 m square and 750 mm depth
Column dimension = 0.50 m square
Concrete f'c = 28 MPa , steel fy = 415 MPa
Concrete cover to the centroid of steel reinforcement = 150 mm
Unit weight of concrete = 23.5 kN/m^3
Unit weight of soil = 16.6 kN/m^3
Allowable stresses at ultimate loads are as follows:
For beam action, allowable shear stress = 0.90 MPa
For two way section = 1.70 MPa

68. Determine the concentrated load (kN) that the footing can carry based on beam action. Apply only effective soil pressure.
    a. 4770.54 b. 4819.22 c. 10800 d. 11700
69. Calculate the concentrated load based on two way action as in (68).
    a. 7830 kN b. 3366 c. 4825.81 d. 810
70. If the allowable soil pressure at service loads is 185 kPa, determine the unfactored axial load can the footing carry if the depth fill is 2 m above the footing .
    a. 536.7 kN b. 810 c. 10800 d. 4825.81

71. A pulley requires 200 Nm torque to get it rotating in the direction as shown. The angle of wrap is π radians, and µs = 0.25. What is the minimum horizontal force F required to create enough tension in the belt so that it can rotate the pulley as shown in Figure 16?
    a. 800 N b. 670.6 c. 1470.6 d. 2141

72. A flanged bolt coupling consists of ten 20-mm-diameter bolts spaced evenly around a bolt circle 400 mm in diameter. Determine the torque capacity of the coupling if the allowable shearing stress in the bolts is 40 MPa.
    a. 80 kN m b. 25.13 c. 40 d. 63.5

SITUATION 21: A W 420 x 85 Steel beam is fully restrained with a uniformly distributed super imposed load of 23 MPa. The beam has a span of 8 m.
Properties of W 420 x 85

A = 10839 mm^2	bf = 180 mm	tf = 18 mm
tw = 11 mm	d = 420 mm	Ix = 310 x 10^6 mm^4

73. Compute the bending stress in MPa.
    a. 95.336 MPa b. 86.11 c. 20.635 d. 23.856
74. Compute the web shear stress.
    a. 95.336 MPa b. 86.11 c. 20.635 d. 23.856
75. Determine the horizontal shear stress.
    a. 95.336 MPa b. 86.11 c. 20.635 d. 23.856

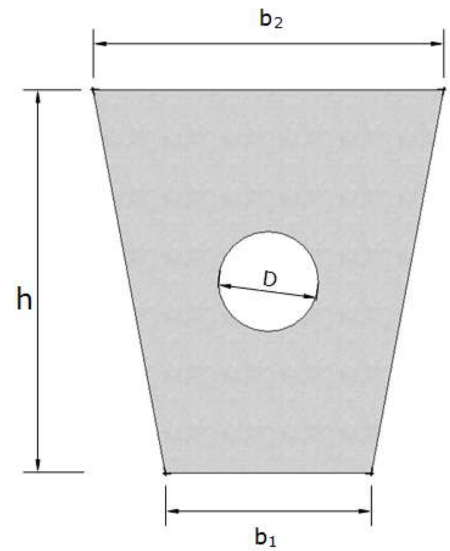


Figure 1

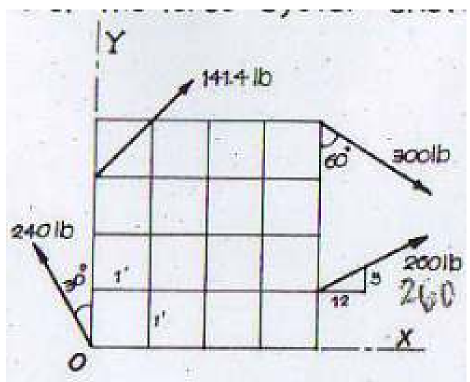


Figure 2

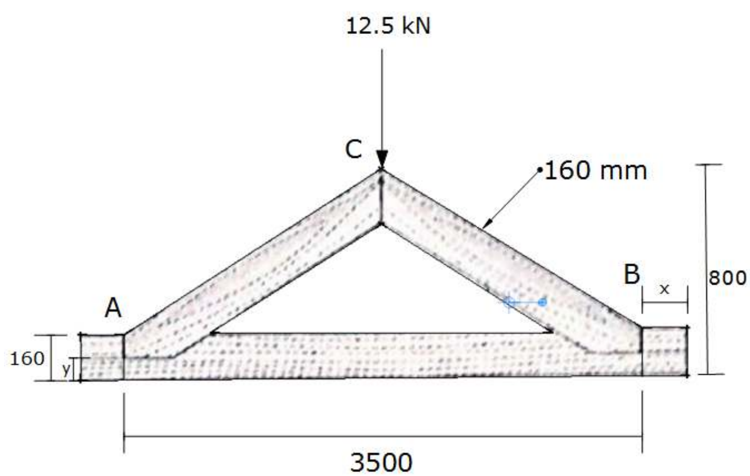


Figure 3

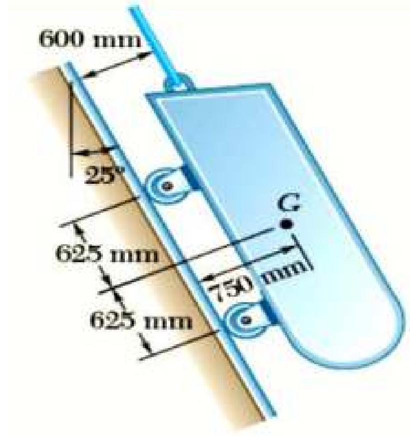


Figure 4

Figure 5

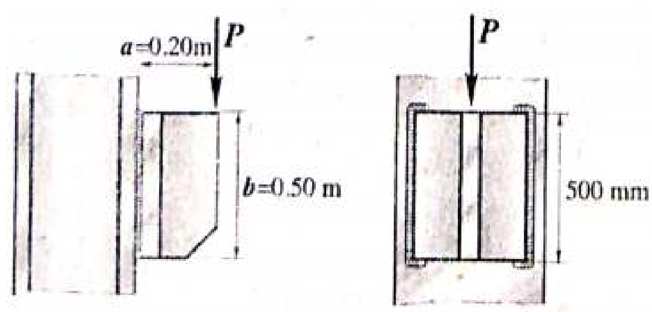


Figure 6

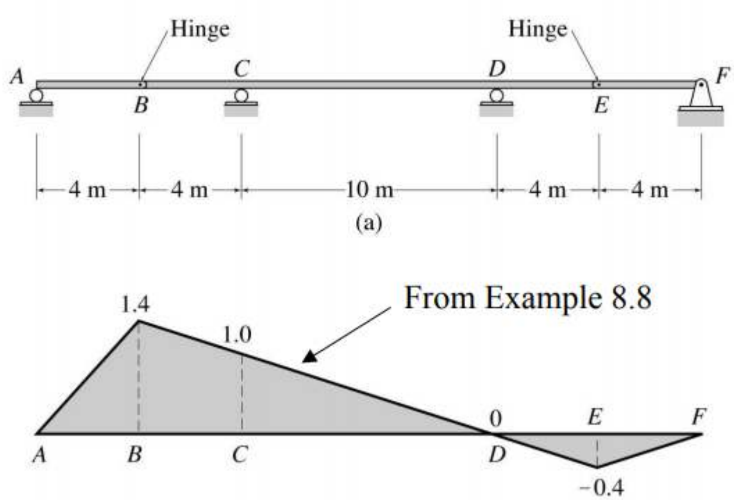


Figure 7

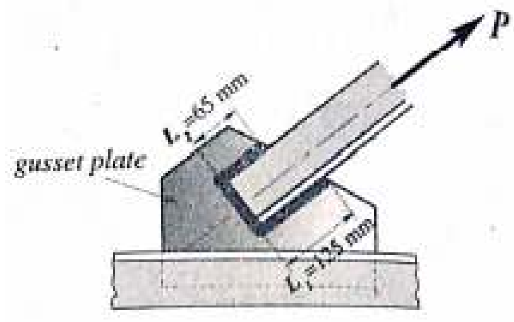


Figure 8

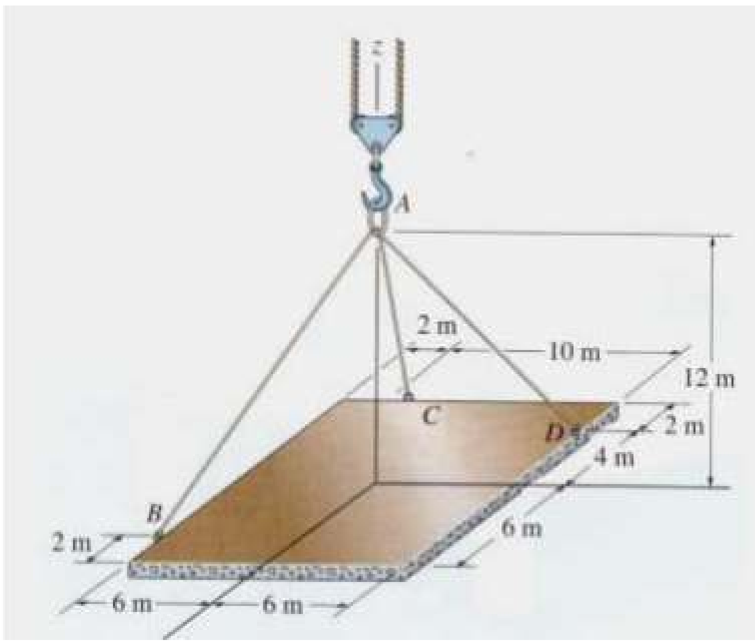


Figure 9

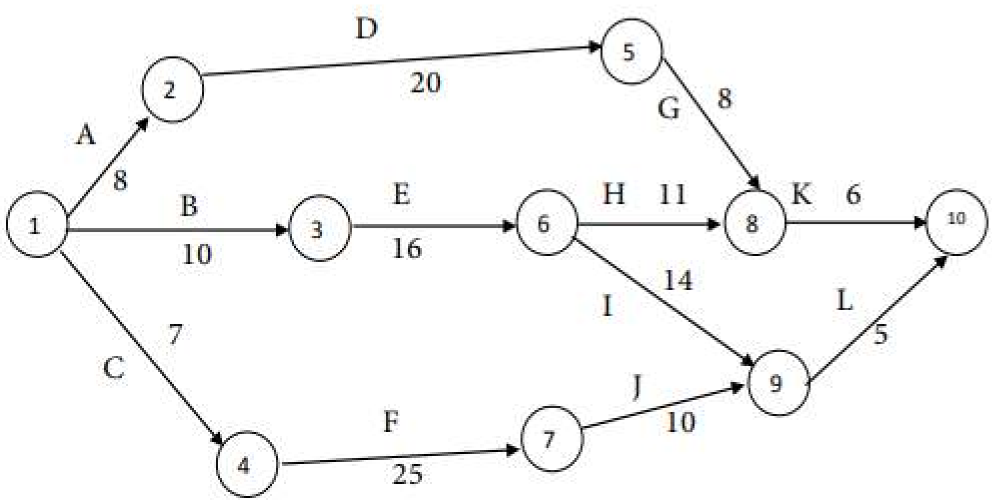


Figure 10

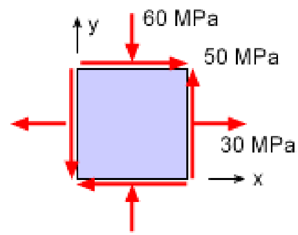


Figure 11

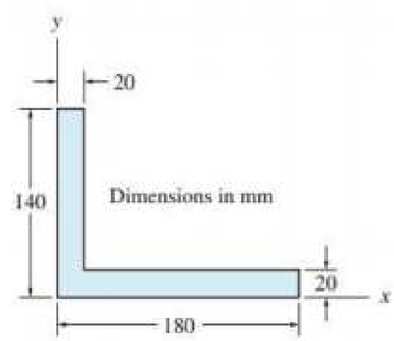


Figure 12

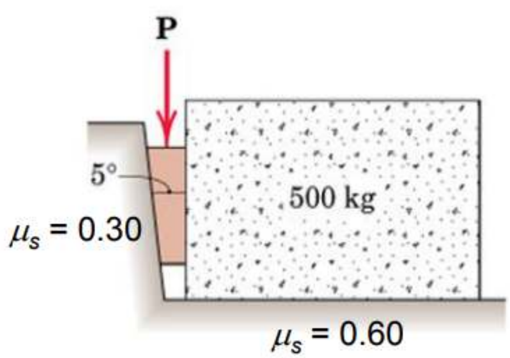


Figure 13

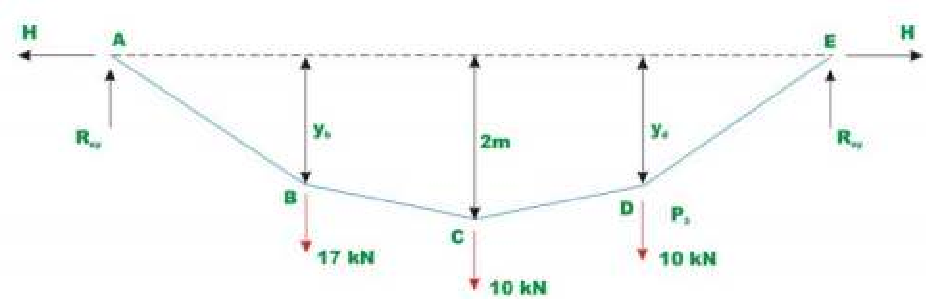


Figure 14

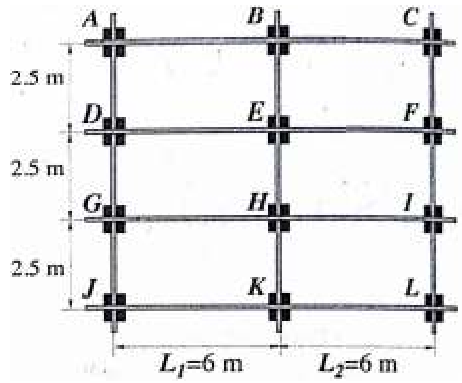


Figure 15

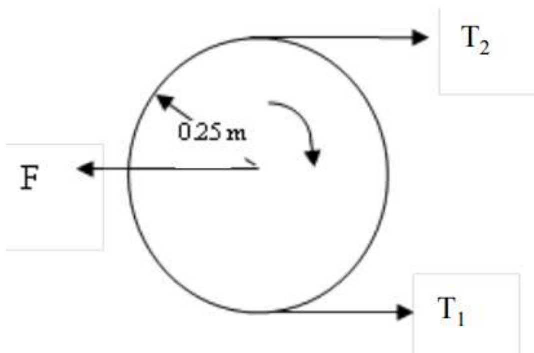


Figure 16