

**MATHEMATICS, SURVEYING AND
 TRANSPORTATION ENGINEERING**

- Consider the arithmetic sequence whose first term is 3 and common difference is -5. Write an expression for the general term a_n . Hint: $a_n = a_1 + (n - 1) d$
 A. $a = 5 + 8n$ C. $a = 8 - 5n$
 B. $a = 8 + 5n$ D. $a = 5 - 8n$
- An engineer wishes to purchase a Php 80,000 home by making a down payment of Php 20,000 and borrowing the remaining Php 60,000, which he will repay on a monthly basis over the next 30 years. If the bank charges interest at the rate of $9\frac{1}{2}\%$ per year, compounded monthly, how much money must the engineer repay each month?
 A. Php 540.51 C. Php 445.51
 B. Php 504.51 D. Php 554.51
- A Toyota Land Cruiser drives east from point A at 30 kph. Another car, Ford Expedition, starting from B at the same time, drives $S30^\circ W$ toward A at 60 kph. B is 30 km from A. How fast in kph is the distance between two cars changing after 30 minutes? Hint: Use the Cosine Law.
 A. 70 kph C. 55 kph
 B. 80 kph D. 60 kph

- A. 2,310 ft. C. 2,001 ft.
 B. 2,010 ft. D. 2,111 ft.

9. Evaluate $\int_1^3 \int_0^{2y} (x^2 + y^2) dx dy$.
 A. 280/3 C. 230/6
 B. 110/7 D. 150/4

10. An engineering consultant company must decide between two jobs. The decision is based on the following information.

Job 1					
Probability	0.2			0.8	
Outcome	Loss of	Php		Profit of	Php
	30,000			100,000	
Job 2					
Probability	0.4			0.6	
Outcome	Loss of	Php		Profit of	Php
	20,000			125,000	

Which job has the greater expected profit?

- A. Job 2 because it has greater expected profit of Php 64,000
 B. Job 1 because it has greater expected profit of

4. On a Richter scale, the magnitude R of an earthquake of intensity I is given $R = \log(I/I_0)$ where I_0 is a certain minimum intensity. If intensity of an earthquake is $1000I_0$, find R .

- A. 3
 B. 7
 C. 5
 D. 9

5. A painter needs to find the area of the gable end of a house. What is the area of the gable if it is a triangle with two sides of 42 ft that meet at a 105° angle?

- A. 822 ft²
 B. 855 ft²
 C. 825 ft²
 D. 852 ft²

6. A farmer owned a square field measuring exactly 2261 m on each side. 1898 m from one corner and 1009 m from an adjacent corner stands Narra tree. A neighbor offered to purchase a triangular portion of the field stipulating that a fence should be erected in a straight line from one side of the field to an adjacent side so that the Narra tree was part of the fence. The farmer accepted the offer but made sure that the triangular portion was a minimum area. What was the area of the field the neighbor received and how long was the fence? Hint: Use the Cosine Law.

- A. $A = 972,325$ and $L = 2,236$

7. Job 1 because it has greater expected profit of Php 64,000
 B. Job 1 because it has greater expected profit of Php 74,000

C. Job 1 because it has greater expected profit of Php 67,000

D. Job 2 because it has greater expected profit of Php 74,000

11. Earth is approximately 93,000,000.00 miles from the sun, and the Jupiter is approximately 484,000,900.00 miles from the sun. How long would it take a spaceship traveling at 7,500.00 mph to fly from Earth to Jupiter?

- A. 9.0 years
 B. 5.0 years
 C. 6.0 years
 D. 3.0 years

12. A meteorologist is inflating a spherical balloon with a helium gas. If the radius of a balloon is changing at a rate of 1.5 cm/sec., express the volume V of the balloon as a function of time t (in seconds). Hint: Use composite function relationship $V_{\text{sphere}} = 4/3 \pi r^2$ as a function of x (radius), and x (radius) as a function of t (time).

- A. $V(t) = 5/2 \pi t^3$
 B. $V(t) = 7/2 \pi t^3$
 C. $V(t) = 9/2 \pi t^3$
 D. $V(t) = 3/2 \pi t^3$

13. On the first six tests in her Mathematics subject, her

long was the fence? Hint: Use the Cosine Law.

- A. $A = 972,325$ and $L = 2,236$
- B. $A = 950,160$ and $L = 2,122$
- C. $A = 946,350$ and $L = 2,495$
- D. $A = 939,120$ and $L = 2,018$

7. The number of accidents for 6 yrs. recorded in a certain section of a highway is 5432. If the average daily traffic is 476, what is the accident rate per million entering vehicles?

- A. 5211
- B. 5106
- C. 5002
- D. 5010

8. A curve banked at 8° will accommodate traffic traveling s mph, if the radius of the curve is r feet, according to the formula $s = 1.45\sqrt{r}$. If engineers expect 65-mph traffic, what radius should they specify?

13. On the first six tests in her Mathematics subject, her scores were 92, 78, 86, 92, 95, and 91. If she took a seventh test and raised the mean of her scores exactly one point, what was her score on the 7th test?

- A. 94
- B. 97
- C. 96
- D. 98

14. In the expansion of $(2x - 1/x)^{10}$, find the coefficient of the 8th term.

- A. 980
- B. 970
- C. 960
- D. 990

15. In many parts of the world, high waters reach their greatest height and the low waters at the least height, soon after the time of full and new moon, these tides are called:

- A. Flood tides
- B. Neap tides
- C. Ebb tides
- D. Spring tides

16. In still water, your small boat average 8 miles per hour. It takes you the same amount of time to travel 15 miles downstream, with the current, as 9 miles upstream, against the current. What is the rate of water's current?

- A. 4 miles/hr
 B. 3 miles/hr
 C. 2 miles/hr
 D. 5 miles/hr

17. The formula $v = \sqrt{2gh}$ give the velocity, in feet per second, of an object when it falls h feet accelerated by gravity g , in feet per second squared. If g is approximately 32 feet per second squared, find how far an object has fallen if its velocity is 80 feet per second.

- A. 80 feet
 B. 100 feet
 C. 70 feet
 D. 90 feet

18. Determine the percentage uncertainty in the area of a square that is 6.08 ± 0.01 m or a side.

- A. 0.27%
 B. 0.25%
 C. 0.26%
 D. 0.29%

19. It is the maximum number of vehicles, which have a reasonable expectation of passing over a given section of lane or roadway in one direction or in both

southeast (45°) for 440 km; the third is (53°) south of west for 550 km. What is the total displacement?

- A. 950 km, -46° below the x-axis (south of east)
 B. 975 km, -55° below the x-axis (south of east)
 C. 940 km, -57° below the x-axis (south of east)
 D. 960 km, -51° below the x-axis (south of east)

26. A meteorologist is inflating a spherical balloon with helium gas. If the radius of the balloon is changing at a rate of 1.5 cm/sec, express the volume V of the balloon as a function of time t (in seconds).

- A. $V(t) = 1/5 \pi t^3$
 B. $V(t) = 4/3 \pi t^3$
 C. $V(t) = 3/7 \pi t^3$
 D. $V(t) = 9/2 \pi t^3$

27. A bus route on a city street is scheduled for 2-min headways. On the average, 7 passengers per bus board at a particular stop and 10 passengers alight. All boarding passengers use the front door and all alighting passengers use the back door. Fare collection is exact fare and farebox, but not single coin. Assume clearance time is 15 s, and that the maximum allowable probability of bus queuing is 1 percent. The stop is a near-side stop at an intersection with g/C ratio of 0.50. How many berths are required?

19. It is the maximum number of vehicles, which have a reasonable expectation of passing over a given section of lane or roadway in one direction or in both directions during one hour under prevailing road and traffic conditions.

- A. Flow Traffic
- B. Road Capacity
- C. Free Flow
- D. Density

20. A company determines that in the production of x units of a commodity its revenue and cost functions are, respectively, $R(x) = -3x^3 + 970x$ and $C(x) = 2x^2 + 500$. Find the maximum profit and maximum average cost.

- A. Php 54.32
- B. Php 25.43
- C. Php 32.94
- D. Php 43.25

21. A plate in the shape of an isosceles triangle 3 ft high and 4 ft wide is submerged vertically, base downward, with the base 5 ft below the surface of the water. Find the force caused by liquid pressure on one side of the plate.

- A. 1764.9 lb
- B. 1649.7 lb
- C. 1497.6 lb
- D. 1976.4 lb

22. Evaluate $\int_0^{\pi/2} 2 \sin^6 x \cos^4 x dx$

percent. The stop is a near-side stop at an intersection with g/C ratio of 0.50. How many berths are required?

- A. 2
- B. 3
- C. 4
- D. 5

28. A contractor has 50 men of the same capacity at work on a job. They can complete the job in 30 days, the working day being 8 hours, but the contract expires in 20 days. He decides to put 20 additional men. If all the men get P3.00 per day for a full or part day and if the liquidated damages are P100 for every full or part day, he requires over his contract. How many days could he finish the job.

- A. 22
- B. 15
- C. 20
- D. 18

29. Halley's Comet has an elliptical orbit with eccentricity = 0.967. The closest the Halley's comet comes to the sun is 0.587 AU. Approximate the maximum distance of the comet from the sun to the nearest 0.1 AU.

- A. 25.0 AU
- B. 53.0 AU
- C. 17.2 AU
- D. 17.8 AU

30. Each plane can carry no more than 80,000 pounds.

22. Evaluate $\int_0^{\pi/2} 2 \sin^6 x \cos^4 x \, dx$
- A. 0.0368 C. 0.0234
 B. 0.0437 D. 0.0184
23. You can design a web site in 30 hours. Your friend can design the same site in 20 hours. How long will it take to design the web site if you both work together?
- A. 12 C. 16
 B. 15 D. 18
24. Hooke's law states that the distance a spring stretches is directly proportional to the weight attached to the spring. If a 40-pound weight attached to the spring stretches the spring 5 inches, find the distance that a 65-pound weight attached to the spring stretches the spring.
- A. 8.125 inches C. 7.125 inches
 B. 5.125 inches D. 6.125 inches
25. An airplane involves three legs with two stopovers. The first leg is due east for 620 km; the second leg is

30. Each plane can carry no more than 80,000 pounds. The bottled water weighs 20 pounds per container and each medical kit weighs 10 pounds. If x represents the number of bottles of water to be shipped and y represents the number of medical kits, write an inequality that models this constraint.
- A. $10x - 20y \leq 80,000$ C. $20x - 10y \leq 80,000$
 B. $10x + 20y \leq 80,000$ D. $20x + 10y \leq 80,000$
31. The areas of two similar polygons are 80 and 5. If the side of the smaller polygon has a length 2, find the length of the corresponding side a larger polygon.
- A. 10 C. 8
 B. 12 D. 14
32. A coin is so unbalanced that you are likely to get two heads in two successive throws as you are to get tails in one. What is the probability of getting heads in a single throw?
- A. 0.168 C. 0.681
 B. 0.618 D. 0.816

33. Based on the expression of the technical resolution of the International Water Way Congress, about how many percent of tide is guaranteed safe for the ships?

- A. 98%
 B. 75%
 C. 95%
 D. 80%

34. The tires of a truck make 60 revolutions as the truck reduces its speed from 90 km/h to 50 km/h. The tires have a diameter of 0.80m. What was the angular acceleration of the tires?

- A. -11.52 rad/sec^2
 B. -11.25 rad/sec^2
 C. -11.55 rad/sec^2
 D. -11.22 rad/sec^2

35. Guide signs are generally in _____ shape.

- A. Triangular
 B. Square
 C. Circle
 D. Rectangular

36. Workers at the Audubon Zoo must move a giant tortoise to his new home. Find the amount of force required to pull a 250-pound tortoise up a ramp leading into a truck. The angle of elevation of the ramp is 30° .

- A. 125 pounds
 B. 135 pounds
 C. 155 pounds
 D. 145 pounds

- A. $\sqrt{3}$
 B. $\sqrt{4}$

- C. $\sqrt{5}$
 D. $\sqrt{2}$

44. A certain isotope ^{14}C of carbon occurs in living organisms in a fixed proportion to ordinary carbon. When that organisms dies, its ^{14}C decay exponentially, and its half-life is 5730 years. Assume that a piece charcoal from a wood fire was found in a cave and contains only 9% of the ^{14}C expected in the corresponding piece of wood in a live tree. How long ago was the wood burned to form that charcoal?

- A. 19906 years
 B. 19606 years
 C. 19706 years
 D. 19806 years

45. A water park is considering two location for development - one in Laguna and one in Cavite. Based on the following weightings for the factors below, which area represents the best location?

Factor description	Weight	Laguna	Cavite
Proximity to Market	0.30	80	50
Infrastructure	0.20	50	40
Weather	0.25	30	70

A. 125 pounds

B. 135 pounds

C. 155 pounds

D. 145 pounds

37. Which of these contour characteristics is not true?

A. Contours on the ground can cross another.

B. Contours are at the right angles to the slope.

C. Contour on the ground closes itself.

D. Contours point upstream.

38. Calculate the recoil velocity of a 5.0-kg rifle that shoots a 0.050-kg bullet at a speed of 120 m/s. Hint: Conservation of Momentum.

A. -2.1 m/s

C. -1.2 m/s

B. 1.2 m/s

D. 2.1 m/s

39. The bases of a right prism are pentagons with each side 6 m. long. The bases are 12 m apart. What is the volume of the prism?

A. 658.60

C. 743.40

B. 460.80

D. 898.60

40. A 50-kg crate is pulled 40 m long a horizontal floor by a constant force exerted by a person $F_p = 100\text{ N}$, which acts at a 37° angle. The floor is rough and exerts a friction force $F = 50\text{ N}$. Determine the net work done on the crate.

Infrastructure	0.20	50	40
Weather	0.25	30	70
Labour Availability	0.25	60	80

A. All of the above

B. Cavite

C. None of the above

D. Laguna

46. The lines OA and OB whose magnetic bearings are $N 39^\circ 25' W$ and $N 75^\circ 50' E$ respectively, what is the angle between the lines?

A. $50^\circ 04'$

C. $115^\circ 15'$

B. $87^\circ 34'$

D. $36^\circ 25'$

47. A soil weighs 1163 kg/Lm^3 (loose cubic meter), 1661 kg/Bm^3 (bank cubic meter), and 2077 kg/Cm^3 (Compacted cubic meter). How many bank cubic meter (Bm^3) and compacted, cubic meter (Cm^3) are contained in $593,300\text{ Lm}^3$ of this soil?

Hint: Bank Volume = Loose cubic meter \times Load Factor

Compacted Volume = Bank cubic meter \times Shrinkage Factor

Bank cubic meter = Loose cubic yard \times Load factor

a friction force $F = 50 \text{ N}$. Determine the net work done on the crate.

- A. 1200 J
- B. 2000 J
- C. 3200 J
- D. 4300 J

41. A mine is for sale. A mining engineer estimates that, at current production levels, the mine will yield an annual income of Php 80,000 for 15 years, after which the mineral will be exhausted. If an investor's MARR is 15%, What is the maximum amount he can bid on this property?

- A. Php 477,760
- B. Php 467,760
- C. Php 466,760
- D. Php 476,760

42. Two forces of 17.5 and 22.5 lb act on a body. If their directions make an angle of $50^\circ 10'$ with each other, find the angle that it makes with the larger force.

- A. $25^\circ 30'$
- B. $40^\circ 21'$
- C. $21^\circ 40'$
- D. $30^\circ 25'$

43. If the equal sides of an isosceles triangle are given, what length of the third side will provide maximum area?

Bank cubic meter = Loose cubic yard \times Load factor

Compacted cubic meter = Bank cubic meter \times Shrinkage factor

- A. Bank Volume = 332,248.00 Bm^3
Compacted Volume = 332,248.00 Cm^3
- B. Bank Volume = 415,310.00 Bm^3
Compacted Volume = 332,248.00 Cm^3
- C. Bank Volume = 415,310.00 Bm^3
Compacted Volume = 415,310.00 Cm^3
- D. Bank Volume = 332,248.00 Bm^3
Compacted Volume = 425,310.00 Cm^3

48. Hardware Inc., a small chain of DIY outlets in the Visayas, has a total operating cost of Php 435,000.00. Having invested in radio campaign, the company's sales have increased from Php 615,000.00 to Php 805,000.00. In addition to the one-off cost Php 80,000.00 for the radio adverts, these extra sales have added Php 63,000.00 in variable costs. Thus, the total operating costs for the firm now stand at Php 578,000.00. By what percentage has EBIT (Earnings

Before Interest and Taxes) improved as a result of the marketing campaign?

- A. 20%
- B. 27%
- C. 24%
- D. 26%

49. Simplify the function $y = (\tan x + \cot x) \sin x$

- A. $\sin x$
- B. $\cot x$
- C. $\cos x$
- D. $\sec x$

50. In the following table, what value for n results in a table showing perfect independence? Hint: Relative frequencies must be equal.

20	50
30	n

- A. 75
- B. 40
- C. 10
- D. 60

51. The overall track structure for a railroad typically consists of the following except one.

I. Subgrade	IV. Ties
II. Ballast	V. Rails
III. Spikes	VI. Rail fastening

- A. V
- B. VI
- C. IV
- D. III

58. The tires of a car make 65 revolutions as the car reduces its speed from 95 km/h to 45 km/h. The tires have a diameter of 0.80 m. If the car continues to decelerate at this rate, how much more time is required for it to stop.

- A. 4.1 s
- B. 6.7 s
- C. 7.6 s
- D. 1.4 s

59. What net force is required to bring a 1500-kg car to rest from a speed of 100 km/h within a distance of 55 m?

- A. $-5.1 \times 10^4 \text{ N}$
- B. $-1.1 \times 10^4 \text{ N}$
- C. $-7.1 \times 10^4 \text{ N}$
- D. $-3.1 \times 10^4 \text{ N}$

60. A projectile is fired with an initial speed of 196 m/s at an angle 30.0° above the horizontal from the top of a cliff 98.0m high. Determine the time to reach maximum height.

- A. 10.5 s
- B. 10.0 s
- C. 11.5 s
- D. 11.0 s

61. An engineer has received Php 10,000 from his employer for a patent disclosure. He has decided to invest the money in a 15-year savings certificate that pays 8% per year, compounded annually. What will

51. The overall track structure for a railroad typically consists of the following except one.

I. Subgrade	IV. Ties
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- A. V
B. III
C. IV
D. VI
52. Pavement markings shall only be applied and/or removed by ____.
- A. LTO
B. PNP
C. DPWH
D. DOTC
53. Indirect Mail Inc. had been mailing out coupons for a clearance sale at a constant rate for 4 days, when they counted the coupons, they still had mail out and discovered they had 120,000 left. After 7 total days of work they had 75,000 left. At what rate are they mailing coupons out?
- A. 11,000 coupons per day
B. 13,000 coupons per day
C. 17,000 coupons per day
D. 15,000 coupons per day
54. A freely falling body, starting from rest, falls 16 ft

A. 10.5 s
B. 10.0 s

C. 11.5 s
D. 11.0 s

61. An engineer has received Php 10,000 from his employer for a patent disclosure. He has decided to invest the money in a 15-year savings certificate that pays 8% per year, compounded annually. What will be the final value of his investment, in terms of today's peso, inflation continues at the rate of 6% per year?
- A. Php 14,242.61
B. Php 15,224.61
C. Php 13,242.61
D. Php 16,424.61
62. Find the slope-intercept form for the line through P(5, -7) that is perpendicular to the line $6x + 3y = 4$.
- A. $19/2$
B. $-2/19$
C. $2/19$
D. $-19/2$
63. Shureka Washburn has scores 72, 67, 82 and 79 on her algebra tests. Use an inequality to find the scores she must take on the final exam to pass the course with an average of 77 or higher, given that the final exam counts as two test.
- A. greater than or equal to 81**
B. greater than or equal to 51
C. greater than or equal to 61
D. greater than or equal to 71

54. A freely falling body, starting from rest, falls 16 ft during the 1st second, 48 ft during the 2nd second, 80 ft during the 3rd second, etc. Calculate the distance it falls during the 15th second.

A. 644 ft C. 564 ft
B. 446 ft D. 464 ft

55. A regular octagon is to be cut out from a square section having a side of 16 m. Determine side of the octagon.

A. 6.63 C. 3.64
B. 4.86 D. 7.92

56. Evaluate the limit of $(x - 5)/(x^2 - 12x + 35)$ as x approaches 5.

A. indeterminate C. 0.5
B. -0.5 D. 0

57. A ball on the end of a string is revolved at a uniform rate in a vertical circle of radius 72.0 cm. If its speed is 4.00 m/s and its 0.300 kg, calculate the tension in the string when the ball is at the top of its path.

Hint: $(\Sigma F = ma)$, $(aR = V^2 / r)$

A. 3.73 N, downward C. 9.62 N, upward
B. 3.73 N, upward D. 9.61 N, downward

A. greater than or equal to 81

B. greater than or equal to 51

C. greater than or equal to 61

D. greater than or equal to 71

64. A lot has a frontage of 120 m. long along a road. The other sides which are both perpendicular to the road are 90 m. and 60 m. respectively. It is desired to subdivide the lot into two parts by another perpendicular line to the road such that the area of the lot that adjoins the 90 m. side is equal to $1/3$ of the whole area. Determine the length of the dividing line.

A. 77.82 m C. 62.46 m
B. 92.46 m D. 81.24 m

65. An engineer selects a sample of 5 iPods from a shipment of 100 that contains 5 defectives. Find the probability that the sample contains at least one defective.

A. 0.23 C. 0.83
B. 0.43 D. 0.63

66. The Lopez family is building a house in the country on 400 ft by 400 ft lot. A telephone pole is at corner of the property. The telephone company will run no more than 200 ft of wire without a pole. The Lopez family wants to be as far back from the road as

Hint: $(\sum F = ma)$, $(aR = V^2 / r)$

- A. 3.73 N, downward C. 9.62 N, upward
B. 3.73 N, upward D. 9.61 N, downward

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the property. The telephone company will run no more than 200 ft of wire without a pole. The Lopez family wants to be as far back from the road as possible, but they don't want to be right of the side

lot line. Assuming that they will use 200 ft. of telephone wire, Using the distance of the house from the road as a function of the distance from side lot, find how far from the road they will be if they are 20 ft from the lot line.

- A. $30\sqrt{100}$ C. $23\sqrt{89}$
B. $17\sqrt{105}$ D. $20\sqrt{99}$

67. Compute the deflection angle at the end point of the spiral if the length of spiral is 80 m, with a degree of curve of the central curve of a spiral easement curve of 6.5° .

- A. 4.33° C. 6.31°
B. 5.42° D. 7.42°

degree of the first curve is $3^\circ 30'$, what is the degree of the second curve?

- A. 7.27° C. 8.21°
B. 6.32° D. 5.34°

74. In the Standard practice of measuring vertical or zenith angles, the following practices are of great importance:

- I.) Be sure the instrument is level
- II.) Sight with the vertical crosshair
- III.) Sight exactly on the target
- IV.) Sight direct and reverse

Which standard practices are true?

- A. I only C. I, III & IV only
B. All of the above D. I & III only

A. 4.33°
B. 5.42°

C. 6.31°
D. 7.42°

68. In triangle BCD, $BC = 25$ m and $CD = 10$ m. Compute the probable perimeter of the triangle.

A. 67
B. 66

C. 69
D. 68

69. The number of hours daylight, $D(t)$ at a particular time of the year can be approximated by $D(t) =$

$$\frac{K}{2} \sin\left[\frac{2\pi}{365}(t-79)\right] + 12 \text{ for } t \text{ days and } t = 0$$

corresponding to January 1. The constant k determines the total variation in day length and depends on the latitude of the locale. When is the day length the longest, assuming that it is NOT a leap year?

A. December 20
B. June 19

C. June 20
D. December 19

70. Determine the speed of sound through a long aluminum rod and the wavelength of the sound waves produced by a 440 Hz vibration in the rod. The elastic modulus of aluminum is 70.0×10^9 N/m² and the density is 2.70×10^3 kg/m³. Hint: $V = (E/\rho)^{1/2}$

A. I only
B. All of the above

C. I, III & IV only
D. I & III only

75. Find the value of 10^{2x+1} if $10^x = 4$.

A. 180
B. 175

C. 160
D. 170

*** END ***

WARNING: Failure to submit your Test Questions (Complete) set will cause the cancellation of your Test-Results for the subject.

elastic modulus of aluminum is $70.0 \times 10^9 \text{ N/m}^2$ and the density is $2.70 \times 10^3 \text{ kg/m}^3$. Hint: $V = (E/\rho)^{1/2}$

- A. $V = 5000 \text{ m/s}$, wavelength = 15.1 m
- B. $V = 5009 \text{ m/s}$, wavelength = 55.1 m
- C. $V = 5900 \text{ m/s}$, wavelength = 51.5 m
- D. $V = 5090 \text{ m/s}$, wavelength = 11.5 m

71. To fight a forest fire, the forest dry department plans to clear a rectangular fire break around the fire. Crews are equipped with mobile communications with a 3,000-yard range. Can crews at point A and B remain in radio contact?

- A. No, because two crews are 2,500 yards apart, it is more than the range of the radios.
- B. Yes, because two crews are 2,900 yards apart, it is less than the range of the radios.
- C. Yes, because two crews are 2,600 yards apart, it is less than the range of the radios.
- D. No, because two crews are 2,600 yards apart, it is more than the range of the radios.

72. A line measures 10,000 m at an average elevation of 500 m. If the average radius of curvature in the area is 7,000 km, determine the sea level reduction factor.

Hint: Sea level reduction factor = $(1 - h/R)$

Where: h = elevation, R = radius

72. A line measures 10,000 m at an average elevation of 500 m. If the average radius of curvature in the area is 7,000 km, determine the sea level reduction factor.
Hint: Sea level reduction factor = $(1 - h/R)$

Where: h = elevation, R = radius

A. 0.999922

C. 0.999999

B. 0.999929

D. 0.999992

73. The common tangent AB of a compound curve is 82.32 m. The angles the common tangent makes with the tangents through PC and PT of the compound curve are $21^{\circ}10'$ and $15^{\circ}20'$, respectively. If the

1. Evaluate the kinetic energy of a unit weight of water, in meters, flowing at 10 m/s?

- A. 0.721 C. 0.815
B. 0.439 D. 0.534

2. A cohesive soil sample was taken from an SPT and taken to the laboratory in a glass jar. It was found to weigh 145 grams. The sample was then placed in a container having a volume $V = 500 \text{ cm}^3$ and 420 cm^3 of water were added to fill the container. Evaluate the unit weight of the soil in kN/m^3 .

- A. 14.1 C. 16.5
B. 17.8 D. 15.3

3. In accordance with the Unified Soils Classification System, a soil grain having a size greater than No. 200 sieve opening (0.074 mm) but less than that of a No. 4 sieve (4.75 mm opening) is called

- A. gravel C. cobble
B. pebble D. sand

4. Given the unit weight of air to be constant at 12 N/m^3 , determine the approximate height of a mountain, in meters, if a mercury barometer at its base reads 750 mm and at the same instant another barometer at the top of the mountain reads 300 mm.

- A. 5013 C. 5003
B. 5023 D. 5033

5. An experiment to determine the permeability of a soil sample was conducted. The permeameter in a falling head permeability test setup involves a cylindrical soil sample 100 mm in diameter and a height of 200 mm. The hydraulic head in the 10-mm diameter standpipe through which the test water passed dropped from 1 meter to 600 mm in one minute of

conditions:
Size of pile: $D = 0.4 \text{ m}$ square
Depth of penetration into the clay layer: $L = 30 \text{ m}$
Unconfined compression strength q_u of the clay:
 $q_u = 200 \text{ kPa}$

- A. 480 C. 410
B. 960 D. 327

9. In order to provide water from a nearby spring, a triangular flume of efficient cross section was provided on a slope of 0.15 percent. Assuming the roughness coefficient of the channel equal to 0.02, obtain the depth of flow in meter(s) of the water in the flume if it is discharging at the rate of 2 cu.m./sec . Utilize the formula $V = (1/n)R^{2/3}S^{1/2}$ for the velocity of flow.

- A. 1.85 C. 1.31
B. 1.77 D. 1.69

10. If the ground water table in a soil formation rises as a resulting of flooding, the bearing capacity of the soil

- A. decreases
B. depends on the footing load
C. increases
D. unaffected

11. A granular soil deposit is considered medium dense if the blow count of a standard penetration test is between

- A. over 50 C. 30 to 50
B. 10 to 30 D. 4 to 10

12. If a container containing water 0.50 m deep is carried inside an elevator that accelerates at 2 m/sec^2 evaluate the pressure, in kPa, exerted by the water at the base of the container if the elevator is travelling downward.

- A. 4.15 C. 3.91
B. 4.01 D. 2.45

soil sample 100 mm in diameter and a height of 200 mm. The hydraulic head in the 10-mm diameter standpipe through which the test water passed dropped from 1 meter to 600 mm in one minute of observation. In that duration the water collected in the graduate was recorded at 2.0 liters. From these data evaluate the coefficient of permeability of the soil sample, in cm/sec.

- A. 0.000224 C. 0.001910
 - B. 0.001700** D. 0.001890
6. A rigid gate of a flood control structure in a river is 6 m wide by 4 m high and weighs 10 kN. With its longer edge horizontal, it is moved up and down with its short edge sliding in vertical channel guides. Evaluate the force, in kN, needed to raise the gate when the surface of water is 2 m above its top edge. The coefficient of friction between the gate and the channel guides is 0.10. Neglect the buoyant effect of the water on the gate and the weight of the cables connected to the gate.
- A. 104 C. 110
 - B. 94 D. 92
7. A tank containing water has a total weight of 80 kg when weighed. Obtain the new reading on the weighing scale if a 50 mm by 50 mm piece of wood is held vertically in the water to a depth of 600 mm.
- A. 86.0 C. 84.5
 - B. 81.5** D. 84.0
8. Evaluate the resisting capacity, in kN, against axial load due to skin friction of a concrete pile embedded

evaluate the pressure, in kPa, exerted by the water at the base of the container if the elevator is travelling downward.

- A. 4.15 C. 3.91
 - B. 4.91 D. 2.45
13. A cube, 300 mm on each side is to be held in equilibrium under water by attaching a lightweight foam buoy to it. The specific weight of the cube and foam are 20 kN/m³ and 0.81 kN/m³, respectively. Evaluate the minimum volume of the foam required, in m³. Neglect the attachments in the calculations.
- A. 0.0426 C. 0.0306
 - B. 0.0557 D. 0.0242
14. The initial void ratio of a layer of soft clay that is 6 m thick is 0.5. Under a pressure of surcharge load above it, the void ratio decreased by one-half. Evaluate the reduction in thickness of the clay layer, in meter(s).
- A. 2.50 C. 1.0
 - B. 3.50 D. 3.0
15. The sector gate shown in FIGURE H11F-1 consists of a cylindrical surface, of which AB is the trace. The length of the gate, perpendicular to the paper, is 10 m. Evaluate the total horizontal force on the gate, in kN.
- A. 1320 C. 1490
 - B. 1080 D. 1180
16. A cohesionless specimen of soil under triaxial shear test was consolidated under a chamber confining pressure of 60 kPa. The axial stress on the specimen

was then increased and failure stress occurred. Determine the angle of internal friction of the sand, in degrees. The axial stress reached 120 kPa. Estimate the angle of internal friction of the soil, in degrees.

- A. 19.5
B. 25.0
C. 35.1
D. 20.2

17. Into a bakery dough mixing chamber water enters at the rate of 200 liters per sec through pipe A. Cooking oil with specific gravity of 0.80 is forced in at 50 liters per sec through pipe B. Assuming the liquids are incompressible and form a homogeneous mixture of oil globules in water, evaluate the average velocity of the mixture leaving through pipe C of diameter 300 mm, in m/sec.

- A. 3.54
B. 3.12
C. 3.76
D. 2.14

Situation 1 - According to the elastic theory, the vertical stress induced by a flexible line load of infinite length that has an intensity of q units/length on the surface of a semi-infinite soil mass can be estimated by the expression

$$p = 0.637 q/N \text{ where } N = z[1 + (r/z)^2]^2$$

r = horizontal distance from the line of the load
 z = depth of interest at which stress is induced

A masonry wall weighing 6 kN per lineal meter is carried by a wall footing 0.60 m wide.

18. Evaluate the bearing pressure in kPa, exerted by the footing onto the supporting soil.

- A. 16
B. 14
C. 10
D. 12

19. Evaluate the stress in kPa in the soil caused by the load at a depth equal to twice the width of the footing but directly below the masonry.

- A. 5.31
B. 7.25
C. 4.43
D. 6.47

- A. 33.7
B. 22.4
C. 27.4
D. 19.8

25. Determine the angle, in degrees, of the failure plane with respect to the horizontal plane.

- A. 50.5
B. 40.6
C. 30.7
D. 61.8

26. Determine the axial stress applied to the specimen, in kPa.

- A. 242
B. 195
C. 142
D. 345

Situation 4 - In order to provide irrigation, water has to be pumped to an elevation 120 m through a 600 - mm pipe where the pressure required at the higher elevation is 172 kPa. The source of the water and the discharge point are at atmospheric pressure. Irrigation requirements dictate that water must be pumped at a rate of 1 m³/s. The loss of head due to friction and other factors is estimated to be 2.45 m.

27. Determine the velocity of the water inside the pipe for the required discharge.

- A. 3.54
B. 2.15
C. 4.22
D. 5.01

28. Determine the amount of energy, in meters, that the pump must furnish.

- A. 80.7
B. 70.6
C. 52.5
D. 61.7

29. The rating of the pump in horsepower if it is only 80% efficient.

- A. 1060
B. 1070
C. 1090
D. 1080

20. Evaluate the stress at a depth of 2 m and a horizontal distance of 3 m from the line of the load.
- A. 0.430 C. 0.668
 B. 0.531 D. 0.302

Situation 2 - An open cylindrical tank 1 - meter diameter contains water to a depth of 3.56 m.

21. If the tank is rotated about its vertical axis at a speed of 80 rpm, evaluate the least height in meters of the vessel so that no water will be spilled out of the container.
- A. 3.55 C. 3.21
 B. 3.87 D. 4.01
22. If the tank is 4 m tall and is rotated at 120 rpm, obtain how much water will be spilled out, in liters.
- A. 452 C. 434
 B. 460 D. 444
23. At 120 rpm of revolution, evaluate the gage pressure at the center of the base of the tank.
- A. 28.7 C. 31.5
 B. 38.5 D. 25.1

Situation 3 - A triaxial shear test was performed on a well-drained sand sample. The normal stress on the failure plane and the shearing stress on the failure plane were determined to be 63 kPa and 42 kPa, respectively.

Situation 5 - A right circular cylinder having a diameter of 1.00 m and weighing 900 N is held in position by an anchor block such that 0.30 m of the cylinder is below the surface of the water with its axis vertical. The anchor block has a volume of 0.50 cubic meter and weighs 24 kN per cubic meter in air. Assume sea water to have specific gravity = 1.03. Neglecting the weight and volume of the cable.

30. Evaluate the buoyant force on the cylinder for the position described, in kN.
- A. 2.38 C. 4.25
 B. 2.95 D. 2.15
31. Evaluate the tensile force in the wire for the given draft, in kN.
- A. 3.25 C. 1.95
 B. 3.95 D. 1.48
32. Evaluate the rise in the tide that will lift the anchor from the bottom of the sea, in meters.
- A. 0.425 C. 0.275
 B. 0.387 D. 0.198

Situation 6 - Given that the field unit weight of a soil sample is 1600 kg/m³, the unit weight of the soil grains 2500 kg/m³ and the moisture content of the soil is 12 percent.

33. Evaluate the void ratio of the soil sample.

- A. 0.534
B. 0.873
C. 0.750
D. 0.646

34. Evaluate the degree of saturation, in percent.

- A. 40.0
B. 42.3
C. 35.6
D. 58.6

35. Evaluate its unit weight when it becomes dry, in kN/m^3 .

- A. 15.6
B. 14.0
C. 17.3
D. 16.8

Situation 7 - A rectangular footing, 3 m x 4 m in plan, is founded 1.2 m below the ground surface for which the bulk unit weight of the soil is 20 kN/m^3 , the cohesion strength is 10 kPa, and the angle of internal friction is 20 deg. Under the condition of general shear failure, evaluate the contribution of the following to the ultimate bearing capacity, in kPa.

The ground water table is at a level that does not affect the unit weight of the soil.

Use Terzaghi's bearing capacity factors.

Use the table below:

ϕ (deg)	N_c	N_q	N_γ	ϕ (deg)	N_c	N_q	N_γ
17	14.60	5.45	2.18	43	134.58	128.58	211.58
18	15.12	6.04	2.39	44	151.95	147.74	261.80
19	15.56	6.70	2.67	45	172.28	173.28	325.34
20	17.69	7.44	3.04	46	196.22	204.19	407.11
21	18.92	8.26	3.51	47	224.55	241.86	512.84
22	20.27	9.19	4.00	48	258.29	287.85	650.67
23	21.75	10.23	4.60	49	299.71	344.63	831.99
24	23.36	11.40	5.30	50	347.50	415.24	1072.80
25	25.14	12.72	6.14				

36. Cohesion strength

- A. 259
B. 230
C. 287
D. 235

Situation 9 - A corner at the bottom of the cross section of a tank is shown in FIGURE IIIIF - 2. The tank is 2 m wide into the plane of this paper. Neglecting atmospheric pressure, evaluate

42. The total horizontal force on the corner plate AB, in kN.

- A. 444
B. 510
C. 394
D. 324

43. The total vertical force on the corner plate AB, in kN.

- A. 444
B. 510
C. 324
D. 394

44. The resultant force acting on the plate AB, in kN

- A. 394
B. 510
C. 458
D. 412

Situation 10 - After 24 hours of pumping at 50 liters/sec, the water level in an observation well at a distance 100 m from the test well is lowered 0.5 m. At another observation well located 50 m from the test well, the water level dropped by 1.0 m.

45. Estimate the rate of flow in cubic meters per day.

- A. 4320
B. 4890
C. 5130
D. 4560

46. Evaluate the coefficient of permeability of the aquifer in meters per day.

- A. 36.3
B. 20.1
C. 44.5
D. 58.3

47. Compute the transmissibility of the aquifer in square meters per day.

- A. 1140
B. 953
C. 1080
D. 1260

37. Soil overburden

- A. 185
B. 247
C. 259
D. 179

38. Footing dimension

- A. 55.0
B. 87.4
C. 95.4
D. 68.0

Situation 8 - A retaining wall 12 m has a horizontal backfill on its vertical face to its base. Under normal condition, the backfill has a water content of 10% and a void ratio of 0.5. The specific gravity of the soil grains is 2.50 and the angle of internal Rankine's theory of lateral earth pressure.

39. Evaluate the total horizontal lateral force per meter width of wall, in kN, due to the water.

- A. 600
B. 520
C. 810
D. 706

40. Evaluate the total horizontal lateral force per meter width of wall, in kN, due to the soil.

- A. 286
B. 250
C. 225
D. 220

41. How many times would the horizontal lateral force be increased if the backfill is fully saturated with rain water?

- A. 1.54
B. 1.36
C. 1.65
D. 1.06

Situation 11 - Figure SMSC-1 shows the sieve analysis of soil samples A, B and C. See chart UCS 08-1 and Figure SMSC-1.

48. Classify soil A in accordance with the Unified Soils Classification System.

- A. SM
B. SC
C. SP
D. SW

49. Classify soil B in accordance with the Unified Soils Classification System.

- A. SP
B. SC
C. SM
D. SW

50. Classify soil C in accordance with the Unified Soils Classification System.

- A. G
B. S
C. M
D. C

*** END ***

WARNING: Failure to submit your Test Questions (Complete) set will cause the cancellation of your Test-Results for the subject.

Situation 1 - Refer to Fig. SAM 18.029 and Figure RC-4. Beam DEF is supported by spandrel beams at the exterior edges and by a column at E. The torsional resistance of beams ADG and CFI are not sufficient to restrain beam DEF at D and at F.

Given:

For all beams, $b \times h = 300 \text{ mm} \times 450 \text{ mm}$

For all columns, Section = $400 \text{ mm} \times 400 \text{ mm}$

$L_1 = 8 \text{ m}$

$L_2 = 7 \text{ m}$

$S = 2.5 \text{ m}$

Dead Load, $w_d = 6.0 \text{ kPa}$ (all weights included)

Live Load, $w_l = 4.6 \text{ kPa}$

- Which of the following gives the critical negative moment (kN-m) for beam DEF?
A. 68.9 C. 60.2
B. 42.4 D. 38.8
- Which of the following gives the critical positive moment (kN-m) for beam DEF?
A. 44.3 C. 49.3
B. 38.8 D. 56.4
- Determine the critical shear force (kN) for beam DEF.
A. 43.6 C. 40.5
B. 46.6 D. 48.8

$b = 350 \text{ mm}$

Effective Cover to the Centroid of $A_s = 80 \text{ mm}$

Effective Cover to the Centroid of $A_s' = 70 \text{ mm}$

- Calculate the moment capacity (kN-m) of the section, M_u .
A. 612 C. 413
B. 431 D. 680
- Calculate the shear strength provided by the shear reinforcement, V_s .
A. 700 C. 646
B. 484 D. 525
- Calculate the nominal shear strength of the section, V_n (kN).
A. 537 C. 700
B. 880 D. 826

Situation 4 - The basic data for proportioning trial batches for normal weight concrete with an average compressive strength of 35 MPa at 28 days are as follows:

Slump	= 75 mm to 100 mm
Water-Cement ratio by weight	= 0.48
Specific gravity of cement	= 3.15
Specific gravity of coarse agg.	= 2.68
Specific gravity of fine agg.	= 2.64
Water (net mixing)	= 180 kg/m ³
Entrapped air	= 1%
Concrete unit weight	= 23.6 kN/m ³

13. What is the total axial load (kN) on a column at the second-floor level due to service LL?
 A. 82.3 C. 164.5
 B. 76.8 D. 153.6
14. What is the total axial load (kN) on a column at the ground floor level due to service LL?
 A. 268.8 C. 288.3
 B. 537.6 D. 466.3
15. What is the total dead load (kN) on a column at the ground floor level?
 A. 1864 C. 932
 B. 1682 D. 1216

Situation 6 - Refer to Fig. SCM 10.07 and Fig. SA-1. A car hit a tubular steel post at B. The post is fixed to the ground at A.

Given:

Force from the Car, P	= 175 kN
Section of the Post	= 300 mm x 300 mm
Thickness of the Post	= 12 mm
Modulus of Elasticity, E	= 200 GPa
H ₁	= 1.5 m
H ₂	= 1.0 m

16. How much is the deflection (mm) at point B?
 A. 1.53 C. 5.15
 B. 14.58 D. 4.68
17. What is the resulting displacement (mm) at point C?
 A. 23.8 C. 28.6
 B. 12.9 D. 10.3
18. What is the resulting maximum bending stress (MPa)?
 A. 645 C. 344
 B. 206 D. 387

20. Cover plates 150 mm wide x 12 mm thick are added. Which of the following gives the allowable axial load (kN)?
 A. 1404 C. 606
 B. 1635 D. 1230

21. Calculate the critical buckling load (kN) if there are no cover plates.
 A. 1725 C. 997
 B. 3990 D. 6900

Situation 8 - A 12m long beam is simply supported at the left end and is fixed at the right end. It is subjected to uniformly distributed loads.

Dead Load, w = 16.7 KN/m.
 Bending is about the major X-axis.

Given:

Section	W540 mm x 150 kg/m
Area, A	= 19,225 mm ²
Depth, d	= 540 mm.
Flange Width, b _f	= 310 mm
Web Thickness, t _w	= 12.5 mm
Flange Thickness, t _f	= 20 mm
Elastic Section Modulus, S _x	= 3.72 x 10 ⁶ mm ³
Elastic Section Modulus, S _y	= 0.66 x 10 ⁶ mm ³
Plastic Modulus, Z _x	= 4.14 x 10 ⁶ mm ³
Plastic Modulus, Z _y	= 1.01 x 10 ⁶ mm ³
Structural Steel, F _y	= 345 MPa
Modulus of Elasticity, E	= 200 GPa

22. Based on the design flexural strength of the beam, Mu, which of the following gives the maximum live load (kN/m) it can carry? Factored Load Combination, U = 1.2D + 1.6L, Resistance Factor for Flexure, phi = 0.9
 A. 59.31 C. 32.11
 B. 51.38 D. 37.07

Situation 7 - Refer to Fig. SCM 10.05 and Fig. S.10.05. Four channels welded at the tip of their flanges form a built-up column. To strengthen the column, cover plates are added at the top and at the bottom flanges.

Unsupported Column Height = 9 m

The column is braced against sidesway in both directions.

Column ends are fixed, $K = 0.5$

Given:

Section Properties of the Channel

Area, A	=	4529 mm ²
Depth, d	=	229 mm
Flange Width, b_f	=	87 mm
Flange Thickness, t_f	=	14 mm
Web Thickness, t_w	=	10 mm
Moment of Inertia, I_x	=	35.4×10^6 mm ⁴
Moment of Inertia, I_y	=	3.0×10^6 mm ⁴
Radius of Gyration, r_y	=	88.4 mm
Radius of Gyration, r_x	=	25.6 mm
Distance from the Back of the Web to the Y-axis, x	=	24.9 mm
Modulus of Elasticity, E	=	200 GPa

19. Without cover plates, which of the following gives the allowable axial load (kN) in the column?

- A. 899 C. 1141
 B. 795 D. 1045

23. Based on the design shear strength of the beam, V_u , how much is the maximum live load (kN/m) that the beam can be subjected to? Factored Load Combination, $U = 1.2D + 1.6L$, Resistance Factor for Shear, $\phi = 1.0$, Shear Stress at Factored Loads, $V_u = 0.6F_y$

- A. 186.3 C. 172.5
 B. 103.9 D. 166.3

24. Which of the following gives the maximum service live load (kN/m) on the beam based on an allowable deflection due to live load of $1/360$ of the span?

- A. 61.26 C. 107.81
 B. 62.39 D. 52.0

Situation 9 - The unsupported height of a spiral column bent in single curvature and braced against sidesway is 2.8 m. it has a diameter of 600 mm. Column ends are pinned.

Given:

Axial Loads at Service Condition

P_{DL}	=	3000 kN
P_{LL}	=	1800 kN
P_{BQ}	=	420 kN
Concrete, f_c'	=	34 MPa
Steel, f_y	=	415 MPa
Strength Reduction factor for Spiral Columns in Compression	=	0.75

$$U = 1.2D + 1.0L + 1.4E$$

25. Which of the following gives the slenderness ratio of the column?

- A. 4.7
B. 9.3
C. 18.7
D. 15.6

26. How many 32 mm bars are needed to provide a steel ratio of 2.5%?

- A. 12
B. 15
C. 18
D. 9

27. Calculate the number of 25 mm diameter bars required for the ultimate axial load.

- A. 7
B. 8
C. 6
D. 9

Situation 10 - Refer to Fig. FDNM 10.03. The pile footing supports a column 600 mm x 600 mm at the center. The piles are precast concrete with 300 mm diameter.

Given:

Net Load on the Footing at Ultimate Condition

$$P_u = 1800 \text{ kN}$$

$$M_u = 165 \text{ kN-m about the x-axis}$$

$$\text{Effective depth of the Footing} = 600 \text{ mm}$$

Dimensions:

$$a = 0.8 \text{ m}$$

$$b = 1.8 \text{ m}$$

$$c = 1.2 \text{ m}$$

$$d = 0.8 \text{ m}$$

Strength Reduction Factor

$$\text{For Shear} = 0.75$$

$$\text{For Moment} = 0.90$$

Visit For more Pdfs, Books of the following gives the nominal balanced
Pdfbooksforum.com, P_b (kN)?

Given:

The depth of the rectangular concrete compressive stress block, $a = 90.4 \text{ mm}$

- A. 2584
B. 2028
C. 954
D. 1320

33. Which of the following gives the nominal axial load (kN) that the column can carry at an eccentricity of 200 mm along the x-axis from the centroidal y-axis?

- A. 1320
B. 398
C. 796
D. 1584

Situation 12 - A simply supported steel beam spans 9 m. It carries a uniformly distributed load of 10 kN/m, beam weight already included.

Given:

Beam Properties:

$$\text{Area} = 8,530 \text{ mm}^2$$

$$\text{Depth} = 306 \text{ mm}$$

$$\text{Flange Width} = 204 \text{ mm}$$

$$\text{Flange Thickness} = 14.6 \text{ mm}$$

$$\text{Moment of Inertia, } I_x = 145 \times 10^6 \text{ mm}^4$$

$$\text{Modulus of Elasticity, } E = 200 \text{ GPa}$$

34. What is the maximum flexural stress (MPa) in the beam?

- A. 107
B. 54
C. 142
D. 71

35. To prevent excessive deflection, the beam is propped at midspan using a pipe column. Find the resulting axial stress (MPa) in the column.

Given:

28. Find the punching shear stress (MPa) around the square column.

- A. 0.556 C. 0.833
 B. 0.741 D. 0.854

29. Find the critical beam shear stress (MPa).

- A. 0.288 C. 0.333
 B. 0.384 D. 0.250

30. Find the critical design moment (kN-m).

- A. 461 C. 540
 B. 692 D. 600

Situation 11 - Details of a rectangular column are as follows:

Column width along the x-axis = 250 mm

Column depth along the y-axis = 600 mm

Reinforcement:

8 of 25 mm diameter bars distributed equally along the longer sides

10 mm diameter ties spaced at 10 mm on centers

Concrete 28th day Compressive Strength, $f_c' = 20.7$ MPa

Reinforcing Steel Yield Strength, $f_y = 415$ MPa

Assume that the compression steel yields.

31. Which of the following gives the location of the plastic centroid (mm) along the geometric centroidal x-axis from the geometric centroidal y-axis?

- A. 0 C. 100
 B. 200 D. 125

Column Properties:

Outside Diameter = 200 mm

Thickness = 10 mm

Height = 4 m

- A. 4.7 C. 18.8
 B. 9.4 D. 2.8

36. How much is the maximum bending stress (MPa) in the propped beam?

- A. 26.7 C. 15.0
 B. 17.8 D. 35.6

Situation 13 - A steel tank has diameter of 3.5 m and wall thickness of 6 mm. The tank is 4m high.

37. Determine the maximum height to which the tank may be filled with water if the allowable stress is 5 MPa.

- A. 1.75 C. 1.30
 B. 3.50 D. 0.60

38. The steel tank is subjected to an internal pressure of 0.5 MPa. Find the allowable bursting force (kN) per unit length.

- A. 175 C. 350
 B. 550 D. 481

39. The stress is limited to 12 MPa. Find the allowable internal pressure (MPa).

- A. 0.062 C. 0.028
 B. 0.041 D. 0.082

Situation 14 - Refer to Fig. SA-2. A three (3) span beam is simply supported at a, b, c, and d.

Given:

DL	=	18.0 kN/m
LL	=	11.5 kN/m
Span, l	=	8 m

Consider pattern loading of live load for maximum stresses.

40. Find the maximum reaction (kN) at c.
 A. 268.8 C. 199.8
 B. 259.6 D. 209.0
41. How much is the maximum shear (kN) at c?
 A. 145.6 C. 143.2
 B. 140.0 D. 141.6
42. Which of the following gives the maximum moment (kN-m) at c?
 A. 208.0 C. 188.8
 B. 201.1 D. 220.3

Situation 15 - A beam rests on a concrete wall 300 mm wide and with 27.5 MPa compressive strength, fc' . Refer to Fig. STCN 18.025

Given:

Beam Properties		
Depth, d	=	450 mm
Flange Width, b_f	=	190 mm
Flange Thickness, t_f	=	18 mm
Web Thickness, t_w	=	10 mm

The critical section for bending in bearing plates is at a distance k, from the centroidal Y-axis: k = 35 mm

Allowable Stresses		
Steel Yield Stress, F_y	=	248 MPa
Bearing Stress on Support, F_p	=	$0.35fc'$

Properties of the Girder:		
Area, A	=	19,226 mm ²
Depth, d	=	540 mm
Flange Width, b_f	=	312 mm
Flange Thickness, t_f	=	20 mm
Web Thickness, t_w	=	12 mm
Elastic Section Modulus, S_x	=	3.72×10^6 mm ³
Plastic Section Modulus, Z_x	=	4.14×10^6 mm ³
R_t	=	83 mm
Steel Yield Stress, F_y	=	344 MPa
C_u	=	1.0

Factored Load, $U = 1.2D + 1.6L$

46. The compression flange of the girder is supported only at midspan. Which of the following gives the allowable flexural stress, F_b (MPa)?
 A. 206 C. 227
 B. 188 D. 144
47. How much is the flexural stress (MPa) at service loads?
 A. 165 C. 149
 B. 107 D. 119
48. What is the maximum flexural stress (MPa) at ultimate load?
 A. 119 C. 107
 B. 149 D. 165

Situation 17 - Refer to Fig. SMN 10.11. The stresses in a bar subjected to uniaxial stress is plotted as shown.

49. Find the area (cm²) of the bar if it is acted on by a tensile force of 120 kN.
 A. 30.0 C. 10.0
 B. 7.5 D. 15.0
50. Find the normal stress (MPa) on a plane inclined at 25 degrees from the horizontal.
 A. 3.8 C. 25.7
 B. 14.3 D. 9.4

Bending Stress on Plate, F_b =
Beam End Reaction =

0.75 F_y
240 kN

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51. Find the shear stress (MPa) on a plane inclined at 25 degrees from the direction of loading.

- A. 16.9
B. 30.6
C. 25.7
D. 14.3

43. Determine the required length of bearing plate (mm) if the width is 250 mm.

- A. 100
B. 400
C. 200
D. 300

44. Using a bearing plate with dimensions 250 mm wide x 200 mm length along the wall, determine the required bearing plate thickness (mm).

- A. 25
B. 32
C. 36
D. 28

45. Determine the web yielding stress (MPa) which occurs at a distance $(N + 2.5k)$ where N is the length of the bearing plate. The bearing plate is 250 mm wide x 200 mm long along the wall.

- A. 166
B. 128
C. 144
D. 83

Situation 16 - A simply supported girder spans 10 m. It carries the following service loads at midspan:

Total Dead Load, D = 82 kN
Live Load, L = 77 kN

Given:

Situation 18 - Refer to Fig. SAM 10.06.

Given:

W_1 = 200 kN/m
 W_2 = 300 kN/m
 L_1 = 2 m
 L_2 = 3 m
 L_3 = 2 m

52. Calculate the total length, L (m), so that the resulting stress, q , is uniform.

- A. 10
B. 9
C. 12
D. 8

53. Which of the following gives the location (m) of the maximum shear from the left end?

- A. 4.0
B. 6.0
C. 5.0
D. 4.5

54. Which of the following gives the location (m) of the point of inflection from the left end?

- A. 1.24
B. 6.28
C. 5.16
D. 3.20

Situation 19 - Refer to Fig. EMM 15.37. Flexible cables and DE brace the truss at its central panel.

Given: $h = 4$ m
 $s = 3$ m
 $W = 30$ kN

55. Find the resulting force in member CD (kN).
A. 15.0 T C. 7.5 C
B. 7.5 T D. 15.0 C
56. Find which diagonal is acting and the force (kN) in it.
A. 12.5 CF C. 25.0 DE
B. 12.5 DE D. 25.0 CF
57. What is the resulting force in member BD (kN)?
A. 25.0 C C. 12.5 T
B. 25.0 T D. 12.5 C

Situation 20 - A simply supported beam has a span of 12 m. The beam carries a total uniformly distributed load of 21.5 kN/m.

58. To prevent excessive deflection, a support is added at midspan. Calculate the resulting moment (kN-m) at the added support.
A. 64.5 C. 258.0
B. 96.8 D. 86.0
59. Calculate the resulting maximum positive moment (kN-m) when a support is added at midspan.
A. 96.75 C. 108.84
B. 54.42 D. 77.40
60. Calculate the reaction (kN) at the added support.
A. 48.38 C. 258.0
B. 96.75 D. 80.62

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Normal Vertical Load, $P = 540$ kN

Resisting Moment = 1,080 kN-m

The footing width is 4 m. How much is the allowable overturning moment (kN-m) such that there will be no tensile stress in the footing?

- A. 360 C. 720
B. 540 D. 1080

66. Given:
Resisting Moment = 945 kN-m
Overturning Moment = 315 kN-m
Total Vertical Load = 450 kN
Footing width = 4.2 m
Which of the following gives the maximum soil pressure (MPa)?
A. 214 C. 107
B. 161 D. 321

Situation 23 - Refer to Fig. SA-1. A cantilever beam, 3.5 m long, carries a concentrated load, P , at mid-length.

Given:
 $P = 200$ kN
Beam Modulus of Elasticity, $E = 200$ GPa
Beam Moment of Inertia, $I = 60.8 \times 10^6$ mm⁴

67. How much is the deflection (mm) at midlength?
A. 1.84 C. 23.50
B. 29.40 D. 14.70
68. What force (kN) should be applied at the free end to prevent deflection?
A. 7.8 C. 62.5
B. 41.7 D. 100.0
69. To limit the deflection at mid-length to 9.5 mm, how much force (kN) should be applied at the free end?

Situation 21 - Figure EMN 12.31 shows the archer aiming to release the arrow. As the archer pulls the cord with his right arm, he applies a force of 540 N with his left arm.

Given:

a	=	200 mm
b	=	300 mm
c	=	300 mm

61. Calculate the resulting tension in the upper cord.
 A. 309
 B. 487
 C. 270
 D. 556
62. Calculate the resulting tension in the lower cord.
 A. 487
 B. 556
 C. 270
 D. 309
63. How much force (N) does the archer exert with his right arm?
 A. 540
 B. 259
 C. 270
 D. 518

Situation 22 - A 300 mm thick concrete wall is to be centrally located on a footing. The allowable soil bearing pressure is 192 kPa.

64. The footing is to be designed for a moment of 160 kN-m and a total vertical load of 320 kN. What should be the minimum footing width (m) to prevent uplift?
 A. 3.00
 B. 2.25
 C. 1.90
 D. 1.50

Situation 24 - Refer to Fig. STCNM 10.020

Given:

W	=	2.4 kN
L1	=	1.2 m
L2	=	1.2 m
L3	=	1.2 m
Strut BC	=	75 mm wide x 10 mm thick
Bar AD	=	100 mm wide x 10 mm thick
Allowable bolt shear stress	=	68 MPa

70. Which of the following gives the stress in strut BC (MPa)?
 A. 3.2
 B. 6.4
 C. 4.8
 D. 9.0
71. Which of the following gives the required minimum bolt diameter (mm) at C?
 A. 16
 B. 12
 C. 10
 D. 18
72. The bolt at A has a diameter of 20 mm. Which of the following gives the resulting bolt stress (MPa)?
 A. 45.8
 B. 15.3
 C. 21.5
 D. 30.6

Situation 25 - Refer to Fig. EMN 12-27. The tower shown is subjected to three forces as follows:

$$F_1 = 4 \text{ kN}$$

$$F_2 = 6 \text{ kN}$$

$$F_3 = 6 \text{ kN}$$

Given: $a = 5.8 \text{ m}$

$$b = 3.2 \text{ m}$$

$$c = 4.8 \text{ m}$$

$$d = 2.0 \text{ m}$$

73. Which of the following gives the resultant reaction at B (kN)?

A. 11.5

C. 18.0

B. 16.0

D. 8.3

74. Which of the following gives the force in member AC (kN)?

A. 12.87 T

C. 12.87 C

B. 9.25 C

D. 9.25 T

75. Which of the following gives the force in member GE (kN)?

A. 5.50 T

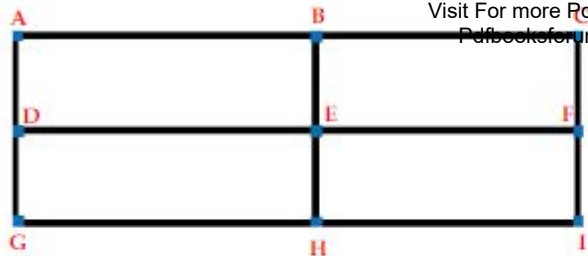
C. 2.75 T

B. 5.50 C

D. 2.75 C

*** END ***

WARNING: Failure to submit your Test Questions (Complete) set will cause the cancellation of your Test-Results for the subject.



SAM 18.029

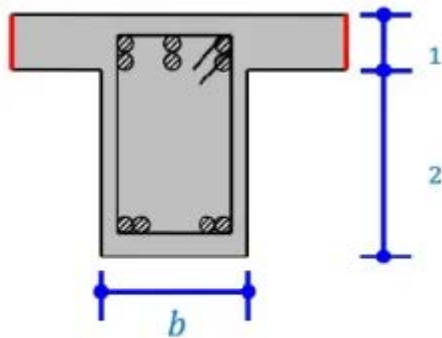


Fig. CBM 10.13

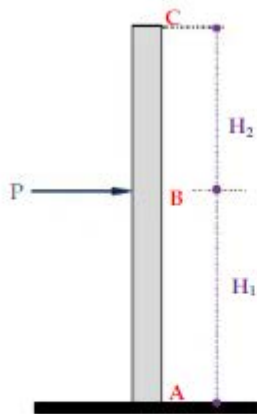


Fig. SCM 10.07

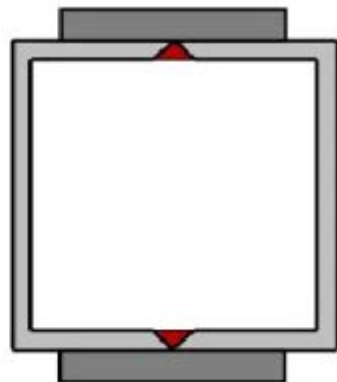


Fig. SCM 10.05

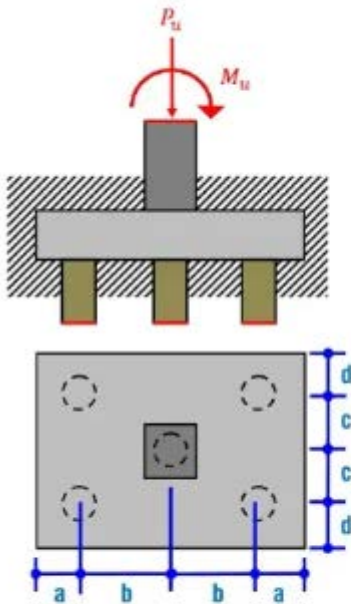


Fig. FDNM 10.03

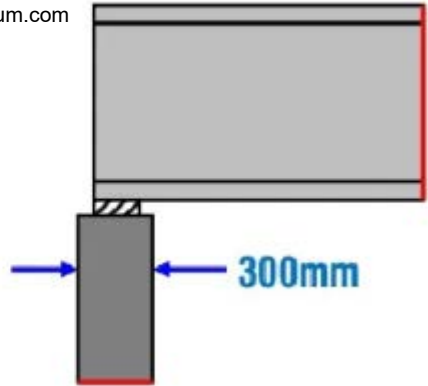


Fig. STCN 18.025

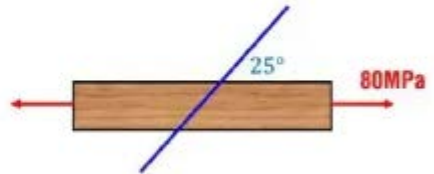


Fig. SMN 10.11

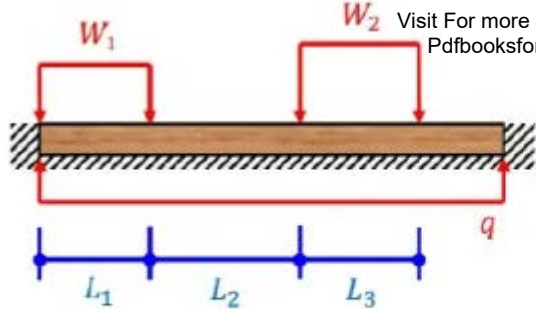


Fig. SAM 10.06

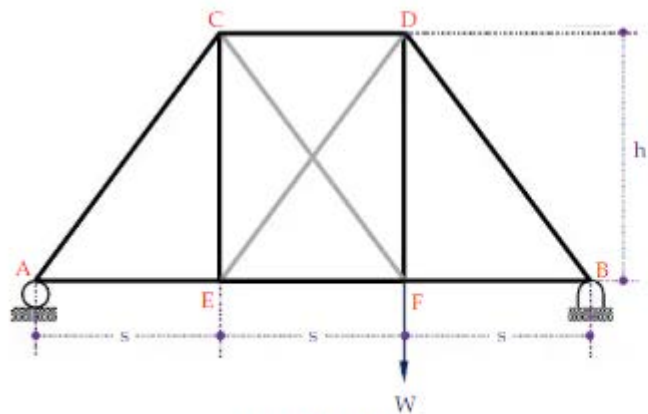


Fig. EMM 15.37

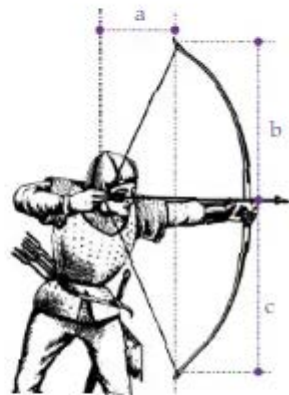


Fig. EMN 12.31

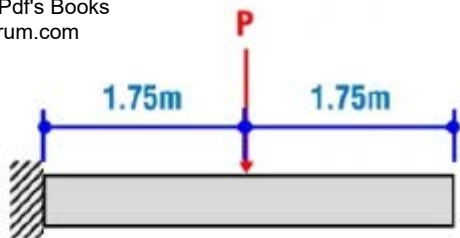


Fig. SA-1

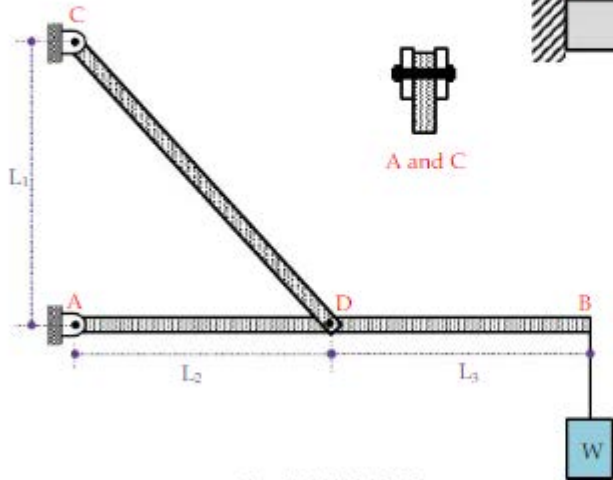


Fig. STCNM 10.020

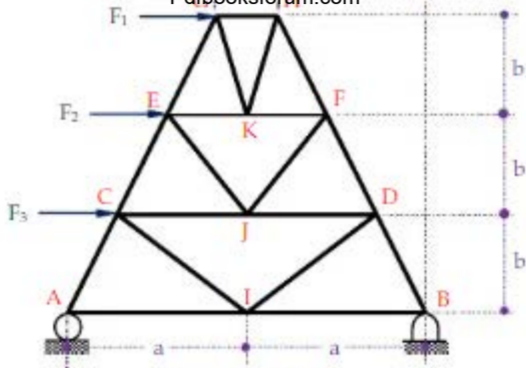


Figure EMN 12.27

NSCP 408.4.3. As an alternate to frame analysis, the following approximate moments and shears shall be permitted to be used in design of continuous beams and one-way slabs (slabs reinforced to resist flexural stresses in only one direction), provided:

1. There are two or more spans,
2. Spans are approximately equal, with the larger of two adjacent clear spans not greater than the shorter by more than 20 percent,
3. Loads are uniformly distributed,
4. Unit live load does not exceed three times unit dead load, and
5. Members are prismatic.

POSITIVE MOMENT

End spans:

Discontinuous end unrestrained..... $w_u l_n^2/11$

Discontinuous end integral with support..... $w_u l_n^2/14$

Interior spans..... $w_u l_n^2/16$

NEGATIVE MOMENT

at exterior face of first interior support

Two spans..... $w_u l_n^2/9$

More than two spans..... $w_u l_n^2/10$

at other faces of interior supports..... $w_u l_n^2/11$

at interior face of exterior supports

for members built integrally with supports

Where support is a spandrel beam..... $w_u l_n^2/24$

When support is a column..... $w_u l_n^2/16$

SHEAR

at face of first interior support..... $1.15w_u l_n/2$

Shear at face of all other supports..... $w_u l_n/2$