CE - 2017

EE25BTECH11043 - Nishid Khandagre

SESSION - 1

1. The matrix P is the inverse of a matrix Q. If I denotes the identity matrix, which one of the following options is correct? (GATE-CE 2017)

   (a) $PQ = I$ but $QP \neq I$
   (c) $PQ = I$ and $QP = I$
   (b) $QP = I$ but $PQ \neq I$
   (d) $PQ - QP = I$

2. The number of parameters in the univariate exponential and Gaussian distributions, respectively, are (GATE-CE 2017)

   (a) 2 and 2 (b) 1 and 2 (c) 2 and 1 (d) 1 and 1

3. Let x be a continuous variable defined over the interval $(-\infty, \infty)$, and $\mathrm{f}(x) = \mathrm{e}^{-x-e^{-x}}$. The integral $g(x) = \int f(x)\,dx$ is equal to (GATE-CE 2017)

   (a) $\mathrm{e}^{e^{-x}}$
   (c) $\mathrm{e}^{-e^{x}}$
   (b) $\mathrm{e}^{-e^{-x}}$
   (d) e^{-x}

4. An elastic bar of length L, uniform cross sectional area A, coefficient of thermal expansion α , and Young's modulus E is fixed at the two ends. The temperature of the bar is increased by T, resulting in an axial stress σ. Keeping all other parameters unchanged, if the length of the bar is doubled, the axial stress would be (GATE-CE 2017)

(a) σ (b) 2σ (c) 0.5σ (d) $0.25\,\alpha\sigma$

5. A simply supported beam is subjected to a uniformly distributed load. Which one of the following statements is true? (GATE-CE 2017)

   (a) Maximum or minimum shear force occurs where the curvature is zero.

   (b) Maximum or minimum bending moment occurs where the shear force is zero.

   (c) Maximum or minimum bending moment occurs where the curvature is zero.

   (d) Maximum bending moment and maximum shear force occur at the same section.

6. According to IS 456 - 2000, which one of the following statements about the depth of neutral axis $X_{u,bal}$ for a balanced reinforced concrete section is correct? (GATE-CE 2017)

   (a) $X_{u,bal}$ depends on the grade of concrete only.

   (b) $X_{u,bal}$ depends on the grade of steel only.

   (c) $X_{u,bal}$ depends on both the grade of concrete and grade of steel.

   (d) $X_{u,bal}$ does not depend on the grade of concrete and grade of steel.

7. The figure shows Fig. 31 a two-hinged parabolic arch of span L subjected to a uniformly distributed load of intensity q per unit length.

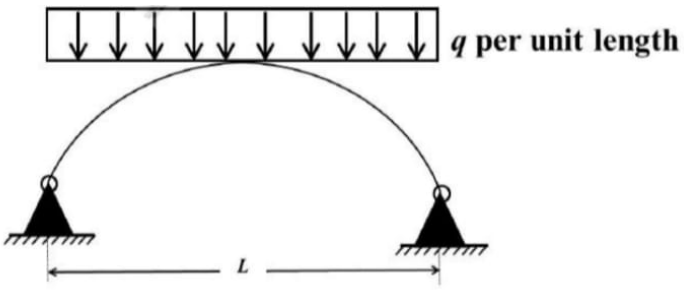

Figure 7:

The maximum bending moment in the arch is equal to (GATE-CE 2017)

(a) $\frac{qL^2}{8}$ (b) $\frac{qL^2}{12}$ (c) zero (d) $\frac{qL^2}{10}$

8. Group I lists the type of gain or loss of strength in soils. Group II lists the property or process responsible for the loss or gain of strength in soils. (GATE-CE 2017)

Group-I	**Group-II**
P. Regain of strength with time	1. Boiling
Q. Loss of strength due to cyclic loading	2. Liquefaction
R. Loss of strength due to upward seepage	3. Thixotropy
S. Loss of strength due to remolding	4. Sensitivity

The correct match between Group I and Group II is

(a) P-4, Q-1, R-2, S-3

(b) P-3, Q-1, R-2, S-4

(c) P-3, Q-2, R-1, S-4

(d) P-4, Q-2, R-1, S-3

9. A soil sample is subjected to a hydrostatic pressure, σ. The Mohr circle for any point in the soil sample would be (GATE-CE 2017)

(a) a circle of radius σ and center at the origin

(b) a circle of radius σ and center at a distance σ from the origin

(c) a point at a distance σ from the origin

(d) a circle of diameter σ and center at the origin

10. A strip footing is resting on the ground surface of a pure clay bed having an undrained cohesion c_u. The ultimate bearing capacity of the footing is equal to (GATE-CE 2017)

(a) $2\pi c_u$ (b) πc_u (c) $(\pi + 1)\, c_u$ (d) $(\pi + 2)\, c_u$

11. A uniformly distributed line load of 500 kN/m is acting on the ground surface. Based on Boussinesq's theory, the ratio of vertical stress at a depth 2 m to that at 4 m, right below the line of loading, is (GATE-CE 2017)

(a) 0.25 (b) 0.5 (c) 2.0 (d) 4.0

12. For a steady incompressible laminar flow between two infinite parallel stationary plates, the shear stress variation is (GATE-CE 2017)

    (a) linear with zero value at the plates

    (b) linear with zero value at the center

    (c) quadratic with zero value at the plates

    (d) quadratic with zero value at the center

13. The reaction rate involving reactants A and B is given by $-k[A]^{\alpha}[B]^{\beta}$. Which one of the following statements is valid for the reaction to be a first-order reaction? (GATE-CE 2017)

    (a) $\alpha = 0$ and $\beta = 0$ (c) $\alpha = 1$ and $\beta = 1$

    (b) $\alpha = 1$ and $\beta = 0$ (d) $\alpha = 1$ and $\beta = 2$

14. The wastewater from a city, containing a high concentration of biodegradable organics, is being steadily discharged into a flowing river at a location S. If the rate of aeration of the river water is lower than the rate of degradation of the organics, then the dissolved oxygen of the river water (GATE-CE 2017)

    (a) is lowest at the location S.

    (b) is lowest at a point upstream of the location S.

    (c) remains constant all along the length of the river.

    (d) is lowest at a point downstream of the location S.

15. Which one of the following is NOT present in the acid rain? (GATE-CE 2017)

    (a) HNO_3 (b) H_2SO_4 (c) H_2CO_3 (d) CH_3COOH

16. A super-elevation e is provided on a circular horizontal curve such that a vehicle can be stopped on the curve without sliding. Assuming a design speed v and maximum coefficient of side friction f_{max}, which one of the following criteria should be satisfied? (GATE-CE 2017)

(a) $e \leq f_{max}$

(b) $e > f_{max}$

(c) no limit on e can be set

(d) $e = \frac{1-(f_{max})^2}{f_{max}}$

17. A runway is being constructed in a new airport as per the International Civil Aviation Organization (ICAO) recommendations. The elevation and the airport reference temperature of this airport are 535 m above the mean sea level and 22.65°C, respectively. Consider the effective gradient of runway as 1%. The length of runway required for a design-aircraft under the standard conditions is 2000 m. Within the framework of applying sequential corrections as per the ICAO recommendations, the length of runway corrected for the temperature is (GATE-CE 2017)

(a) 2223 m (b) 2250 m (c) 2500 m (d) 2750 m

18. The accuracy of an Electronic Distance Measuring Instrument (EDMI) is specified as $\pm(amm + bppm)$. Which one of the following statements is correct? (GATE-CE 2017)

(a) Both a and b remain constant, irrespective of the distance being measured.

(b) a remains constant and b varies in proportion to the distance being measured.

(c) a varies in proportion to the distance being measured and b remains constant.

(d) Both a and b vary in proportion to the distance being measured.

19. The number of spectral bands in the Enhanced Thematic Mapper sensor on the remote sensing satellite Landsat-7 is (GATE-CE 2017)

(a) 64 (b) 10 (c) 8 (d) 15

20. Consider the following partial differential equation:

$$3\frac{\partial^2\phi}{\partial x^2} + B\frac{\partial^2\phi}{\partial x \partial y} + 3\frac{\partial^2\phi}{\partial y^2} + 4\phi = 0 \quad (1)$$

For this equation to be classified as parabolic, the value of B^2 must be _____ (GATE-CE 2017)

21.

$$\lim_{x \to 0} \left(\frac{\tan x}{x^2 - x} \right) \tag{2}$$

is equal to _____ (GATE-CE 2017)

22. A 3 m thick clay layer is subjected to an initial uniform pore pressure of 145 kPa as shown in the figure Fig. 22

Figure 22:

For the given ground conditions, the time (in days, rounded to the nearest integer) required for 90% consolidation would be _____(GATE-CE 2017)

23. A triangular pipe network is shown in the figure Fig. 23

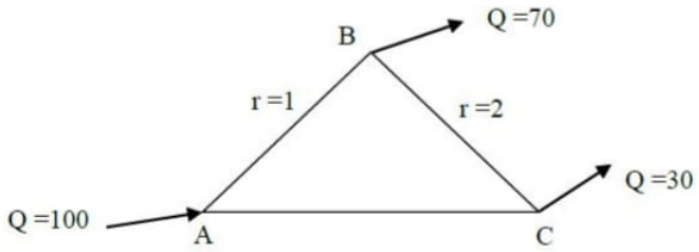

Figure 23:

The head loss in each pipe is given by $h_f = rQ^{1.8}$, with the variables expressed in a consistent set of units. The value of r for the pipe AB is 1 and

for the pipe BC is 2. If the discharge supplied at the point A (i.e., 100) is equally divided between the pipes AB and AC, the value of r (up to two decimal places) for the pipe AC should be _____ (GATE-CE 2017)

24. The ordinates of a 2-hour unit hydrograph for a catchment are given as:

Time (h)	0	1	2	3	4
Ordinate (m^3/s)	0	5	12	25	41

The ordinate (in m^3/s) of a 4-hour unit hydrograph for this catchment at the time of 3 h would be _____ (GATE-CE 2017)

25. Vehicles arriving at an intersection from one of the approach roads follow the Poisson distribution. The mean rate of arrival is 900 vehicles per hour. If a gap is defined as the time difference between two successive vehicle arrivals (with vehicles assumed to be points), the probability (up to four decimal places) that the gap is greater than 8 seconds is _____ (GATE-CE 2017)

26. For the function $f(x) = a + bx$, $0 \leq x \leq 1$, to be a valid probability density function, which one of the following statements is correct? (GATE-CE 2017)

(a) a = 1, b = 4
(b) a = 0.5, b = 1
(c) a = 0, b = 1
(d) a = 1, b = -1

27. The solution of the equation $\frac{dQ}{dt} + Q = 1$ with $Q = 0$ at $t = 0$ is (GATE-CE 2017)

(a) $Q(t) = e^{-t} - 1$
(b) $Q(t) = 1 + e^{-t}$
(c) $Q(t) = 1 - e^{t}$
(d) $Q(t) = 1 - e^{-t}$

28. Consider the matrix $\begin{pmatrix} 5 & -1 \\ 4 & 1 \end{pmatrix}$. Which one of the following statements is TRUE for the eigenvalues and eigenvectors of this matrix? (GATE-CE 2017)

(a) Eigenvalue 3 has a multiplicity of 2, and only one independent eigenvector exists.

(b) Eigenvalue 3 has a multiplicity of 2, and two independent eigenvectors exist.

(c) Eigenvalue 3 has a multiplicity of 2, and no independent eigenvector exists.

(d) Eigenvalues are 3 and -3, and two independent eigenvectors exist.

29. A planar truss tower structure is shown in the figure Fig. 29

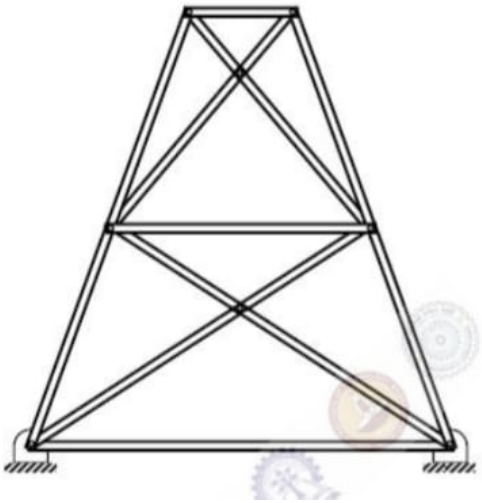

Figure 29:

Consider the following statements about the external and internal determinacies of the truss:

(a) Externally Determinate

(b) External Static Indeterminacy = 1

(c) External Static Indeterminacy = 2

(d) Internally Determinate

(e) Internal Static Indeterminacy = 1

(f) Internal Static Indeterminacy = 2

Which one of the following options is correct? (GATE-CE 2017)

(a) P-False; Q-True; R-False; S-False; T-False; U-True

(b) P-False; Q-True; R-False; S-False; T-True; U-False

(c) P-False; Q-False; R-True; S-False; T-False; U-True

(d) P-True; Q-True; R-False; S-True; T-False; U-True

30. Group I contains three broad classes of irrigation supply canal outlets. Group II presents hydraulic performance attributes. The correct match of the items in Group I with the items in Group II is (GATE-CE 2017)

Group-I	**Group-II**
P. Non-modular outlet	1. Outlet discharge depends on the water levels in both the supply canal and the receiving water course
Q. Semi-modular outlet	2. Outlet discharge is fixed and is independent of the water levels
R. Modular outlet	3. Outlet discharge depends only on the water level in the supply canal

The correct match of the items in Group I and Group II

(a) P-1; Q-2; R-3

(b) P-3; Q-1; R-2

(c) P-2; Q-3; R-1

(d) P-1; Q-3; R-2

31. A 1 m wide rectangular channel has a bed slope of 0.0016 and the Manning's roughness coefficient is 0.04. Uniform flow takes place in the channel at a flow depth of 0.5 m. At a particular section, gradually varied flow (GVF) is observed and the flow depth is measured as 0.6 m. The GVF profile at that section is classified as (GATE-CE 2017)

(a) S_1 (b) S_2 (c) M_1 (d) M_2

32. The following observations are made while testing aggregate for its suitability in pavement construction:

(a) Mass of oven-dry aggregate in air = 1000 g

(b) Mass of saturated surface-dry aggregate in air = 1025 g

(c) Mass of saturated surface-dry aggregate under water = 625 g

Based on the above observations, the correct statement is _____
(GATE-CE 2017)

(a) bulk specific gravity = 2.5 and water absorption = 2.5%

(b) bulk specific gravity = 2.5 and water absorption = 2.4%

(c) apparent specific gravity = 2.5 and water absorption = 2.5%

(d) apparent specific gravity = 2.5 and water absorption = 2.4%

33. The queue length (in number of vehicles) versus time (in seconds) plot for an approach to a signalized intersection with the cycle length of 96 seconds is shown in the figure Fig. 33

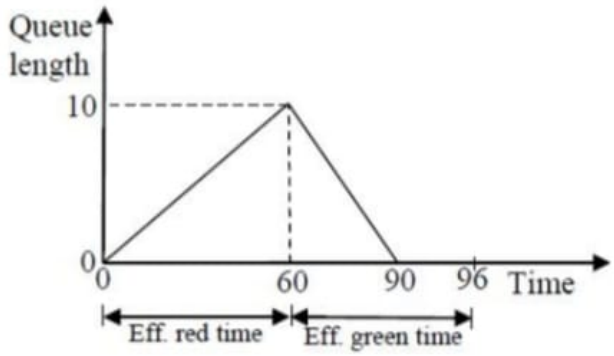

Figure 33:

At time $t = 0$, the light has just turned red. The effective green time is 36 seconds, during which vehicles discharge at the saturation flow rate, s (in vph). Vehicles arrive at a uniform rate, v (in vph), throughout the cycle. Which one of the following statements is TRUE? (GATE-CE 2017)

(a) $v = 600vph$,and for this cycle,the average stopped delay per vehicle = 30 sec

(b) $s = 1800vph$,and for this cycle,the average stopped delay per vehicle = 28.125 sec

(c) $v = 600vph$,and for this cycle,the average stopped delay per vehicle = 45 sec

(d) $s = 1200vph$,and for this cycle,the average stopped delay per vehicle = 28.125 sec

34. The radius of a horizontal circular curve on a highway is 120 m. The design speed is 60 km/hour, and the design coefficient of lateral friction between the tyre and the road surface is 0.15. The estimated value of superelevation required (if full lateral friction is assumed to develop), and the value of coefficient of friction needed (if no superelevation is provided) will, respectively, be (GATE-CE 2017)

(a) $\frac{1}{11.6}$ and 0.10

(b) $\frac{1}{10.5}$ and 0.37

(c) $\frac{1}{11.6}$ and 0.24

(d) $\frac{1}{12.9}$ and 0.24

35. The observed bearings of a traverse are given below:

Line	Bearing	Line	Bearing
PQ	46°15′	QP	226°15′
QR	108°15′	RQ	286°15′
RS	201°30′	SR	20°30′
ST	321°45′	TS	141°45′

The stations most likely to be affected by the local attraction is/are (GATE-CE 2017)

(a) Only R (b) Only S (c) R and S (d) P and Q

36. The laboratory tests on a soil sample yields the following results: natural moisture content = 18%, liquid limit = 60%, plastic limit = 25%, percentage of clay sized fraction = 25%. The liquidity index and activity (as per the expression proposed by Skempton) of the soil, respectively, are (GATE-CE 2017)

(a) -0.2 and 1.4

(b) 0.2 and 1.4

(c) -1.2 and 0.714

(d) 1.2 and 0.714

37. Consider the equation $\frac{du}{dt} = 3t^2 + 1$ with $u = 0$ at $t = 0$. This is numerically solved by using the forward Euler method with a step size, $\Delta t = 2$. The absolute error in the solution at the end of the first time step is _____ (GATE-CE 2017)

38. A pre-tensioned rectangular concrete beam 150 mm wide and 300 mm depth is prestressed with three straight tendons, each having a cross-sectional area of 50 mm^2, to an initial stress of 1200 N/mm^2. The tendons are located at 100 mm from the soffit of the beam. If the modular ratio is 6, the loss of prestressing force (in kN, up to one decimal place) due to the elastic deformation of concrete only is _____ (GATE-CE 2017)

39. Consider the stepped bar made with a linear elastic material and subjected to an axial load of 1 kN, as shown in the figure Fig. 39

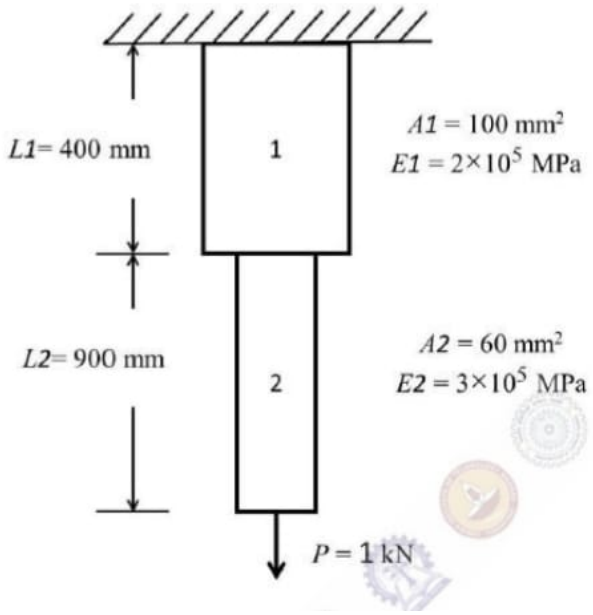

Figure 39:

Segments 1 and 2 have cross-sectional area of 100 mm^2 and 60mm^2 Young's

modulus of 2×10^5 MPa and 3×10^5 MPa, and length of 400 mm and 900 mm. respectively. The strain energy (in N-mm, up to one decimal place) in the bar due to the axial load is _____ (GATE-CE 2017)

40. The value of M in the beam ABC shown in the figure Fig. 40 is such that the joint B does not rotate.

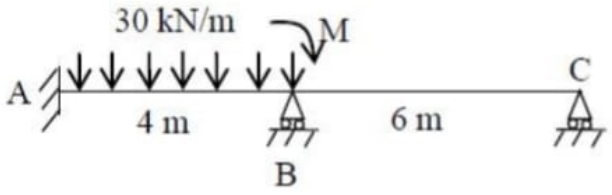

Figure 40:

The value of support reaction (in kN) at B should be equal to _____ (GATE-CE 2017)

41. Consider the beam ABCD shown in the figure Fig. 41

Figure 41:

For a moving concentrated load of 50 kN on the beam, the magnitude of the maximum bending moment (in kN-m) obtained at the support C will be equal to _____ (GATE-CE 2017)

42. Consider two axially loaded columns, namely, 1 and 2, made of a linear elastic material with Young's modulus 2×10^5 MPa, square cross-section with side 10 mm, and length 1 m. For Column 1, one end is fixed and the other end is free. For Column 2, one end is fixed and the other end is pinned.

Based on the Euler's theory, the ratio (up to one decimal place) of the buckling load of Column 2 to the buckling load of Column 1 is _____ (GATE-CE 2017)

43. A column is subjected to a load through a bracket as shown in the figure Fig. 43

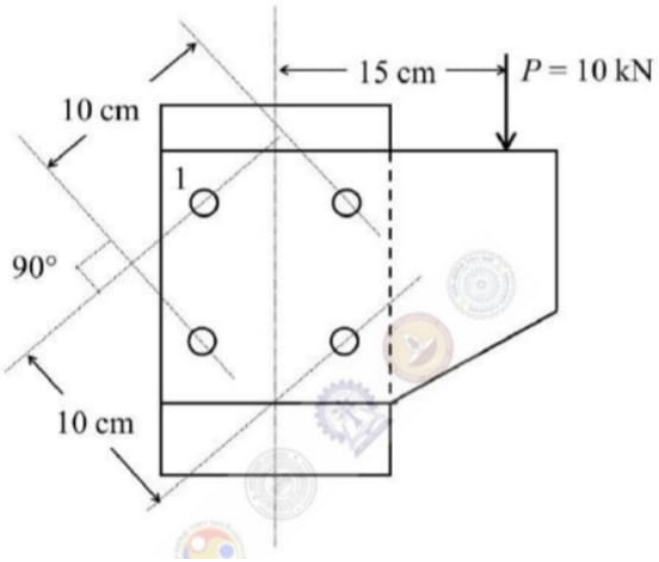

Figure 43:

The resultant force (in kN, up to one decimal place) in the bolt 1 is _____ (GATE-CE 2017)

44. A particle of mass 2 kg is travelling at a velocity of 1.5 m/s. A force $f(t) = 3t^2$ (in N) is applied to it in the direction of motion for a duration of 2 seconds, where t denotes time in seconds. The velocity (in m/s, up to one decimal place) of the particle immediately after the removal of the force is _____ (GATE-CE 2017)

45. The activity details of a project are given below:

Activity	Depends on	Duration (in days)
P	–	6
Q	P	15
R	Q, T	12
S	R	16
T	P	10
U	Q, T	14
V	U	16

The estimated minimum time (in days) for the completion of the project will be _____ (GATE-CE 2017)

46. It is proposed to drive H-piles up to a depth of 7 m at a construction site. The average surface area of the H-pile is 3 m^2 per meter length. The soil at the site is homogeneous sand, having an effective friction angle of 32°. The ground water table (GWT) is at a depth of 2 m below the ground surface. The unit weights of the soil above and below the GWT are 16 kN/m^3 and 19 kN/m^3, respectively. The total axial frictional resistance (in kN, up to one decimal place) mobilized on the pile against the driving is _____ (GATE-CE 2017)

47. The infinite sand slope shown in the figure Fig. 47 is on the verge of sliding failure. The ground water table coincides with the ground surface. Unit weight of water $\gamma_w = 9.81 kN/m^3$

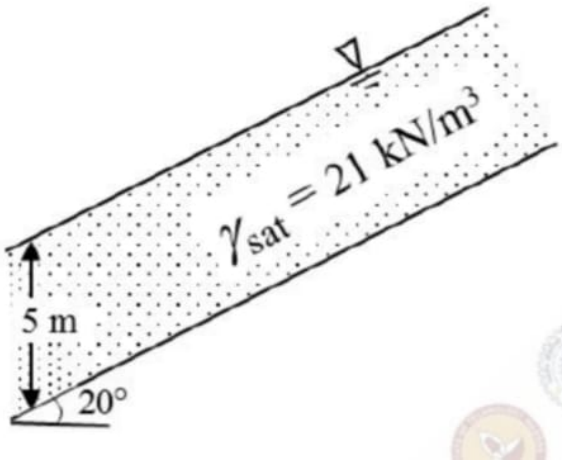

Figure 47:

The value of the effective angle of internal friction (in degrees, up to one decimal place) of the sand is _____ (GATE-CE 2017)

48. A sluice gate used to control the flow in a horizontal channel of unit width is shown in the figure Fig. 48

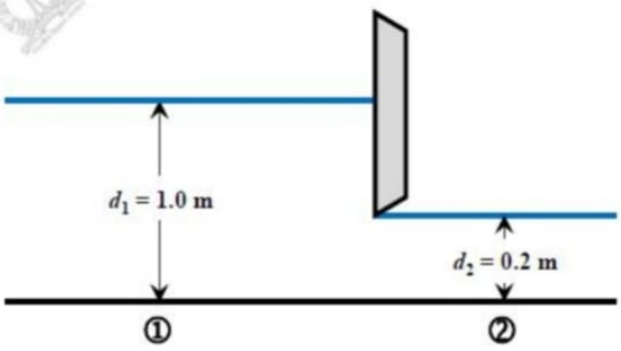

Figure 48:

It is observed that the depth of flow is 1.0 m upstream of the gate, while the depth is 0.2 m downstream of the gate. Assuming a smooth flow transition across the sluice gate without any energy loss, and the acceleration due to

gravity as 10 m/s^2, the discharge (in m^3/s, up to two decimal places) passing under the sluice gate is _____ (GATE-CE 2017)

49. Water flows through a 90° bend in a horizontal plane as depicted in the figure Fig. 49

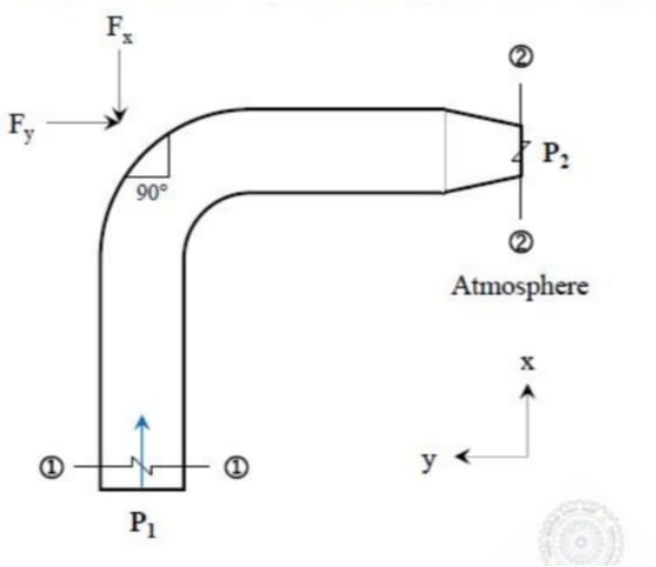

Figure 49:

A pressure of 140 kPa is measured at Section 1-1. The inlet diameter marked at Section 1-1 is $27/\sqrt{\pi}$cm, while the nozzle diameter marked at Section 2-2 is $14/\sqrt{\pi}$cm. Assume the following:

(i) Acceleration due to gravity = 10m/s^2

(ii) Weights of both the bent pipe segment as well as water are negligible

(iii) Friction across the bend is negligible.

The magnitude of the force (in kN, up to two decimal places) that would be required to hold the pipe section is _____ (GATE-CE 2017)

50. A consolidated undrained (CU) triaxial compression test is conducted on a normally consolidated clay at a confining pressure of 100 kPa. The deviator stress at failure is 80 kPa, and the pore-water pressure measured at failure is 50 kPa. The effective angle of internal friction (in degrees, up to one decimal place) of the soil is _____ (GATE-CE 2017)

51. An effective rainfall of 2-hour duration produced a flood hydrograph peak of 200 m^3/s. The flood hydrograph has a base flow of 20 m^3/s. If the spatial average rainfall in the watershed for the duration of storm is 2 cm and the average loss rate is 0.4 cm/hour, the peak of 2-hour unit hydrograph (in m^3/s-cm, up to one decimal place) is _____ (GATE-CE 2017)

52. The equivalent sound power level (in dB) of the four sources with the noise levels of 60 dB, 69 dB, 70 dB and 79 dB is _____ (GATE-CE 2017)

53. The spherical grit particles, having a radius of 0.01 mm and specific gravity of 3.0, need to be separated in a settling chamber. it is given that

    (a) g = 9.81 m/s^2
    (b) the density of the liquid in the settling chamber = 1000 kg/m^3
    (c) the kinematic viscousity of the liquid in the settling chamber = 10^{-6} m^2/s

    Assuming laminar conditions, the settling velocity (in mm/s, up to one decimal place) is _____ (GATE-CE 2017)

54. Two wastewater streams A and B, having an identical ultimate BOD are getting mixed to form the stream C. The temperature of the stream A is 20° and the temperature of the stream C is 10°. The 5-day BOD (in mg/l, up to one decimal place) of the stream C, calculated at 10°C, is _____ (GATE-CE 2017)

55. The wastewater having an organic concentration of 54 mg/l is flowing at a steady rate of 0.8 m^3/day through a detention tank of dimensions 2 m × 4 m × 2 m. If the contents of the tank are well mixed and the decay constant is 0.1 per day, the outlet concentration (in mg/l, up to one decimal place) is _____ (GATE-CE 2017)

56. The bacteria in milk are destroyed when it _____ heated to 80° Celsius. (GATE-CE 2017)

    (a) would be (b) will be (c) is (d) was

57. _____ with someone else's email account is now a very serious offence. (GATE-CE 2017)

(a) Involving (b) Assisting (c) Tampering (d) Incubating

58. Consider the following sentences: All benches are beds. No bed is a bulb. Some bulbs are lamps. Which of the following can be inferred? (GATE-CE 2017)

a)Some beds are lamps.
b)Some lamps are beds.

(a) only i
(b) only ii
(c) both i and ii
(d) neither i not ii

59. If the radius of a right circular cone is increased by 50%, its volume increases by _____ (GATE-CE 2017)

(a) 75% (b) 100% (c) 125% (d) 237.5%

60. The following sequence of numbers is arranged in increasing order: 1, x, x, x, y, y, 9, 16, 18. Given that the mean and median are equal, and are also equal to twice the mode, the value of y is (GATE-CE 2017)

(a) 5 (b) 6 (c) 7 (d) 8

61. The old concert hall was demolished because of fears that the foundation would be affected by the construction of the new metro line in the area. Modern technology for underground metro construction tried to mitigate the impact of pressurized air pockets created by the excavation of large amounts of soil. But even with these safeguards, it was feared that the soil below the concert hall would not be stable.

From this, one can infer that (GATE-CE 2017)

(a) the foundations of old buildings create pressurized air pockets underground
(b) metro construction has to be done carefully considering its impact on existing buildings
(c) old buildings in an area form an impossible hurdle to metro construction

(d) pressurized air can be used to excavate large amounts of soil

62. Students applying for hostel rooms are allotted rooms in order of seniority. Students already staying in a room will move if they get a room in their preferred list. Preferences of lower ranked applicants are ignored during allocation. Given the data below, which room will Ajit stay in? (GATE-CE 2017)

Names	Student seniority	Current room	Room preference list
Amar	1	P	R, S, Q
Akbar	2	None	R, S
Anthony	3	Q	P
Ajit	4	S	Q, P, R

(a) P (b) Q (c) R (d) S

63. The last digit of $(2171)^7 + (2172)^9 + (2173)^{11} + (2174)^{13}$ is (GATE-CE 2017)

(a) 2 (b) 4 (c) 6 (d) 8

64. Two machines M1 and M2 are able to execute any of four jobs P, Q, R and S. The machines can perform one job on one object at a time. Jobs P, Q, R and S take 30 minutes, 20 minutes, 60 minutes and 15 minutes each respectively. There are 10 objects each requiring exactly 1 job. Job P is to be performed on 2 objects, Job Q on 3 objects, Job R on 1 object and Job S on 4 objects. What is the minimum time needed to complete all the jobs? (GATE-CE 2017)

(a) 2 hours (b) 2.5 hours (c) 3 hours (d) 3.5 hours

65. The bar graph below shows the output of five carpenters over one month, each of whom made different items of furniture: chairs, tables, and beds.

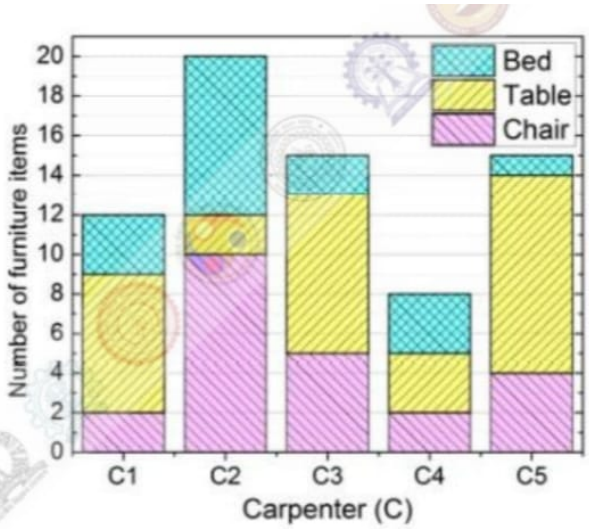

Figure 65:

Consider the following statements:

(a) The number of beds made by carpenter C2 is exactly the same as the number of tables made by carpenter C3.

(b) The total number of chairs made by all carpenters is less than the total number of tables.

Which one of the following is true? (GATE-CE 2017)

(a) Only i
(b) Only ii
(c) Both i and ii
(d) Neither i nor ii

SESSION - 2

1. Consider the following simultaneous equations (with c_1 and c_2 being constants):

$$3x_1 + 2x_2 = c_1 \tag{3}$$

$$4x_1 + x_2 = c_2 \tag{4}$$

The characteristic equation for these simultaneous equations is

(a) $\lambda^2 - 4\lambda - 5 = 0$

(b) $\lambda^2 - 4\lambda + 5 = 0$

(c) $\lambda^2 + 4\lambda - 5 = 0$

(d) $\lambda^2 + 4\lambda + 5 = 0$

(GATE-CE 2017)

2. Let $w = f(x, y)$, where x and y are functions of t. Then, according to the chain rule, $\frac{dw}{dt}$ is equal to

(a) $\frac{dw}{dx}\frac{dx}{dt} + \frac{dw}{dy}\frac{dt}{dt}$

(b) $\frac{\partial w}{\partial x}\frac{\partial x}{\partial t} + \frac{\partial w}{\partial y}\frac{\partial y}{\partial t}$

(c) $\frac{\partial w}{\partial x}\frac{dx}{dt} + \frac{\partial w}{\partial y}\frac{dy}{dt}$

(d) $\frac{dw}{dx}\frac{\partial x}{\partial t} + \frac{dw}{dy}\frac{\partial y}{\partial t}$

(GATE-CE 2017)

3. Given that the scope of the construction work is well-defined with all its drawings, specifications, quantities and estimates, which one of the following types of contract would be most preferred?

(a) EPC contract

(b) Percentage rate contract

(c) Item rate contract

(d) Lump sum contract

(GATE-CE 2017)

4. Let G be the specific gravity of soil solids, w the water content in the soil sample, γ_w the unit weight of water, and γ_d the dry unit weight of the soil. The equation for the zero air voids line in a compaction test plot is

(a) $\gamma_d = \frac{G\gamma_w}{1+Gw}$ (b) $\gamma_d = \frac{G\gamma_w}{Gw}$ (c) $\gamma_d = \frac{Gw}{1+\gamma_w}$ (d) $\gamma_d = \frac{Gw}{1-\gamma_w}$

(GATE-CE 2017)

5. Consider the following statements related to the pore pressure parameters, A and B:

(a) A always lies between 0 and 1.0

(b) A can be less than 0 or greater than 1.0

(c) B always lies between 0 and 1.0

(d) B can be less than 0 or greater than 1.0

For these statements, which one of the following options is correct?

(a) P and R (b) P and S (c) Q and R (d) Q and S

(GATE-CE 2017)

6. Consider a rigid retaining wall with partially submerged cohesionless backfill with a surcharge. Which one of the following diagrams closely represents the Rankine's active earth pressure distribution against this wall?

(a) (A) (b) (B) (c) (C) (d) (D)

Figure 6:

Figure 6:

Figure 6:

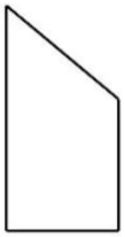

Figure 6:

(GATE-CE 2017)

7. If a centrifugal pump has an impeller speed of N (in rpm), discharge Q (in m^3/s) and the total head H (in m), the expression for the specific speed N_s of the pump is given by

(a) $N_s = \frac{NQ^{0.5}}{H^{0.5}}$ (b) $N_s = \frac{NQ^{0.5}}{H}$ (c) $N_s = \frac{NQ^{0.5}}{H^{0.75}}$ (d) $N_s = \frac{NQ}{H^{0.75}}$

(GATE-CE 2017)

8. As per Noise Pollution (Regulation and Control) Rules 2000 of India, the day time noise limit for a residential zone, expressed in dB(A) L_{eq}, is

(a) 55 (b) 65 (c) 75 (d) 85

(GATE-CE 2017)

9. Following observations have been made for the elevation and temperature to ascertain the stability of the atmosphere:

Elevation (in m)	Temperature (in °C)
10	15.5
60	15.0
130	14.3

The atmosphere is classified as

(a) Stable (b) Unstable (c) Neutral (d) Inverse

(GATE-CE 2017)

10. The most important type of species involved in the degradation of organic matter in the case of activated sludge process is

(a) autotrophs
(b) heterotrophs
(c) prototrophs
(d) photo-autotrophs

(GATE-CE 2017)

11. For a broad gauge railway track on a horizontal curve of radius R (in m), the equilibrium cant e required for a train moving at a speed of V (in km per hour) is

(a) $e = 1.676\frac{V^2}{R}$
(b) $e = 1.315\frac{V^2}{R}$
(c) $e = 0.80\frac{V^2}{R}$
(d) $e = 0.60\frac{V^2}{R}$

(GATE-CE 2017)

12. The safety within a roundabout and the efficiency of a roundabout can be increased, respectively, by

(a) increasing the entry radius and increasing the exit radius
(b) increasing the entry radius and decreasing the exit radius
(c) decreasing the entry radius and increasing the exit radius

(d) decreasing the entry radius and decreasing the exit radius

(GATE-CE 2017)

13. The method of orientation used, when the plane table occupies a position not yet located on the map, is called as

(a) traversing (b) radiation (c) levelling (d) resection

(GATE-CE 2017)

14. Consider the frame shown in the figure Fig. 14

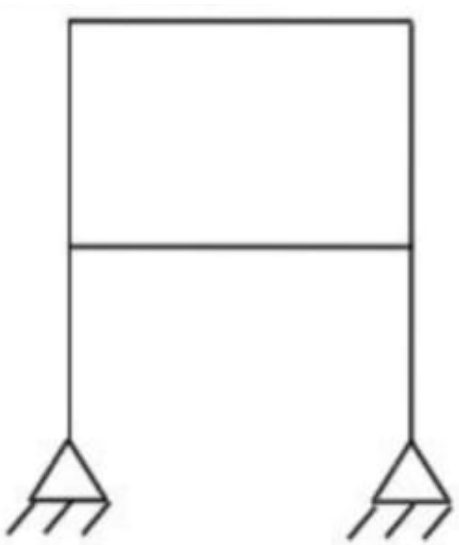

Figure 14:

If the axial and shear deformations in different members of the frame are assumed to be negligible, the reduction in the degree of kinematical indeterminacy would be equal to

(a) 5 (b) 6 (c) 7 (d) 8

(GATE-CE 2017)

15. Let the characteristic strength be defined as that value, below which not more than 50% of the results are expected to fall. Assuming a standard deviation of 4 MPa, the target mean strength (in MPa) to be considered in the mix design of a M25 concrete would be

(a) 18.42 (b) 21.00 (c) 25.00 (d) 31.58

(GATE-CE 2017)

16. In a material under a state of plane strain, a 10×10mm square centered at a point gets deformed as shown in the figure Fig. 16

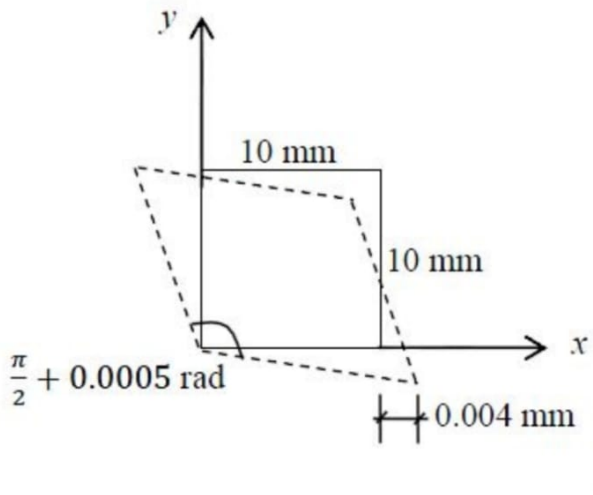

Figure 16:

If the shear strain γ_{xy} at this point is expressed as $0.001k$ (in rad), the value of k is

(a) 0.50 (b) 0.25 (c) -0.25 (d) -0.50

(GATE-CE 2017)

17. The plate load test was conducted on a clayey strata by using a plate of $0.3m \times 0.3m$ dimensions, and the ultimate load per unit area for the plate was found to be 180 kPa. The ultimate bearing capacity (in kPa) of a 2 m wide square footing would be

(a) 27 (b) 180 (c) 1200 (d) 2000

(GATE-CE 2017)

18. For a construction project, the mean and standard deviation of the completion time are 200 days and 6.1 days, respectively. Assume normal distribution and use the value of standard normal deviate $z = 1.64$ for the 95% confidence level. The maximum time required (in days) for the completion of the project would be _____ (GATE-CE 2017).

19. The divergence of the vector field $V = x^2 i + 2y^3 j + z^4 k$ at $x = 1$, $y = 2$, $z = 3$ is _____ (GATE-CE 2017).

20. A two-faced fair coin has its faces designated as head H and tail T. This coin is tossed three times in succession to record the following outcomes: H, H, H. If the coin is tossed one more time, the probability (up to one decimal place) of obtaining H again, given the previous realizations of H, H and H, would be _____ (GATE-CE 2017).

21. A sheet pile has an embedment depth of 12 m in a homogeneous soil stratum. The coefficient of permeability of soil is $10^{-6} m/s$. Difference in the water levels between the two sides of the sheet pile is 4 m. The flow net is constructed with five number of flow lines and eleven number of equipotential lines. The quantity of seepage (in cm^3/s per m, up to one decimal place) under the sheet pile is _____ (GATE-CE 2017).

22. The VPI (vertical point of intersection) is 100 m away (when measured along the horizontal) from the VPC (vertical point of curvature). If the vertical curve is parabolic, the length of the curve (in meters and measured along the horizontal) is _____ (GATE-CE 2017).

23. During a storm event in a certain period, the rainfall intensity is 3.5 cm/hour and the ϕ-index is 1.5 cm/hour. The intensity of effective rainfall (in cm/hour, up to one decimal place) for this period is _____ (GATE-CE 2017).

24. The infiltration capacity of a soil follows the Horton's exponential model, $f = c_1 + c_2 e^{-kt}$. During an experiment, the initial infiltration capacity was observed to be 200 mm/h. After a long time, the infiltration capacity was reduced to 25 mm/h. If the infiltration capacity after 1 hour was 90 mm/h,

the value of the decay rate constant, k (in h^{-1}, up to two decimal places) is _____ (GATE-CE 2017).

25. While aligning a hill road with a ruling gradient of 6%, a horizontal curve of radius 50 m is encountered. The grade compensation (in percentage, up to two decimal places) to be provided for this case would be _____ (GATE-CE 2017).

26. The tangent to the curve represented by $y = x \ln x$ is required to have 45° inclination with the x-axis. The coordinates of the tangent point would be

(a) $(1, 0)$ (b) $(0, 1)$ (c) $(1, 1)$ (d) $\left(\sqrt{2}, \sqrt{2}\right)$

(GATE-CE 2017)

27. Consider the following definite integral:

$$I = \int_0^1 \frac{\left(\sin^{-1} x\right)^2}{\sqrt{1 - x^2}} dx \tag{5}$$

The value of the integral is

(a) $\frac{\pi^3}{24}$ (b) $\frac{\pi^3}{12}$ (c) $\frac{\pi^3}{48}$ (d) $\frac{\pi^3}{64}$

(GATE-CE 2017)

28. If $A = \begin{pmatrix} 1 & 5 \\ 6 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 7 \\ 8 & 4 \end{pmatrix}$, then AB^T is equal to

(a) $\begin{pmatrix} 38 & 28 \\ 32 & 56 \end{pmatrix}$ (b) $\begin{pmatrix} 3 & 40 \\ 42 & 8 \end{pmatrix}$ (c) $\begin{pmatrix} 43 & 27 \\ 34 & 50 \end{pmatrix}$ (d) $\begin{pmatrix} 38 & 32 \\ 28 & 56 \end{pmatrix}$

(GATE-CE 2017)

29. Consider the following second-order differential equation:

$$y'' - 4y' + 3y = 2t - 3t^2 \tag{6}$$

The particular solution of the differential equation is

(a) $-2-2t-t^2$ (b) $-2t-t^2$ (c) $2t-3t^2$ (d) $-2-2t-3t^2$

(GATE-CE 2017)

30. Group I gives a list of test methods and test apparatus for evaluating some of the properties of Ordinary Portland Cement (*OPC*) and concrete. Group II gives the list of these properties.

Group I	**Group II**
P. Le Chatelier test	1. Soundness of OPC
Q. Vee-Bee test	2. Consistency and setting time of OPC
R. Blaine air permeability test	3. Consistency or workability of concrete
S. The Vicat apparatus	4. Fineness of OPC

The correct match of the items in Group I with the items in Group II is

(a) P-1, Q-3, R-4, S-2

(b) P-2, Q-3, R-1, S-4

(c) P-4, Q-2, R-4, S-1

(d) P-1, Q-4, R-2, S-3

(GATE-CE 2017)

31. Two prismatic beams having the same flexural rigidity of 1000 kN-m^2 are shown in the figure Fig. 31

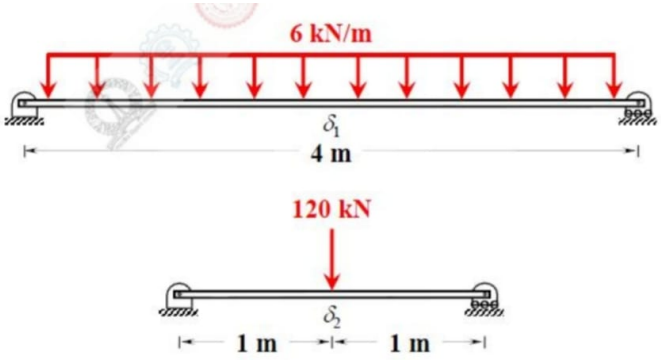

Figure 31:

If the mid-span deflections of these beams are denoted by δ_1 and δ_2 (as indicated in the figures), the correct option is

(a) $\delta_1 = \delta_2$ (b) $\delta_1 < \delta_2$ (c) $\delta_1 > \delta_2$ (d) $\delta_1 >> \delta_2$

(GATE-CE 2017)

32. Consider the three prismatic beams with the clamped supports P, Q, and R as shown in the figure Fig. 32

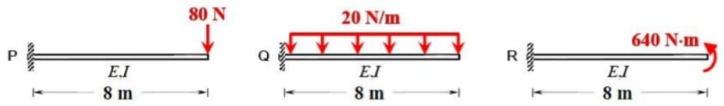

Figure 32:

Given that the modulus of elasticity, E is $2.5 \times 10^4 MPa$; and the moment of inertia, I is $8 \times 10^8 mm^4$, the correct comparison of the magnitudes of the shear force S and the bending moment M developed at the supports is

(a) $S_P < S_Q < S_R$; $M_P = M_Q = M_R$

(b) $S_P = S_Q > S_R$; $M_P = M_Q > M_R$

(c) $S_P < S_Q > S_R$; $M_P = M_Q = M_R$

(d) $S_P < S_Q < S_R$; $M_P < M_Q < M_R$

(GATE-CE 2017)

33. Consider the following statements:

(a) P. Walls of one brick thick are measured in square meters.

(b) Q. Walls of one brick thick are measured in cubic meters.

(c) R. No deduction in the brickwork quantity is made for openings in walls up to 0.1 m^2 area.

(d) S. For the measurement of excavation from the borrow pit in a fairly uniform ground, deadmen are left at suitable intervals.

For the above statements, the correct option is

(a) P - False; Q - True; R - False; S - True

(b) P - False; Q - True; R - False; S - False

(c) P - True; Q - False; R - True; S - False

(d) P - True; Q - False; R - True; S - True

(GATE-CE 2017)

34. Two identical concrete piles having the plan dimensions $50cm \times 50cm$ are driven into a homogeneous sandy layer as shown in the figures. Consider the bearing capacity factor N_q for $\phi = 30°$ as 24.

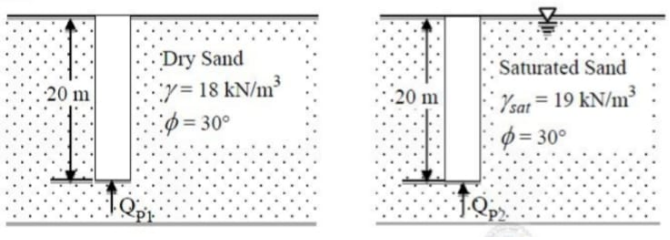

Figure 34:

If Q_{P1} and Q_{P2} represent the ultimate point bearing resistances of the piles under dry and submerged conditions, respectively, which one of the following statements is correct?

(a) $Q_{p1} > Q_{p2}$ by about 100%

(b) $Q_{p1} < Q_{p2}$ by about 100%

(c) $Q_{p1} > Q_{p2}$ by about 5%

(d) $Q_{p1} < Q_{p2}$ by about 5%

(GATE-CE 2017)

35. Following are the statements related to the stress paths in a triaxial testing of soils:

- P. If $\sigma_1 = \sigma_3$, the stress point lies at the origin of the $p - q$ plot.
- Q. If $\sigma_1 = \sigma_3$, the stress point lies on the p-axis of the $p - q$ plot.
- R. If $\sigma_1 > \sigma_3$, both the stress points p and q are positive.

For the above statements, the correct combination is

(a) P - False; Q - True; R - True

(b) P - True; Q - False; R - True

(c) P - False; Q - True; R - False

(d) P - True; Q - False; R - False

(GATE-CE 2017)

36. Two cars P and Q are moving in a racing track continuously for two hours. Assume that no other vehicles are using the track during this time. The expressions relating the distance travelled d (in km) and time t (in hour) for both the vehicles are given as

$$P : d = 60t \tag{7}$$

$$Q : d = 60t^2 \tag{8}$$

Within the first one hour, the maximum space headway would be

(a) 15 km at 30 minutes

(b) 15 km at 15 minutes

(c) 30 km at 30 minutes

(d) 30 km at 15 minutes

(GATE-CE 2017)

37. For the construction of a highway, a cut is to be made as shown in the figure Fig. 37

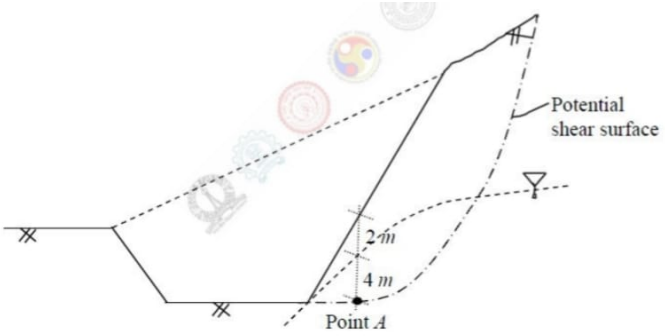

Figure 37:

The soil exhibits $c' = 20kPa$, $\phi' = 18°$, and the undrained shear strength = $80kPa$. The unit weight of water is 9.81 kN/m^3. The unit weights of the soil above and below the ground water table are 18 and 20kN/m^3, respectively. If the shear stress at Point A is 50 kPa, the factors of safety against the shear failure at this point, considering the undrained and drained conditions, respectively, would be

(a) 1.6 and 0.9 (b) 0.9 and 1.6 (c) 0.6 and 1.2 (d) 1.2 and 0.6

(GATE-CE 2017)

38. Two towers, A and B, standing vertically on a horizontal ground, appear in a vertical aerial photograph as shown in the figure Fig. 38

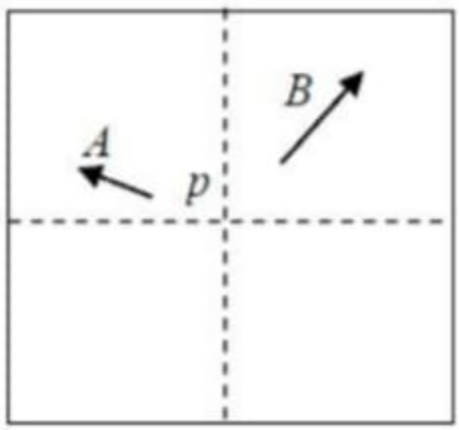

Figure 38:

The length of the image of the tower A on the photograph is 1.5 cm and of the tower B is 2.0 cm. The distance of the top of the tower A (as shown by the arrowhead) is 4.0 cm and the distance of the top of the tower B is 6.0 cm, as measured from the principal point p of the photograph. If the height of the tower B is 80 m, the height (in meters) of the tower A is _____ (GATE-CE 2017).

39. A hollow circular shaft has an outer diameter of 100 mm and inner diameter of 50 mm. If the allowable shear stress is 125 MPa, the maximum torque (in kN-m) that the shaft can resist is _____ (GATE-CE 2017).

40. A simply supported rectangular concrete beam of span 8 m has to be pre-stressed with a force of 1600 kN. The tendon is of parabolic profile having zero eccentricity at the supports. The beam has to carry an external uniformly distributed load of intensity 30 kN/m. Neglecting the self-weight of the beam, the maximum dip (in meters, up to two decimal places) of the tendon at the mid-span to balance the external load should be _____ (GATE-CE 2017).

41. Two plates of 8 mm thickness each are connected by a fillet weld of 6 mm thickness as shown in the figure Fig. 42

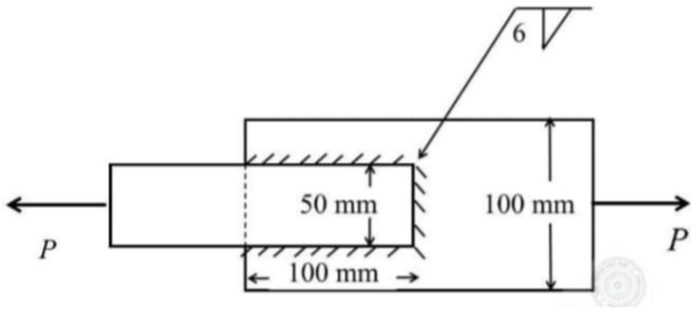

Figure 41:

The permissible stresses in the plate and the weld are 150 MPa and 110 MPa, respectively. Assuming the length of the weld shown in the figure to be the effective length, the permissible load P (in kN) is _____ (GATE-CE 2017).

42. Consider the portal frame shown in the figure Fig. 42 and assume the modulus of elasticity, $E = 2.5 \times 10^4 MPa$ and the moment of inertia, $I = 8 \times 10^8 mm^4$ for all the members of the frame.

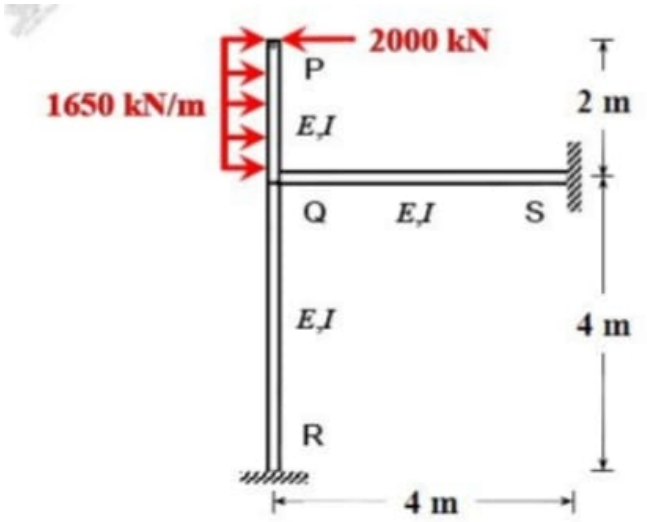

Figure 42:

The rotation (in degrees, up to one decimal place) at the rigid joint Q would be _____ (GATE-CE 2017).

43. A 2 m long, axially loaded mild steel rod of 8 mm diameter exhibits the load-displacement ($P - \delta$) behavior as shown in the figure Fig. 43

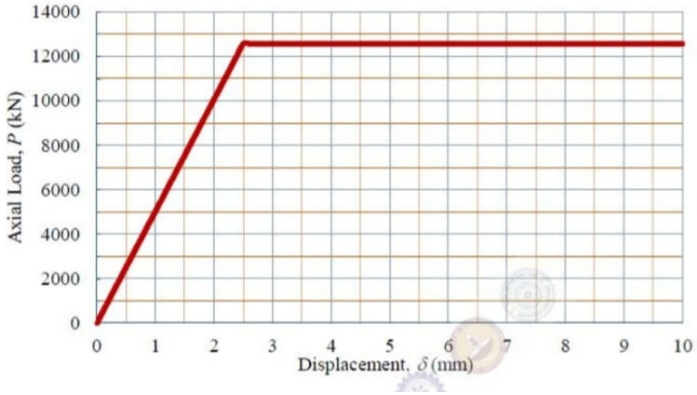

Figure 43:

Assume the yield stress of steel as 250 MPa. The complementary strain

energy (in N-mm) stored in the bar up to its linear elastic behavior will be _____ (GATE-CE 2017).

44. Consider a square-shaped area $ABCD$ on the ground with its centre at M as shown in the figure Fig. 45 . Four concentrated vertical loads of $P = 5000$ kN are applied on this area, one at each corner.

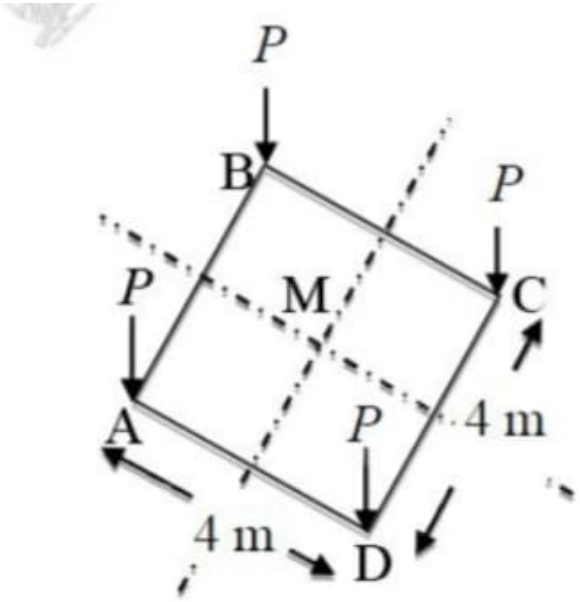

Figure 44:

The vertical stress increment (in kPa, up to one decimal place) due to these loads according to the Boussinesq's equation, at a point 5 m right below M, is _____ (GATE-CE 2017).

45. The figure Fig. 45 shows a U-tube having a 5 mm $\times$ 5 mm square cross-section filled with mercury (specific gravity = 13.6) up to a height of 20 cm in each limb (open to the atmosphere).

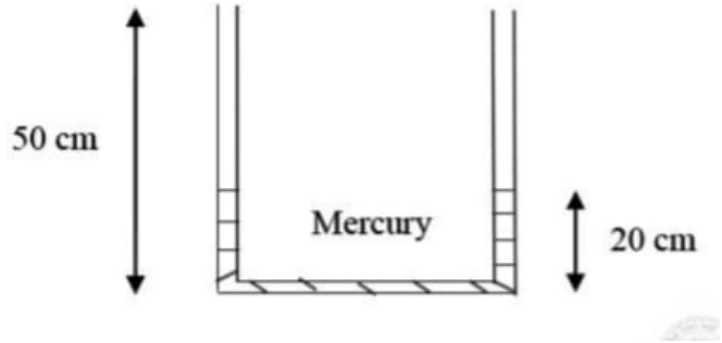

Figure 45:

If 5 cm^3 of water is added to the right limb, the new height (in cm, up to two decimal places) of mercury in the LEFT limb will be _____ (GATE-CE 2017).

46. A 1 m wide rectangular channel carries a discharge of 2 m^3/s. The specific energy-depth diagram is prepared for the channel. It is observed in this diagram that corresponding to a particular specific energy, the subcritical depth is twice the supercritical depth. The subcritical depth (in meters, up to two decimal places) is equal to _____ (GATE-CE 2017).

47. A catchment is idealized as a 25 km × 25 km square. It has five rain gauges, one at each corner and one at the center, as shown in the figure Fig. 65

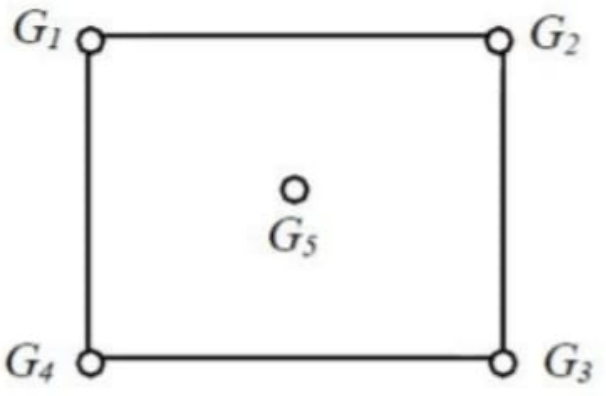

Figure 47:

During a month, the precipitation at these gauges is measured as $G_1 = 300mm$, $G_2 = 285mm$, $G_3 = 272mm$, $G_4 = 290mm$ and $G_5 = 288mm$. The average precipitation (in mm, up to one decimal place) over the catchment during this month by using the Thiessen polygon method is _____ (GATE-CE 2017).

48. The culturable command area of a canal is 10,000 ha. The area grows only two crops-rice in the Kharif season and wheat in the Rabi season. The design discharge of the canal is based on the rice requirements, which has an irrigated area of 2500 ha, base period of 150 days and delta of 130 cm. The maximum permissible irrigated area (in ha) for wheat, with a base period of 120 days and delta of 50 cm, is _____ (GATE-CE 2017).

49. Water is pumped at a steady uniform flow rate of 0.01 m^3/s through a horizontal smooth circular pipe of 100 mm diameter. Given that the Reynolds number is 800 and g is 9.81 m/s^2, the head loss (in meters, up to one decimal place) per km length due to friction would be _____ (GATE-CE 2017).

50. The composition of a municipal solid waste sample is given below:

Component	**Percent by Mass**	**Moisture Content (%)**	**Energy Content (kJ/kg, on as-discarded basis)**
Food Waste	20	70	2500
Paper	10	4	10000
Cardboard	10	4	8000
Plastics	10	1	14000
Garden Trimmings	40	60	3500
Wood	5	20	14000
Tin Cans	5	2	100

The difference between the energy content of the waste sample calculated on dry basis and as-discarded basis (in kJ/kg) would be _____ (GATE-CE 2017).

51. For a given water sample, the ratio between $BOD_{5-day,20^{\circ}C}$ and the ultimate BOD is 0.68. The value of the reaction rate constant k (on base e) (in day^{-1}, up to two decimal places) is _____ (GATE-CE 2017).

52. A municipal corporation is required to treat 1000 m^3/day of water. It is found that an overflow rate of 20 m/day will produce a satisfactory removal of the discrete suspended particles at a depth of 3 m. The diameter (in meters, rounded to the nearest integer) of a circular settling tank designed for the removal of these particles would be _____ (GATE-CE 2017).

53. The analysis of a water sample produces the following results:

Ion	**milligram per milli-equivalent for the ion**	**Concentration (mg/L)**
Ca^{2+}	20.0	60
Mg^{2+}	12.2	36.6
Na^{+}	23.0	92
K^{+}	39.1	78.2
Cl^{-}	35.5	71
SO_4^{2-}	48.0	72
HCO_3^{-}	61.0	122

The total hardness (in mg/L as $CaCO_3$) of the water sample is _____ (GATE-CE 2017).

54. The radii of relative stiffness of the rigid pavements P and Q are denoted by l_p and l_q, respectively. The geometric and material properties of the concrete slab and underlying soil are given below:

Pavement	**Length of Slab**	**Breadth of Slab**	**Thickness of Slab**	**Modulus of Elasticity**	**Poisson's Ratio**	**Subgrade Reaction Modulus**
P	L	B	h	E	μ	K
Q	L	B	0.5h	E	μ	2K

The ratio (up to one decimal place) of l_p/l_q is _____ (GATE-CE 2017).

55. An observer standing on the deck of a ship just sees the top of a lighthouse. The top of the lighthouse is 40 m above the sea level and the height of the observer's eye is 5 m above the sea level. The distance (in km, up to one decimal place) of the observer from the lighthouse is _____ (GATE-CE 2017).

56. The event would have been successful if you _____ able to come.

(a) are
(b) had been
(c) have been
(d) would have been

(GATE-CE 2017)

57. There was no doubt that their work was thorough.

Which of the words below is closest in meaning to the underline word above?

(a) pretty (b) complete (c) sloppy (d) haphazard

(GATE-CE 2017)

58. Four cards lie on a table. Each card has a number printed on one side and a colour on the other. The faces visible on the cards are 2, 3, red, and blue.

Proposition: If a card has an even value on one side, then its opposite face is red.

The card which MUST be turned over to verify the above proposition are

(a) 2, red (b) 2, 3, red (c) 2, blue (d) 2, red, blue

(GATE-CE 2017)

59. What is the value of x when $81 \times \left(\frac{16}{25}\right)^{x+2} \div \left(\frac{3}{5}\right)^{2x+4} = 144$?

(a) 1
(b) -1
(c) -2
(d) Cannot be determined

(GATE-CE 2017)

60. Two dice are thrown simultaneously. The probability that the product of the numbers appearing on the top faces of the dice is a perfect square is

(a) 1/9 (b) 2/9 (c) 1/3 (d) 4/9

(GATE-CE 2017)

61. Bhaichung was observing the pattern of people entering and leaving a car service centre. There was a single window where customers were being served. He saw that people inevitably came out of the centre in the order that they went in. However, the time they spent inside seemed to vary a lot: some people came out in a matter of minutes while for others it took much longer.

    From this what can one conclude?

    (a) The centre operates on a first-come-first-served basis, but with variable service times, depending on specific customer needs.

    (b) Customers were served in an arbitrary order, since they took varying amounts of time for service completion in the centre.

    (c) Since some people came out within a few minutes of entering the centre, the system is likely to operate on a last-come-first-served basis.

    (d) Entering the centre early ensured that one would have shorter service times and most people attempted to do this.

    (GATE-CE 2017)

62. A map shows the elevations of Darjeeling, Gangtok, Kalimpong, Pelling, and Siliguri. Kalimpong is at a lower elevation than Gangtok. Pelling is at a lower elevation than Gangtok. Pelling is at a higher elevation than Siliguri. Darjeeling is at a higher elevation than Gangtok.

    Which of the following statements can be inferred from the paragraph above?

    - i) Pelling is at a higher elevation than Kalimpong
    - ii) Kalimpong is at a lower elevation than Darjeeling
    - iii) Kalimpong is at a higher elevation than Silguri
    - iv) Silguri is at a lower elevation than Gangtok

    (a) Only ii (c) Only ii and iv

    (b) Only ii and iii (d) Only iii and iv

(GATE-CE 2017)

63. P, Q, R, S, T and U are seated around a circular table. R is seated two places to the right of Q. P is seated three places to the left of R. S is seated opposite U. If P and U now switch seats, which of the following must necessarily be true?

    (a) P is immediately to the right of R

    (b) T is immediately to the left of P

    (c) T is immediately to the left of P or P is immediately to the right of Q

    (d) U is immediately to the right of R or P is immediately to the left of T

(GATE-CE 2017)

64. Budhan covers a distance of 19 km in 2 hours by cycling one fourth of the time and walking the rest. The next day he cycles (at the same speed as before) for half the time and walks the rest (at the same speed as before) and covers 26 km in 2 hours. The speed in km/h at which Budhan walks is

    (a) 1 (b) 4 (c) 5 (d) 6

(GATE-CE 2017)

65. The points in the graph Fig. 65 below represent the halts of a lift for durations of 1 minute, over a period of 1 hour.

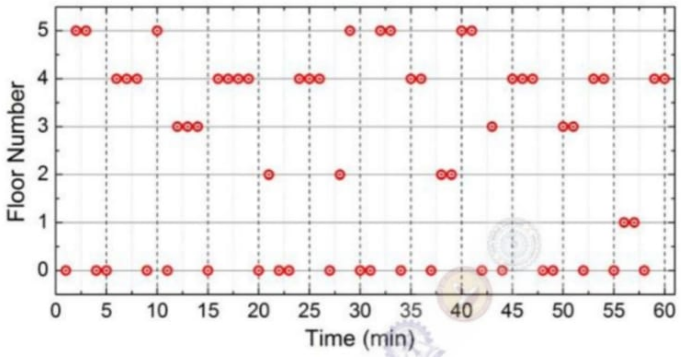

Figure 65:

Which of the following statements are correct?

- The elevator never moves directly from any non-ground floor to another non-ground floor over the one hour period
- The elevator stays on the fourth floor for the longest duration over the one hour period

(a) only i
(b) only ii
(c) both i and ii
(d) neither i nor ii

(GATE-CE 2017)