GATE 2026 Civil Engineering Shift II Question Paper

Time Allowed :3 Hours	Maximum Marks :100	Total Questions :65

General Instructions

Read the following instructions very carefully and strictly follow them:

1. Each GATE 2024 paper consists of a total of 100 marks. The examination is divided into two sections – General Aptitude (GA) and the Candidate's Selected Subjects. General Aptitude carries 15 marks, while the remaining 85 marks are dedicated to the candidate's chosen test paper syllabus.
2. GATE 2024 will be conducted in English as a Computer Based Test (CBT) at select centres in select cities. The duration of the examination is 3 hours.
3. MCQs carry 1 mark or 2 marks.
4. For a wrong answer in a 1-mark MCQ, 1/3 mark is deducted.
5. For a wrong answer in a 2-mark MCQ, 2/3 mark is deducted.
6. No negative marking for wrong answers in MSQ or NAT questions.

1. A portal frame has a span of 4 m (2 m + 2 m) and a height of 3 m. The left base is hinged and the right base is roller supported. A horizontal load of 50 kN acts at the top left joint. A vertical concentrated load of 90 kN acts at the midspan of the top beam. Determine the absolute value of the maximum bending moment in the frame.

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2. A bridge has an expected design life of 50 years. It is designed for a flood discharge of 1000 m^3/s, which corresponds to a return period of 100 years. Determine the risk (probability) that the design flood will be equalled or exceeded at least once during the design life of the bridge. (Enter the numerical value of risk in decimal form, correct up to three decimal places.)

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4. A bridge has an expected design life of 50 years. It is designed for a flood discharge of 1000 m^3/s, which corresponds to a return period of 100 years. Determine the risk (probability) that the design flood will be equalled or exceeded at least once during the design life of the bridge. (Enter the numerical value of risk in decimal form, correct up to three decimal places.)

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5. A rectangular catchment ABCD has an area of 7 hectares. The times of concentration from the four extreme points A, B, C and D to the outlet are 10, 20, 15 and 25 minutes, respectively. The rainfall intensity-duration relationship is given by $I = \frac{25}{t+20}$, where I = rainfall intensity in cm/hr and t = time of concentration in minutes. The runoff coefficient of the catchment is 0.4. Determine the peak discharge from the catchment. (Enter the numerical value only in m^3/s.)

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6. Long-term deformation of a material under sustained constant loading is primarily governed by:

(a) Creep
(b) Modulus of toughness
(c) Modulus of resilience
(d) Yield strength

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7. In a reinforced concrete slab, 10 mm diameter bars are provided at a centre-to-centre spacing of 150 mm to resist a given design moment. If instead of 10 mm bars, 12 mm diameter bars of the same grade of steel are used, determine the required centre-to-centre spacing (in mm) so that the slab resists the same design moment. (Assume effective depth and other parameters remain unchanged. Enter the numerical value only in mm.)

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8. Which of the following methods are used to check whether the flexural stresses in a prestressed concrete beam remain within permissible limits at transfer and final stages? Select all the correct option(s).

(a) Hoyer's effect
(b) Limiting zone of prestress method
(c) Magnel's graph
(d) Load balancing method

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9. Let $P = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$. Which of the following statements is/are correct?

1. $\mathbf{P}^T\mathbf{P} = \mathbf{I}$
2. P is skew-symmetric
3. The value of each eigenvalue of P is 1
4. The trace of P is equal to the sum of its eigenvalues

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10. Consider the differential equation $x^2 \frac{d^2y}{dx^2} = 6y$. The general solution of the above equation is

(a) $y = ax^3 + \frac{b}{x^2}$
(b) $y = ax^3 + \frac{b}{x^3}$
(c) $y = ax^3 + b \ln x$
(d) $y = ax^2 + b \ln x$

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11. Consider the function $f(x) = e^{-x} - x$. Using the Newton-Raphson method, obtain the first improved approximation starting from the initial guess $x_0 = 0.5$. Enter the value of the second approximation, correct to two decimal places.

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12. $(y+3x-13)^3+(x+y-7)^2 = 0$ where x and y are integers. The value of x^3+y^3 is _____.

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13. Consider the homogeneous system of linear equations: $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 0 & 2 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$.

What does the solution set of this system represent geometrically?

(a) A point
(b) A line
(c) A plane
(d) A volume

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14. A function f(x) is defined on the interval with values in R. It satisfies $\int_0^2 f(x)[x - f(x)]dx = \frac{2}{3}$. Find the value of f(1).

15. Bag-I contains 4 white and 6 black balls, Bag-II contains 4 white and 3 black balls. A ball is selected at random and it comes out to be a black ball. What is the probability that it is from Bag-I?

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16. Consider the matrix $A = \begin{pmatrix} 9 & 15 \\ 15 & 50 \end{pmatrix}$. The matrix A is decomposed using Cholesky decomposition. Determine the value of l_{22}.

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17. Given the following data: x: (-2, 1, 2), y: (28, 4, 16). Let $P_2(x)$ be the quadratic interpolating polynomial passing through the above three points. Find the value of $P_2(0)$.
