Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2021

Subject Code:3170620 Date:29/12/2021

Subject Name:Computational Geotechnics

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Find a real root of the equation $x^3 - \cos x = 0$ using the Newton-Raphson method correct to three decimal places starting from $x_0 = 1$.	**03**
	(b)	Explain Bisection method with suitable example.	**04**
	(c)	Solve the following system by Gauss Jacobi method. $20x+y-2z = 17$, $3x+20y-z = -18$ and $2x-3y+20z = 25$	**07**
Q.2	**(a)**	Explain False Position method with suitable example.	**03**
	(b)	Enlist the types of boundary conditions. Explain Disichlet conditions.	**04**
	(c)	Use fourth order Runge-Kutta method to find y(0.2) with h=0.1, given that $10\frac{dy}{dx} = x^2+y^2$, y(0)=1.	**07**
		OR	
	(c)	Use second order Runge-Kutta method of solve initial value problem y'= -y, where y(0)=1 for $x_1 = 0.2$ and $x_2 = 0.4$	**07**
Q.3	**(a)**	Differentiate between discrete modeling versus continuum modeling.	**03**
	(b)	Briefly explain Drucker-Prager theory.	**04**
	(c)	Explain One-dimensional (1D) plasticity theory.	**07**
		OR	
Q.3	**(a)**	Briefly explain continuum modeling.	**03**
	(b)	Briefly explain discrete element method (DEM).	**04**
	(c)	Explain Mohr-Coulomb theory.	**07**
Q.4	**(a)**	Briefly explain soil constitutive model.	**03**
	(b)	Explain the flow through porous media.	**04**
	(c)	Explain earth pressure coefficients based upon Lade-Duncan criterion.	**07**
		OR	
Q.4	**(a)**	Differentiate between elastic models and plastic models.	**03**
	(b)	Give the importance of boundary value problems in geotechnical engineering.	**04**
	(c)	What is classical plasticity? Explain general framework of classical plasticity.	**07**
Q.5	**(a)**	Define following terms: 1. Immediate Settlement 2. Primary Consolidation 3. Secondary Consolidation	**03**
	(b)	A saturated clay layer of 5 m thickness takes 1.5 years for 50% primary consolidation when drained on both sides. Its coefficient of volume change m_v is 1.5×10^{-3} m^2/kN. Determine the coefficient of consolidation (m^2/yr) and coefficient of permeability (m/year). Assume $\gamma_w = 10$ kN/m^3	**04**
	(c)	Explain Tri-axial Test.	**07**
		OR	

Q.5 **(a)** Enlist the assumptions made in Terzaghi's theory of 1-dimensional consolidation. **03**

(b) Spring analogy to explain consolidation theory. **04**

(c) A laboratory specimen of clay 30 mm thick drained at top as well as bottom, has taken 400 second to reach 40% consolidation. When the pressure increased from 80 kN/m^2 to 160 kN/m^2. The initial void ratio was 0.85 and the final void ratio due to increasing of the load was 0.50. Determine coefficient of permeability. **07**

****

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3170620 Date:10/06/2022

Subject Name:Computational Geotechnics

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain Newton-Raphson method with suitable example.	**03**
	(b)	Find a root of the equation $x^3 - 4x = 9$ using the Bisection method in four stages.	**04**
	(c)	Solve the following system by Gauss Jacobi method $6x + y + z = 105$ $4x + 8y + 3z = 155$ $5x + 4y - 10z = 65$	**07**
Q.2	**(a)**	Explain False Position method with suitable example.	**03**
	(b)	Explain Newton's Raphson method with suitable example.	**04**
	(c)	Use the Runge-Kutta method of fourth order to solve $\frac{dy}{dx} = 1 + y^2$ Subject to $y(0) = 0$, find $y(0.2)$ and $y(0.4)$.	**07**
		OR	
	(c)	Use 2nd order Range – Kutta method to find y (0.2), given that $\frac{dy}{dx} = 2x + y$, $y(0) = 1$; (use $h = 0.1$).	**07**
Q.3	**(a)**	Define discrete element method. How it is useful to the geotechnical engineering?	**03**
	(b)	Explain application of FEM method for geotechnical engineering.	**04**
	(c)	Explain Mohr-Coulomb theory.	**07**
		OR	
Q.3	**(a)**	Give difference between discrete modeling versus continuum modeling.	**03**
	(b)	Briefly explain Drucker-Prager theory.	**04**
	(c)	Explain in detail One- dimensional plasticity theory for understanding the behavior of soil.	**07**
Q.4	**(a)**	Explain basic concept of discrete modelling.	**03**
	(b)	Explain Modified Mohr Coulomb failure theory for shear strength? Sketch typical strength envelop for different type of soil.	**04**
	(c)	Explain earth pressure coefficients based upon Lade-Duncan criterion.	**07**
		OR	
Q.4	**(a)**	Explain the flow through porous media.	**03**
	(b)	Briefly explain 1-Dimentional consolidation.	**04**
	(c)	Explain Terzaghi's theory of 1-dimensional consolidation with assumptions.	**07**
Q.5	**(a)**	Give detail explanation on various types of consolidation.	**03**
	(b)	Differentiate between consolidation and compaction.	**04**
	(c)	Explain consolidation mechanism through spring analogy theory.	**07**

OR

Q.5	**(a)**	Explain consolidation in detail.	**03**
	(b)	A saturated clay layer of 4 m thickness takes 2 years for 50% primary consolidation when drained on both sides. Its coefficient of volume change m_v = 1.5 x 10^{-3} m^2/kN. Determine the coefficient of consolidation and coefficient of permeability. Assume γ_w= 10 kN/m^3	**04**
	(c)	Explain tri-axial test with neat sketch.	**07**

****