

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 Dirichlet 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:	03
	1. Immediate Settlement	
	2. Primary Consolidation	
	3. Secondary Consolidation	
	(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 $1.5 \times 10^{-3} \text{ m}^2/\text{kN}$. Determine the coefficient of consolidation (m^2/yr) and coefficient of permeability (m/year). Assume $\gamma_w = 10 \text{ kN}/\text{m}^3$	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**

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 2 nd 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-Dimensional 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 $m_v = 1.5 \times 10^{-3} \text{ m}^2/\text{kN}$. Determine the coefficient of consolidation and coefficient of permeability. Assume $\gamma_w = 10 \text{ kN/m}^3$ **04**
- (c) Explain tri-axial test with neat sketch. **07**
