

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
M.Tech. Summer 2017 - 18 Examination

Semester: 2

Subject Code: 03215151

Subject Name: Numerical Methods in Geotechnical Engineering

Date: 18/05/2018

Time: 02:00PM TO 04:30PM

Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 A) Find a root of the equation $x^3 - 4x - 9 = 0$ using Bisection Method correct up to 3 decimal places. (05)

B) Solve the following system using Gauss-Jordan Method (05)

$$2x + y + 3z = 16; 3x + 2y + w = 16; x + 2z - 5w = 5$$

C) Find a real root of $xe^x = 2$, correct upto three decimal places, by using Newton-Raphson's method. (05)

Q.2 Answer the following questions. (Attempt any three) (15)

A) Explain the importance of risk assessment in geotechnical engineering.

B) Use Newton-Raphson's method to obtain iterative formula to find \sqrt{N} ; hence find $\sqrt{28}$.

C) Solve the system by Gauss- Jacobi method correct up to 2-decimal places.

$$6x + 2y - z = 4, x + 5y + z = 3, 2x + y + 4z = 27$$

D) Find the equation of regression line of x on y from the following data and estimate x for $y = 4$.

x	0	2	4	5	7
y	5	3	2	1	0

Q.3 A) Using the False Position method, find a root of the function $f(x) = e^x - 3x^2$ to an accuracy of 5 digits. The root is known to lie between 0.5 and 1.0. (07)

B) Find the Pearson's Correlation Coefficient of the following data: (08)

x	3	4	6	7	10
y	9	11	14	15	16

OR

B) A two layered soil mass is loaded as shown in the figure and it reduces to determine deformation under the load at the surface of the ground and at the function of two soil layers. Analyse the problem by FEM. (08)

↓	↓	↓	↓	↓	100kPa
↑ 4	$Mv = 2.5 \times 10^{-4} \text{ m}^2/kN$				↓
↑ 4	$Mv = 1.5 \times 10^{-4} \text{ m}^2/kN$				↓

Q.4 A) Solve $u_{tt} = u_{xx}$ given $u(0, t) = u(1, t) = 0, u_t(x, 0) = 0$ and $u(x, 0) = x(1 - x)$ with $h = 0.2, \alpha = 1/2$ using explicit finite difference formula. (07)

OR

A) A 2.5 m thick clay layer is sandwiched between sand layer has $C_v = 0.1 \text{ m}^2/\text{month}$. Using FDM, determine degree of consolidation after three months from the commencement of consolidation. (07)

B) Using explicit algorithm solve parabolic equation $u_t = u_{xx}$ ($0 < x < 1, t > 0$) given $u(0, t) = t^2(1 - t), u(1, t) = t(1 - t^2), u(x, 0) = \sin \pi x$ for two-time steps with $\alpha = \frac{1}{2}$ and $h = 0.2$ (08)