L–2/T–2/CE Date: 27/5/2008

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L–2/T–2 B. Sc. Engineering Examinations 2006-2007

Sub : **CE 205** (Numerical Methods)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are FOUR questions in this section. Answer any THREE.

1. (a) Explain Gauss-quadrature and derive relevant parameters for n = 3. **(10)**

   (b) With the following data, find a suitable interpolating polynomial **($13\frac{1}{3}$)**

   ln(1) = 0

   ln (2) = 0.69315

   ln(5) = 1.60944

   Also estimate ln(3).

2. (a) Explain the method of iteration. **(10)**

   (b) Using the following table, find a suitable degree of Gregory-Newton interpolating polynomial: **($13\frac{1}{3}$)**

x	0.150	0.30	0.45	0.60	[illegible]	0.90
f(x)	0.7917	0.7734	0.7437	0.70[illegible]	0.6563	0.6023

   Also estimate f (0.38), considering $x_1 = 0.30$.

3. (a) Find the normal equation in least square method to fit a curve of the form $y = e^{bx}$. **($5\frac{1}{3}$)**

   (b) Apply Newton-Raphson's method to determine root of the equation: **(8)**

   $xSinx - 2e^{2x} = 0$

   (c) Use Simpson's rule to find the deflection at the centre of the beam shown in Fig. 1(a).

   The deflection is provided by the expression: **(10)**

   $$\delta = \int_0^L \frac{Mm}{EI}\,dx$$

   The distribution of M is shown in Fig. 1(b). The stiffness EI of the beam is constant throughout its length.

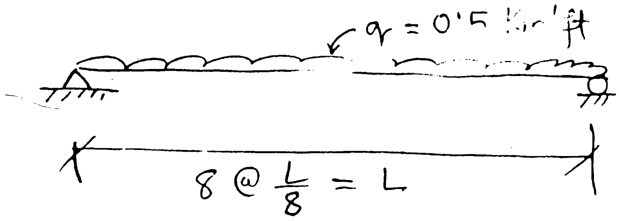
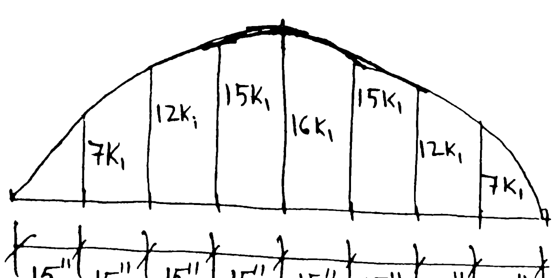


Fig 1(a)



$K_1 = \frac{qL^2}{128}$

M-diagram

Fig. 1(b)

Contd P/2

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4. (a) Derive an expression for next approximate root in the Newton-Raphson iteration method. How is it different from the Chebysher formula? **($11\frac{1}{3}$)**

(b) In Geotechnical Engineering Laboratory, the result of an Unconfined Compression Test shows the following stress-strain data. Fit the data to the following polynomial equation: **(12)**

$y = k_0 + k_1x + k_2x^2$

Strain (%)	1	2	3	5	7	10	12	15
Stress (psi)	11	23	48	97	121	144	175	192

SECTION – B

There are **FOUR** questions in this section. Answer 5 and any **TWO** from the rest

Question No. 5 is COMPULSORY

5. (**COMPULSORY QUESTION**) Answer any five of the following Seven questions. **(5×4=20)**

(a) Describe the two basic approaches that are employed for solving a system of linear equations.

(b) What are the possible solution conditions of a system of linear equations? Explain each of them with an illustration.

(c) What is pivoting? Distinguish between partial pivoting and complete pivoting.

(d) State the two important factors that are to be considered while applying iterative methods.

(e) Gauss-Seidel method is similar in principle to Jacobi method. Then what is the difference between them?

(f) Using Taylor's expansion, derive a formula for estimating the first derivative of a function.

(g) State the formula of Picard's method to solve the differential equation of the type $\frac{dy}{dx} = f(x, y)$. What are its limitations?

6. (a) Apply Gauss-Seidel iteration method to solve the following systems of linear equations (correct up to 3 decimal places). **(13)**

$$4x + 5y - 2z = -9$$
$$9x - 2y + z = 17$$
$$x - 3y - 5z = 4$$

(b) From the following values of x and y, find $\frac{dy}{dx}$ at $x = 6$. **(12)**

x	4.5	5.0	5.5	6.0	6.5	7.0
y	9.69	12.90	16.71	21.18	26.37	32.34

7. (a) Solve the following system of equations by Gauss-Jordan method. **(13)**

$$2x_1 + x_2 + x_3 = 7$$
$$4x_1 + 2x_2 + 3x_3 = 4$$
$$x_1 - x_2 + x_3 = 0$$

(b) Use 4^{th} order Runge method to estimate y(0.4) correct to four decimal places, when $\frac{dy}{dx} = 1 + y^2$, with y = 0 at x = 0. Use h = 0.2. **(12)**

8. (a) Solve the following system of equation by LU decomposition method. **(13)**

$$3x + 2y + z = 10$$
$$2x + 3y + 2z = 14$$
$$x + 2y + 3z = 14$$

(b) Given the $\frac{dy}{dx} = 3x^2 + 1$ with y(1) = 2. Use Euler's method to estimate y(2). Consider h = 0.2. **(12)**