

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2012
Program: B. Sc. Engineering (Civil)

Course Code: CE 205

Course Title: Numerical Analysis & Computer Programming

Time: 3 hours

Full Marks: 90 (60+30)

[There are two sections **SECTION A** and **SECTION B**. Answer both the sections]

SECTION A (Numerical Analysis)

[Answer **any 6 (Six)** of the following **8** questions]

1. Use Taylor's method to evaluate the numerical solution of the following ordinary differential equation, for $x = 7$. Here $y(0) = 1$ and desired accuracy = 0.0001. 10

$$\frac{dy}{dx} = 5x - 3xy^2$$

2. By Newton's forward difference formula obtain dy/dx and d^2y/dx^2 for $x = 1.2$ from the following table of values of x and y : 10

x	y	x	y
1.0	2.7183	1.8	6.0496
1.2	3.3201	2.0	7.3891
1.4	4.0552	2.2	9.0250
1.6	4.9530		

3. The strength (S) of concrete at different times (t) is shown in the following table. Derive a best-fit equation of the form $S = 3(1 - e^{-at})$ for the data shown in table and calculate S for $t = 28$ days. 10

t (days)	3	7	14	21
S (ksi)	1.5	2.1	2.6	3.1

2.9

4. The discharge (Q) through a hydraulic structure for different values of head (H) is shown below. Calculate the discharge Q for $H=3.0$ ft, using Newton's Divided-Difference Interpolation Method. 10

H (ft)	1.3	2.2	2.8	4.2
Q (cft/sec)	28	66	98	165

5. A solid of revolution is formed by rotating about the x-axis, the area between the x-axis, the lines $x = 0$ and $x = 1$, and a curve through the points with the following co-ordinates: 10

x	0.00	0.25	0.50	0.75	1.00
y	1.0000	0.9896	0.9589	0.9089	0.8415

Estimate the volume of the solid formed (Use *Simpson's 1/3* Rule).

6. Using Gauss-Seidel method solve the following systems of equations: 10

$$\begin{aligned} 12x_1 + 3x_2 - 5x_3 &= 1 \\ x_1 + 5x_2 + 3x_3 &= 28 \\ 3x_1 + 7x_2 + 13x_3 &= 76 \end{aligned}$$

Will the solution converge using this method? Initially use $x_1 = 1$, $x_2 = 0$ and $x_3 = 1$.

7. Solve the following system by Crout's method: 10

$$\begin{aligned} 3x_1 + 2x_2 + x_3 &= 10 \\ 2x_1 + 3x_2 + 2x_3 &= 14 \\ x_1 + 2x_2 + 3x_3 &= 14 \end{aligned}$$

8. Derive a best-fit equation in the form of $y = a_0 + a_1x + a_2x^2 + a_3x^3$ for the points (0,1), (1,2), (2,4), (3,5) and (4,6). Also find the S. 10

SECTION B (Computer Programming)

[Answer any 3 (Three) of the following 4 questions]

1. Write a program to find out the summation of the following series: 10
 $1^2 + 2^2 + 3^2 + 4^2 + \dots + n^2$

2. Illustrate a program that can add matrix A and matrix B given below. 10

$$A = \begin{pmatrix} 2.0 & 5.5 & 3.2 \\ 5.1 & -7.4 & 1.9 \\ 2.5 & 3.7 & 8.1 \end{pmatrix} \quad B = \begin{pmatrix} 4.0 & 3.1 & 4.5 \\ 0.0 & -1.2 & 7.2 \\ 2.2 & 0.9 & 2.0 \end{pmatrix}$$

3. Write a program that reads a number and writes on the screen if it is even or odd. 10

4. Describe a program that calculates the real roots of any quadratic equation $ax^2+bx+c=0$ for given values of a, b and c. 10