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

Course Code: CE 205 Course Title: Numerical Analysis & Computer Programming

Time: 3 hours Credit Hours: 3.0 Full Marks: 90 (= 60+30)

[There are two sections **SECTION A** and **SECTION B.** Answer both the sections]
[All questions carry equal marks]

SECTION A (Numerical Analysis)

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

1. Use Taylor's method to obtain the numerical solution of the following ordinary differential equation for x = 4 with step-size equal to 2. Given that, y(0)=1.

$$\frac{dx}{dy} = \frac{x+y}{y-x}$$

2. Determine the velocity of a automobile at time, t = 12.9 sec for the following data using Gregory Newton Interpolation Method.

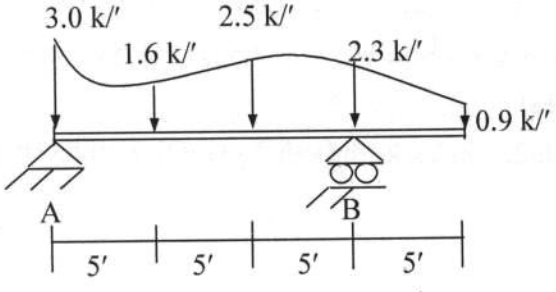
Time (sec)	5	10	15	20
Velocity (mps)	0.0736	0.2849	0.7632	1.5735

3. The non-linear first-order Ordinary Differential Equation (ODE) governing unsteady radion heat transfer per unit time from a mass can be expressed as follows:
$\frac{dT}{dt} = -\alpha (T^4 - T_a^4)$ where, $\alpha = 4x10^{-12}$, $T_a = 250$ K, $T(1) = 2500$ K
Solve the ODE for t = 5 by 4th order Runge-Kutta Method using step-size of 2.

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.

H (ft)	1.2	2.1	2.7	4.0
Q (cft/sec)	25	60	90	155

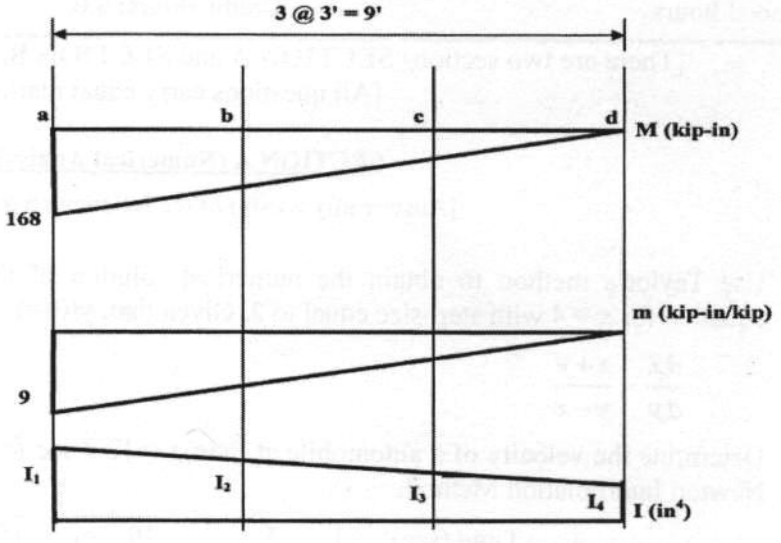
5. For the beam loaded as shown in the figure below, calculate the vertical reaction R_B at support B using ***Simpson's ⅓*** Rule [The summation of moments at A due to R_B and the distributed load equal to zero].



6. Use the least-square method to fit an equation of the form $S = at^{0.3}$ for the data shown below. Using the best-fit equation, calculate S for t = 28 days.

t (days)	3	7	14	21
S (ksi)	1.3	1.8	2.3	2.5

7. The following diagrams show the variation of bending moments ***M*** and ***m*** and moment of inertia ***I*** in a beam. Estimate I_1 (use ***Simpson's ⅜ rule***).
[Given: Deflection of a beam, $\int(Mm/EI)dx = 0.014$ in, and $I_1:I_4 = 4:1$, E=29000 ksi]



8. Given the (x,y) ordinates of four points (0,2.2), (2.1,3.1), (3.2,3.5), (4.6,4.3), fit a general straight line [$y = f(x) = a_0 + a_1 x$], through this set of data points.

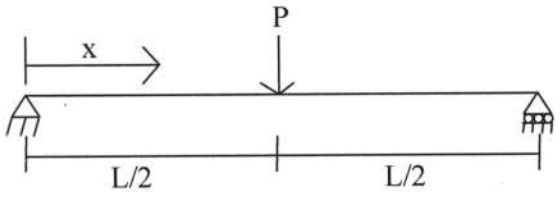
Formula:

1. $P = (x-x_1)(x-x_2)\ldots.(x-x_n)/\{(x_0-x_1)(x_0-x_2)\ldots.(x_0-x_n)\}f(x_0) + (x-x_0)(x-x_2)\ldots.(x-x_n)/\{(x_1-x_0)(x_1-x_2)\ldots.(x_1-x_n)\}f(x_1) + \ldots + (x-x_0)(x-x_2)\ldots.(x-x_{n-1})/\{(x_n-x_0)(x_n-x_1)\ldots.(x_n-x_{n-1})\}f(x_n)$
2. $P = f(x_1) + \{\Delta f(x_1)*u\}/1! + \{\Delta^2 f(x_1)*u*(u-1)\}/2! + \{\Delta^3 f(x_1)*u*(u-1)*(u-2)\}/3! + \ldots\ldots..$
3. $\Delta^n f(x_1) = {}^nc_0\, f(x_1 + n*h) - {}^nc_1\, f\{x_1 + (n-1)*h\} + {}^nc_2\, f\{x_1 + (n-2)*h\} - \ldots.. + {}^nc_n\, f(x_1)$
4. $A = h\,\{(y_0 + y_n)/2 + (y_1 + y_2 + \ldots\ldots + y_{n-1})\}$
5. $A = (h/3)\,\{y_0 + y_n + 4\,(y_1 + y_3 + \ldots\ldots\ldots\ldots + y_{n-1}) + 2\,(y_2 + y_4 + \ldots\ldots.. + y_{n-2})\}$
6. $A = (3h/8)\,\{y_0 + y_n + 3\,(y_1 + y_2 + y_4 + y_5 + y_7 + \ldots. + y_{n-1}) + 2\,(y_3 + y_6 + \ldots)\}$
7. $y_1 = y_0 + 1/6\,(k_1 + 2k_2 + 2k_3 + k_4)$
   here $k_1 = hf(x,y)$; $k_2 = hf(x+h/2, y+k_1/2)$; $k_3 = hf(x+h/2, y+k_2/2)$; $k_4 = hf(x+h, y+k_3)$

SECTION B (Computer Programming)

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

1. Write a program that can display shear and moment values of the simply supported beam shown below at an interval of L/4 [Here L and P are real positive number].



Location (From Left)	SF	BM
$0 \le x < L/2$	P/2	Px/2
$x = L/2$	0	PL/2
$L/2 < x \le L$	-P/2	P(L-x)/2

2. (i) Using *'for'* loop, write a program that can read two separate odd numbers and display the sum of all the odd numbers in between the two.

   (ii) If any of the assigned values is not an odd number, modify the above program in a way that it can alert the user and suggest to reassign that value.

3. Four students took all three theory courses of Mr. X in Spring, 2012. Class test marks of all four students in these courses are shown below. Using array, write a program to determine the maximum and calculate the average value for every student.

	Student 1	Student 2	Student 3	Student 4
CE 205	8.5	6.5	Absent	4
CE 333	7	8	6	6
CE 411	Absent	5	2	9.5

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