Philadelphia University
Faculty of Engineering

Student Name:
Student Number

Dept. of Computer Engineering
Final Exam, First Semester: 2015/2016

Course Title: Engineering Analysis II	**Date: 7/2/2016**
Course No: (630262)	**Time Allowed: 2 hours**

Please choose your section:

Instructor: ☐ **Eng. Anis Nazer** ☐ **Eng. Sultan Al-Rushdan**

Lecture time: ☐ **10:10 خ ث ح** ☐ **13:10 خ ث ح** ☐ **11:15 ر ن**

Question 1: **(5 marks)**

Use false position method to solve the following equation starting with x_L = 5.5 and x_U = 7.5. Perform iterations until the absolute error is less thatn 0.01

$$3x\cos(x)=36-x^2\sin(x)$$

Question 2: **(6 marks)**

Perform three Gauss-Seidel iterations to approximate the solution of the following system of linear equations and calculate the relative error in the last iteration iteration:

$$2.5x+6.5y-3z=22.6$$
$$1.5x+2.3y-4.8z=29.76$$
$$5.2x-1.7y-3.2z=5.33$$

Question 3: **(5 marks)**

Use 3rd order lagrange interpolation to approximate f(x) for x=3.1 using the following data:

x	1.5	2.3	3.6	4.1
$f(x)$	3.125	5.197	20.58	32.79

Question 4: **(6 marks)**

Use Linear Regression to find the relation between x and y, and find SSE for that relation

x	3.2	6.5	6.6	7.1	8.5	9.3
y	-23.3	-52.1	-52.9	-57.3	-69.2	-75.8

Question 5: **(5 marks)**

a) Approximate the following integral using composite trapezoidal rule with 7 sampling points

$$I=\int_{3.8}^{4.7}\frac{dx}{x^2-9}dx$$

b) What is relative error in the approximation in part (a) if the true solution is: $\frac{1}{6}\ln\left|\frac{x-3}{x+3}\right|$

Question 6: **(5 marks)**

Use Huen's method to approximate y(2) with 4 steps:

$$\frac{dy}{dx}=6y^2x \quad , \quad y(1)=0.04$$

Good Luck

Question 7: **(3 marks)**

Given the following data:

x	1.7	1.8	1.9	2.0	2.1	2.2	2.3
$f(x)$	7.67	9.52	11.6	13.9	16.4	19.1	22.0

a) approximate f'(1.7) using a formula with error of order $O(h^2)$

b) approximate f'(2) using formula with minimum error

c) approximate f''(2) using a formula with error of order $O(h^4)$

Question 8: **(5 marks)**

Choose the correct answer: (1 mark each)

Questions	Answer
1) If E_rel = 0.01% and E_abs = 0.001, then the approximation is true for _____ significant digits a) one b) two c) three d) four	
2) The newton raphson formula to solve the equation $x^4=5$ is: a) $\frac{3x^4-5}{4x^3}$ b) $\frac{3x^4+5}{4x^3}$ c) $\frac{x^4+5}{4x^3}$ d) the equation has no solution	
3) What is the inverse of $[A]=\begin{bmatrix}1 & 0\\ 2 & 5\end{bmatrix}$? a) $\begin{bmatrix}1 & 0\\ -2 & 1\end{bmatrix}$ b) $\begin{bmatrix}1 & 0\\ -0.4 & 0.2\end{bmatrix}$ c) $\begin{bmatrix}5 & 0\\ -2 & 1\end{bmatrix}$ d) $\begin{bmatrix}1 & 0\\ 0.4 & -0.2\end{bmatrix}$	
4) The eigen values of $[A]=\begin{bmatrix}1 & 0\\ 2 & 5\end{bmatrix}$ are: a) $\lambda_1=5,\ \lambda_2=1$ b) $\lambda_1=-5,\ \lambda_2=-1$ c) $\lambda_1=-5,\ \lambda_2=1$ d) $\lambda_1=5,\ \lambda_2=-1$	
5) Using 2nd order Newoton difference method for interpolation for the points (x_0, y_0) , (x_1, y_1) , (x_2, y_2) the resulting function is: $f(x)=b_0+b_1(x-x_0)+b_2(x-x_0)(x-x_1)$. The value of b_1 is: a) $b_1=\frac{x-x_1}{x_0-x_1}$ b) $b_1=\left(\frac{x-x_0}{x_0-x_1}\right)\left(\frac{x-x_2}{x_0-x_2}\right)$ c) $b_1=\frac{y_1-y_0}{x_1-x_0}$ d) $b_1=\frac{y_2-y_1}{x_2-x_1}$	

Formulas for the derivative:

	$f'(x)$	$f''(x)$
$O(h^2)$	$f'(x)=\frac{f_1-f_{-1}}{2h}$ $f'(x)=\frac{3f_0-4f_{-1}+f_{-2}}{2h}$ $f'(x)=\frac{-3f_0+4f_1-f_2}{2h}$	$f''(x)=\frac{f_1-2f_0+f_{-1}}{h^2}$ $f''(x)=\frac{2f_0-5f_{-1}+4f_{-2}-f_{-3}}{h^2}$ $f''(x)=\frac{2f_0-5f_1+4f_2-f_3}{h^2}$
$O(h^4)$	$f'(x)=\frac{-f_2+8f_1-8f_{-1}+f_{-2}}{12h}$	$f''(x)=\frac{-f_2+16f_1-30f_0+16f_{-1}-f_{-2}}{12h^2}$

Good Luck