Philadelphia University
Faculty of Engineering

Student Name:
Student Number

Dept. of Computer Engineering
Final Exam, Second Semester: 2016/2017

Course Title: Engineering Analysis II	**Date: 10/6/2017**
Course No: (630262)	**Time Allowed: 2 hours**

NOTES: - Round ALL your calculations to 4 significant digits
- Angles for trigonometric functions are in radian scale

Please choose your section:

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

Lecture time: ☐ **9:10 ح ث خ** ☐ **13:10 ح ث خ** ☐ **11:15 ن ر** ☐ **9:45 ن ر**

Question 1: **(5 marks)**

Use false position method to approximate the root of the equation with a relative error less than 0.02. Start with $x_L=0.18$ and $x_U=0.21$

$$\frac{\ln(x)}{x^2+2x}=-3.71$$

Question 2: **(4 marks)**

Use Newton-Raphson iterations to solve the equation $5e^{2x+4}=8$. Start with $x_0=-1.5$ and perform three iterations

Question 3: **(5 marks)**

Given the following data points,

x	-2	0	5	7
f(x)	5	-3	397	977

a) Use third order Lagrange interpolation to approximate f(6)
b) Assume that the true value of f(6) is 642, how many significant digits are correct in your answer in part (a)

Question 4: **(5 marks)**

Consider the integral:

$$\int_4^{16}\frac{x+1}{x+2\sqrt{x}-3}dx$$

a) Use 1/3 Simpson's rule to approximate the integral with 7 points
b) Find the absolute in the approximation of part (a) error if the solution is:

$$\int\frac{x+1}{x+2\sqrt{x}-3}dx=x-4\sqrt{x}+\ln(\sqrt{x}-1)+15\ln(\sqrt{x}+3)$$

Question 5: **(5 marks)**

Approximate y(0.6) using Huen's method with h = 0.2.

$$\frac{dy}{dx}=2\sin(3x)+0.5y \quad , \quad y(0)=-0.5$$

Question 6: **(4 marks)**

Use Euler method with h=0.1 to solve the following differential equation and approximate x(0.3) and y(0.3)

$$\frac{dx}{dt}=t-y \quad , \quad x(0.1)=1.3$$
$$\frac{dy}{dt}=\sin(y) \quad , \quad y(0.1)=-1$$

Good Luck

Question 7: **(12 marks)**

Choose the best answer in the following questions (1.5 mark for each part)

Question	Answer
1) Assume that the true value is 1.2345, and the absolute error in x_1 is 0.1, and the relative error in x_2 is 0.1. Which statement is true ? A) x_1 is better than x_2 B) x_1 and x_2 have the same error C) x_2 is better than x_1 D) All the choices are false	
2) Using bisection method, $x_3=3.21$, and the absolute error in x_3 is 0.1. Which approximation is guarenteed to have an error less than 0.02 A) x_1 B) x_5 C) x_6 D) Cannot be determined from the given information	
3) Given the equation e^x = 5, which of the following Newton Raphson formulas will solve the equation ? A) $x_{i+1}=x_i+5e^{-x_i}-1$ B) $x_{i+1}=x_i-1-5e^{-x_i}$ C) $x_{i+1}=x_i+5e^{-x_i}-1$ D) None of the choices	
4) Assume that $[A]=\begin{bmatrix}-3 & 5\\ 1 & -1\end{bmatrix}$, the value of $[\mathrm{A}]^{-1}[\mathrm{A}]^T$ A) $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ B) $\begin{bmatrix}1.5 & -2.5\\ -0.5 & 0.5\end{bmatrix}$ C) $\begin{bmatrix}-14 & 3\\ 9 & -2\end{bmatrix}$ D) None of the choices	
5) Assume that $[A]=\begin{bmatrix}-3 & 5\\ 1 & -1\end{bmatrix}$, the eigen values of [A] are : A) $\lambda_1=0.4495$, $\lambda_2=-4.4495$ B) $\lambda_1=4$, $\lambda_2=-2$ C) $\lambda_1=-3.414$, $\lambda_2=-0.5858$ D) $\lambda_1=0.8284$, $\lambda_2=-4.8284$	
6) The function $f(x)=ax^2+bx+c$ passes through the points (-1, 3) (0, 2) (1, -6). Use interpolation to find the value of c A) c = 3 B) c = 0 C) c = 2 D) None of the choices	
7) Apply linear regression for the following data and find the sum square error for f(x) A) SSE = 0.5 B) SSE = 0.015 C) SSE = 0.2 D) None of the choices	

x	y
1	1.5
2	1
3	0.2

Good Luck

Question 7... continued

8) Given the following data,

x	y
0.0	0.5
0.1	0.6
0.2	0.7
0.3	0.79
0.4	0.89
0.5	0.98
0.6	1.06
0.7	1.1
0.8	1.2
0.9	1.28
1.0	1.31

use composite trapezoidal rule to approximate $\int_{0.1}^{0.9} f(x)\,dx$ with 5 points

A) 0.762 B) 0.557 C) 0.700 D) 1.5505