Philadelphia University
Faculty of Engineering

Student Name:
Student Number

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

Course Title: Engineering Analysis II	**Date: 29/3/2017**
Course No: (630262)	**Time Allowed: 50 minutes**

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: (8 marks)

Given the following equation, start with $x_L=0$, $x_U=1$. **Perform three iterations using both bisection and false position methods**. Also, find the absolute error in the last iteration for both solutions.

$$x\left(x^2-5\right)=x-3$$

$x^3-5x-x+3=0 \rightarrow f(x)=x^3-6x+3$, f(x) is continous
$f(0)=3$ positive
$f(1)=-2$ negative

Bisection

x_L	x_U	x_M	$f(x_M)$	E_{abs}
0	1	0.5	0.125	
0.5	1	0.75	-0.1078	0.25
0.5	0.75	0.625	-0.5059	0.125

False Position

x_L	$f(x_L)$	x_U	$f(x_U)$	x_M	$f(x_M)$	E_{abs}
0	3	1	-2	0.6	-0.384	
0	3	0.6	-0.384	0.5319	-0.04092	0.0681
0	3	0.5319	-0.04099	0.5247	-0.0037448	0.0072

Good Luck

Question 2: **(6 marks)**

Consider the following equation:

$$\ln(x^2)=5$$

a) Write the Newton Raphson folrmula in the **simplest form**

b) Start with $x_0=10$ and perform iterations until the relative error is less than 0.003

$$f(x)=\ln(x^2)-5 \quad \rightarrow \quad f'(x)=\frac{1}{x^2}(2x)=\frac{2}{x}$$

a) Newton-Raphson formula:

$$x=x-\frac{f(x)}{f'(x)}=x-\frac{\ln(x^2)-5}{\frac{2}{x}}=x-\frac{x}{2}(\ln(x^2)-5)=3.5x-0.5x\ln(x^2) \quad \text{so,} \quad x_{i+1}=3.5x_i-0.5\ln(x_i^2)$$

b) $x_0=10$

$x_1=3.5\times10-0.5\times10\times\ln(10^2)=11.974$, $E_{rel}=0.1649$

$x_2=3.5\times11.974-0.5\times11.974\times\ln(11.974^2)=12.181$, $E_{rel}=0.01699$

$x_3=3.5\times12.181-0.5\times12.181\times\ln(12.181^2)=12.182$, $E_{rel}=8.2\times10^{-5}$

Question 3: **(6 marks)**

Choose the answer in the following questions

Question	Answer
1) An approximation is correct for at least _____ significant digits if the relative error is less than 6.2×10^{-3} % A) 1 B) 2 **C) 3** D) 4	C
2) Assume that $[X]=\begin{bmatrix}1&2&3\\4&5&6\\7&8&9\end{bmatrix}$, $[Y]=\begin{bmatrix}1&1&1\end{bmatrix}$, and $[Z]=\begin{bmatrix}1\\1\\1\end{bmatrix}$ then [Y][X] = **A)** $\begin{bmatrix}12&15&18\end{bmatrix}$ B) $\begin{bmatrix}6&15&24\end{bmatrix}$ C) $\begin{bmatrix}6\\15\\24\end{bmatrix}$ D) the multiplication is invalid	A
3) If $[A]=\begin{bmatrix}1&a_{12}\\2&-1\end{bmatrix}$ and $\lvert A\rvert=-7$, then $a_{12}=$ A) -3 B) 4 **C) 3** D) cannot be determined	C
4) Given $[A]=\begin{bmatrix}-3&5\\1&-1\end{bmatrix}$ and $[B]=\begin{bmatrix}7&-9\\4&2.5\end{bmatrix}$, which of the following statements is true ? (I) $[A][B]=[B][A]$ (II) $[A]^T+[B]^T=([A]+[B])^T$ A) (I) only **B) (II) only** C) (I) and (II) D) both are false	B

Good Luck