Philadelphia University
Faculty of Engineering

Student Name:
Student Number

Dept. of Computer Engineering
Final Exam, Second Semester: 2017/2018

Course Title: Engineering Analysis II (630262)	**Date: 3/6/2018**	**Time Allowed: 2 hours**

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

Question number	Q1 / 15	Q2 / 16	Q3 / 15	Q4 / 10	Q5 / 20	Q6 / 24	Total / 100
Grade							

Please choose your instructor:

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

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

Question 1: (15 marks)

Perform three false position iterations (find x_1 , x_2 , x_3) to approximate the solution to the following equation, the root is between [2 , 4]

$$\sin(x) = \ln(x) - 1.5$$

Question 2: **(16 marks)**

You are required to use Gauss-Seidel iterations to solve the following system of linear equations:

$$\begin{bmatrix} 3.1 & -4.9 & 1.1 \\ 2.5 & -1.3 & 4.9 \\ -5.7 & 1.2 & -2.0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 12 \\ 3 \\ 3 \end{bmatrix}$$

a) Rearrange the system to make sure that the iterations will converge

b) Start with $x=0,\ \ y=0,\ \ z=0$ and perform 2 Gauss-Seidel iterations

Question 3: **(15 marks)**

The distance of a car is recorded at different times. Use 2nd order Lagrange interpolation to find the relation between the time and distance. **Write the resulting function in the form** $f(x)=a_0+a_1x+a_2x^2$

x : time is seconds	5	10	15
$f(x)$: distance in meter/second	342	872	1530

Question 4: **(10 marks)**

Given the following data, use linear regression to find the relation between x and y, then find SSE for that relation

x	*y*
1.0	-0.76
1.5	0.55
2.0	1.83
2.5	3.00

Question 5: **(20 marks)**

Consider the following differential equation:

$$y' = -2y + 5e^{-t} \quad , \quad y(2) = 1.5$$

a) Approximate y at x = 2.6, using Euler method with a **step size of 0.2**

b) Approximate y at x = 2.6, using Heun's method with a **step size of 0.3**

c) Which approximation is better, given that the true value is $y(2.6) = 0.619348$

Question 6: **(24 marks)**

Choose the correct answer in the following questions (3 marks each)

Question	Answer
1) If the computer stores $\sqrt{5}$ as the number 2.2360680103, then the approximation is true for _____ significant digits? Assume that the true value of $\sqrt{5}$ is 2.236067977 A) 6 B) 7 C) 8 D) cannot be determined	
2) When using interpolation with 4 points, the order of the resulting polynomial **may be** __?___ A) first order B) 2nd order C) 3rd order D) All of the choices	
3) Which of the following formulas can be used to solve $x e^x = 1$ using Newton Raphson iterations A) $x = \frac{x^2 e^x + 1}{e^x (x+1)}$ B) $x = \frac{x^2 e^x + 1}{e^x}$ C) $x = \frac{x e^x - 1}{e^x (x+1)}$ D) None of the choices	
4) Which of the following is true? ($[A], [B], [C]$ are square matrices) A) $[A][B] = [B][A]$ B) $[A][I] = [I][A]$ C) $([A]^T)^T = [A]^{-1}$ D) $[A]([B][C]) = ([A][C])[B]$	
5) The eigen values of $\begin{bmatrix} a_{11} & 0 \\ -1 & 4 \end{bmatrix}$ are $\lambda_1 = 1$ and $\lambda_2 = 4$, then a_{11} = A) 0 B) 2.1324 C) 1 D) 4	
6) Given the integral $\int_1^2 e^{-x} dx$, which of the following will result in the best approximation? (the true value is 0.2325441579) A) using Composite Trapezoidal with h=0.2 B) using Composite 1/3 Simpson with h=0.1 C) using Composite 1/3 Simpson with 7 points D) Cannot be detirmined	
7) A square matrix [A] is lower triangular if: A) $a_{ij} = 0$ for all i = j B) $a_{ij} = 0$ for all i > j C) $a_{ij} = 0$ for all i < j D) $a_{ij} \neq 0$ for all i > j	
8) The polynomial that passes through the points (18,24) (22,25) (24,123) is given by $y = 8.125x^2 - 324.75x + 3237$ The function using Newton's divided difference polynomial is given by $f_2(x) = b_0 + b_1(x - 18) + b_2(x - 18)(x - 22)$ The value of b_2 is : A) 8.125 B) 24 C) 3237 D) 0.25	

GOOD LUCK