Philadelphia University
Faculty of Engineering

Student Name:
Student Number

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

Course Title: Engineering Analysis II	Date: 8/2/2017
Course No: (630262)	Number of Pages: 2
	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: ☐   **Eng. Anis Nazer**   ☐   **Eng. Sultan Al-Rushdan**

Lecture time: ☐   **ح ث خ 8:10**   ☐   **ن ر 8:15**   ☐   **ن ر 11:15**

Question 1: (6 marks)

Approximate the solution of the following nonlinear equation using newton-raphson method starting from $x_0 = 0.6$ perform iterations until the relative error is less than 0.01.

$$f(x) = 3\sin^2(5x)$$

Question 2: (6 marks)

Use the following data to approximate y at x = 1.3 using third order lagrange interpolation.

x	1.2	1.5	1.8	2.1
y	-4.52	-3.2	-2.12	-0.38

Question 3: (8 marks)

a) Use nonlinear regression to find the exponential function $y = C\,e^{Dx}$ that best fits the points.
b) Find the SSE for the function in part (a).

x	2.1	2.3	2.5	2.6	2.8	3
y	160	225	315	374	525	738

Question 4: (6 marks)

Consider the following integration:

$$\int_{\frac{\pi}{3}}^{\frac{4\pi}{3}} \frac{\cos^2(x)}{1+\sin(x)}\,dx$$

a) Use composite 1/3 Simpson rule to approximate the integration using 7 sampling points.
b) The solution of the integration is $y = x + \cos(x)$, find the relative error.

Question 5: (6 marks)

a) Use midpoint method to approximate the solution of the following differential equation at x=0.15 if the initial condition is y(0)=2. Use a step size of 0.05

$$y^2 \frac{dy}{dx} - 5y^3 = e^{-2x} \qquad , \qquad y(0) = 2$$

b) If the solution of the previous differential equation is $y = \sqrt[3]{\dfrac{(139\,e^{15x} - 3\,e^{-2x})}{17}}$, find the absolute error in your

approximation of y(0.15)

Good Luck   1/2

Choose the most correct answer in the following questions:

Question	Answer
1) If the relative error in x_4 is 0.066 % then x_4 is correct for at least _____ significant digits A) 2 B) 3 C) 4 D) 5	
2) Which formula can be used to solve $f(x)=x^3-5$ using Newtorn Raphson iterations A) $x_{i+1}=\dfrac{-2}{3}x_i-\dfrac{5}{3x_i^2}$ B) $x_{i+1}=\dfrac{2}{3}x_i+\dfrac{5}{3x_i^2}$ C) $x_{i+1}=3x_i^2$ D) None of the choices	
Refer to the following matrices to answer parts (3) and (4) $[A]=\begin{bmatrix}2 & -1\\0 & 3\end{bmatrix}$, $[B]=\begin{bmatrix}1 & 2\\4 & 3\end{bmatrix}$, $[C]=\begin{bmatrix}2 & -2\end{bmatrix}$, $[D]=\begin{bmatrix}-1\\1\end{bmatrix}$ 3) The inverse of [A] is: A) $\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}$ B) $\begin{bmatrix}3 & 1\\0 & 2\end{bmatrix}$ C) $\begin{bmatrix}2 & 0\\-1 & 3\end{bmatrix}$ D) None of the choices	
4) The eigen values of [B] are : A) $\lambda_1=5$, $\lambda_2=-1$ B) $\lambda_1=2$, $\lambda_2=3$ C) $\lambda_1=1$, $\lambda_2=3$ D) undefined	
5) Given the data (1, 1.4) (2, 6.3) (3, 13), the SSE for $f(x)=1.5x^2$ is: A) 0.8 B) 0.54 C) 0.35 D) 0	
6) Given the following data points (5, 3) (4, 2) (3, 1) , the interpolating polynomial is: A) $f(x)=x^2-5x+3$ B) $f(x)=x-2$ C) $f(x)=0.5x^2-3.5x+8$ D) $f(x)=0.5x$	
7) Refer to the figure to approximate $\displaystyle\int_{0.5}^{2.5} f(x)\,dx$ using Simpson's rule with three sample points A) 1.1867 B) 7.22 C) 2.4067 D) the integran cannot be approximated from the given information	
8) Use Euler method with two steps to approximate y(2) for the differential equation $y'=t-y$, where $y(1)=1$. A) $y(2)\approx1.25$ B) $y(2)\approx3$ C) $y(2)\approx1.125$ D) $y(2)\approx1.5$	

Good Luck