Philadelphia University Faculty of Engineering Department of Computer Engineering		Date:- 19/08/2018 Allowed time:-2 Hours No. of pages: 7.

Engineering Analysis II (630262) Final Exam

Student Name:-.. **ID:-**..............................

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Lecture Time:	☐ 10:20	☐ 11:30	☐ 12:40

Notes: All trigonometric functions are in radian scale.
Round your calculations to 4 significant digits

Question 1: Approximate the solution of the following equation using **False Position** method with initial interval $x_l=0.5$, $x_u=1$, perform iterations until the **Absolute Error** is less than 0.02. **14 points**

$$f(x) = 4\,cos(x) - 0.5e^{3x}$$

Question 2: Approximate the solution of the following equation using **Newton-Raphson** method with initial guess $\mathbf{x_0=0.7}$, perform iterations until the **Relative Error** less than 0.01. **14 points**

$$f(x) = 10\,sin(x^2) - 3$$

Question 3: Use **non-linear regression** to find the equation $\boldsymbol{y = Ce^{Dx}}$ that best fits the following points. **14 points**

x	3.1	3.6	4.2	4.8	5.3
y	5.5	7.1	8.6	10.8	14.2

Question 4: Given the following points. **14 points**

x	-2	0	1
f(x)	24	2	3

A. Use **<u>Second order Lagrange interpolation</u>** polynomial to find $f_2(x)$ in its simplest form.

B. Find ***f(4)*** using the equation obtained in part A.

Question 5: Given the following integration: **18 points**

$$\int_{\frac{\pi}{6}}^{\frac{5\pi}{6}} \cos^2(2x)\sin(x)\,dx$$

A. Approximate the result of the integration using **composite Simpson 1/3** method with 6-sub intervals (N=6).

B. If the true solution is $y = -\cos(x) + \frac{4}{3}\cos^3(x) - \frac{4}{5}\cos^5(x)$ calculate the absolute error with respect to true value.

Question 6: Given the following differential equation. **14 points**

$$\frac{dy}{dx} = e^{-y}(x^2 - 6) \qquad \text{with initial condition} \qquad y(3) = 0$$

A. Approximate **y(3.24)** with step size $h = 0.12$ using <u>**Heun's method(2RK)**</u>.

B. If the true solution of the differential equation is $y = ln(\frac{x^3}{3} - 6x + 10)$ calculate the <u>**Absolute Error**</u> at y(3.36).

Question 7: Choose the correct answer for the following questions:

12 points (2 points each)

1- If $\boldsymbol{f(x) = 2x^2 - 1}$ and $\mathbf{x_e}$**=0.8** and $\mathbf{x_s}$**=0.2** then the absolute error after performing 2 bisection iterations is:			
A). 0.15	B). 0.23	C). 0.3	D). 0.03
2- The Eigen values of $A=\begin{bmatrix}-3 & 10\\ 2 & 5\end{bmatrix}$ are:			
A). $\lambda_1=5$ $\lambda_2=7$	B). $\lambda_1=5$ $\lambda_2=-7$	C). $\lambda_1=-5$ $\lambda_2=7$	D). $\lambda_1=-5$ $\lambda_2=-7$
3- The inverse of $A=\begin{bmatrix}4 & -6\\ -5 & 7\end{bmatrix}$ is			
A). $\begin{bmatrix}3.5 & 3\\ 2.5 & 2\end{bmatrix}$	B). $\begin{bmatrix}-3.5 & -3\\ -2.5 & -2\end{bmatrix}$	C). $\begin{bmatrix}-2 & -3\\ -2.5 & -3.5\end{bmatrix}$	D). $\begin{bmatrix}-3.5 & 3\\ 2.5 & -2\end{bmatrix}$
4- Using simple Trapezoidal rule to Approximate $\int_5^7 (2x-7)dx$ the result is:			
A). 4	B). 6	C). 8	D). 10
5- In Linear regression for function ***y=Ax+B*** if **Σy =35.2** , **Σx=15.6** , **A=3.21** and **N=5** then the value of **B** is:			
A). -2.975	B). 17.06	C). -19.48	D). 25.72
6- If $\frac{dy}{dx} + 2xy = -2x^3$ ***and*** $y(2) = -3$ then ***y(2.25)*** with step size ***h=0.25*** using **Euler method** is:			
A). -3.5	B). -3.75	C). -4	D). -4.25