

Dept. of Computer Engineering
Final Exam, First Semester: 2013/2014

Course Title: Engineering Analysis II
Course No: (630262)

Date: 28/1/2014
Time Allowed: 2 hours
No. of Pages: 2



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. Muteeah Al-Jawarneh

Lecture time: 8:10 ح ث خ 9:10 ح ث خ 11:10 ح ث خ 9:45 ن ر

Question 1: (6 points)

Use Gaussian Elimination to solve the following system of linear equations:

$$\begin{aligned} 3x + 2y + z &= 1 \\ 5x + 3y + 4z &= 2 \\ x + y - z &= 1 \end{aligned}$$

Question 2: (6 points)

Find the root of the following equation using three Newton-Raphson iterations, start with $x_0=0.5$ and find x_1, x_2, x_3 , find the relative error in each iteration.

$$\cos(x) = x^3$$

Question 3: (6 points)

a) Torque T and Speed w for a motor is given in the table below. Use 3rd order Newton interpolating polynomial to estimate the torque at a speed of 1.8 rpm

Scaled Speed (rpm)	0.5	1.0	1.5	2.0
Torque (N·m)	31	28	24	14

b) Consider the following table of functional values for $f(x) = \ln(x)$

x	0.5	0.7	0.8
$\ln(x)$	-0.69315	-0.35667	-0.22314

Apply 2nd order Lagrange interpolation to approximate $f(0.6)$, and find the relative error in your approximation

Question 4: (6 points)

Assume that you currently have 1.5 million Dinars, it grows at a rate given by the differential equation:

$$m' = 0.3 \left(1 + t - \frac{m}{10} \right) m$$

approximate the amount of money after one (1.0) year. Use Runge-Kutta order 2 method (RK2) with a step size $h=0.5$

Question 5:**(6 points)**

Approximate the integral:

$$\int_{-0.5}^1 \frac{2}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} dx$$

using:

- a) Composite Trapezoidal method with 5 points (3 marks)
 b) Composite 1/3 Simpson Method with 5 points (3 marks)

Question 6:**(6 points)**

Use non-linear regression to fit the points to a function of the form $y = Ce^{Dx}$ then approximate $y(10)$

x	0	1	3	5	7	9
y	5	3.72	2.01	1.21	0.64	0.34

Question 7:**(4 points)**

Choose the correct answer (answer on question sheet):

1) if 5 and 2 are the eigen values of $[A] = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$ then the eigen values of $[A]^2$ are:

- a) 2 and 5
 b) 4 and 7
 c) 4 and 10
 d) 4 and 25

2) $[A]$ and $[B]$ are square matrices, if $[B] = [A]^T$, which of the following is true?

- (I) $[B]^2 = ([A]^2)^T$
 (II) $\det(A) = \det(B)$

- a) (I) only
 b) (II) only
 c) (I) and (II)
 d) both are false

3) To find the root of $x^3 - 2x + 5 = 3$, you can start with x_L and x_U

- a) $x_L = -3$, $x_U = -2$
 b) $x_L = -2$, $x_U = -1$
 c) $x_L = 2$, $x_U = 3$
 d) $x_L = 1$, $x_U = 2$