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MAIN EXAMINATION

JANUARY – APRIL 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

PART TIME PROGRAMME

MAT 437: NUMERICAL ANALYSIS II

Date: APRIL 2018	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

Q1. a) Solve $\left.\begin{array}{l} 2x+4y=10 \\ x-y=2 \end{array}\right\}$ using Gaussian elimination method. **(5 marks)**

b) Explain briefly Crout's method For solving system of linear equations. **(3 marks)**

c) Find the least square polynomial of the form $y = a_0 + a_1 x + a_2 x^2$ that best fit the data below

x	-2	-1	0	1	2
y	0	-4	-4	0	8

(6 marks)

d) Obtain a linear relation from $y = \frac{ax}{b+x}$ where a and b are constants. **(5 marks)**

e) Find exact solution of $\frac{dy}{dx} = x + y; y(0) = 1$ at x=0.2. **(5 marks)**

f) Linearize the relation $y = ax^b$ where a and b are constants. **(5 marks)**

Q2. a) Find the eigenvalues and the corresponding eigenvector of matrix

$$A = \begin{bmatrix} 4 & 2 & 1 \\ 0 & -5 & 3 \\ 0 & 0 & 6 \end{bmatrix}.$$ **(13 marks)**

b) Solve the system below using Gaussian elimination with pivoting. Perform the computation to 4 decimal places.

$$5x + 3y + z = 18$$
$$10x + 6y + 7z = 43$$ **(7 marks)**
$$20x + y - z = 19$$

Q3. a) Use Jacobi's iterative method to solve the system of equations below using $x^{(0)} = 1, y^{(0)} = 0, z^{(0)} = 0$.

$$3x + 20y + 30z = 12.3$$
$$20x + 5y + 7z = 4.9$$ **(15 marks)**
$$5x + 20y + 4z = 7.3$$

b) Derive normal equations of least square fit of the form $y = a_1 f_1(x) + a_2 f_2(x) + a_3 f_3(x) + \ldots\ldots\ldots\ldots + a_n f_n(x)$.

(5 marks)

Q4. a) Find the Taylor series solution of the differential equation

$\frac{dy}{dx} = 2\frac{y}{x}; y(1) = 2$ up to the term in $(x-1)^4$. **(10 marks)**

b) Given $\frac{dy}{dx} = 2x - y; y(0) = 1$ find y(1) using simple Euler method with 10 steps. **(10 marks)**

Q5. Given that $\underline{x} = [0 \quad 1 \quad 0]$. Use the power method to get the dominant eigenvalue of the matrix

$A = \begin{bmatrix} 1 & 5 & -8 \\ 5 & -2 & 5 \\ -8 & 5 & 1 \end{bmatrix}$ to the nearest whole number and the corresponding eigenvector with components whole numbers. Verify that $[1 \quad 0 \quad -1]^T$ is also an eigenvector and state the corresponding eigenvalue.

Using the fact that eigenvectors of a symmetric matrix are mutually orthogonal find the third eigenvector and the corresponding eigenvalue.

(20 marks)