Fayoum University
Faculty of Engineering
2[st] year Electrical Comm. Eng.
Department of Eng. Math.

Final Exam of: Date: Oct.-Jan. 2015/2016
Selected Mathematical Topic For Engineering (MTH217) Allowed time: 3Hrs.

Question 1.

(a)- Transform the vectors x_1, x_2 and x_3 to the orthogonal vectors (5 Marks)

(b)- Find the value of k which the system $Ax = b$ has (6 Marks)

(i) Unique solution (ii) more than one solution (iii) no solution

$$x_1 = \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}, \quad x_2 = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}, \quad x_3 = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}, \qquad A = \begin{pmatrix} 1 & -2 & k \\ -1 & k & -2 \\ k & -4 & k \end{pmatrix}, \quad b = \begin{pmatrix} k^2 \\ -4 \\ -8 \end{pmatrix}$$

Question 2.

Use the Gauss seidel method to solve the system of equations. (7 Marks)

$$\begin{aligned} 10x_1 - 3x_2 - 2x_3 &= 15 \\ -x_1 + 5x_2 + x_3 &= 2 \\ -2x_1 + 4x_2 + 8x_3 &= 12 \end{aligned}$$

Use $\vec{x}^{(0)} = (0 \quad 0 \quad 0)^t$ (four iterations are required).

Question 3.

(a)- Find the eigenvalues and eigenvectors of the matrix A (5 marks)

(b)- Find the eigenvalues and Determinant of the matrix $A^3 + 10I$ (2 marks)

(c)- Find $\|A\|_\infty$, $\|B\|_2$ (6 marks)

(d) - compute e^A (5 marks)

$$A = \begin{pmatrix} 3 & 1 & 2 \\ 0 & 3 & 4 \\ 0 & -1 & -2 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$$

Question 4.

(a) $u(x,y) = e^{3x} \cos(my)$ (8 marks)

(i) Find the constant **m** such that the function is harmonic

(ii) Find the harmonic conjugate **v**(x,y) and the analytic function f(z).

(iii) find the derivative of the function f(z).

(b) Prove that $\sin^{-1} z = i \ln(iz + \sqrt{1 - z^2})$ and then find $\frac{d}{dz}(\sin^{-1} z)$ (4 marks)

Question 5.

(a) Find the solutions of the following functions (9 marks)

i)- $e^z = 4-3i$

ii)- $\tanh(2z) = 10$

iii)- $z^4 = -i$

(b) Find $(-2+2i)^{2-i}$ (4 marks)

Question 6.

Evaluate:

(a) - $\int_0^{1+i} (1 - i + \bar{z})dz$; along the path $y = x^2$. (4 marks)

(b) - $\int_{|z-i|=3} \frac{z-1}{z(z+i)(z-2i)} dz$ (4 marks)

(c)- $\int_c \frac{\sin(\pi z)}{(z+1)(z-3)^3} dz$; $c : |z+i| = 5$ (4 marks)

Question 7.

Expand the follow functions

(a) - $f(z) = (2+z)^z$ about z=1 (4 marks)

(b) - $f(z) = \frac{1}{(z-1)(z+2)}$ valid for: (i) $0 < |z-1| < 3$ (ii) $0 < |z| < 1$ (4 marks)

(c) - $f(z) = \frac{1}{z(z-1)(z+3)}$ in the following regions: (6 marks)

(i) $|z-1|<1$, (ii) $1<|z-1|<4$, (iii) $|z-1|>4$

Best Wishes Dr. Ibrahim Hamdy