Benha University Faculty of Engineering- Shoubra Eng. Mathematics & Physics Department **Qualifying Courses (Mathematics)**		Final Term Exam Date: 14 – 1 – 2015 Course: Linear Algebra EMM 402 Duration: **3** hours
• Answer **All** questions The exam consists of one page	• No. of questions: 5	Total Mark: 200

[1] (a)Determine the linearly independent and linearly dependent:

(i) u = (2, 2), v = (1, 3)   (ii) u = (2, 1, 2), v = (1, 2, 0), w = (3, 3, 2) **10**

(b) If $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 4 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 0 & 3 \\ 1 & 3 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 3 & -1 \\ 1 & 5 & 1 \end{bmatrix}$ **40**

Find, if possible, $A + B$, $A + B^t$, $A.B$, $A.B^t$, $A.C$, $|A|$ and $|C|$.

[2](a)If $A = \begin{bmatrix} 2 & 6 \\ 2 & 3 \end{bmatrix}$.

(i)Find the eigenvalues and the eigenvectors. **20**

(ii)Find the eigenvalues of the matrices $B = f(A) = 2^A$ and $C = f(A) = A^4$ **10**

(b) Show that the eigenvalues of : $A = \begin{bmatrix} a & c \\ c & b \end{bmatrix}$ are real numbers, where a, b, c are real numbers. **10**

[3]Write the following expressions in matrix form and determine the type: **30**

(a) $P = 3x^2 + 4y^2 + 2z^2 + 2xy - 2xz + yz$

(b) $P = 2xy + 4xz - 2yz - 3x^2 - 2y^2 - 2z^2$

(c) $P = 2xy + 6xz - 2yz + 3x^2 + y^2 + z^2$

[4](a)Write the Hessian matrix of : $f(x, y, z) = ye^{2x} + \cos^3 y + x^3 \sin z^5$. **10**

(b) Show that the eigenvectors of the matrix $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$ are orthogonal and linear independent. **20**

(c) Find $f(A) = \dfrac{24}{A+I}$ where $A = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$ **20**

[5](a)Write the equations: $a_{11}x + a_{12}y + a_{13}z = b_1$, $a_{21}x + a_{22}y + a_{23}z = b_2$, $a_{31}x + a_{32}y + a_{33}z = b_3$ in matrix form and discuss the types of solutions. **20**

Also, state two methods with their procedures for solving this linear system.

(b)Determine the type of solution of the linear system: **10**

$2x - y + 3z = 2$, $x + 3y - 4z = 3$, $3x + 2y - z = 5$

Good Luck   *Dr. Mohamed Eid*