Course specifications

Programme(s) on which the course is given M.Sc. Mathematics, Pure mathematics

Major or minor element of programmes Major

Department offering the programme Mathematics

Department offering the course Mathematics

Academic year / Level **Second(2)**

Date of specification approval 2004-2005

A- Basic Information

Title: Linear Algebra Code: M6111

Credit Hours: 2 Lecture: 2

Tutorial: 0 Practical: 0 Total: 2

Teaching Staff Prof. Dr. Mohamed A. Ramadan

B- Professional Information

1 – Overall aims of course

To develop understanding of modern methods of numerical linear algebra for solving linear systems, least squares problems and the eigenvalue problem. To introduce students to matrix analysis through the development of essential tools such as the Jordan canonical form, Perron-Frobenius theory, the singular value decomposition, and matrix functions. This course unit is an introduction to matrix analysis, covering both classical and more recent results that are useful in applying matrix algebra to practical problems. In particular it treats eigenvalues and singular values, matrix factorizations, function of matrices, and structured matrices. It builds on the first year graduate linear algebra course. Apart from being used in many areas of mathematics, linear algebra has broad applications in fields such as engineering, physics, statistics, econometrics and in modern application areas.

On successful completion of this course unit students will

- be familiar enough with matrix analysis and linear algebra that they can effectively use the tools and ideas of these fundamental subjects in a variety of applications,

- understand the importance of spectral decomposition, Schur decomposition, Jordan canonical form and singular value decomposition,
- understand the role of matrix functions in solving differential and algebraic equations,
- understand how to exploit the structure in certain classes of matrices.

2 – Intended learning outcomes of course (ILOs)

a- Knowledge and understanding:

a1-Understand the vector spaces, subspaces, the linear combination, linear dependence, independence, spanning sets and the bases of vector spaces.

a2- Know the linear transformations, range space, rank, kernel, and matrix and algebra of linear transformations.

a3- Compute the eigenvalue and eigenvectors of matrices and the matrix rank.

a4- Solve systems of linear equations

b- Intellectual skills

b1- Identify the difference between the vector spaces and subspaces.

b2- Think perfectly to check for linear dependence and independence of vectors.

c- Professional and practical skills

c1-apply the understanding of the vector spaces, subspaces, the linear combination, linear dependence, independence, spanning sets, bases of vector spaces in further related mathematical courses .

c2- use the knowledge and understanding of computing the eigenvalue and eigenvectors of matrices , the matrix rank, and solving systems of linear equations in practice for other related courses.

d- General and transferable skills

d1- creative thinking to use the concepts and principles learned from this course.

d2- able to develop his skills in this area of study.

3- Contents

Topic	No. of	Lecture
Isomorphism, The Kernel and Image of a Linear Transformation, **Linear Transformations**	6	3
Equivalence of Matrices Similarity of Matrices, Linear	6	3
Linear Systems of Equations . Solutions of Linear Systems . Null Space: The Orthogonal Complement .	6	3
Generalized Inverses . Generalized Inverses of Sums of Matrices . Generalized Inverses of Partitioned Matrices . Pseudoinverse or Moore-Penrose Inverse . - Least Squares Approximation	6	3

4– Teaching and learning methods

4.1- Lectures
4.2- Working on hand in assignments
4.3- Attainting practical classes

5- Student assessment methods

5.1 Mid term written exam… to assess understanding competencies
5.2 Semester hand in assignments to assess attendance and interesting
5.3Final term written Exam to assess
Learning outcomes and understanding .

Assessment schedule

Assessment 1… Mid term……. Week 4 and 7 …….
Assessment 2 …semester activities…… Week 5 and 8 …….
Assessment 3…Final term oral exam…… Week 13…….
Assessment 4…final term written exam……. Week 14…….

Weighting of assessments

Mid-Term Examination	20%
Final-term Examination	60%
Oral Examination.	00%
Practical Examination	00%
Semester Work	20%
Other types of assessment	00%
Total	100%

Any formative only assessments

6- List of references

6.1- Course notes

Collected and prepared notes that cover the main topics

6.2- Essential books (text books)

Linear Algebra , Vol.2, Eagle Mathematics series , Michael O' Nan, 1971

6.3- Recommended books

ISBN Number	Author	Date	Title	Publisher
0-534-02738-5	Grossman S I	1994	Elementary Linear Algebra	Wadsworth
0-201-59290-8	C F Gerald P O Wheatley	1994	Applied Numerical Analysis	Addison-Wesley
	C. W. Curtis	1994	*Linear Algebra--an Introductory Approach*	Springer
	T. S. Blyth and E. F. Robertson	1998	*Basic Linear Algebra*	Springer

6.4- Periodicals, Web sites, … etc

None

7- Facilities required for teaching and learning

Non

Course coordinator: Prof. Dr. Mohamed A. Ramadan
Head of Department: Prof. Dr. Mohamed A. Ramadan

Date: / /