



A. Basic Information

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|--|---|---------------------|-----------------------|
| Course Title: Linear Algebra | Code: EMM 402 | Units: 2 | |
| Lecture: 2 Hours | Tutorial: - | Practical: - | Total: 2 Hours |
| Program on which the course is given: | M. Sc. in Engineering Mathematics | | |
| Major or Minor element of program: | Major | | |
| Department offering the program: | Engineering Mathematics and Physics | | |
| Department offering the course: | Engineering Mathematics and Physics | | |
| Academic year / Level: | Academic year 2012 / 2013- First Semester | | |
| Date of specification approval: | | | |

B. Professional Information

1. Overall aims of course

- To provide the students essential information and fundamentals of linear algebra and its applications in engineering.
- To teach the students algebra of matrices.
- To apply mathematical techniques for modeling, solving and analyzing real problems.

2. Intended Learning outcomes of Course (ILOs)

a. Knowledge and Understanding:

2.1.1 Identify theories, fundamentals and specialized knowledge in operations research.

2.1.2 Describe the two way impact of the relation between professional practice and its effect on the engineering applications.

b- Intellectual Skills

2.2.3 Link different knowledge sources to prove theorems and solve problems.

2.2.7 Make professional decisions in various professional contexts.

**c- Professional and Practical Skills**

2.3.2 Write and evaluate professional reports via mathematical logic.

d- General and Transferable Skills

2.4.1 Communicate effectively using different means.

2.4.3 Assess him/her self and identify his/her own personal learning needs.

3. Contents

| No | Topic | No. of hours | ILOs | Teaching / learning methods and strategies | Assessment method |
|----|------------------------------|--------------|-----------------------------------|--|---------------------------|
| 1 | Introduction, Basic concepts | 2 | 2.1.1, 2.1.2 | Lectures | Assignments |
| 2 | Types of matrices | 2 | 2.1.1, 2.1.2 | Lectures | Assignments, Written exam |
| 3 | Algebra of matrices | 2 | 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2 | Lectures | Assignments, Written exam |
| 4 | Determinants | 2 | 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2 | Lectures, Tutorial | Written exam |
| 5 | Eigenvalues, Eigenvectors | 2 | 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2 | Lectures, Tutorial | Written exam |
| 6 | Positive definite matrices | 2 | 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2 | Lectures, Tutorial | Written exam |
| 7 | Negative definite matrices | 2 | 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2 | Lectures, Tutorial | Written exam |
| 8 | Mid-Term Exam | 2 | -- | -- | Mid-Term exam |



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|----|-----------------------|---|-----------------------------------|--------------------------|-----------------------|
| 9 | Linear Independence | 2 | 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2 | Lectures, Tutorial | Written exam |
| 10 | Quadratic forms | 2 | 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2 | Lectures, Tutorial | Written exam |
| 11 | Hessian matrix | 2 | 2.2.3, 2.2.7, 2.3.2, 2.4.1, 2.4.3 | Lectures, Tutorial | Written exam |
| 12 | Matrix functions | 2 | 2.2.3, 2.2.7, 2.3.2, 2.4.1, 2.4.3 | Lectures, Tutorial | Written exam |
| 13 | Functions of matrices | 2 | 2.2.3, 2.2.7, 2.3.2, 2.4.1, 2.4.3 | Lectures, Class activity | Research, Assignments |
| 14 | Functions of matrices | 2 | 2.2.3, 2.2.7, 2.3.2, 2.4.1, 2.4.3 | Lectures, Class activity | Research, Assignments |
| 15 | Final exam | | | | |

4. Teaching and Learning Methods

Lectures, Seminar / workshop, Class activity, Research / Report, Assignments / homework

5. Student Assessment Methods

Assignments to assess 2.1.1, 2.1.2, 2.2.7, 2.4.1, 2.4.3

Mid-Term exam to assess 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2

Quiz to assess 2.1.2, 2.2.3, 2.3.2, 2.4.3

Final exam to assess 2.1.1, 2.1.2, 2.2.3, 2.2.7, 2.3.2

6. Assessment schedule

Assessment 1 on weeks 2, 4, 6, 10, 12.

Assessment 2 Quizzes on weeks 5, 11.

Assessment 3 Mid-year exam on week 8

Assessment 5 Final exam on week 15



7. Weighting of Assessments

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|-----------------------|-------|
| Semester Work | 16 % |
| Mid- Year Examination | 17 % |
| Final Examination | 67 % |
| Total | 100 % |

8. List of References

8.1 **Course Notes:** Lecture material and training sheets.

8.2 Essential Books (Text Books):

- "The Theory of Matrices", 2nd Edition, P.Lancaster and M.Tismenetsky, Academic Press, London, New York, 1985.
- "Linear Algebra And Its Applications", 3rd Edition, Gilbert Strang, Thomson Brooks / Cole, U.S.A, 1988.

8.3 **Recommended Books:** Applications of Abstract Algebra With MAPLE', R. E. Klima and N. Sigmon, CRC Press, London, 1999.

8.4 Periodicals Web sites, etc: <http://www.gap-system.org> <http://www.intmath.com> <http://www.thomsonrights.com>

9. Facilities Required for Teaching and learning

Data show, Overhead Projector, White board

**Course Aims and ILOs**

| Course Aims | ILOs | | | | | | |
|--|-------|-------|-------|-------|-------|-------|-------|
| To provide the students essential information and fundamentals of linear algebra and its applications in engineering | 2.1.1 | 2.1.2 | 2.2.3 | 2.2.7 | 2.3.2 | | |
| To teach the students algebra of matrices | 2.1.1 | 2.1.2 | 2.2.3 | 2.2.7 | 2.3.2 | | |
| To apply mathematical techniques for modeling, solving and analyzing real problems | | | 2.2.3 | 2.2.7 | 2.3.2 | 2.4.1 | 2.4.3 |

Course Contents and ILOs

| Course Contents | ILOs | | | | | | |
|--|-------|-------|-------|-------|-------|-------|-------|
| Basic concepts, Types of matrices | 2.1.1 | 2.1.2 | | | | | |
| Algebra of matrices, Determinants, Eigenvalues, Eigenvectors | 2.1.1 | 2.1.2 | 2.2.3 | 2.2.7 | 2.3.2 | | |
| Positive definite matrices, Negative definite matrices | 2.1.1 | 2.1.2 | 2.2.3 | 2.2.7 | 2.3.2 | | |
| Linear Independence, Quadratic forms, Hessian matrix, Matrix functions | 2.1.1 | 2.1.2 | 2.2.3 | 2.2.7 | 2.3.2 | | |
| Functions of matrices | | | 2.2.3 | 2.2.7 | 2.3.2 | 2.4.1 | 2.4.3 |

Course coordinator: Dr. Mohamed Husien Eid

Course instructor: Dr. Mohamed Husien Eid

Head of department: Associate. Prof. Dr. Ahmed Mohamed Abdullah

Date: 10 / 9 / 2012