

**Linear Algebra**

**MACT2132 Spring 2023**

**Course Syllabus**

**What’s the course schedule?**

| **Section** | **Instructor** | **Time** | **Location** | **Days** | **TA** | **UG TA** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | Isabel Müller | 02:00 - 03:15 | Waleed CP63 | MR | Kamal Eldin | Youssif Abuzied  Moaz Essam  Ahmed Jaheen  Adham Elasfar |
| 2 | Isabel Müller | 11:30 - 12:45 | Waleed CP57 | MR | Kamal Eldin |
| 3 | Eslam Badr | 02:00 - 03:15 | SSE CP 37 | WU | Kamal Eldin |
| 4 | Eslam Badr | 03:30 - 04:45 | SSE CP 32 | WU | Kamal Eldin |

**Instructor for sections 1 and 2**

**Name:** Isabel Muller

**E-mail:** [isabel.muller@aucegypt.edu](mailto:eslammath@aucegypt.edu)

**Department:** Mathematics and Actuarial Science, Office 1034

**Office Hours\*:** open door, by appointment.

**Instructor for sections 3 and 4**

**Name:** Eslam Badr

**E-mail:** [eslammath@aucegypt.edu](mailto:eslammath@aucegypt.edu)

**Department:** Mathematics and Actuarial Science, Office 1037

**Office Hours\*:** WU 12:45 – 2:00 pm, or by an appointment.

**Teaching Assistant**

**Name:** Kamal Tawfik

**E-mail:** [kamaleddin@aucegypt.edu](mailto:kamaleddin@aucegypt.edu)

**Office Hours\*:** TBA

**Undergraduate Teaching Assistants:**

**Name:** Youssif Abuzied **Name:** Moaz Essam

**E-mail:** [youssif.abuzied@aucegypt.edu](mailto:fariddahmyy@aucegypt.edu) **E-mail:** [moaaaaz@aucegypt.edu](mailto:fariddahmyy@aucegypt.edu)

**Office Hours\*:** TBA **Office Hours\*:** TBA

**Name:** Ahmed Jaheen **Name:** Adham Elasfar

**E-mail:** [ahmed.jaheen@aucegypt.edu](mailto:fariddahmyy@aucegypt.edu) **E-mail:** [adham\_samy@aucegypt.edu](mailto:fariddahmyy@aucegypt.edu)

**Office Hours\*:** TBA **Office Hours\*:** TBA

\*Note: For the most updated hours, please check the Blackboard.

**Important Note**

Please read this Course Syllabus closely, as it provides you with all the course requirements, course readings, schedule of activities, and due dates for deliverables, which are all listed in the appropriate sections in this syllabus. By taking this course, **you, the TAs, and the lecturers agree to abide by all the rules and regulations provided in this syllabus**. Changes in this syllabus may occur during the semester, so make sure to check blackboard for the latest updates. We will be as flexible as possible but within the limits that ensure fairness to all students.

**Communication Procedures**

URL: http://blackboard.aucegypt.edu requires your AUC email credentials to login. Once logged in, select this course. If successful, you will see a link to the complete syllabus, class announcements, assigned homework, and any additional course material. You can view your grades, use the email tool, or utilize the discussion tool to communicate with your classmates. You will receive a notice via blackboard (either an announcement, or an email) if there is additional information, exam date change, etc, or an urgent message, class canceled, etc, that directly impacts this course.

Also, you can use Whatsapp to facilitate communications among yourselves and the TAs. Please click on the following link through your phone to join our Whatsapp group:

**https://chat.whatsapp.com/ETgluQ38dATA3iT7ev8LcA**

### **What’s this course?**

This course covers topics in linear algebra, including solutions of linear equations, matrices and determinants, vector spaces and subspaces, linear independence, bases and dimension, inner product and orthonormal bases, linear transformations, eigenvalues and eigenvectors.

**What will I be able to do after finishing this course?**

After completing the course, students will be able to:

* Apply the Gauss-Jordan algorithm to determine all solutions of a given system of linear equations, in particular, to see if the system admits a unique solution.
* Calculate the determinant of a given square matrix, and conclude whether the matrix is invertible or singular.
* Select an appropriate matrix or vector technique to obtain a solution to a given description of an application problem.
* Evaluate whether definitions of a set of objects with a well-defined addition and scalar multiplication constitute a real vector space. If valid, demonstrate all axioms; if not, give a counterexample to a vector space property.
* Determine whether a given function defines an inner product on a vector space or not. If valid, use it to compute length, directions and orthogonal projections.
* Describe the kernel and the image of a linear transformation between vector spaces. In particular, decide whether it is one-to-one and/or onto.
* Investigate the eigenvalues and the corresponding eigenvectors of a given square matrix. In particular, conclude whether such a matrix is diagonalizable or not.
* Follow a proof of a theorem as well as prove simple mathematical statements.

**What are the course materials?**

* We will mainly follow the following textbook: *Elementary Linear Algebra*, by R. Larson (Metric Version), 8th Edition, 2017, Cengage Learning.

WebAssign ISBN : 9781337699839

* We will cover most of Chapters 1-7.
* We will do all of our homework assignments online using **WebAssign** (used for Calculus I-III). The goal of this system is to provide you with rapid feedback on your homework assignments. The system responds immediately to a submitted FINAL answer. In some cases, it also provides some hints and explanations when you input an incorrect response. **Additionally,** in each assignment you need to submit your work to some selected problems through **Gradescope**, which will be announced beforehand.
* We have a discounted price (£ 15.5) for those who can buy their access codes online. **Note that** the access codes for the calculus text are **NOT** valid for this course, as we are using a different textbook.

**How do I enroll in the Webassign course?**

* Please follow the enrolment directions in the attached link

<https://www.cengage.com/coursepages/American_WA_MACT2132211>

* Class Key: [**AUC.EG62557109**](http://auc.eg/)
* **If you have any questions or you need any help from the WebAssign team, you will need to issue a support ticket by going to the URL in the enrolment directions file.**

**How do I enroll in the Gradescope course?**

* First, visit www.gradescope.com and sign up using your AUC email.
* Join our Linear Algebra (MACT 2132). Write your **name exactly as written in Blackboard**, preceded by your section number. For example, “03 Fulana Ahmed” or “01 John Doe”. The entry code is **8NZP3P.**
* Make sure you add your ID number.
* Please make sure you download the appropriate scanner app for free onto your phone as described in the handouts. These free apps are the most compatible with Gradescope but any scanner app that allows you to convert images to pdfs should be sufficient.
* You can go on YouTube or watch the provided linked videos below for instructions on how to upload assignments.

<https://www.youtube.com/watch?v=oHvYPaYVhpo>  
<https://www.youtube.com/watch?v=K6IEuGEUikc>

* For further questions, feel free to ask the instructor or TA. It is better to upload as a pdf as opposed to scanned images (This will make sense when you watch the videos).

**How is my grade determined?**

All exams, and assignments will be counted toward your final numeric score and letter grade in the course. In particular, there will be no "best *m* out of *n*". Also, there is no prespecified cut off points that will be used for transforming your final numeric scores to your final letter grade.

* 10% Online WebAssign + 10% Gradescope hardcopies: **Late submissions will NOT be accepted.**
* 10% MATLAB Exercises **(7% regular assignments + 3% programming part)**
* Two Midterms (20% each). **Both midterms will be counted.**
* Comprehensive Final: 30%.

|  | **Date** | **Time** |
| --- | --- | --- |
| Exam 1 | Tuesday, March 14 | 06:00 pm - 07:30 pm |
| Exam 2 | Saturday, April 29 | 10:00 am - 11:30 am |
| Final Exam | Wednesday, May 24 | 11:30 am - 01:30 pm |

(\*) February 7 is the closing date of Drop/Add.

(\*\*) March 30 is the deadline for course dropping.

**Make-up exams** will only be given to students who could not take the regular exam for a well-documented excuse that is approved by the dean of students. The excuse needs to be initiated with the dean of students, and communicated with the instructor, prior to (and not after) the exam.

**Can I use a calculator in this class?**

A scientific calculator might be helpful. However, graphing calculators and programmable calculators are **NOT ALLOWED** on exams.

**Is there anything I need to know for the exams?**

* All exams are cumulative. What you fail to learn in the beginning may hurt you at the end.
* All exams are closed books, closed notes, and closed colleagues.
* You must SHOW ALL YOUR WORK in exams.  Unsupported answers are considered miracles and, while inspirational, will receive little or no credit.
* All exams are planned to be face to face unless stated otherwise.
* **Important Note:** As our recent experience showed, cheating in the exams gets discovered. Cheaters will then fail the course and will be reported to the academic integrity committee, which usually gives severe punishments.

**Emotional Support**

The basis for effective learning is mental self-care and health. If you feel overwhelmed at any point during the term, please do not hesitate to seek help.

**Center for Student Well-being (CSW)**

The Center for Student Well-Being (CSW) works to help students develop resiliency to enable them to cope with challenges on the emotional, behavioral, or cognitive levels. They offer private consultation as well as general information. See <https://www.aucegypt.edu/students/well-being> for further information.

**Disability Policy**

If you have established accommodations with Student Disability Services (SDS), please activate your accommodations via Simplicity and contact the instructor to discuss how the approved accommodations will be implemented in this course.

**Is there anything I need to know concerning academic integrity?**

While we expect you to help and cooperate with each other in study groups, and during the project, the work in the assignments, and exams is expected to be your own. Academic integrity is a commitment, even in the face of adversity, to five fundamental values: honesty, trust, fairness, respect and responsibility. All activities at AUC, from teaching to administrative and support functions, serve the process of learning.

Academic fraud and dishonesty include, but are not limited to, the following categories: cheating, plagiarism, fabrication, multiple submissions, obtaining unfair advantage, unauthorized access to academic or administrative systems, aiding and abetting, impersonation, threatening harm, and copyright infringement. For more details see

<http://in.aucegypt.edu/aucacademics/academic-integrity>.

University’s Academic Standards, Integrity, and Honesty Codes (see http://www.aucegypt.edu/academics/integrity/Pages/default.aspx) will be strictly enforced.

**We have zero-tolerance for any violation of the academic integrity code**

**Attendance and Participation Policy:**

Attendance and participation in class sessions are essential to the process of education at AUC. If students fail to attend classes, they fail to take advantage of an educational opportunity. For this reason, students are expected to attend classes regularly. In fact, your attendance in all classes is strongly advised. **In the event you miss more than 6 classes during the semester for any reason, you should drop the course if the absences occur before the last date for dropping classes; otherwise, you may be given a grade of “F” for the course.**

**Important Notes**

* Respect both my responsibility to teach and the right of other students to learn.
* Attend ALL lectures.
* Full attendance is highly appreciated.
* Lectures will start punctually on time, being late will count as partial attendance (2/3) only.
* Copied assignments will initiate an academic integrity case.
* More than 6 absences may drop your letter grade or fail you the course.
* Refrain from side-talking.
* Put your mobile phones on silent mode.
* Feel free to interrupt and ask questions.
* The ultimate goal of the lecture is to enrich your knowledge.

**How do I benefit best from this course?**

Below is a study guide for the wise student to be successful in an online course:

1. Access the Blackboard course website and the Whatsapp's group frequently, at least every other day for announcements and discussions.
2. Read the section of the textbook ahead of time, watch and listen to the online lectures, and take notes.
3. Participate in class discussions.
4. Do all homework problems.
5. Ask the lecturer and/or the TA during their office hours.
6. Review the material before each exam.
7. Take a good night's sleep.

**Course Plan**

| **Section** | **Title** | **Section** | **Title** |
| --- | --- | --- | --- |
| 1.1 | Systems of Linear Equations | 4.3 | Subspaces |
| 1.2 | Gauß-Jordan Method | 4.4 | Spanning Sets & Linear Independence |
| 2.1 | Matrix Operations | 4.5 | Basis and Dimension |
| 2.2 | Properties of Matrices | 4.6 | Rank of a Matrix |
| 2.3 | The Inverse of a Matrix | 5.1 | Dot Product |
| 2.4 | Elementary Matrices | 5.2 | Inner Product Spaces |
| 3.1 | The Determinant of a Matrix | 5.3 | Orthonormal Bases |
| 3.2 | Determinants & Operations | 6.1 | Linear Transformations |
| 3.3 | Properties of Determinants | 6.2 | Kernel and Range |
| 3.4 | Applications of Determinants | 6.3 | Matrix Representation |
| 4.1 | as a Vector Space | 7.1 | Eigenvalues and Eigenvectors |
| 4.2 | Abstract Vector Spaces | 7.2 | Diagonalisation\* |

\* If time permits.

**MR classes**:

| **Week** | **Monday** | **Sections covered** |  | **Thursday** | **Sections covered** | **Important Events** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  |  | Feb 02 | 2.1/2.2 |  |
| 2 | Feb 06 | 2.2/1.1 |  | Feb 09 | 1.1/1.2 |  |
| 3 | Feb 13 | 1.1/1.2 |  | Feb 16 | 2.3 | HW1 (2.1, 2.2) |
| 4 | Feb 20 | 2.4 |  | Feb 23 | 3.1/3.3/3.2 | HW2 (1.1, 1.2) |
| 5 | Feb 27 | 3.1/3.3/3.2 |  | Mar 02 | 3.2/3.4 | HW3 (2.3), MATLAB 1 |
| 6 | Mar 06 | 4.1/4.2 |  | Mar 09 | 4.1/4.2 | HW4 (3.1, 3.2, 3.3),  MATLAB 2 |
| 7 | Mar 13 | 4.3 |  | Mar 16 | 4.4 | **Exam 1**, MATLAB 3 |
| **Exam 1 is on Tuesday, Mar 14, time tba, covering chapters 1, 2, 3.** | | | | | | |
| 8 | Mar 20 | 4.4 |  | Mar 23\* | 4.5 | HW5 (4.1, 4.2) |
| 9 | Mar 27\* | 4.5/4.6 |  | Mar 30\* | 4.6 | HW6 (4.3) |
| 10 | April 03\* | 7.1 |  | April 06\* | 7.1/7.2\*\* | HW7 (4.4, 4.5) |
| 11 | Apr 10 | **Break** |  | April 13 | **Break** | HW8 (4.6), MATLAB 4 |
| 12 | Apr 17 | **Break** |  | April 20 | **Eid Holiday** | HW9 (7.1, 7.2), MATLAB 7 |
| 13 | April 24 | 6.1/6.3 |  | April 27 | **Holiday** | **Exam 2** |
| **Exam 2 is on Saturday, April 29 at 10:00 am - 11:30 am, covering chapters 4, 7.** | | | | | | |
| 14 | May 01 | 6.2 |  | May 04 | **Holiday** | HW10 (6.1, 6.3) |
| 15 | May 08 | 6.2 |  | May 11 | 5.1/5.2 | HW11 (6.2), MATLAB 6 |
| 16 | May 15 | 5.1/5.2 |  | May 18 | 5.3 | HW12 (5.1, 5.2, 5.3),  MATLAB 5 |
| 17 | May 22 | 5.3 |  |  |  | **Final Exam,**  MATLAB Programming |
| **The Comprehensive Final Exam is on May 24, 11:30 am - 1:30 pm.** | | | | | | |

**UW classes**:

| **Week** | **Sunday** | **Sections covered** |  | **Wednesday** | **Sections covered** | **Important Events** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  |  | Feb 01 | 2.1/2.2 |  |
| 2 | Feb 05 | 2.2/1.1 |  | Feb 08 | 1.1/1.2 |  |
| 3 | Feb 12 | 1.1/1.2 |  | Feb 15 | 2.3 | HW1 (2.1, 2.2) |
| 4 | Feb 19 | 2.4 |  | Feb 22 | 3.1/3.3/3.2 | HW2 (1.1, 1.2) |
| 5 | Feb 26 | 3.1/3.3/3.2 |  | Mar 01 | 3.2/3.4 | HW3 (2.3), MATLAB 1 |
| 6 | Mar 05 | 4.1/4.2 |  | Mar 08 | 4.1/4.2 | HW4 (3.1, 3.2, 3.3),  MATLAB 2 |
| 7 | Mar 12 | 4.3 |  | Mar 15 | 4.4 | **Exam 1**  MATLAB 3 |
| **Exam 1 is on Tuesday, Mar 14 at 6:00 pm - 7:30 pm, covering chapters 1, 2, 3.** | | | | | | |
| 8 | Mar 19 | 4.4 |  | Mar 22\* | 4.5 | HW5 (4.1, 4.2) |
| 9 | Mar 26\* | 4.5/4.6 |  | Mar 29\* | 4.6 | HW6 (4.3) |
| 10 | April 02\* | 7.1 |  | April 05\* | 7.1/7.2\*\* | HW7 (4.4, 4.5) |
| 11 | Apr 09 | **Break** |  | April 12 | **Break** | HW8 (4.6), MATLAB 4 |
| 12 | Apr 16 | **Break** |  | April 19 | 6.1/6.3 | HW9 (7.1, 7.2), MATLAB 7 |
| 13 | April 23 | **Eid Holiday** |  | April 26 | 6.1/6.3 | **Exam 2** |
| **Exam 2 is on Saturday, April 29 at 10:00 am - 11:30 am, covering chapters 4, 7.** | | | | | | |
| 14 | April 30 | 6.2 |  | May 03 | 6.2 | HW10 (6.1, 6.3) |
| 15 | May 07 | 5.1/5.2 |  | May 10 | 5.1/5.2 | HW11 (6.2), MATLAB 6 |
| 16 | May 14 | 5.2/5.3 |  | May 17 | 5.3 | HW12 (5.1, 5.2, 5.3),  MATLAB 5 |
| 17 | May 21 | Q & A |  |  |  | **Final Exam,**  MATLAB Programming |
| **The Comprehensive Final Exam is on Wednesday, May 24, 11:30 am - 1:30 pm.** | | | | | | |

\*\* If time permits.

\* Lectures during Ramadan

Holidays

**Notes:**

# March 30 is the deadline for course dropping.

* **There are 3 trials for each homework assignment.**
* **Note that all homework assignments are due at 11:59 PM**.

**Good luck and a successful term to everyone!**

**Dr. Isabel and Dr. Eslam**