MATH 2418.HN Sp 2024

Section	Course Number	Location	Days	Time	Instructor
HN1	Math 2418	SCI 3.240	M-W	5.30-6.45pm	Dr. Viswanath Ramakrishna

Modality F\ F

Instructor Information

Instructor	Office	E-mail	Office Hours
Dr. Viswanath Ramakrishna	FO 2.408C	vish@utdallas.edu	M-W 4-5pm

Problem Sections

Section	**Day**	**Room**	**Time**	**TA's Name**	**Office**	**Contact**
2418.398	W	SCI 3.270	8-9.50 am	Mahesh Dewage		

Optional Problem Session

Starting Jan 26th (Friday), I (not the TA) will conduct an optional problem session every Friday between **2-3 pm** in ECSW 2.325. The problem session is optional. It will be used to cover HWs and additional material related to the course. Though optional, it is recommended. Students in the past have found it to be important for succeeding in this and subsequent courses which use this course as a prerequisite.

Textbook

Class Lecture Notes will be provided. **They supersede all textbooks.** Useful texts include those by P. Klein, G. Strang etc., Full titles will be provided on the first day of class.

Course Description

The course basics of matrix theory and vector spaces. Topics include ordinary and block matrix algebra, Gaussian elimination, determinants, eigenvalues and diagonalization, inner products, spectral theorem for normal matrices, quadratic forms and positivity, generalized inverses, singuar value decomposition, abstract vector spaces. Time permitting we will also cover applications to graphs, coding and the JCF.

Student Learning Objectives

1. Students will be able to work with and manipulate matrices.
2. Students will be able to use Gaussian elimination to find the rank of a matrix and bases for its four fundamental subspaces.
3. Students will be able to calculate eigenvalues, singular values and normal forms for matrices.
4. Students will be able to study linear transformations between vector spaces via matrices.

Assignments, Quizzes and Exams

Assignments: The homework assignments will be posted weekly at `e-Learning` and they form a very important part of this class. All the assignments should be completed independently by the students. Each assignment is due on the due date posted on the HW. **Please note carefully: i) You may turn in only your HW - not those of your colleagues; ii) Answer sheets must be stapled and have your full name on it; iii) HWs may be turned in only at the time that is posted - not before and certainly not after - unless I explicitly give you permission for a separate time. In particular, classes and problem sections may not be disrupted for merely turning in HWs, or for that matter for any other reason. Failure to observe protocol and decorum will result in a zero for that particular assignment.**

Quizzes: From Jan 24th, there will be a weekly quiz during the problem session organized and marked by the teaching assistant..

The **dates for the quizzes** are as follows

- *January*: 24th, 31st
- *February*: 7th, 14th, 21st.
- *March:* 6th, 20th, 27th.
- *April:* 10th, 17th, 24th.

Attendance: Attendance, *marked via a roll call on days not announced in advance*, is worth 5 points. More details on how this will effected will be announced on the first day of classes.
Exams: There will be three examinations. Textbooks, notes, calculators or other electronic devices won't be allowed during examination. Missed exams and assignments are assigned a zero. The three examinations have been scheduled as the following:

1. I examination on February 28th (Wednesday) The examination lasts 75 minutes, and will be held in the problem section for this course in SCI 3.270. It is worth **20 percent of your grade**.
2. II examination on April 3rd (Wednesday) The examination lasts 75 minutes, and will be held in the problem section for this course in SCI 3.270. It is worth **20 percent of your grade**.
3. III examination will be held on May 1st (Wednesday) - the last day of classes for this course, and will be held during lecture hours in SCI 3.240. It is 75 minutes long. It is worth **20 percent of your grade**.

Makeup Policy:

- In general makeups will be allowed only if there is a valid reason which is supported by official documentation. Examples of valid documentation are i) Doctors' notes; ii) Letter from employer (in case there is required work related travel, which conflicts with the day of an examination); iii) Travel documents (e.g., when a dire family related emergency travel conflicts with the day of an examination). Furthermore, the onus is on the student to intimate the instructor in a timely fashion (in particular, before the scheduled test), the possibility of having to miss the scheduled assignment.
- However, note that all such documentations will be rendered null and void, if there is any evidence that the student was, in fact, in a position to take the examination/quiz/HW at the originally scheduled time. Thus, for instance, a doctor's note advising rest on the date of an examination for this course will be considered null and void, if the student was known to have taken an examination for a different course on the same day.
- The makeup quiz/HW/examination must be taken at the earliest opportunity convenient to the instructor, once the reason for missing the scheduled examination is no longer in force.

- The makeup quiz/HW/examination cannot be guaranteed to be at the same level of difficulty as the original quiz/HW/examination which was missed.
- Failure to observe any of the above procedures will result in a score of zero being assigned for the quiz/HW/examination in question.

Grading Policy

Your grade is based on your cumulative score out of a 100 and the grading scale indicated below:
Grading Scale:

- ≥ 97 : A+; $\geq 90, < 97$: A; $\geq 85, < 90$: A-
- $\geq 80, < 85$: B+; $\geq 75; < 80$: B; $\geq 72 :< 75$: B-
- $\geq 68, < 72$: C+; $\geq 65; < 68$: C; $\geq 62 :< 65$: C-
- $\geq 58, < 62$: D+; $\geq 55; < 58$: D; $\geq 52 :< 55$: D-
- < 52: F

Your cumulative score will be calculated as follows:

1. Attendance: 5 percent
2. Homeworks: 20 percent;
3. Quizzes: 15 percent;
4. I Examination: 20 percent
5. II Examination: 20 percent
6. III Examination: 20 percent

The UTD academic calendar lists important dates, such as university closings and withdrawal deadlines. Please consult that for these important dates.

Detailed Course Description

The course consists of the following topics. For all topics my lecture notes are the main source. Where possible, I hav indicated the appropriate sections in the texts by Stewart; and Marsden & Tromba. Please note that for certain topics neither of these books is adequate. But my lecture notes cover all that is needed.

1. Vectors and matrices, Linear maps between R^n and R^m, composition and matrix products, transposes, permutation matrices, block matrix algebra, quadratic forms and symmetric matrices, other matrix products, complex numbers, linear algebra over finite fields.
2. Gaussian elimination, elementary matrices, using GE to find the rank of a matrix and bases for the four fundamental subspaces, LU decomposition, matrix inverses, Schur complements.
3. Abstract vector spaces, bases, linear transformations and matrix representations, rank-nullity theorem.
4. Determinants, Laplace expansion, Cramer's rule, Volumes.
5. Inner products, orthogonality, Gram matrices, Cauchy-Schwarz Inequality, Norms, orthogonal projections.
6. Eigenvalues, eigenspaces, generalized eigenvectors, Cayley-Hamilton theorem, diagonalization, matirx exponential and differential equations, spectral theorem, specialization to positive definite matrices, statement of the Jordan canonical form and its uses.
7. Singular Value Decomposition, principal component analysis, applications of the SVD, matrix norms.
8. Time permitting: Basic aspects of graphs and matrices, Nonnegative matrices, Applications to coding and cryptography, Fourier series and DFT, Convex sets.

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. For these policies, please go to

`http://coursebook.utdallas.edu/syllabus-policies/`

These descriptions and timelines are subject to change at the discretion of the Instructor.