

# **graduate COMMITTEE curriculum PROPOSAL FORM**

## A. Cover page (rover over text for more instructions- please delete red instructions)

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| --- | --- | --- |
| A.1[. Course or program](#_acknowledge) | **MATH 530 ADVANCED LINEAR algebra** |  |
| Academic Unit | Faculty of Arts and Sciences  |  |
| A.2. [Proposal type](#type) | Course: creation |  |
| A.3. [Originator](#Originator) | Leonardo Pinheiro, Lisa Humphreys  | [Home department](#home_dept) | Department of Mathematical Sciences |
| A.4. [Rationale](#Rationale) | This course is a natural continuation of the undergraduate course in Linear Algebra, it expands the contents of a traditional linear algebra course to include more advanced topics related to operator theory and applications. The class has been offered several times as a topics course; the materials cover an area of mathematics that is widely used in research and industry which warrants its designation as a core course.  |
| A.5. [Student impact](#student_impact) | The creation of this course will simplify course selection and advising. |
| A.6. [Impact on other programs](#impact) | None |
| A.7. [Resource impact](#Resource) | [Faculty PT & FT](#faculty" \o "Need to hire new full-time or part-time faculty? This is where you indicate if this proposal will be affecting FLH in your department/program.):  | No change to faculty load hours.  |
|  | [Library:](#library) | None  |
|  | [Technology](#technology) | None |
|  | [Facilities](#facilities): | None |
| A.8. [Semester effective](#Semester_effective) | Fall 2022 | A.9. [Rationale if sooner than next Fall](#Semester_effective) |  |
| A.10 [Changes to the website](#Signature_2) | None |

## B. NEW OR REVISED COURSES

|  | Old ([for revisions only](#Revisions)) | New |
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| B.1. [Course prefix and number](#cours_title)  |  | MATH 530 |
| B.2. Cross listing number if any |  |  |
| B.3. [Course title](#title)  |  | Topics in Linear Algebra |
| B.4. [Course description](#description)  |  | Advanced topics in linear algebra are explored. Topics may include inner product spaces, self-adjoint operators, Jordan canonical form, and the spectral theorem |
| B.5. [Prerequisite(s)](#prereqs) |  | Graduate status or consent of department chair |
| B.6. [Offered](#Offered) |  | As needed. |
| B.7. [Contact hours](#contacthours)  |  | 3  |
| B.8. [Credit hours](#credits) |  | 3 |
| B.9. [Justify differences if any](#differences) |  |
| B.10. [Grading system](#grading)  | Letter grade | Letter grade |
| B.11. [Instructional methods](#instr_methods) |  | Lecture  |
| B.11.a [Delivery Method](#instr_methods) |  | On campus  |
| B.12.[Categories](#required) |  | Free elective  |
| B.13. [How will student performance be evaluated?](#performance) |  | Attendance | Class participation | Exams |Presentations | Papers | Class Work | | Projects  |
| B.14. [Redundancy with, existing courses](#competing) |  | None |
| B. 15. Other changes, if any |  |

| B.16. [Course learning outcomes](#outcomes): List each outcome in a separate row | [Professional organization standard(s)](#standards), if relevant  | [How will each outcome be measured?](#measured) |
| --- | --- | --- |
| Students will understand the main elementary definitions in liner algebra. |  | See B.13.  |
| Students will generalize the study of elementary linear algebra to more abstract settings such as spaces of functions and spaces of operators.  |  | See B.13. |
| Students will make connections between abstract linear algebra and applications to other areas of mathematics. |  | See B.13. |
| Students will acquire the necessary background in linear algebra to pursue further studies in operator theory, functional analysis and other related areas. |  | See B.13. |

| B.17. [Topical outline](#outline): Please do not include a full syllabus |
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| 1. Vector Spaces
2. Finite-dimensional vector spaces
3. The vector space of linear maps
4. Range and Kernel, Matrices
5. Invertibility and Isomorphic Vector Spaces
6. Invariant Subspaces, Eigenvalues and Eigenvectors
7. Existence of Eigenvalues, Upper-Triangular Matrices
8. Eigenspaces and Diagonal Matrices
9. Inner Products, Norms Orthogonal Complements, Minimization Problems Self-Adjoint and Normal Operators
10. The Spectral Theorem
11. Positive Operators and Isometries
12. Polar Decomposition
13. The Spectral Theorem
14. Orthonormal Bases, Functionals on Inner Product Spaces
15. Singular Value Decomposition
16. Generalized Eigenvectors and Nilpotent Operators
17. Jordan Form
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## D. Signatures

##### D.1. Approvals:

##### Required from department chairs, program directors, and deans from the academic unit originating the proposal.

| Name | Position/affiliation | [Signature](#_Signature" \o "Insert electronic signature, if available, in this column) | Date |
| --- | --- | --- | --- |
| Dr. Lisa Humphreys  | Program Director - Mathematical Studies M.A. | Lisa Humphreys | 03/18/2022 |
| Dr. Rebecca Sparks | Chair of Mathematical Sciences | Rebecca Sparks | 03/18/2022 |
| Dr. Earl Simson | Dean of Arts and Sciences | Earl Simson | 04/01/2022 |