COURSE APPROVAL ROUTING CHECK LIST

1. **Course Number:** ~~PSM~~ ACM 630 — 1st Bulletin 11-5-09, 2nd Bulletin 11-19 09 — 091023

2. **Course Title:** Numerical Linear Algebra
(*no more than 70 characters*)

Title Abbreviation: Num Lin Alg
For use in Master Schedule (*no more than 19 characters*)

3. **Action:** ☒ New Course ☐ Revision ☐ IF Designation ☐ WAC

Requested Designation(s): _____

Course Proposal/Revision Check List

This checklist will help departments avoid some of the most common mistakes made on course proposals. Your use of the checklist will allow the College Senate Curriculum Committee to focus its review on more substantive issues and expedite the approval process.

☒ Proposal format conforms to the Directory of Policy Statements, Section IV:02.00 (2002).

☒ Proposal has been proofread for spelling, punctuation, grammar, style and gender-neutral language.

☒ If the course is a new course, reasons for the additions are included; if the course is a revision of an existing course, reasons for revision and a copy of the old course are included as well as the IF Narrative when appropriate.

☑ Catalog description follows the guidelines in the Curriculum Handbook, Appendix C.

☒ Student learning outcomes are coherent with course content and assessment.

☑ Outcomes are referenced with course content.

☒ All resource entries are alphabetized and conform to a specific style manual.

☐ Cross listed courses have been checked with all chairs and deans included in development of the course.

DEPARTMENT ACTION

MG Sale — 10/16/09

Chair, Department Curriculum Committee — Date

4. **Approved** with confirmation that all necessary laboratories, studios, resources, facilities and personnel for support of this course are available.

David C. Wilcox — MATH — 10/16/09

Signature of Department Chairperson — Department — Date

(OVER)

Faculty (Check one)

- ☒ **SNSS** *School of Natural and Social Sciences*
- ☐ **SOE** *School of Education*
- ☐ **SAH** *School of Arts and Humanities*
- ☐ **SOP** *School of Professions*

DEAN'S ACTION

Approved with confirmation that all necessary laboratories, studios, resources, facilities and qualified faculty for support of this course are available.

10/26/09 Karen O'Connor
Date Signature of Dean (both Dean's if cross-listing)

COURSE PACKET INCLUDES:

- ☐ Electronic proposal form
- ☐ Attached electronic document with explanations of contingencies as stipulated at Dean's level
- ☐ One hard copy of proposal with attached contingencies and routing sheet with all appropriate signatures (copy of routing sheet in packet sent to Academic Affairs)
- ☐ For all revisions, one hard copy of current course should be submitted (e-copy is preferable when available)

COLLEGE SENATE ACTION

1. **Received**, logged and electronic packet and hard copies forwarded to the College Senate Office. Program title to be published in the *College Bulletin*.

10/27/09 Vincent A. Masi 091023
Date Signature of College Senate Office Log Number

2. Action for Intellectual Foundations' Designation

_____ Recommend approval _____
Signature of Assistant Dean, Intellectual Foundations

_____ Recommend disapproval _____
Signature of Assistant Dean, Intellectual Foundations

3. **Action** of the College Senate Curriculum Committee

X Recommend approval and forward to College Senate

11/17/2009 Nancy A. Nicola
Date Signature of Chair, College Senate Curriculum Committee

_____ Recommend disapproval and return to Department

_____ _____
Date Signature of Chair, College Senate Curriculum Committee

ACTION OF THE OFFICE OF ACADEMIC AFFAIRS

X Approved and forwarded to President FM 11/19/09
Signature Date

_____ Disapproved and returned to Department _____ _____
Signature Date

Prefix, Number and Name of Course: PSM 630 Numerical Linear Algebra

Credit Hours: 1
In Class Instructional Hours: 1 **Labs:** 0 **Studio:** 0 **Field Work:** 0

Catalog Description:
Prerequisite: Admission to program or instructor permission
Numerical algorithms for linear algebra problems, matrix operations, matrix decompositions, solving systems of linear equations, selected problems from applied settings.

Reasons for Addition or Revision:
To create a one-semester-hour core module for the graduate Professional Applied and Computational Mathematics program where students will study numerical algorithms for linear algebra problems arising from image and signal processing, computational finance, material science simulations, structural biology, data mining, and bioinformatics, fluid dynamics, and many other areas.

Student Learning Outcomes: Students will	**Course Content References:**	**Assessment:**
1. analyze and assess techniques of matrix operations and decompositions.	I	Group work in class, individual homework assignments, exams.
2. classify and compare various numerical methods for solving systems of linear equations.	I–II	Group work in class, individual homework assignments, exams, and computer projects.
3. apply numerical linear algebraic methods to solve real world problems using appropriate techniques.	I–III	Group work in class, individual homework assignments, and computer projects.
4. modify and test computer software for diverse practical settings.	I-III	Group computer projects.

Course Content:

I. Basic concepts
   A. Types of matrices in numerical analysis
   B. Algorithms for matrix operations

II. Solving systems of linear equations
   A. Gaussian elimination
   B. Matrix decompositions (LU, SV, QR)

C. Iterative methods

III. Selected applications
- A. The assignment problem
- B. Markov chains
- C. Graph theory
- D. Leontief economic models
- E. Computer graphics

Resources

Scholarship:

Allaire, G., and Craig, A., (translator), *Numerical Analysis and Optimization: An Introduction to Mathematical Modeling and Numerical Simulation,* Oxford Press, 2007.

Atkinson, K. E., and Han, W., *Elementary Numerical Analysis,* John Wiley & Sons Inc, 2003.

Atkinson, K. E., *Elementary Numerical Analysis*, John Wiley & Sons, 1993.

Burden, R. L., and Faires, J. D., *Numerical Analysis*, 4th ed., PWS-Kent, 1989.

Curtis, F. G., and Wheatley, P. O., *Applied Numerical Analysis,* Addison-Wesley, 2008.

Gilat, A., *MATLAB: An Introduction with Applications*, 2nd ed., John Wiley & Sons, 2004.

Golub, G. H., and Van Loan, F. C., *Matrix Computations*, 2nd ed., Johns Hopkins University Press, 1989.

Griffiths, D. V., and Smith, I. M., *Numerical Methods for Engineers,* CRC Press, 2006.

Higham, N. J., *Accuracy and Stability of Numerical Algorithms*, 2nd ed., SIAM, 2002.

Leader, J. J., *Numerical Analysis and Scientific Computation,* Addison-Wesley, 2004.

Liu, J. P., *Focus on Numerical Analysis,* Nova Science, 2006.

Mathews, J. H., *Numerical Methods for Computer Science, Engineering and Mathematics*, Prentice Hall, 1987.

Richard, L. B., and Faires, J. D., *Numerical Analysis,* Thomson Brooks/Cole, 2005.

Press, W. H., et al., *Numerical Recipes: The Art of Scientific Computing,* Cambridge University Press, 1986.

Sewell, G., *The Numerical Solution of Ordinary and Partial Differential Equations,* Academic Press, 1988.

Smith, W. A., *Elementary Numerical Analysis,* Prentice-Hall, 1986.

Steinberg, D. I., *Computational Matrix Algebra,* McGraw-Hill, 1974.

Wilkinson, J. H., *The Algebraic Eigenvalue Problem,* Oxford University Press, 1988.

Periodicals:

Electronic Journal of Boundary Elements

Electronic Transactions on Numerical Analysis

IMA Journal of Numerical Analysis

International Journal of Numerical Analysis and Modeling

International Journal for Numerical Methods in Engineering Advance in Numerical Analysis – An Open Access Journal Journal of Numerical Analysis

Industrial and Applied Mathematics ESAIM: Mathematics Modeling and Numerical Analysis

Journal of Online Mathematics and its Applications

SIAM Journal on Numerical Analysis

Electronic and/or Audiovisual Resources:

DMOZ (Open Directory Project), "Numerical Analysis Category," http://www.dmoz.org/Science/Math/Numerical_Analysis/.

Matthews, J.H., "Numerical Analysis – Numerical Methods Project," http://math.fullerton.edu/mathews/numerical.html.

Mhatre, P.N., "Numerical Methods Resources," http://www.onesmartclick.com/engineering/numerical-methods.html.

MITOpenCourseware, "Introduction to Numerical Analysis for Engineering," http://ocw.mit.edu/OcwWeb/Mechanical-Engineering/2-993JSpring-2005/CourseHome/.

Naiman, A., "Numerical Methods – Online Course/Slides," http://www.math.jct.ac.il/~naiman/nm/.

Numerical Mathematics.com, "Numerical Mathematics," http://www.numericalmathematics.com.

Numerical-methods.com, "Numerical-methods.com," http://www.numerical-methods.com/.

Numerical Recipes Software, "Numerical Recipes: The Art of Scientific Computing (Third Edition)," www.nr.com.

Stat/Math Center, Indiana University, "Numerical Computing Resources on the Internet," http://www.indiana.edu/~statmath/bysubject/numerics.html.

Sullivan, S.J., "Scientific Computing and Numerical Analysis FAQ," http://mathcom.com/corpdir/techinfo.mdir/index.html.

Ward, R.C., "Eigenvalue Problems: Theory, Algorithms and Application," http://www.cs.utk.edu/~ward/talks/research_intro/index.htm.