COURSE APPROVAL ROUTING CHECK LIST

091021

1. **Course Number:** ~~PSM~~ AEM 621 1st Bulletin 11-5-09 2nd Bulletin 11-19-09

2. **Course Title:** Empirical Model Building
(*no more than 70 characters*)

Title Abbreviation: Emprical Mod Build
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

_____ 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.

_____ 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 — 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 — Date — Signature of College Senate Office — 091021 — 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 — 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 — Signature — 12/18/09 — Date

_____ Disapproved and returned to Department — Signature — Date

Prefix, Number and Name of Course: PSM 621 Empirical Model Building

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

Catalog Description:
Prerequisite: Admission to program or instructor permission
Exploratory data analysis, polynomial interpolation, curve fitting, least squares, cubic splines, minimax polynomial, Taylor and Chebyshev series, applications to fitting experimental data.

Reasons for Addition:
To create a one-semester-hour core module for the graduate Professional Applied and Computational Mathematics program where students will construct and analyze the best fitting model for a given set of data points.

Student Learning Outcomes: Students will	**Course Content References:**	**Assessment:**
1. construct and apply different models for fitting data.	I, II, III	Group work in class, individual homework assignments, exams and computer projects.
2. analyze, compare and contrast, and approximate various models.	III, IV	Group work in class, individual homework assignments, exams, and computer projects.
3. write and utilize computer programs to solve for the best fitting curves.	I–IV	Group work in class, individual homework assignments, and computer projects.

Course Content:

I. Interpolating data
   A. Lagrange polynomials
   B. Newton polynomials: divided differences
   C. General curve fitting using determinants

II. Smoothing data
   A. Divided differences and model selection
   B. Transforming data
   C. Polynomial least squares fitting
   D. Cubic spline models

III. Minimizing absolute deviations
   A. Single term models: golden section and dichotomous search methods
   B. Best fitting polynomial of given degree using a linear program

C. Minimax trigonometric polynomial
D. Choosing a best model

IV. Approximating models
A. Taylor series
B. Weierstrass approximation theorem
C. Minimax polynomials: Chebyshev equioscillation condition
D. Chebyshev series
E. Error analysis

Resources

Scholarship:

Alberth, O., *Precise Numerical Analysis*, Wm. C. Brown, 1988.

Asaithambi, N. S., *Numerical Analysis: Theory and Practice*, Saunders, 1995.

Atkinson, K. E., *An Introduction to Numerical Analysis*, 2nd ed., Wiley, 1989.

Bradie, B., *A Friendly Introduction to Numerical Analysis*, Pearson Prentice Hall, 2006.

Burden, R. L., and Faires, J. D., *Numerical Analysis*, 7th ed., Brooks/Cole, 2001.

Chapra, S. C., and Canale, R. P., *Numerical Methods for Engineers*, 5th ed., McGraw-Hill, 2006.

Fausett, L. V., *Applied Numerical Analysis using MATLAB*, 2nd ed., Pearson Prentice Hall, 2008.

Gerald, C. F., and Wheatley, P. O., *Applied Numerical Analysis*, 5th ed., Addison-Wesley, 1994.

Giordano, F. R., Fox, W. P., Horton, S. B., and Weir, M. D., *A First Course in Mathematical Modeling*, 4th ed., Brooks/Cole, 2009.

Kincaid, D., and Cheney, W., *Numerical Analysis: Mathematics of Scientific Computing*, 3rd ed., Brooks/Cole, 2002.

Lindfield, G., and Penny, J., *Numerical Methods using MATLAB*, 2nd ed., Prentice Hall, 2000.

Linz, P., and Wang, R. L. C., *Exploring Numerical Methods*, Jones and Bartlett, 2003.

Maron, M. J., *Numerical Analysis: A Practical Approach*, Macmillan, 1982.

Mathews, J. H., and Fink, K. D., *Numerical Methods using MATLAB*, 4th ed., Pearson Prentice Hall, 2008.

Morris, J. L., *Computational Methods in Elementary Numerical Analysis*, Wiley, 1983.

Neter, J., and Wassermann, W., *Applied Linear Statistical Models*, 4th ed., McGraw-Hill, 1996.

Plybon, B. F., *An Introduction to Applied Numerical Analysis*, PWS-Kent, 1992.

Rao, S. S., *Applied Numerical Methods for Engineers and Scientists*, Prentice Hall, 2002.

Recktenwald, G., *Numerical Methods with MATLAB*, Prentice Hall, 2000.

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

Stiefel, E. L., *An Introduction to Numerical Mathematics*, Academic Press, 1963.

Vellman, P. F., and Hoaglin, D. C., *Applications, Basics, and Computing of Exploratory Data Analysis*, Duxbury Press, 1984.

Yakowitz, S., and Szidarovszky, F., *An Introduction to Numerical Computations*, Macmillan, 1989.

Periodicals:

Applied Numerical Analysis and computational Mathematics

IMA Journal of Numerical Analysis

International Journal of Mathematical Modeling

International Journal of Numerical Analysis and Modeling

Mathematical Modeling

Mathematical Modeling and Analysis

Mathematical and Computer Modeling

Natural Resource Modeling

SIAM Journal on Numerical Analysis

Electronic and/or Audiovisual Resources:

COMAP, "MATHmodels, A New Resource to Make Math Modeling a Year Round Activity," http://www.mathmodels.org/.

COMAP, "Project Intermath," http://www.comap.com/undergraduate/projects/intermath/.

COMAP, "UMAP Tools for Teaching", collection of CD-ROMS available at http://www.comap.com/product/cdrom/.

Weisstein, E.W., "Cubic Spline," mathworld.wolfram.com/CubicSpline.html.

Weisstein, E.W., "Least Squares Fitting—Polynomial," mathworld.wolfram.com/LeastSquaresFittingPolynomial.html