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

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

Catalog Description:
Prerequisites: (MAT 162 and MAT 202) or equivalents
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 or Revision:
Where students will create a one-semester-hour core module for the graduate Professional Applied and Computational Mathematics program where students will determine the best fitting model for a given set of data points.

<table>
<thead>
<tr>
<th>Student Learning Outcomes:</th>
<th>Course Content</th>
<th>Assessment:</th>
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<tbody>
<tr>
<td>Students will:</td>
<td>References:</td>
<td>1. Group work in class, individual homework assignments, exams and computer projects.</td>
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<tr>
<td>1. construct and apply different models for fitting data.</td>
<td>I, II, III</td>
<td>2. Group work in class, individual homework assignments, exams, and computer projects.</td>
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<tr>
<td>2. analyze, compare and contrast, and approximate various models</td>
<td>III, IV</td>
<td>3. Group work in class, individual homework assignments, and computer projects.</td>
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<td>3. write and utilize computer programs to solve for the best fitting curves.</td>
<td>I, II, III, III</td>
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<th>Course Content:</th>
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<tr>
<td>I. Interpolating data</td>
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<tr>
<td>A. Lagrange polynomials</td>
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<td>B. Newton polynomials: divided differences</td>
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<tr>
<td>C. General curve fitting using determinants</td>
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<tr>
<td>II. Smoothing data</td>
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<td>A. Divided differences and model selection</td>
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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:

Scholarships in the Field:


**Periodicals:**


Undergraduate Applications in Mathematics Modules, COMAP.