MATERIALS SCIENCE AND ENGINEERING 2094
ANALYTICAL METHODS IN MATERIALS ENGINEERING
(ADP TITLE: ANALYTICAL METHODS)

I. CATALOG DESCRIPTION

2094 ANALYTICAL METHODS IN MATERIALS ENGINEERING

This course is designed to reinforce the use of the computer in engineering problem solving with emphasis on a variety of problems selected from all areas of Materials Science and Engineering. Emphasis will be placed on the selection of appropriate computational tools, statistical analysis of engineering data, and the proper preparation and presentation of results in professionally accepted written and oral formats. Pre: EF 1005; 2034 or 2044;Co: 3205 (2H,2C)

II. (a) TECHNICAL LEARNING OBJECTIVES

Upon successful completion of this course, the student will be able to:

- select the most appropriate computing tools to solve specific Materials Science and Engineering problems;
- solve computational problems in Materials Science and Engineering using a personal computer and a wide range of commercial software;
- perform statistical analyses of engineering data; and
- prepare and present results in professionally accepted written and oral formats.

(b) COMMUNICATION LEARNING OBJECTIVES

Upon successful completion of this course, the student will be able to:

- graphically and visually represent engineering ideas in the form of graphs, figures and charts;
- prepare memos on specific, well-focused assignments;
- prepare longer memos on more ill-defined topics which require engineering judgement and assumptions, and in which personal recommendations must be made; and
- make an in-class presentation on a pre-selected topic which the student has researched and discussed in a collaborative (small group) format.

our objective is to introduce the student to the technical and communication aspects of the representation and visualization of engineering and scientific data.

III. JUSTIFICATION

All successful modern engineering careers are inextricably tied to three basic engineering skills: computing, problem solving, and engineering communication. This course is designed to complement EF 1005, MSE 2044 (2034), and MSE 3305 in a way that reinforces and advances the computing and engineering problem solving skills introduced in EF 1005, while building upon the specific Materials Science and Engineering concepts introduced in MSE 2044 (2034). It will introduce the students to the application of computer calculation and simulation in solving modern MSE problems, and will teach them how to select the appropriate computing tools for a specific problem. It will also introduce the statistical

treatment of experimental data, and will emphasize written and oral engineering communication skills in presenting solutions to engineering problems.

Changes to this course outline are justified by the fact that the computing capabilities available to undergraduate engineering students have expanded dramatically since the last course outline was written. A combination of modern, more powerful hardware/software tools and a growing interest in improved engineering problem solving and communication skills have made a revision of this course essential in order to properly prepare our undergraduates for modern Materials Science and Engineering career paths.

The 2000 level of this course is justified by the fact that engineering skills introduced in the Engineering Fundamentals program are required to master the course materials. However, the information presented in this course is primarily intended to be used as "tools" in advanced MSE courses taken during the Junior and Senior years.

IV. PREREQUISITES & COREQUISITES

EF 1005 (Introduction to Engineering), 2034 or 2044 (Elements of Materials Engineering), 3205 (Structure Property Relationships).

These courses provide the necessary background in computer usage, programming, engineering problem solving, and basic Materials Science and Engineering concepts for a proper understanding of the assigned problems.

V. TEXTS AND SPECIAL TEACHING AIDS

Required

Glantz, Stanton A., PRIMER OF BIOSTATISTICS, Third Edition, McGraw Hill, New York, 1992. 440 pages.

MINITAB for Windows, Release 9.2, Copyright 1993, Minitab Inc., State College, PA. (Or department approved substitution.)

Any Windows-based spreadsheet program (e.g., Excel, Lotus, etc).

(Or department approved substitution.)

VI. SYLLABUS

	Percent of Course
Proper preparation of a written engineering document (PC word processors, equation editors, and graphics editors)	10%
Proper preparation and execution of an oral presentation	10%
Statistical treatment of engineering data (MINITAB for Windows, Release 9.2)	20%
Development of engineering problem solving skills	20%
Assessment of the appropriate computing tool:	
programming languages (FORTRAN Pascal, C, etc.)	10%
spreadsheets (Excel, Lotus, etc.)	10%
equation solvers (TKSolver, Mathematica, etc.)	10%
other computing tools (graphics, visualization, etc.)	10%

	100%

VII. OLD (CURRENT) SYLLABUS

VIII. CORE CURRICULUM CONSIDERATIONS

This course is included in the MSE Writing Across the Curriculum (WAC) program. The WAC learning objectives are described in Section II(b). The methodology for inclusion in the curriculum is described in Section IX. The written work and records of the oral and poster presentation become components of the student's portfolio as described in MSE 4894 and Writing Intensive (WI) credit for this work is earned by passing 4894.

IX. ABET CONSIDERATIONS

COMPUTER USAGE

Appropriate usage of available computer resources to solve problems in materials science and engineering is heavily emphasized in this course. Students are asked to not only use a wide variety of PC and workstation computing tools, but are also taught how to make critical selections of the appropriate tools for solving a specific problem from among the wide range of available computing options. Students use PC-based packages such as equation solvers (e.g., EES, TKSolver, Mathematica, etc.), spreadsheets (e.g., Excel, Lotus, etc.), and programming languages (e.g., Fortran, Pascal, C, etc.), along with other computing tools such as graphics packages, statistics packages, and engineering visualization tools. Students are also introduced to information networks and are given the opportunity to retrieve information from and prepare information for global networks.

LABORATORY PROJECTS

Traditional laboratory projects are not required in this course. However, the students do perform some class projects and assignments in the College of Engineering's "Engineering Visualization" and "Multimedia" computer laboratories.

CLASSROOM EXHIBITS

Classroom presentation of class projects (e.g., WWW pages, etc.) is often required.

APPLICATION OF PROBABILITY AND STATISTICS

This course serves as the first in a series of courses designed to present probability and statistics "across the curriculum" in an integrated way. Basic statistical treatment of engineering data is introduced through classroom instruction, homework assignments, and incorporation of statistics into class computer projects. For example, basic statistical concepts are introduced into a materials-related computer project by asking students to calculate and display the basic statistics of a polymer's molecular weight (e.g., number average, weight average, standard deviation, etc.) using an equation-solver package, a spreadsheet, and a Fortran program. The student is then asked to compare the advantages and disadvantages of preparing their statistical analysis with each of these software packages.

DESIGN CONTENT

Although there is no formal design content in this course, the assigned projects are necessarily "ill-defined" in nature, and involve engineering judgment, decision making, and the synthesis of ideas typically associated with the engineering design process. For example, final course projects often require engineering judgment, assumptions, and personal recommendations to be made.

APPLICATION OF WRITTEN AND ORAL COMMUNICATION SKILLS

Written and oral communication skills are heavily emphasized in this course. Students are taught appropriate techniques for visually presenting engineering data in the form of two-dimensional and multi-dimensional graphs, figures, and charts. They also communicate with the instructor using the memo format, practicing the preparation of both short, well-focused memos and longer memos on more ill-defined topics. Finally, in-class presentations are also required on topics which the students research and discuss in small work groups. These group activities encourage the students to interact with their peers and develop team communication and interpersonal relationship skills.

ABET CATEGORY CONTENT

Engineering Science	2 Credits
Engineering Design	0 Credits
Total	2 Credits

X. DEPARTMENT APPROVALS

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Course Supervisor, Ronald G. Kander

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ABET Coordinator/MSE Curriculum Committee, R. W. Hendricks

Date Prepared: 2-3-94

XI. UNIVERSITY APPROVALS

COMM UNDRGRAD	2/28/94
UNIV COUNCIL UNDRGR	2/28/94