# APPENDIX I

## B. Course Syllabi

**Core Courses in the Industrial Engineering Curriculum**

<table>
<thead>
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<th>Course Title</th>
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</thead>
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<td>IENG 301</td>
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<td>IENG 311/311L</td>
<td>Work Methods &amp; Measurement</td>
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<td>IENG 321/321L</td>
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<td>IENG 331</td>
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<td>IENG 362</td>
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<td>IENG 366</td>
<td>Stochastic Models</td>
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<td>IENG/MATH 381</td>
<td>Intro to Probability and Statistics</td>
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<tr>
<td>IENG/MATH 382</td>
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<td>IENG 425</td>
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<td>IENG 441</td>
<td>Simulation</td>
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<td>IENG 464</td>
<td>Senior Design Project I</td>
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<tr>
<td>IENG 465</td>
<td>Senior Design Project II</td>
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<td>IENG 471</td>
<td>Facilities Planning</td>
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<tr>
<td>IENG 475</td>
<td>Computer Controlled Manufacturing</td>
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<tr>
<td>IENG 486</td>
<td>Statistical Quality and Process Control</td>
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**Other Required Engineering Courses**

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>CEE 117/117L</td>
<td>Computer Aided Design &amp; Interpretation in CE</td>
<td>93</td>
</tr>
<tr>
<td>EE 301/301L</td>
<td>Introductory Circuits, Machines, and Systems</td>
<td>95</td>
</tr>
<tr>
<td>EM 216</td>
<td>Engineering Mechanics – Statics &amp; Dynamics</td>
<td>97</td>
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<tr>
<td>GE 115/115L</td>
<td>Professionalism in Engr &amp; Sci</td>
<td>99</td>
</tr>
<tr>
<td>GE 117/117L</td>
<td>Professionalism in Engr &amp; Sci II</td>
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<tr>
<td>MET 232</td>
<td>Properties of Materials</td>
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**Support Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CHEM 112</td>
<td>General Chemistry I</td>
<td>105</td>
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<tr>
<td>CHEM 112L</td>
<td>General Chemistry I Lab</td>
<td>107</td>
</tr>
<tr>
<td>ENGL 101</td>
<td>Composition I</td>
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<td>ENGL 279</td>
<td>Technical Communications I</td>
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<tr>
<td>ENGL 289/289L</td>
<td>Technical Communications II</td>
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<td>Calculus I</td>
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<td>MATH 125</td>
<td>Calculus II</td>
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<td>MATH 225</td>
<td>Calculus III</td>
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<td>MATH 321</td>
<td>Differential Equations</td>
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<td>MATH 353</td>
<td>Linear Optimization</td>
<td>123</td>
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<td>PHYS 211/211A</td>
<td>University Physics I</td>
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<tr>
<td>PHYS 213/213A</td>
<td>University Physics II</td>
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</tr>
<tr>
<td>PHYS 213L</td>
<td>University Physics II Lab</td>
<td>129</td>
</tr>
</tbody>
</table>
IENG 301: Basic Engineering Economics

CATALOG DATA:
IENG 301 – Basic Engineering Economics: (2-0) 2 credits
Prerequisite: Junior or higher standing preferred. Introduces the concepts of economic
evaluation regarding capital investments, including the time value of money and income tax
effects. Graduation credit cannot be given for both IENG 301 and IENG 302

DESIGNATION: N/A for IE

TEXTBOOK:

INSTRUCTOR:
Jennifer Karlin
Office hours: M, W: 10-11 AM; M, F 1-2 PM, or by appointment

PREREQUISITE KNOWLEDGE:

CLASS SCHEDULE:
Lecture: 3 hours per week, M, W, F 12 - 12:50 PM, CB 204W

ENGINEERING COMPONENT:
Engineering Topics – 1 credit, Other – 2 credits

TOPICS:
1. Time Value of Money
2. Nominal and Effective Interest Rates
3. Present Worth Analysis
4. Annual Worth Analysis
5. Rate of Return Analysis
6. Benefit / Cost Analysis
7. Replacement and Retention Decisions

COMPUTER USAGE:
Application of Microsoft Excel to spreadsheet based problems.

LABORATORY:
No laboratory component is included in this course.

COURSE OBJECTIVES:
After completing this course, students should be able to:
1. Identify how time and interest affect cash flows.
2. Identify the best engineering economy tool for evaluating alternatives.
3. Utilize present worth analysis, annual worth analysis, rate of return analysis, and
   benefit/cost analysis for evaluating alternatives.
4. Utilize replacement analysis and economic service life for evaluating asset
   replacement.
COURSE OUTCOMES:
Engineering Economy Fundamentals
1. Be able to move various cash flows across time while accounting for discrete or continuous compound interest, e.g., single payment factors, uniform-series factors, and arithmetic and geometric gradient factors.
2. Apply the concept of minimum attractive rate of return in economic decision-making.

Tools for Evaluating Alternatives
3. Be able to identify the best engineering economy tool for evaluating alternatives.
4. Be able to evaluate asset alternatives using present worth analysis, annual worth analysis, rate of return analysis, benefit / cost analysis.
5. Be able to utilize computer spreadsheets and their functions to solve engineering economy problems.

Making Decisions on Real-World Projects
6. Be able to determine the economic service life of an asset that minimizes the total annual worth of costs.
7. Be able to perform an asset replacement study between the defender and the best challenger.

Relation of Course Outcomes to Program Outcomes
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

<table>
<thead>
<tr>
<th>IENG 301 Course Outcomes</th>
<th>Math/Sc.</th>
<th>Exprmts</th>
<th>Tech Tools</th>
<th>Comm.</th>
<th>Team</th>
<th>Mgmt</th>
<th>System</th>
<th>Profess</th>
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ASSESSMENT AND EVALUATION:
Course assessment will involve embedded assessments. Sample problems from student exams will be collected and scored by the instructor against a proficiency rubric. Problems will be saved for IE faculty review. Course results will be compared to weighted average results on FE in engineering economy.

PREPARED BY:
Jennifer Karlin, Date: November 6, 2003.
IENG 302: Engineering Economics

CATALOG DATA:
IENG 302 – Engineering Economics: (3-0) 3 Credits
Prerequisite: Junior or higher standing preferred. Studies economic decision making regarding capital investment alternatives. Covers compound interest and depreciation models, replacement and procurement models. Analysis is made variously assuming certainty, risk and uncertainty. Graduation credit cannot be given for both IENG 301 and IENG 302.

DESIGNATION: Required

TEXTBOOK:

INSTRUCTOR:
Jennifer Karlin
Office hours: M, W: 10-11 AM; M, F 1-2 PM, or by appointment

PREREQUISITE KNOWLEDGE:

CLASS SCHEDULE:
Lecture: 3 hours per week, M, W, F 12 - 12:50 PM, CB 204W

ENGINEERING COMPONENT:
Engineering Topics – 1 credit, Other – 2 credits

TOPICS:
1. Time Value of Money
2. Nominal and Effective Interest Rates
3. Present Worth Analysis
4. Annual Worth Analysis
5. Rate of Return Analysis
6. Benefit / Cost Analysis
7. Replacement and Retention Decisions
8. Inflation
9. Depreciation
10. After-Tax Analysis

COMPUTER USAGE:
Application of Microsoft Excel to spreadsheet based problems.

LABORATORY:
No laboratory component is included in this course.

COURSE OBJECTIVES:
After completing this course, students should be able to:
1. Identify how time and interest affect cash flows.
2. Identify the best engineering economy tool for evaluating alternatives.
3. Utilize present worth analysis, annual worth analysis, rate of return analysis, and benefit/cost analysis for evaluating alternatives.
5. Incorporate various depreciation methods in after-tax economic analysis.
**Course Outcomes:**

Engineering Economy Fundamentals
1. Be able to move various cash flows across time while accounting for discrete or continuous compound interest, e.g., single payment factors, uniform-series factors, and arithmetic and geometric gradient factors.
2. Apply the concept of minimum attractive rate of return in economic decision-making.
3. Tools for Evaluating Alternatives
4. Be able to identify the best engineering economy tool for evaluating alternatives.
5. Be able to evaluate asset alternatives using present worth analysis, annual worth analysis, rate of return analysis, benefit / cost analysis.
6. Be able to utilize computer spreadsheets and their functions to solve engineering economy problems.
7. Making Decisions on Real-World Projects
8. Be able to determine the economic service life of an asset that minimizes the total annual worth of costs.
9. Be able to perform an asset replacement study between the defender and the best challenger.
10. Advanced Techniques
11. Be able to determine the difference inflation makes between money now and money in the future.
12. Be able to apply straight-line and MACRS depreciation models to reduce the value of the capital investment in an asset.
13. Be able to calculate before-tax and after-tax cash flows.

**Relation of Course Outcomes to Program Outcomes**
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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<tr>
<th>IENG 302</th>
<th>IE Program Outcomes</th>
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</table>

**Assessment and Evaluation:**
Course assessment will involve embedded assessments. Sample problems from student exams will be collected and scored by the instructor against a proficiency rubric. Problems will be saved for IE faculty review. Course results will be compared to weighted average results on FE in engineering economy.

**Prepared By:**
Jennifer Karlin, Date: November 6, 2003.
IENG 311/311L: Work Methods & Measurement

CATALOG DATA:
IENG 311/311L – Work Methods & Measurement: (2-1) 3 Credits

Co-requisite: IENG 381. This course presents the underlying theory and basic methodology for work methods and measurement techniques. Emphasis is placed on knowledge of the basis for selection of a technique appropriate for the individual as related to the task to be performed.

DESIGNATION: Required

TEXTBOOK:

INSTRUCTOR:
Carter J. Kerk
Office hours: M, W 11:00-12:00; T, Th 3-4 PM, or by appointment

PREREQUISITE KNOWLEDGE: Probability and statistics

CLASS SCHEDULE:
Lecture: 2 hours per week, 2:00-2:50 pm, MW.
Lab: 3 hours per week, Noon – 2:50 pm, T or Th

ENGINEERING COMPONENT:
Engineering Topics – 3 credits (significant design)

TOPICS:
1. Time Studies
2. Learning Curves
3. Predetermined Time Systems
4. Standard Data
5. Allowances
6. Engineering Design
7. Operations Analysis
8. Search
9. Value Engineering
10. Occurrence Sampling

COMPUTER USAGE:
Microsoft Excel, Word, PowerPoint, Project; ERGO 2000

LABORATORY:
Process Organization; Lean Manufacturing; Work Sampling; Course Project

COURSE OBJECTIVES:
After completing this course, students should be able to:
1. identify the milestones in the evolution of industrial society.
2. identify the major issues in the time study of manual work.
3. identify techniques used in the evaluation of work systems.
4. incorporate principles of work science in the evaluation of a real-world work system.

**COURSE OUTCOMES:**

Overview and History of Industrial Society
1. Be able to relate the evolution of the industrial engineering profession to the evolution of industrial society.
2. Be able to identify measures of productivity in work systems.
3. Time Study Concepts for Work Systems
4. Be able to determine time standards with allowances for appropriate work tasks.
5. Be able to evaluate learning curve data and make performance predictions.
6. Understand the applications for predetermined time systems and standard data.
7. Evaluation Methods for Work Systems
8. Be able to select and apply various work methods analysis techniques.
9. Be able to estimate the required number of sampling observations.
10. Applying Work Science on a Project
11. Be able to apply concepts of work science in the evaluation of a real-world work system.
12. Be able to make practical recommendations and justifications for project solutions.

**Relation of Course Outcomes to Program Outcomes**
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

<table>
<thead>
<tr>
<th>IENG 311 Course Outcomes</th>
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</table>

**ASSESSMENT AND EVALUATION:**
Course assessment will involve embedded assignments. Sample problems from student exams will be collected. Problems will be saved for IE faculty review.

**PREPARED BY:**
Carter J. Kerk, Date: April 26, 2004.
IENG 321/321L: Human Factors Engineering

CATALOG DATA:
IENG 321/321L – Human Factors Engineering: (2-1) 3 Credits
Prerequisites: IENG 381, PSYC 101. Introduction to the concepts and practice of Human Factors Engineering and Ergonomics in the analysis and design of work. Topics include anatomy, anthropometry, work physiology, posture, musculoskeletal and neurovascular disorders, ADA, health & wellness, manual materials handling, lifting, psychophysics, workstation design, office considerations, controls, displays, hand tools, occupational biomechanics, noise, vibration, and illumination.

DESIGNATION: Required

TEXTBOOK:

INSTRUCTOR:
Carter J. Kerk
Office hours: M, W 2:00-3:00; T 4-5 PM, or by appointment

PREREQUISITE KNOWLEDGE:
Probability and Statistics, basic psychology

CLASS SCHEDULE:
Lecture: 2 hours per week, 1:00-1:50 pm, MW.
Lab: 3 hours per week, Noon – 2:50 pm, T or Th

ENGINEERING COMPONENT:
Engineering Topics – 3 credits (significant design)

TOPICS:
1. Anatomy
2. Anthropometry
3. Musculoskeletal and Neurovascular Disorders
4. Energy Expenditure
5. Work Physiology
6. ADA
7. Posture Analysis
8. Health & Wellness
10. Office Ergonomics
12. Controls & Displays
13. Handtools
14. Occupational Biomechanics

COMPUTER USAGE:
Microsoft Excel, Word, PowerPoint, Project; ERGO 2000, 3DSSPP

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LABORATORY:
Anthropometry; Submaximal Stress Test; ADA; Health & Wellness; Office Ergonomics; Course Project

COURSE OBJECTIVES:
After completing this course, students should be able to:
1. identify the key physical components associated with work, e.g. anatomy, physiology, anthropometry, and posture.
2. identify major work-related musculoskeletal and neurovascular disorders.
3. incorporate principles of human factors and ergonomics in the evaluation and design of work.

COURSE OUTCOMES:
Introductory Physical Concepts
1. Be able to identify key human anatomic components.
2. Be able to evaluate human size variation with relation to work requirements.
3. Be able to identify risk factors associated with the development of musculoskeletal and neurovascular disorders.
4. Evaluation and Design Methods
5. Be able to select and apply various evaluation techniques.
6. Be able to incorporate fundamental concepts into design.
7. Applying Human Factors and Ergonomics on a Project
8. Be able to apply concepts of human factors and ergonomics in the evaluation of work.
9. Be able to make practical recommendations and justifications for project solutions.

Relation of Course Outcomes to Program Outcomes
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

<table>
<thead>
<tr>
<th>IENG 321</th>
<th>IE Program Outcomes</th>
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</thead>
<tbody>
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<td>Course Outcomes</td>
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</table>

ASSESSMENT AND EVALUATION:
Course assessment will involve embedded assignments. Sample problems from student exams will be collected. Problems will be saved for IE faculty review.

PREPARED BY:
Carter J. Kerk, Date: April 26, 2004.
IENG 331: Safety Engineering

CATALOG DATA:
IENG 331 – Safety Engineering: (3-0) 3 Credits
Prerequisites: Junior or Senior Standing. Overview to the field of Safety Engineering emphasizing quantitative problem solving. Will draw on fundamental knowledge from the fields of chemistry, physics, mechanics, mathematics, and statistics. Contents: fundamental concepts and terminology, injury and accident statistics, ethics, certification, regulations, standards, hazards and their control, and management aspects.

DESIGNATION: Required

TEXTBOOK:

INSTRUCTOR:
Carter J. Kerk
Office hours: M, W 11:00-Noon; Tu/Th 3-4 PM, or by appointment

PREREQUISITE KNOWLEDGE:

CLASS SCHEDULE:
Lecture: 3 hours per week, 3:00-3:50 pm, MWF.

ENGINEERING COMPONENT:
Engineering Topics – 3 credits

TOPICS:
1. Professionalism / Ethics
2. Fundamental concepts
3. Laws & Regulations
4. Workers’ Compensation
5. Product Liability
6. Recordkeeping & Reporting
7. Hazard Controls
8. Mechanics & Structures
9. Walking & Working Surfaces
10. Electrical Safety
11. Tools & Machines
12. Materials Handling
13. Fire Protection
14. Pressure
15. Chemicals
16. Ventilation
17. Biohazards
18. Personal Protective Equipment
19. Job Safety Analysis
20. Safety Management
21. Risk Management
22. System Safety
COMPUTER USAGE:  
Microsoft Excel, Word; Internet; Expert Systems

COURSE OBJECTIVES:  
After completing this course, students should be able to:  
1. identify the key terms and fundamental concepts of safety engineering.  
2. identify types and causes of common industrial injuries and illnesses.  
3. identify key occupational regulations  
4. identify the techniques by which occupational hazards can be identified, evaluated, and controlled.

COURSE OUTCOMES:  
Introductory Concepts  
1. Be able to identify and describe fundamental safety theories.  
2. Be able to identify types and causes of common industrial injuries and illnesses.  
3. Be able to identify ethical behavior and professionalism in the profession.  
4. Regulatory Aspects  
5. Be able to search for appropriate safety regulations.  
6. Be able to document recordkeeping of injury/illness data.  
7. Be able to describe basic concepts of workers’ compensation insurance  
8. Occupational Hazards  
9. Be able to identify occupational hazards.  
10. Be able to evaluate occupational hazards  
11. Be able to recommend appropriate control strategies for occupational hazards.

Relation of Course Outcomes to Program Outcomes  
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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<th>Course Outcomes</th>
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<th>Team Mgmt</th>
<th>System</th>
<th>Profess</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.2</td>
<td>0.1</td>
<td>0</td>
<td>0.3</td>
<td>1.4</td>
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</tbody>
</table>

Assessments  
Course assessment will involve embedded assignments. Sample problems from student quizzes will be collected. Problems will be saved for IE faculty.

PREPARED BY: Carter J. Kerk, Date: April 27, 2004.

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IENG 345: Entrepreneurship

CATALOG DATA:
IENG 345 – Entrepreneurship: (4-0) 4 Credits
Prerequisite: ACCT 211 and IENG 301 or IENG 302 or permission of instructor. This course covers topics on the legal aspects, management skills, business plans and sources of capital as well as case studies of successful and unsuccessful entrepreneurial initiatives. This course is cross-listed with BAD 345

DESIGNATION: Required

TEXTBOOK:

PREREQUISITE KNOWLEDGE: Financial statements, time value-of-money

INSTRUCTOR:
John Lofberg
Office hours: M, W, F 10:00-11:00 or by appointment

PREREQUISITE KNOWLEDGE:
Upon entering this course, the students will be considered competent in the following:
1) Fundamental accounting procedures
2) Knowledge of time value of money

CLASS SCHEDULE:
Lecture: 2.5 hours per week, 3:00 - 4.15 pm, Tu & Th
Special presentations 4.00 – 5.30 pm Weds

ENGINEERING COMPONENT:
Engineering Topics – 2 credits, Other – 2 credits (significant design)

TOPICS:
1. Creative thinking
2. Business fundamentals
3. Ethics in business
4. Financing a business
5. Teamwork

COMPUTER USAGE:
Use of Microsoft Word, PowerPoint and Excel to develop and present a business plan.

LABORATORY:
No laboratory component is included in this course.

COURSE OBJECTIVES:
The primary focus of this course is to introduce students to the rigors of the business world through entrepreneurial endeavors. Students are prepared for the challenges of starting a business or a new product line both for their own economic advancement and for the economic advancement of the society in which they live.
COURSE OUTCOMES:
Upon completion of the course, students will be able to
1. identify entrepreneurial strengths and weaknesses
2. identify a business opportunity
3. develop and present a business plan
4. develop and present a marketing plan
5. develop and present the financial requirements associated with the business
6. effectively work within self defined teams

Relation of Course Outcomes to Program Outcomes
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

<table>
<thead>
<tr>
<th>IENG 345</th>
<th>Math/Sc.</th>
<th>Exernts</th>
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ASSESSMENT AND EVALUATION:
Course assessment is conducted through course exams, preparation and presentation of a business plan, and a review of the student work.

PREPARED BY:
John Lofberg,
IENG 362: Stochastic Models

CATALOG DATA:
IENG 362 – Stochastic Models: (3-0) 3 Credits
Prerequisite: MATH 231 or MATH 315 or permission of instructor. This course covers stochastic models in operations research and is a complementary course to MATH 353. Topics include queuing theory, Markov chains, Pert/CPM, decision theory, dynamic programming, and inventory control models.

DESIGNATION: Required

TEXTBOOK:

PREREQUISITE KNOWLEDGE: Probability and statistics

INSTRUCTOR:
Stuart Kellogg
Office hours: M, W, F 10:00-12:00, by appointment

EXPECTATIONS:
Upon entering this course, the students will be considered competent in the following:
1. Fundamentals of probability and statistics including expected value, conditional probability, law of total probability, and properties of the exponential distribution
2. Fundamental matrix algebra

COURSE OBJECTIVES:
After completing this course, students should be able to utilize quantitative techniques in Operations Research to solve practical problems in Industrial Engineering.

CLASS SCHEDULE:
Lecture: 3 hours per week, 9:00-9:50 am, MWF.

ENGINEERING COMPONENT:
Engineering Topics – 3 credits

TOPICS:
1. Markov Chains
2. Queuing Theory
3. Queuing Applications
4. Simulation
5. Dynamic Programming
6. Pert/CPM
7. Decision Theory

GRADING
Exams(3) - 80% 92-100% A 80-81% B-
Homework - 20% 90-91% A- 78-79% C+
88-89% B+ 72-77% C

COMPUTER USAGE:
Application of Microsoft Excel to spreadsheet based problems.
COURSE OUTCOMES:
1. solve for steady state transition probabilities and first passage times for a markov chain
2. identify and model markovian processes using a markov chain
3. model waiting line models using queuing theory
4. solve for steady state conditions for simple M/M/s/k systems
5. utilize queuing models governed by nonexponential distributions
6. formulate and utilize waiting cost functions in queuing applications
7. generate random observations from a probability distribution
8. utilize a spreadsheet to conduct a simple discrete event simulation
9. model a stage problem using dynamic programming
10. determine an optimal solution for a dynamic programming model
11. determine the critical path for an activity network
12. determine the probability a project will be completed within a given time frame
13. determine the best alternative using maximin, max likelihood, or Baye’s decision criteria for a decision
14. construct a decision tree for a sequence of decisions

Relation of Course Outcomes to Program Outcomes

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<th>IE Program Outcomes</th>
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LABORATORY:
No laboratory component is included in this course.

ASSESSMENT AND EVALUATION:
Course assessment is conducted through an end-of-semester course student self-assessment and through course embedded assessments on specific problems. Supporting assessments include a review of results from the fundamentals of engineering (FE) exam and through a concepts inventory in probability and statistics.

PREPARED BY:
Stuart D. Kellogg, Date: September 16, 2003.
IENG 366: Stochastic Models

CATALOG DATA:
IENG 366 – Management Processes: (3-0) 3 Credits
Junior or senior standing preferred. A survey course designed to acquaint the student with information and operation of business and industrial enterprises. Management and decision making are explored through analysis of the functions of principal staff and line departments.

DESIGNATION: Required

TEXTBOOK:

PREREQUISITE KNOWLEDGE:

INSTRUCTOR:
Stuart Kellogg
Office hours: M, W, F 10:00-12:00, by appointment

EXPECTATIONS:
There are no prerequisite expectations for this course

COURSE OBJECTIVES:
This course will acquaint the student with formation and operation of business and industrial enterprises. Principal topics covered will include the nature of American business, the determination of a firm's structure and management, production, human resources management, marketing, financing, and controlling business operations.

CLASS SCHEDULE:
Lecture: 3 hours per week, 9:30-10:50 am, T, R.

ENGINEERING COMPONENT:
Engineering Topics – 3 credits

TOPICS:
1. Strategic Planning
2. Organizational Structure
3. Environment
4. Inter-organizations
5. International Environment
6. Life Cycle
7. Organizational Culture
8. Organizational Ethics
9. Innovation and Change
10. Conflict Management

GRADING
Quizzes (6) - 80% 92-100% A 80-81% B-
Case Study - 20% 90-91% A- 78-79% C+
88-89% B+ 72-77% C

COMPUTER USAGE:
Computer use for this course is limited to word processing and slideshow presentations.
COURSE OUTCOMES:
Upon completion of the course, students will be able to
1. demonstrate an understanding of modern management functions
2. evaluate the organizational effectiveness of a business/process given the environment in
   which that firm operates
3. evaluate appropriate operational strategies for a firm operating in a global environment
4. incorporate the organizational culture and code of ethics when determining an effective
   competitive strategy
5. identify key elements of change management when considering an organizational
   change

Relation of Course Outcomes to Program Outcomes
The following table indicates the relative strengths of each course outcome in addressing the
program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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<tr>
<th>IENG 366 Course Outcomes</th>
<th>IE Program Outcomes</th>
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LABORATORY:
No laboratory component is included in this course.

ASSESSMENT AND EVALUATION:
Students are required to submit a case study project report to the digital archive. Reports are
assessed annually by IE faculty using the IE project rubric.

PREPARED BY:
Stuart D. Kellogg, Date: February 2004.
IENG/MATH 381 Introduction to Probability and Statistics

CATALOG DATA:
IENG/MATH 381
(3-0) 3 credits. Prerequisite: MATH 225 concurrently. Introduction to probability theory, discrete and continuous distributions, sampling distributions and the Central Limit Theorem with general principles for statistical inference and applications of random sampling to hypothesis testing, confidence limits, correlation, and regression.

Prerequisite: Calculus III (concurrently).

INSTRUCTORS:
Geary, Johnson, Riley, Trimble
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:
Probability and Statistics for Engineering and the Sciences, 6th edition, Jay L. Devore

TOPICS:
1) Graphical and numerical summaries of data
2) Counting techniques to compute probabilities in the equally-likely outcome case
3) The addition and multiplication rules for computing probabilities
4) Conditional probability including “Law of Total Probability”, and “Bayes’ Rule”
5) Special discrete (e.g. binomial) and continuous (e.g. normal) random variables
6) Summary measures for random variables
7) Central Limit Theorem and applications to confidence intervals and tests on a single mean in the large sample case
8) Least squares and simple linear regression

COURSE OBJECTIVE: Students will learn fundamental language and notation of probability and statistics, learn how to summarize data, compute probabilities, estimate parameters, and conduct some simple hypothesis tests.

PROFESSIONAL COMPONENT:
Mathematics: 2 credits
Engineering: 1 credit

OUTCOMES:
A student who successfully completes this should, at a minimum, be able to:

1. Produce and interpret a variety of descriptive summaries of data (e.g. numerical summary statistics, boxplots, and histograms).
2. Determine the least-squares line for a bivariate dataset.
3. Compute probabilities ...
   a. Using elementary counting techniques
   b. Using fundamental rules of probability, including Bayes’ Rule and the Law of Total Probability
c. By recognizing and using standard probability mass functions (e.g. binomial) and
density functions (e.g. normal)
d. Approximately, using the Central Limit Theorem
4. Produce and interpret point and interval estimates for a population mean.
5. Understand the fundamental logic behind a formal hypothesis test and be able to carry out
such tests on a population mean.
6. Develop some proficiency in the use of a statistical software package.
7. Learn, and correctly use, fundamental probability and statistics language and notation.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
IEng/Math 381, Introduction to Probability and Statistics, meets part of ABET Criterion 3,
outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering

PREPARED BY: Roger Johnson May 2004
IENG/MATH 382 Probability Theory and Statistics II

CATALOG DATA:
IENG/MATH 382
(3-0) 3 credits. Prerequisite: IENG/MATH 382. Review of general principles of statistical inference, linear regression and correlation, multiple linear regression, ANOVA, and statistical design of experiments.

Prerequisite: Introduction to Probability and Statistics

INSTRUCTORS:
Johnson
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:
Probability and Statistics for Engineering and the Sciences, 6th edition, Jay L. Devore

TOPICS:
1) One-sample tests on a population mean and proportion (review)
2) Distribution of a linear combination of independent (normal) random variables (review)
3) Confidence intervals and hypothesis tests for two-sample tests on means and on proportions
4) Paired-sample t-test
5) Multiple comparison problem of controlling a Type I error and Bonferroni’s method
6) One-way ANOVA F-test of equality of means
7) Introduction to nonparametric methods (e.g. Kruskal-Wallis Test)
8) Introduction to 2^k factorial designs
9) Least squares and simple linear regression (review)
10) Multiple regression and tools to build multiple regression models - graphical displays including residual plots, adjusted R squared, and other diagnostic measures (e.g. Cook’s D) as time allows

COURSE OBJECTIVE:
Students will be able to design and conduct standard two- and several-sample tests of hypotheses on means and proportions. Students will also be able to build multiple regression models with the aide of appropriate software. When conducting hypothesis tests or building regression models students will be able to state the assumptions involved and how to reasonably verify such.

PROFESSIONAL COMPONENT:
Mathematics: 2 credits
Engineering: 1 credit

OUTCOMES:
A student who successfully completes this should, at a minimum, be able to:

1. Conduct the following tests of hypotheses – understanding the assumptions behind them and how to reasonably verify such:
   a. two-sample tests of the equality of means and proportions
   b. paired-sample t-test
   c. a one-way ANOVA F-test of the equality of means

77
2. Compute confidence intervals for a difference in means or difference in proportions
3. Apply blocking and randomization in the design of simple experiments (e.g. paired-sample t-tests, randomized complete block designs)
4. Build, with the aide of appropriate numerical and graphical tools/diagnostics, multiple regression models.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
IEng/Math 382, Probability Theory and Statistics II, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering

PREPARED BY: Roger Johnson May 2004
IENG 425: Production And Operations Management

CATALOG DATA:
IENG 425 – Production And Operation: (3-0) 3 Credits
Prerequisites: MATH 123; IENG/MATH 381 or BADM 221. Management of the production environment. Topics such as bills of materials, inventory control, production control, production scheduling and MRP will be discussed. The impact of production management on the design process and how products can be designed for better manufacture.

DESIGNATION: Required

TEXTBOOK:
Production and Operations Analysis, 4th. ed., by Steven Nahmias, IRWIN
McGraw-Hill.

PREREQUISITE KNOWLEDGE: Probability and Statistics

INSTRUCTOR:
Frank Matejeik
Office hours: Mondays, Wednesdays, Fridays 9 to 10 & 1-3 PM Or by appointment

COURSE OBJECTIVES:
To solve practical problems in current common production control techniques and to apply of their underlying theory.

CLASS SCHEDULE:
Lecture: 3 hours per week, 10:00-10:50 am, MWF.

ENGINEERING COMPONENT:
Engineering Topics – 3 credits

TOPICS:
1. Optimal order policies
2. Forecasting
3. Aggregate planning
4. JIT and MRP systems
5. Job shop schedules
6. Transportation problems

COMPUTER USAGE:
Application of Microsoft Excel to spreadsheet based problems.

COURSE OUTCOMES:
Upon completion of the course, students will be able to
1. Find optimal order policies for inventory problems with known demand.
2. Find optimal order policies for inventory problems with unknown demand.
3. Prepare forecasts given demand history with trends, seasonal factors, and stationarity.
4. Prepare Aggregate plans.
5. Use explosion calculus, alternative lot sizing schemes, and capacity constraints to compute order release schedules.
6. State advantages and disadvantages of JIT and MRP systems.
7. Prepare job shop schedules.
8. Solve transportation problems & their generalizations.
9. Solve problems in vehicle scheduling.

**Relation of Course Outcomes to Program Outcomes**

The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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**LABORATORY:**

No laboratory component is included in this course.

**ASSESSMENT AND EVALUATION:**

Course assessment is conducted through an end-of-semester course student self-assessment and through course embedded assessments on specific problems. Supporting assessments include a review of results from the fundamentals of engineering (FE) exam and through a concepts inventory in probability and statistics.

**PREPARED BY:**

Frank J. Matejeck, Date: April 29, 2004.
IENG 441: Simulation

CATALOG DATA:
IENG 441 – Simulation (3-0) 3 credits.
Prerequisite: IENG 381 or MATH 441. Development of computer simulation models of real
or conceptual systems. Interpretation of results of computer simulation experiments
IENG 362 – Stochastic Models: (3-0) 3 Credits

DESIGNATION: Required
TEXTBOOK:
Simulation with Arena, Kelton, Sadowski, & Sturrock, McGraw-Hill, 3rd

PREREQUISITE KNOWLEDGE: Probability and statistics

INSTRUCTOR:
Frank Matejcik
Office hours: M 9-6  W 9-2 F 9-11 PM  (other times by appointment)

COURSE OBJECTIVES:
Develop computer simulation models of real or conceptual systems with the Arena software
package, and to appropriately design, analyze and interpret the results of computer simulation
experiments.

CLASS SCHEDULE:
Lecture: 3 hours per week, 8:00-8:50 am, MWF.

ENGINEERING COMPONENT:
Engineering Topics – 3 credits (significant design)

TOPICS:
1. Types of Models
2. Simulation History
3. Fundamental Simulation Concepts
4. Basic Modeling Operations in Arena
5. Animation and graphics in Arena
6. Dynamic Programming
7. Input Analysis
8. Output Analysis
9. Writing for Simulation clients

COMPUTER USAGE:
Application of Microsoft Excel to spreadsheet based problems.

COURSE OUTCOMES:
Upon completion of the course, students will be able to
1. Identify and define various types of Models
2. State characteristics of Simulation History
3. Identify and define the pieces of Simulation and type of world views
4. Develop Basic Models in Arena
5. Animate processes and add graphics in Arena
6. Perform Input Analysis using Arena Input Analyzer
7. Use appropriate methods for Output Analysis in Simulation
8. Write memos and/or reports to Simulation clients

Relation of Course Outcomes to Program Outcomes
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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<th>Course Outcomes</th>
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LABORATORY:
No laboratory component is included in this course.

ASSESSMENT AND EVALUATION:
Course assessment is conducted through an end-of-semester course student self-assessment and through course embedded assessments on specific problems. Supporting assessments include a review of results from the fundamentals of engineering (FE) exam and through a concepts inventory in probability and statistics.

PREPARED BY:
Frank Matejeck, Date: April 29, 2004.
IENG 464: Senior Design Project I

Catalog Data:
IENG 464 – Senior Design Project I: (0-3) 3 Credits
Prerequisite: Senior standing or graduation within three (3) semesters. Small groups of
students work on original design projects. Topics are solicited from local companies,
hospitals, banks, mines, government agencies, thus providing students the opportunity to
apply their knowledge and techniques to real problems in business and industry.

designation: Required

Textbook:
The Memory Jogger II, Brassard, Ritter, & Oddo, Goal/Qpc, 1994. (suggested text, not required)

Prerequisite Knowledge:

Instructor:
Carter J. Kerk
Office hours: M, W 11:00-12:00; T, Th 3-4 PM, or by appointment

Class Schedule:
Meeting Time: 1 hour per week, 11:00-Noon, Th

Engineering Component:
Engineering Topics – 3 credits (significant design)

Topics:
1. Introduction to Senior Design
2. Project Selection Process
3. Microsoft Project
4. Intellectual Property
5. ABET Content Matrix
6. Team Developer

Computer Usage:
Microsoft Excel, Word, PowerPoint, Project

Course Objectives:
After completing this course, students should be able to:
1. operate successfully on a team
2. identify project objectives and effective analytical tools
3. produce a coherent project report
4. produce and deliver an effective project presentation

Course Outcomes:
Team Efforts
1. Be able to define a project objective.
2. Be able to select and use effective analytical tools.
3. Be able to produce and deliver an interim technical report and presentation.
Relation of Course Outcomes to Program Outcomes
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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<th>IENG 464</th>
<th>IE Program Outcomes</th>
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ASSESSMENT AND EVALUATION:
Evaluate teaming skills of individuals and team by using Team Developer software. Evaluation of progress reports and interim reports.

PREPARED BY:
IENG 465: Senior Design Project II

CATALOG DATA:
IENG 465 – Senior Design Project II: (0-3) 3 Credits

Continuation of IENG 464. Small groups of students work on original design projects. Topics are solicited from local companies, hospitals, banks, mines, government agencies, thus providing students the opportunity to apply their knowledge and techniques to real problems in business and industry. As applicable, these are continuation projects started in IENG 464.

DESIGNATION: Required

TEXTBOOK:
The Memory Jogger II, Brassard, Ritter, & Oddo, Goal/Qpc, 1994. (suggested text, not required)

PREREQUISITE KNOWLEDGE:

INSTRUCTOR:
Carter J. Kerk
Office hours: M, W 2:00-3:00; T 4-5 PM, or by appointment

CLASS SCHEDULE:
Meeting Time: 1 hour per week, 11:00-Noon, Th

ENGINEERING COMPONENT:
Engineering Topics – 3 credits (significant design)

TOPICS:
1. ABET Content Matrix
2. Senior Design Fair
3. Team Developer

COMPUTER USAGE:
Microsoft Excel, Word, PowerPoint, Project

COURSE OBJECTIVES:
After completing this course, students should be able to:
1. operate successfully on a team
2. identify project objectives and effective analytical tools
3. produce a coherent project report
4. produce and deliver an effective project presentation

COURSE OUTCOMES:
Team Efforts
1. Be able to define a project objective.
2. Be able to select and use effective analytical tools.
3. Be able to produce and deliver an interim technical report and presentation.
Relation of Course Outcomes to Program Outcomes

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ASSESSMENT AND EVALUATION:
Evaluate teaming skills of individuals and team by using Team Developer software.

PREPARED BY:
IENG 471: Facilities Planning

CATALOG DATA:
IENG 471 Facilities Planning (3-0) 3 credits
Prerequisite: Senior standing or graduation within three (3) semesters. Topics covered include:
material handling, computerized layout planning, storage facilities, flexible manufacturing
systems, and "Factory of the Future."

DESIGNATION: Required

TEXTBOOK:

PREREQUISITE KNOWLEDGE:

INSTRUCTOR:
Frank Matejcik
Office hours: Mondays, Wednesdays, Fridays 9 to 10 & 1-3 PM Or by appointment

COURSE OBJECTIVES:
After completing this course, students should be able to:
1. identify the major issues concerning facilities location and site selection.
2. develop an efficient facility layout and material handling system.
3. integrate quantitative and qualitative techniques for facility design.
4. incorporate sound principles of shipping and receiving in warehouse design.

CLASS SCHEDULE:
Lecture: 3 hours per week, 9:35-10:50 am T,R

ENGINEERING COMPONENT:
Engineering Topics – 3 credits (significant design)

TOPICS:
1. Facility planning processes
2. Integration in the facility design process.
3. Strategies to expand capacity
4. Facility location
5. Facility layout
6. Facility software
7. Evaluative alternative facility configurations
8. Material Handling
9. Principles of material handling
10. Shipping and receiving in warehouse design
11. Facility design projects

COMPUTER USAGE:
Application of Microsoft Excel to spreadsheet based problems. Use of AutoCAD or Visio to present plans

COURSE OUTCOMES:
Upon completion of the course, students will be able to
1. Be able to incorporate the 10 steps of the facility planning process.
2. Identify techniques and rational for integrating product, process, quality, scheduling, and material handling in the facility design process.
3. Be able to use the strategies to expand capacity.
4. Determine a facility location using both quantitative and qualitative methods.
5. Given the necessary space requirements be able to construct a facility layout.
6. Given space requirements be able to construct a facility utilizing facility software.
7. Be able to evaluative alternative facility configurations.
8. Incorporate the principles of material handling when designing material handling.
9. Be able to incorporate the principles of shipping and receiving in warehouse design.
10. Be able to adapt a facility design to meet the needs of a client.

Relation of Course Outcomes to Program Outcomes
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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LABORATORY:
No laboratory component is included in this course.

ASSESSMENT AND EVALUATION:
A required element of this course will be the facility design project. Students will be assigned to a team for completion of a practical design problem. Each team will be assigned a team grade. In addition, all students will be required to submit a project report to the IE portfolio collection system. The project will be scored against an assessment rubric at a later date. The rubric will include a team and a communications component as well as a facilities component.

For the student projects, students will be required to utilize the Team Developer. Results from the team developer will be compared with the team self-assessment sheet including in the project grade.

Instructor will review a weighted average of FE results for the facilities and material handling components.

PREPARED BY:
Frank Matejcik, Date: April 29, 2004.
IENG 475: Computer Controlled Manufacturing

CATALOG DATA:
IENG 475 – Computer Controlled Manufacturing; (3-1) 3 Credits
Prerequisite: Senior standing or permission of instructor. Fundamental concepts of using computers in the design of a computer integrated, discrete-item, manufacturing facility are covered. Basic ideas of Computer Aided Design (CAD), Group Technology (GT), process planning, integrated production control and computer numerical control are covered. The manufacturability issues and concepts of selecting and using robots in the workplace are explored.

DESIGNATION: Required

TEXTBOOK:

PREREQUISITE KNOWLEDGE:

INSTRUCTOR:
Stuart Kellogg
Office hours: M, W, F 10:00-12:00, by appointment

EXPECTATIONS:
Upon entering this course, the students will be considered competent in the following:
1. Fundamentals of mathematics through matrix algebra
2. Use of computer aided design (AutoCad or SolidWorks)

COURSE OBJECTIVES:
To provide the student with basic concepts of components in a computer-controlled, discrete item manufacturing environment. Topics covered are: computer aided design, group technology, process planning, production control, computer numerical control, and robotics. Concurrent engineering concepts are introduced. Students will have hands-on laboratory work in CNC, robotics, and, time permitting, programmable logic controllers.

CLASS SCHEDULE:
Lecture: 3 hours per week, 2:00-2:50 am, MWF.

ENGINEERING COMPONENT:
Engineering Topics – 3 credits

TOPICS:
1. NC Control
2. NC Programming
3. CAD/Constructive Geometry
4. Machine Calculations
5. Robotics
6. Group Technology
7. Integrated Manufacturing

GRADING
Exam(3) - 80% 92-100% A 80-81% B-
HWK/Labs - 20% 90-91% A- 78-79% C+
88-89% B+ 72-77% C

COMPUTER USAGE:
1. SolidWorks
2. MasterCam
3. SpectraCam
4. ACL/PCL

**Course Outcomes:**
Upon completion of the course, students will be able to
1. write the g-code necessary to create a simple design
2. design and machine a simple part using MasterCam and CNC programming
3. import a DXF or SLDPR T part into MasterCam and generate the necessary CNC code to machine the part
4. design and machine a simple part using SpectraCam
5. Train a robot to repeat a simple program
6. Define the part, the machine processing, and the integration necessary to machine the part through integrated manufacturing techniques

**Relation of Course Outcomes to Program Outcomes**
The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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**Laboratory:**
No laboratory component is included in this course.

**Assessment and Evaluation:**
Course assessment is conducted through a SALG (Student Assessment of Learning Gains) and through use of the LASSI (Learning and Studying Strategies Inventory). Student will successfully design and manufacture simple parts through the OpenCim system. Supporting assessments include a review of results from the fundamentals of engineering (FE) exam in areas related to machining and material handling.

**Prepared By:**
Stuart D. Kellogg, Date: April, 2004.
IENG 486: Statistical Quality And Process Control

CATALOG DATA:
IENG 486 – Statistical Quality And Process Control: (3-0) 3 Credits
Prerequisites: IENG 381 or MATH 441 or permission of instructor. This course covers the
development of statistical methods for application to problems in quality and process control.
Statistical topics include: basics of processes and variability, statistically controlled processes, variable
and attribute control charts, moving averages, individual trend and others, process capability, sampling
plans for attributes and variables. This course is cross-listed with MATH 486

DESIGNATION: Required

TEXTBOOK:

PREREQUISITE KNOWLEDGE: Probability and statistics

INSTRUCTOR:
Frank Matejcik  Office hours:  M, W, F 9 to 10 & 1-3 PM Or by appointment

COURSE OBJECTIVES:
After completing this course, students should be able to use Quality Control techniques to solve practical
problems in Industrial Engineering.

CLASS SCHEDULE:
Lecture: 3 hours per week, 11:00-11:50 am, MWF.

ENGINEERING COMPONENT:
Engineering Topics – 3 credits

TOPICS:
1. Pareto Charts
2. Fishbone diagrams
3. Shewhart control charts
4. Process Capability Analysis
5. Histogram or probability plot.
6. Process Capability Ratio
7. Gage and measurement system studies
8. Specification limits
9. Cusum, EWMA, and MA control charts
10. Short Run control charts
11. Modified and Acceptance control charts.
12. Control chart methods for special cases
13. Single sampling plans

COMPUTER USAGE:
Application of Microsoft Excel to spreadsheet based problems and Minitab for control charts.

COURSE OUTCOMES:
1. Upon completion of the course, students will be able to Prepare and interpret Pareto Charts
   and Fishbone diagrams.
2. Develop and interpret Shewhart control charts for variables.
3. Develop and interpret Shewhart control charts for attributes.
4. Perform Process Capability Analysis Using a Histogram or probability plot.
5. Compute and interpret Process Capability Ratio estimates, intervals, and tests.
6. Perform gage and measurement system studies using control charts and tabular methods.
7. Set specification limits on discrete components.
8. Develop and interpret Cusum, EWMA, and MA control charts for variables.
9. Develop and interpret Short Run control charts.
10. Develop and interpret some control chart methods for short runs.
11. Develop and interpret Modified and Acceptance control charts.
12. Develop and interpret some control chart methods for Multiple Stream Processes, Auto-correlated Process data, and economic design of control charts.
13. Apply and develop single sampling plans for attributes.

Relation of Course Outcomes to Program Outcomes

The following table indicates the relative strengths of each course outcome in addressing the program objectives (on a scale of 1 to 4 where 4 indicates a strong emphasis):

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Average: 3.6429 3.8462 4 2

LABORATORY:
No laboratory component is included in this course.

ASSESSMENT AND EVALUATION:
Course assessment is conducted through an end-of-semester course student self-assessment and through course embedded assessments on specific problems. Course assessment will involve embedded assessments. Sample problems from student exams will be collected and scored by the instructor against a proficiency rubric. Problems will be saved for IE faculty review. Supporting assessments include a review of results from the fundamentals of engineering (FE) exam and through a concepts inventory in probability and statistics.

PREPARED BY:
Frank J. Matejcik, Date: April, 29 2004
CEE 117/117L – Computer Aided Design and Interpretation in Civil Engineering
Required Course

CATALOG DATA:
CEE 117/117L COMPUTER AIDED DESIGN AND INTERPRETATION IN CIVIL ENGINEERING
(1-1) 2 credits. Students will learn to construct drawing documents using AutoCAD, the use of engineering and architectural scales, lettering practices, geometric construction (manually and AutoCAD), and the ability to visualize in three dimensions.

TEXTBOOK:

INSTRUCTOR:
Lois Arneson-Meyer, CM 121
Office Hours: open door

Teaching Assistants: Zhong Tan, Homework Grader
Jonathan Brinson, Lab Assistant

COURSE OBJECTIVES:
Students learn the principles of engineering graphics including orthographic projections, auxiliary views, section, dimensioning and working drawings. These concepts are illustrated using a variety of techniques including freehand sketching and computer aided design software.

COURSE OUTCOMES:
The students successfully completing this course will have the ability to:
• Visualize objects and ideas
• Use and understand engineering drawing terminology
• Interpret technical drawings
• Communicate ideas in a visual medium
• Sketch multiviews, auxiliary views and sectional views of objects
• Demonstrate proficiency in the basics of AutoCAD.

TOPICS:
1. Basic technical drawing skills – lettering, scales, linetypes, geometric construction.
2. Introduction AutoCAD features
   • Starting and setting up drawings
   • Drawings, saving drawings
   • Drawing lines, erasing objects, using layers and making prints
3. AutoCAD – Drawing basic shapes
   • Object snap, geometric constructions, placing text on drawing
4. Freehand drawing – sketching, multiviews
5. AutoCAD - multiviews
6. AutoCAD – arrays, working with drawing files, basic editing
7. Freehand sketching – isometric views, dimensioning
8. AutoCAD – draw and edit polylines
9. Freehand auxiliary view, AutoCAD auxiliary views
10. Freehand sectional views, AutoCAD sectional views
LABORATORY PROJECTS:
Students have two projects a semester. The first project will be the drawing of a cabin from the beginning sketches to a complete drawing in AutoCAD. The second project is a drawing that students come up with that utilizes most of the concepts learned in this class. The projects are first cleared through the instructor.

PROFESSIONAL COMPONENT:

RELATIONSHIP BETWEEN PROGRAM OBJECTIVES AND COURSE OBJECTIVES:

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ASSESSMENT AND EVALUATION:
Independent Course Assessment (homework, exams, quizzes,
  • design projects)
  * Student Self Assessment Survey
  * Institutional Student Course Evaluation

PREPARED BY: Lois Arneson-Meyer, Spring 2004
EE 301/301L: Introductory Circuits, Machines, and Systems
Required Course

CATALOG DATA:
EE301/301L – Introductory Circuits, Machines, and Systems: (3-1) 4 Credits
Prerequisite: GE115 or equivalent, Math 125 completed with a “C-“ or better, and Math321 completed or concurrent. Not for majors in electrical engineering or computer engineering. Introduces the essential concepts of electrical engineering concerning circuits, machines, electronics, and systems.
Required for: IE, ME, MET, MINING
Elective for: other non-ECE majors

TEXTBOOK:

COORDINATOR:
Elaine Linde, Instructor

PROFESSIONAL COMPONENT:
Engineering Science – 4 Cr. – 100%

TOPICS:
1. Fundamentals of Electric Circuits:
2. DC Circuit Analysis Techniques:
3. AC Circuit Analysis:
4. Transient Analysis:
5. Frequency Analysis:
6. Operational Amplifiers:
7. Semiconductors
8. Digital Logic
9. Electrical Machines and AC Power (time permitting)

LABORATORY:
A one credit hour laboratory EE 301L accompanies this course. The laboratory meets for two hours every week. The following laboratories are performed:
1. Introduction to EE Lab
2. Ohm’s Law
3. Voltage and Current Division
4. Voltage and Current Division Applications
5. Nodal Analysis
6. Mesh Analysis
7. Thevenin and Norton Circuits
8. Use of the Signal Generator and Oscilloscope
9. Transient Response of a Circuit
10. Low and High Pass Filtering
11. Fourier Series and FFT
12. Diodes, Transistors and Op-Amps
13. Digital Logic
14. Laboratory Practical Exam (individual)
COURSE OUTCOMES:
1. Understand and use the fundamentals of electric circuits including Ohm’s Law, Kirchhoff’s Current and Voltage Laws, and voltage and current division.
2. Understand and use DC circuit analysis techniques such as node analysis, mesh analysis, and Norton and Thevenin equivalent circuits.
3. Extend DC analysis techniques to AC networks using phasor notation and conversion of time domain sinusoidal voltages and currents.
4. Understand the characteristics of first and second order transients.
5. Have an awareness of the advantages of using the frequency domain by way of Bode plot, Fourier series and filtering.
6. Understand the basic operation and applications of operational amplifiers including inverting, non-inverting, summing, differential amplifiers using ideal analysis and the limitations of real op-amps.
7. Understand the basic operation and applications of semiconductor devices such as diodes, LED’s, and BJT transistors.
8. Understand the basic operation of digital logic gates and their application and link to other technologies (PLC, microcontrollers).
9. Have an awareness of electric machines and AC power and their uses.
10. Use basic laboratory measurement equipment including the power supplies, digital multimeters, function generators, and oscilloscopes to conduct experiments.
11. Be able to write clear, concise, conceptual technical reports based on laboratory results.

RELATION OF COURSE TO PROGRAM OUTCOMES:
The following table indicates the relative strengths of each course outcome in addressing the program outcomes listed above (on a scale of 0 to 4 where 4 indicates a strong emphasis)

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PREPARED BY:
Elaine Linde, Date: August 20, 2003
revised for spring 2004 on Jan. 5, 2004,
revised for ABET requirement May 13, 2004
Course Description: Prerequisite: MATH 125 completed with a grade of “C” or better.
STATICS: The study of effects of external forces acting on stationary rigid bodies in equilibrium. Frames and machines, friction, centroids and moments of inertia of areas and mass are discussed. DYNAMICS: Newton’s laws of motion are applied to particles and rigid bodies. Topics considered are absolute and relative motion; force, mass, and acceleration (of particles and rigid bodies); work and energy; and impulse and momentum (of particles).


Instructor: Lois Arneson-Meyer, CM 121
Office Hours: open door

Teaching Assistants: Homework Grader

Expectations:

Students should know all trigonometric functions associated with right angles, sine and cosine law, algebra skills: solving linear equations, exponents, factoring, solving systems of equations, similar triangles and fundamental calculus skills (integration, differentiation)

Course Objectives:

This course is designed to provide students with the basic knowledge for the analysis of the effects of external forces acting on stationary rigid bodies in equilibrium and the study of particles and rigid bodies in motion.

Course Outcomes:

The students successfully completing this course will have the ability to:

1. Determine the components of a force in rectangular coordinates.
2. Draw complete and correct free-body diagrams and write appropriate equilibrium equations from the free-body diagrams.
3. Evaluate forces acting on static bodies including determining resultants and 3D components.
4. Calculate moments in 2D and 3D about a point utilizing cross products.
5. Determine the support reactions on a structure.
6. Determine the connection forces in trusses and in general frame structures.
7. Given standard shapes and corresponding centroids and or moment of inertia be able to compute centroids and or moment of inertia for composite bodies.
8. Determine forces required to overcome initial friction and calculate friction losses for bodies in motion.
9. List the principles of rectilinear and curvilinear kinematics and apply them to problems of particle motion.
10. List the principles of rectilinear and curvilinear kinematics and apply them to problems of
rigid bodies in motion.

11. Explain and apply Newton’s Second Law of Motion, linear and angular momentum and motion under a central force for particles.

12. Explain and apply equation of motion for rigid bodies: forces and accelerations using D’Alembert’s Principle.

Topics:
Review fundamental concepts
Statics of particles
Rigid bodies: equivalent systems of forces
Equilibrium of rigid bodies.
Distributed forces: centroids and centers of gravity.
Analysis of structures
Friction
Kinematics of Particles
Kinematics of Rigid bodies
Kinetics of Particles
Kinetic of rigid bodies
Plane motion of rigid bodies: forces and accelerations
Semester review

Laboratory Projects: None

Professional Component: None

Relationship Between Program Objectives and Course Objectives:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>ABET Program Outcomes</th>
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</table>

Assessment and Evaluation:

- Independent Course Assessment (homework, exams, quizzes)
- FE Exam Topical Results
- Student Self Assessment Survey
- Institutional Student Course Evaluation

Prepared by: Lois Arneson-Meyer
GE 115: Professionalism in Engineering and Science I

CATALOG DATA:
GE 115 – Professionalism in Engineering and Science I: (1-1) 2 Credits
A course based upon professional issues pertinent to engineers and scientists along with an overview of the various engineering and science disciplines. Case studies based upon actual technical problems will be presented by practicing engineers and scientists. These case studies will involve both societal and professional questions. The format for a particular case study will involve an overview of a particular engineering or science discipline, and introduction to an actual technical problem, and a discussion of the societal implications of decisions that result.

DESIGNATION: Required

TEXTBOOK:
Student Manual (CD available at the Tech Bookstore. Supplements online)

INSTRUCTORS:
Dr. Stetler, Kellar, Dixon, Kellogg, Stone, Simonson, and Hladysz, Mr. Ash, Ms. Sieverding

PREREQUISITE KNOWLEDGE:
This is a freshman course with no specific incoming expectations except a commitment to pursue a degree in engineering.

COURSE OBJECTIVES:
To make the most of this course, it is recommended that students adopt the following five learning objectives to guide their priorities and actions during this term.
1. Be able to use technology tools (World Wide Web, Excel, PowerPoint, analysis software) to analyze, solve, and present solutions to engineering problems.
2. Become an effective team member.
3. Develop the communication skills necessary to package acquired technical and professional abilities that are required to succeed in engineering practice.
4. Understand the engineering profession enough to commit to a major and create an education/career plan.

CLASS SCHEDULE:
Lecture/Lab: 3 hours per week, 11:00PM-11:50PM, MWF (Section 9), 1:00PM-1:50PM, MWF (Section 1).

ENGINEERING COMPONENT:
Engineering Topics – 1 credit, Other – 1 credits (significant design)

TOPICS:
The course will cover the following engineering related topics
- Technical Library Orientation
- Teams and Teaming
- Webpage Development and Publishing
- Professional Engineering Ethics
- Dimensions, Units, and Significant Figures
- Technical Writing Overview
- Analytical Methods for Engineering
- Problem Solving and Chart Creation Using Excel
- Experimental Lab and Data Analysis
- Final Teaming Project

COMPUTER USAGE:
Microsoft FrontPage – web development
Microsoft Excel - engineering problem solving
Microsoft Word – for writing memos/technical reports
Microsoft PowerPoint – final team presentation
Logger Pro – data acquisition software used for experimental lab
**Course Outcomes:**
Upon completion of this course, students will have demonstrated the ability to:
1. Document a rational for selection in their chosen major.
2. Author a web page and post to the Internet.
3. Incorporate the rules of significant digits when solving problems and check for dimensional consistency.
4. Incorporate the 7-step approach to solving engineering problems.
5. Utilize Excel to solve fundamental problems in engineering.
6. Use a data acquisition system to collect experimental data.
7. Utilize Excel to analyze data and conduct a trend analysis on experimental data.
8. Utilize the fundamental principles of engineering design and team problem solving to design a rudimentary engineering system.
9. Utilize fundamental principles of technical writing to prepare a technical report, resume, and technical memorandum.
10. Utilize ethical principles in professional engineering decision making.

**Relation of Course Outcomes to Program Outcomes:**
The following table indicates the relative strength of each course outcome in addressing the program outcomes (on a scale of 1 to 4, 4 indicating strong emphasis).

<table>
<thead>
<tr>
<th>GE 115 Course Outcomes</th>
<th>ABET Criteria a-k</th>
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**Laboratory:**
The students will utilize the Lab Pro data acquisition devices to measure the temperature in a coffee pot as a function of time from when the coffee pot is turned on. This data will be collected and analyzed by the students and then placed into a technical report. In addition, extensive lab work is used during the final team project.

**Assessment and Evaluation:**
- Homework
- Laboratory Project
- Writing, reports, presentation
- Professionalism/Attendance
- Portfolio
- FE Exam
- Exit Exam

**Prepared By:**
S. Kellogg, Date: April 20, 2004
GE 117: Professionalism in Engineering and Science II
Required Course

CATALOG DATA:
GE 117 – Professionalism in Engineering and Science II: (1-1) 2 Credits

The course is a continuation of GE 115. A survey of team skills, problem solving skills, and communication skills necessary for today’s environment. The laboratory component continues the societal and professional questioning required of engineers and scientists through the application of student teams working on applied projects with faculty members.*

*Note: This is the catalog description as listed, but the course has evolved and now only ME’s, MET’s, and IE’s take the course as either a requirement or free elective. The Spring 2004 semester is the last time it will be taught and the course name will revert back to a previous ME 110 course – Introduction to Mechanical Engineering who’s course description fits more closely with what is currently taught and reads:

An introductory course for incoming mechanical engineering freshman which will introduce the student to the profession they have chosen. Topics to be covered include: Solid modeling, CAD lab, professional development, engineering design, technical communications, personal development, and academic success skills.

TEXTBOOK:

INSTRUCTOR:
Mr. Jason Ash, ME Instructor
Office: CM102 Office Hours: 10-12 and 4-5 MWF or by appointment.
Phone: 355-3736 Email: Jason.Ash@sdsmt.edu

EXPECTATIONS:
This is a freshman course with no specific incoming expectations except a commitment to pursue a degree in engineering.

COURSE OBJECTIVES:
To make the most of this course, it is recommended that students adopt the following five learning objectives to guide their priorities and actions during this term.
1. Be able to use physical principles in the design process to address engineering problems.
2. Become an effective team member.
3. Develop the communication skills necessary to package their technical and professional skills to succeed in engineering practice.
4. Develop an understanding of 3-D modeling.
5. Understand the engineering design process and how 3-D modeling fits into it.

CLASS SCHEDULE:
Lecture/Lab: 3 hours per week, 2:00PM-2:50PM, MWF (Section 2), 3:00PM-3:50PM, MWF (Section 1).

PROFESSIONAL COMPONENT:
Engineering Science: 1.50 credits or 75%
Engineering Design: 0.50 credit or 25%

TOPICS:
The course will cover the following engineering related topics
• Engineering Design
• Engineering Drawings/Sketching
• Solid Modeling (SolidWorks)
• Dimensioning and Tolerancing Standard Introduction

COMPUTER USAGE:
Much of the class and lab time will be devoted to learning the use of SolidWorks. Microsoft Word and PowerPoint will be used as needed for memos and course projects.

101
COURSE OUTCOMES:
Upon completion of this course, students will have demonstrated the ability to:
1. Discuss the concept of concurrent engineering and how it relates to engineering design and manufacturing.
2. Read and produce mechanical drawings/sketches (orthographic/multiview, isometric, oblique).
3. Visualize and/or produce a conversion between the various drawing/sketching forms.
4. Understand how 3-D modeling fits into the engineering design process.
5. Be able to produce a 3-D solid model for a specific part and create a dimensioned orthographic drawing of it.
6. Be able to combine numerous part files into an assembly drawing.
7. Understand the need for a dimensioning and tolerancing standard and where to locate that if needed.

RELATION OF COURSE OUTCOMES TO PROGRAM OUTCOMES:
The following table indicates the relative strengths of each course outcome in addressing the program outcomes (on a scale of 1 to 4 where 4 indicates a strong emphasis):

<table>
<thead>
<tr>
<th>GE 117 Program Outcome</th>
<th>Objective 1</th>
<th>Objective 2</th>
<th>Objective 3</th>
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<tbody>
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<td>Course Outcomes</td>
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* (For a list of Program Objectives and Program Outcomes, please go to [http://www.hpcnet.org/MEobjectives_outcomes](http://www.hpcnet.org/MEobjectives_outcomes))

LABORATORY:
The students will utilize the SolidWorks software extensively to produce 3-D solid parts, mechanical drawings of those, and take in-class quizzes.

ASSESSMENT AND EVALUATION:
Course objectives:
The course objectives will be evaluated from input supplied from instructors of cohered courses such as: ME 262. Also the following assessment instruments will be used for evaluating the course objectives:
1. FE exam
2. Exit exam

Course outcomes:
The course outcomes will also be evaluated from in-class testing and other instruments deemed suitable. The following weights will be used to determine the final grade:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Quizzes</td>
<td>30%</td>
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<tr>
<td>Homework</td>
<td>30%</td>
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<tr>
<td>Projects</td>
<td>20%</td>
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<tr>
<td>Attendance</td>
<td>10%</td>
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<tr>
<td>Portfolio</td>
<td>10%</td>
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</tbody>
</table>

Grading Scale: A (90-100) B (80-90) C (70-80) D (60-70) F (<60)

PREPARED BY:
Jason Ash, Date: April 12, 2004
MET 232 PROPERTIES OF MATERIALS  
(Required Course)

CATALOG DATA:  
(3-0) 3 credits. Prerequisite: MATH 123 and PHYS 111  
A course in engineering materials and their applications. The different technological uses of  
metals, ceramics, plastics, and composite materials are discussed and explained in terms of their  
basic atomic structure, and mechanical, thermal, optical, electrical, and magnetic properties.  
Material selection in engineering design is emphasized.

TEXTBOOK:  

INSTRUCTOR:  
Dr. Glen A Stone, Office Hours: 2:00-3:00 p.m. M-W-F

REQUIRED/ELECTIVE:  
This course is required for all B.S. Metallurgical, Mechanical and Industrial Engineering students.

COURSE OBJECTIVES:  
The objective of this lecture program is to relate the properties of engineering materials to the  
materials microstructure developed during thermal mechanical processing. Students develop tools  
to make informed engineering material selection decisions that will be safe and economic. The  
majority of laboratory exercises in M 231 are timed to follow or coincide with lecture content.

COURSE OUTCOMES:  
• Student will understand the basics of atomic bonding and the resulting structure of  
crystalline solids.  
• Student will know and be able to identify the role imperfections in solids play in the  
development of mechanical and physical properties of materials.  
• Students must be accomplished in using mass transport in solids as it pertains to design of  
  homogeneous alloys and the carburization of steels.  
• Students will have experience in the interpretation of mechanical properties of materials,  
  and apply these material properties in the design system components.  
• Student will be introduced to dislocation theory and the role dislocations play in the  
development of mechanical and physical properties of materials.  
• Student must be able to identify ductile, brittle, fatigue and high strain rate fractures.  
• Student must be accomplished in the use of binary phase diagrams to predict equilibrium  
  and non-equilibrium structures.  
• Students be accomplished in the thermal processing of ferrous and non-ferrous alloys.  
• Students must understand the basic mechanical properties of polymers as the pertain to  
  the Voigt and Maxwell mechanical models.  
• Student are introduced and have some skills as to predicting the properties of composite  
  materials using the most basic rules of superposition.

TOPICS COVERED:  
• Metal Structures  
• Imperfections in Solids  
• Solid State Diffusion  
• Mechanical Behavior of Metals
- Strengthening Mechanisms
- Phase diagrams
- Kinetics of Phase Transformations
- Iron Carbon Alloys – Properties/Microstructure
- Nonferrous metals Alloys -- Properties/Microstructure
- Polymer Structures/Polymer Types/Mechanical Properties
- Composite Materials

CLASS SCHEDULE:
3 hours per week MWF, 1:00-1:50 p.m.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES: (a), (c)

LECTURE:
The course lectures parallels the laboratory portion, both in terms of objectives and topics covered. A design project beginning at midterm involves individual team research and the preparation of a technical style report.

CONTRIBUTION OF COURSE TO MEETING THE PROFESSIONAL COMPONENT:
One major team prepared design report is a critical part of this course.

PERSON WHO PREPARED THIS DESCRIPTION AND DATE OF PREPARATION:
Glen Stone, January 14, 2004
CHEM 112 GENERAL CHEMISTRY I
(Required Course)

CATALOG DATA:
CHEM 112 GENERAL CHEMISTRY I
(3-0) 3 credits. Prerequisites Prerequisite or corequisite MATH 102. An introduction to the basic principles of chemistry for students needing an extensive background in chemistry (including chemistry majors, science majors, and pre-professional students). Completion of a high school course in chemistry is recommended. Duplicate credit for CHEM 106 and 112 not allowed.

TEXTBOOK:
2. Arrington, D. E., "General Chemistry I CD." This CD contains self-tests for this course. You will need an IBM-compatible computer, equipped with a CD-ROM drive, and Windows 9x or NT variants as the operating system.

INSTRUCTOR:
Dr. Dale Arrington, C-313 (394-1236)
E-mail: dale.arrington@sdsmt.edu
Office Hours: 10 a.m. MWF

EXPECTATIONS:
Students are expected to have a fundamental understanding of:
• Algebra
• Prior course in chemistry

COURSE OBJECTIVES:
Students will obtain a foundation in the fundamental principles and models of chemistry necessary for an understanding of the composition, structure, and properties of matter and the changes that matter undergoes.

CLASS SCHEDULE:
C-228 (sec. 1) Monday-Wednesday-Friday; 8:00 – 8:50 a.m.
C-228 (sec. 2) Monday-Wednesday-Friday; 9:00-9:50 a.m.

PROFESSIONAL COMPONENT:
Basic Science: 3 credits or 100%

TOPICS:
• Properties of matter
• Atomic structure
• Stoichiometry
• Reactions in aqueous solution
• Thermochemistry
• Electronic structure
• Periodic properties
• Bonding
• States of matter
• Intermolecular forces
• Properties of solutions
COMPUTER USAGE:
None

COURSE OUTCOMES:
Each student successfully completing Chem112 is expected to have the following abilities:

- Understand, and use correctly, the symbolic representations, chemical notation, formulas, and systematic rules of nomenclature that characterize the language of chemistry.
- Understand and apply the mole concept in a variety of chemical calculations, including calculating the number of particles in a given mass of substance (and vice versa), and the quantitative relationships between reactants and products in a chemical reaction.
- Recognize the different types of chemical transformations: acid-base, precipitation, combination, decomposition, single-replacement, oxidation-reduction, double replacement, and combustion.
- Understand the basic principles of energy transfer involving chemical systems, including the transfer of heat and work between system and surroundings, the qualitative and quantitative interpretation of thermochemical equations, and the application of Hess's Law.
- Understand the various models of atomic structure, the basic principles of quantum theory, and the experiments that led to those principles.
- Write ground-state electron configurations for atoms and ions of any representative element and the 3d transition series elements.
- Understand the fundamental aspects of chemical bonding, including writing Lewis structures, describing the bonding in molecules by simple valence-bond theory, and using Valence Shell Electron Pair Repulsion Theory to predict the geometries of molecules and ions.
- Use modern atomic theory to understand and predict the properties of different elements.
- Recognize, and account for, in terms of the underlying electronic factors involved, the characteristic properties of the different groups in the periodic table.
- Understand the properties of the different states of matter.
- Qualitatively and quantitatively describe the properties of the gaseous state and the fundamental laws governing the behavior of gases.
- Understand, qualitatively and quantitatively, the behavior of solutions and their colligative properties.
- Understand how fundamental intermolecular interactions among particles determine the physical and chemical properties of a system.
- Understand the fundamental postulates of kinetic-molecular theory and use them to explain the physical behavior of the three states of matter.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
CHEM 112, General Chemistry I, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

LABORATORY:
None

ASSESSMENT AND EVALUATION:
Cumulative percent average on the five hour exams is the sole determinant of the grade in this course.

PREPARED BY:
Dale Arrington, Fall 2003
CHEM 112L GENERAL CHEMISTRY I LAB
(Required Course)

CATALOG DATA:
CHEM 112L GENERAL CHEMISTRY I LAB
(0-1) 1 credit. Prerequisite or corequisite: CHEM 112. Laboratory designed to accompany CHEM 112.

TEXTBOOK:
1. Prepackaged set of experiments from the Modular Laboratory Program in Chemistry (Chemical Education Resources, Palmyra, PA). A complete set consists of the following numbered experiments: 368, 387, 388, 389, 394, 395, 399, 451, 455, 460, 484, and 498.
2. Approved safety goggles, which must be worn at all times while in the laboratory. Goggles may be purchased in the bookstore or at the first and second lab meetings.
3. Roll of paper towels. A roll of paper towels should be purchased by you and kept in your lab locker. Any budget brand will do.

INSTRUCTOR:
Dr. Dale Arrington, C-313 (394-1236)
E-mail: dale.arrington@sdsmt.edu
Office Hours: 10 a.m. MWF

EXPECTATIONS:
Students are expected to have a fundamental understanding of:
• Algebra
• Prior course in chemistry

COURSE OBJECTIVES:
Students will gain familiarity with common chemical laboratory safety practices and the apparatus and experimental methods used in analyzing and investigating the properties and behavior of matter.

CLASS SCHEDULE:
C-204/201 (sec. 51 & 52) Tuesday; 8:00 – 9:50 a.m.
C-201/204 (sec 55 & 56) Thursday; 8:00 – 9:50 a.m.
C-204/201 (sec. 53 & 54) Tuesday 1:00-3:50 p.m.
C-201/204 (sec. 57 & 58) Thursday 1:00-3:50 p.m.

TOPICS:
• Safety Video. Locker check-out.
• Relating Mass and Volume (bring a metric ruler to lab).
• Detecting Signs of Chemical Change.
• Separating and Isolating the Components of a Binary Mixture of Solids.
• Empirical Formula of an Oxide.
• Single Replacement Reactions and Relative Reactivity.
• Percent Water in a Hydrate.
• Heat of Neutralization (partners; bring a watch with a second hand).
• Paper Chromatography of Selected Transition-metal Cations (bring a ruler to lab).
• Separating and Determining the Mass of Calcium Ion in a Calcium-Enriched Tablet.
• Paper Chromatography of Selected Transition-metal Cations (bring a ruler to lab).
• Determining the Molar Concentration of a Sodium Hydroxide Solution.
• Titrating Vinegar and locker check-in.

COMPUTER USAGE:
None
COURSE OUTCOMES:
Each student successfully completing Chem112L is expected to have the following abilities:

- Understand the distinction between qualitative and quantitative chemical analysis.
- Understand the fundamental and operational principles upon which common methods of separation and purification of chemical substances are based.
- Identify sources of error in chemical experiments.
- Interpret experimental results and draw reasonable conclusions.
- Analyze data in terms of the precision and accuracy of results.
- Learn and understand laboratory safety procedures.
- Anticipate, recognize, and respond to hazards of chemical materials and manipulations.
- Learn the importance of performing accurate and precise quantitative measurements.
- Keep legible and complete experimental records.
- Collaborate with peers in obtaining and interpreting data.
- Understand the concept of standardization.

LABORATORY:
100%

ASSESSMENT AND EVALUATION:
Pre-lab questions
Lab Reports

PREPARED BY:
Dale Arrington, Fall 2003
ENG 101 COMPOSITION I
(Required Course)

CATALOG DATA:
ENGL 101 COMPOSITION I
(3-0) 3 credits. Appropriate student placement based on entry level assessment or completion of (or concurrent enrollment in) ENGL 031, 032, or 033. Practice in the skills, research, and documentation needed for effective academic writing. Analysis of a variety of academic and non-academic texts, rhetorical structures, critical thinking, and audience will be included.

TEXTBOOK:
Mims and Nolan, Mirror on America: Short Essays and Images, 2nd Edition
Rimes, Keys for Writers, third edition.

INSTRUCTOR:
Palmer, Morgan, Antonen, and Neumann
Humanities office phone: 394-1243. Leave a message if no one answers.

EXPECTATIONS:
None

COURSE OBJECTIVES:
At the conclusion of English 101, students should be able to:
- understand the basic principles of organization and development necessary to write an essay
- understanding writing as a process that requires analysis, interpretation, drafting and revision
- master basics of expository prose and use of rhetorical strategies to write effectively and critically for a variety of audiences
- know techniques of basic research in order to communicate knowledge and ideas professionally and ethically of the composition, structure, and properties of matter and the changes that matter undergoes.

PROFESSIONAL COMPONENT:
English: 3 credits or 100%

TOPICS:
- Critical Reading
- Argumentation
- Logical Fallacies
- Peer Review
- Brainstorming, Free writing
- Titles, Topic Sentences, Thesis Statements
- Using & Citing Sources
- Textual Analysis
- Using the Library
- Research Writing, MLA Style
- Documentation
- Sentences, Punctuation, Analyzing Texts
- Portfolio Consultations

COMPUTER USAGE:
Word Processing
COURSE OUTCOMES:
In English 101 students will demonstrate effective communication by:
  • designing and producing writing adapted to various audiences and purposes
  • composing clear, effective sentences and combining them into focused, coherent paragraphs that support the purpose of their essays
  • using basic research skills and appropriate documentation of sources
  • exhibiting awareness of ethical standards by accurately using sources and formulating text
  • practicing a prose style based on conciseness, clarity, and fluency
  • using standard English grammar, punctuation, and other mechanical aspects

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
ENGL 101, Composition I, meets part of ABET Criterion 3, outcome (g):
  (g) Ability to communicate effectively.

LABORATORY:
None

ASSESSMENT AND EVALUATION:
  • Papers
  • Quizzes & Assignments
  • Oral Presentation
  • Portfolio

PREPARED BY:
Sally Palmer, Spring 2004
ENG 279 TECHNICAL COMMUNICATIONS I
(Required Course)

CATALOG DATA:
ENGL 279 TECHNICAL COMMUNICATIONS I
(3-0) 3 credits. Prerequisites: ENGL 101 or equivalent and sophomore standing. Introductory written and oral technical communications with emphasis on research and explanations of scientific and engineering topics.

TEXTBOOK:
Companion Website to text: http://www.ablongman.com/lannontechcomm

Class WebCT Site: http://webct.sdsmt.edu:8900/

Other Materials: Computer disk for storing writing & videotape for recording speeches

INSTRUCTORS:
Sneller, Hudgens, Palmer, and Boysen,
Humanities office phone: 394-1243. Leave a message if no one answers.

EXPECTATIONS:
Students will have completed English 101, or equivalency.

COURSE OBJECTIVES:
At the conclusion of English 279, students should be able to
• understand the principles of organization and development that are required to produce a variety of short, basic technical documents,
• understand technical writing as a process requiring analysis, interpretation of data, drafting and revision;
• understand the basic components of planning and preparing effective oral presentation of technical and professional material;
• conduct basic technical research using both traditional and electronic methods to communicate in an ethical manner; and
• improve communication and problem solving skills by working on speaking and writing projects in teams.

PROFESSIONAL COMPONENT:
English: 3 credits or 100%

TOPICS:
• What is “technical communication” and what does it entail?
• Audience Analysis
• The “How Top’s” of speaking in public
• “Students Take Charge” presentations
• Peer Review
• Summary Writing
• Research / Identifying Sources
• Ethics and/in technical communication
• Visual Aids
• Job Search
• Resumes
• Definitions & Descriptions
• Persuasive Speaking
COMPUTER USAGE:
• Word Processing
• PowerPoint

COURSE OUTCOMES:
Students will demonstrate effective technical communication by
• producing well organized and effectively designed short, basic technical documents;
• employing drafting, revision, and analytical skills to take a document from initial conception to final product;
• producing individual and collaborative documents and oral presentations for a variety of technical, professional, and general audiences;
• recognizing and using appropriate conventional formats and visuals for a variety of basic technical/professional documents;
• the basic research skills and documentation techniques necessary to produce effective written and oral technical communications;
• exhibiting awareness of ethical standards by accurately using sources and formulating text; and
• practicing a technical communication style based on conciseness, clarity, fluency; and using standard English grammar, punctuation, and other mechanical aspects.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
ENGL 279, Technical Communication I, meets part of ABET Criterion 3, outcome (d), (f), (g):
  (d) Ability to function on multi-disciplinary teams
  (f) Understanding of professional and ethical responsibility
  (g) Ability to communicate effectively

LABORATORY:
None

ASSESSMENT AND EVALUATION:
• Formal writing assignments
• Formal speeches
• Quizzes
• Attendance & participation

PREPARED BY:
Judy Sneller, Spring 2004
ENG 289/289L TECHNICAL COMMUNICATIONS II
(Required Course)

CATALOG DATA:
ENGL 289/289L TECHNICAL COMMUNICATIONS II
(2-1) 3 credits. Prerequisites: ENGL 279 or equivalent and sophomore standing. Advanced written and oral technical communications with emphasis on the research, preparation, and delivery of complex technical documents.

TEXTBOOK:

INSTRUCTORS:
Rice, Boysen, Lee, Westergaard, and Antonen
Humanities office phone: 394-1243. Leave a message if no one answers.

EXPECTATIONS:
Students will have completed ENGL 279 or equivalent.

COURSE OBJECTIVES:
At the conclusion of English 289, students should be able to
- Understand the advanced principles of organization and development that are required to produce different types of complex technical documents,
- Understand technical writing as a process requiring analysis, interpretation of data, drafting and revision;
- Understand the advanced principles of planning and preparing effective oral presentations of technical and professional material;
- Conduct advanced technical research using a variety of traditional and electronic methods to communicate in an ethical manner;
- Improve communication and problem solving skills by working on speaking and writing projects in teams; and
- Use writing, speaking, researching, and networking skills to compete effectively in the job market.

PROFESSIONAL COMPONENT:
English: 3 credits or 100%

TOPICS:
- Elements of the proposal
- Formal reports: preliminary guidelines
- Style review
- Style: clarity
- Style: conciseness
- Summaries and abstracts
- Writing evaluations
- Proposal briefing
- Communication issues in professional writing
- Communication issues workshop
- Team communication problems
- Peer review
- Oral presentations
**Computer Usage:**
- Word Processing
- PowerPoint

**Course Outcomes:**
In English 289 students will demonstrate effective technical communication by:
- Producing well organized and effectively designed complex technical documents;
- Producing well organized and effectively designed resumes and other job application documents;
- Employing drafting, revision, and analytical skills to take a document from initial conception to final product;
- Producing individual and collaborative documents and oral presentations for a variety of technical, professional, and general audiences;
- Recognizing and using appropriate formats and elements of document design applicable to a variety of complex technical documents;
- Using appropriate, effective graphics in speaking and writing projects;
- Using the advanced research skills and documentation techniques necessary to produce effective written and oral technical communications;
- Exhibiting awareness of ethical standards by accurately using sources and formulating text;
- Adopting a technical communication style based on conciseness, clarity, fluency, and consistency;
- Using standard English grammar, punctuation, and other mechanical aspects.

**Relationship of Course to Program Outcomes:**
ENGL 289289L, Technical Communication II, meets part of ABET Criterion 3, outcome (d), (f), (g):
- (d) Ability to function on multi-disciplinary teams
- (f) Understanding of professional and ethical responsibility
- (g) Ability to communicate effectively

**Laboratory:**
None

**Assessment and Evaluation:**
- Written Assignments
- Presentations
- Attendance & Participation

**Prepared By:**
Rodney Rice, Spring 2004
MATH 123 Calculus I
(Required Course)

CATALOG DATA:
MATH 123 CALCULUS I
(4-0) 4 credits. Prerequisite: MATH 115 or appropriate mathematics placement or permission of instructor. Prerequisite: MATH 115 completed with a minimum grade of “C.” The study of limits, continuity, derivatives, applications of the derivative, antiderivatives, the definite and indefinite integral, and the fundamental theorem of calculus.

Prerequisite: Pre-calculus.

INSTRUCTORS:
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:
Calculus 2nd edition Smith and Minton.

TOPICS:
1) Functions
2) Limits and continuity
3) Derivatives of polynomial and trigonometric functions
4) Derivatives of logarithmic and exponential functions
5) Applications of derivatives
   i) Curve sketching
   ii) Related rates
   iii) Newton’s method
   iv) Velocity and acceleration
6) Applications of derivatives
   i) Optimization
7) Antiderivatives
8) Integration using u-substitution
9) Topics for Exam 4
10) Definite integrals
11) Applications of integration
    i) Area
    ii) Volume using disks, shells, and washers

COURSE OBJECTIVE:
This course is intended for students majoring in mathematics, physics, chemistry, engineering and related fields. Students will apply the concepts of limits, derivatives and integrals in solving problems in their respective disciplines. They will be able to identify, graph, integrate, and differentiate polynomial, trigonometric, logarithmic, exponential and algebraic functions.

PROFESSIONAL COMPONENT:
Mathematics 4 credits or 100%
OUTCOMES.
A student who successfully completes this should, at a minimum, be able to:

1. Understand functions.
2. Be able to use functional notation in manipulating mathematical expressions.
3. Understand the concept of a limit and how it applies to calculus.
4. Be able to compute limits using various methods.
5. Be able to determine where a function is continuous.
6. Understand the concept of the derivative.
7. Be able to compute derivatives using the power rule, product rule, quotient rule and chain rule.
8. Be able to use the concept of the derivatives in applications such as related rates, linear approximations, Newton’s Method, curve sketching, optimization, velocity and acceleration.
9. Understand the concept of an antiderivative.
10. Be able to manipulate expressions using sigma notation.
11. Be able to integrate using substitution and the power rule.
12. Understand and be able to apply the Fundamental Theorem of Calculus.
13. Be able to use the concept of the integral in applications such as area, volume, velocity and acceleration.
14. Understand the use of numerical integration techniques such as Trapezoidal and Simpson’s rules.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
MATH 123, Calculus I, meets part of ABET Criterion 3, outcome (a):
   (a) Ability to apply knowledge of mathematics, science, and engineering.

PREPARED BY:
Laura Geary and Arden Davis      May, 2004
MATH 125 Calculus II  
(Required Course)

CATALOG DATA:
MATH 125 CALCULUS II  
(4-0) 4 credits. Prerequisite: MATH 120 completed with a minimum grade of “C” or appropriate score on departmental Trigonometry Placement Examination and MATH 123 completed with a minimum grade of “C.” A continuation of the study of calculus, including the study of sequences, series, polar coordinates, parametric equations, techniques of integration, applications of integration, indeterminate forms, and improper integrals.

Prerequisite: Calculus I.

INSTRUCTORS:
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:
Calculus (Smith, Minton 2nd ed.) We will cover Chapters 5-9.

OBJECTIVES:
1) The student will continue to learn differentiation and integration techniques, building on the skills learned in Calculus I.
2) The student will learn basic concepts dealing with infinite sequences and series.
3) The student will learn how to work with parametric equations and polar coordinates.

TOPICS:
1. Further applications of the definite integral
   a. Arc length
   b. Surface area
   c. Work
   d. Moments and center of mass
2. Properties of logarithms, exponentials, trig and inverse trig functions Derivatives and antiderivatives of exponential, logarithms, trig and inverse trig functions.
3. Evaluation of antiderivatives using:
   a. Trig integrals
   b. Trig substitutions
   c. Parts
   d. Partial fractions
4. L'Hospital's rule and improper integrals
5. Infinite series and convergence using:
   a. Definition
   b. Integral test
   c. Ratio test
   d. Comparison test
   e. nTh term test
   f. Alternating series, conditional and absolute convergence
6. Interval of convergence of power series
7. Taylor series expansions
8. Fourier series expansions
9. Parametric and polar graphs and equations, derivatives and integrals
PROFESSIONAL COMPONENT:
Mathematics 4 credits or 100%

OUTCOMES:
A student who successfully completes this course should, at a minimum:

1. Know how to differentiate exponential and logarithmic functions and integrate the corresponding functions.
2. Know how to differentiate inverse trigonometric functions and integrate the corresponding functions.
3. Know how and when to use various integration techniques, including integration by parts and partial fractions.
4. Know how to evaluate limits of infinite sequences, including how and when to use L'Hopital's Rule.
5. Know how to evaluate improper integrals.
6. Recognize common infinite series, including the geometric and harmonic series.
7. Know how and when to use various tests for convergence of infinite series, including the Ratio Test, the Alternating Series Test, and Comparison Tests.
8. Know how to determine the interval of convergence for a power series.
9. Know how to use infinite series such as the Taylor Series or Fourier Series to approximate functions.
10. Know how to convert between rectangular and parametric form, graph parametric curves, find derivatives, and do other calculus applications using parametric functions.
11. Know how to convert between rectangular and polar coordinates, graph polar curves, and do calculus applications using polar coordinates.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
MATH 125, Calculus II, meets part of ABET Criterion 3, outcome (a):
   (a) Ability to apply knowledge of mathematics, science, and engineering.

PREPARED BY:
Don Teets, Harold Carda, and Arden Davis May, 2004
MATH 225 Calculus III
(Required Course)

CATALOG DATA:
MATH 225 CALCULUS III
(4-0) 4 credits. Prerequisite: MATH 125 completed with a grade of "C." A continuation of the study of calculus, including an introduction to vectors, vector calculus, partial derivatives, and multiple integrals.

Prerequisite: Calculus II.

INSTRUCTORS:
Teets, Burgoine, Carda, Dahl, and Riley.
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:
Calculus (Smith, Minton 2nd ed.) We will cover Chapters 10-14 with some omissions.

TOPICS:
- Vector and vector functions.
- Functions of several variables.
- Partial derivatives.
- Multiple and line integrals.
- Vector analysis.

OBJECTIVES:
1) The student will learn the basic tools and methods of multivariate calculus.
2) The student will understand applications of multivariate calculus.

PROFESSIONAL COMPONENT:
Mathematics: 4 credits or 100%

OUTCOMES:
A student who successfully completes this course should, at a minimum:
1. Know basic vector operations.
2. Know how to work with lines and planes in space.
4. Be able to compute position, velocity, and acceleration vectors.
5. Understand functions of several variables.
6. Be able to compute partial derivatives and gradients using multivariate chain rules.
7. Be able to find extremals of constrained and unconstrained functions.
8. Understand iterated integrals.
9. Be able to set up and evaluate double and triple integrals in various coordinate systems.
10. Understand field vectors.
11. Be able to compute line integrals.
12. Understand the basic integral theorems of vector analysis.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
MATH 225, Calculus III, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

PREPARED BY: Don Teets, Kyle Riley, and Arden Davis May, 2004
MATH 321 Differential Equations
(Required Course)

CATALOG DATA:
MATH 321 DIFFERENTIAL EQUATIONS
(4-0) 4 credits Prerequisites: MATH 125 with a minimum grade of "C." Selected topics from ordinary
differential equations including development and applications of first order, higher order linear and systems
of linear equations, general solutions and solutions to initial-value problems using matrices. Additional
topics may include Laplace transforms and power series solutions. MATH 225 and 321 may be taken
concurrently or in either order. In addition to analytical methods this course will also provide an
introduction to numerical solution techniques.

Prerequisite: Calculus II.

INSTRUCTORS:
Geary, Burgoyne, Carda, and Dahl
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:

TOPICS:
1) Basic definitions and terminology
2) Direction fields and solution curves
3) First order differential equations and their applications
   a) Separable
   b) Linear
   c) Exact
   d) Bernoulli
   e) Numerical Methods
4) Higher order differential equations...homogeneous and nonhomogeneous
5) Method of undetermined coefficients
6) Method of variation of parameters
7) Applications of higher order differential equations
   a) Simple harmonic motion
   b) Damped motion
   c) Forced motion
   d) Electric circuits and analogous systems
8) Basic LaPlace transforms and their inverses
9) Laplace transforms
10) Inverse Laplace transforms
11) Operational Properties
12) Applications
13) Systems of linear first order equations
14) Matrices
15) Gauss elimination
16) Systems of ordinary differential equations
17) Eigenvalues
18) Variation of parameters
PROFESSIONAL COMPONENT:
Mathematics 4 credits or 100%

COURSE OBJECTIVES:

1) The student will learn how to apply basic techniques to solve ordinary differential equations.
2) The student will understand how to determine whether a function is a solution to a given ordinary differential equation or initial value problem.

STUDENT OUTCOMES:

A student who successfully completes this should, at a minimum, be able to:

1) Know how to use separation of variables.
2) Be able to solve first order ordinary differential equations.
3) Be able to solve second order linear ordinary differential equations.
4) Understand the difference between homogeneous and non-homogeneous linear systems.
5) Be familiar with at least one science or engineering application of differential equations.
6) Be able to compute the Laplace transform and inverse Laplace transform for simple functions.
7) Understand the basic process of how to use the Laplace transform to solve an initial value problem.
8) Be familiar with a numerical technique for solving an initial value problem, such as Euler's Method or the Runge Kutta method.
9) Be able to carry out basic matrix addition and matrix multiplication.
10) Be able to solve a linear system in matrix form.
11) Be able to use matrices to solve simple linear first order systems of ordinary differential equations.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
MATH 321, Differential Equations, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

PREPARED BY:
Laura Geary and Arden Davis May, 2004
MATH 353 Linear Optimization

CATALOG DATA:
MATH 353
(3-0) 3 credits. Prerequisite: MATH 321 or MATH 315 or permission of instructor. Convex sets and functions, linear inequalities and combinatorial problems; topics in linear programming from fundamental theorems of simplex method through sensitivity analysis, duality, transportation, and assignment problems.

INSTRUCTORS:
Johnson, Riley, Teets
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:
Introduction to Operations Research, 7th edition, by Hillier and Lieberman

TOPICS:
1) Linear programming problems in two variables and their solution using a graphical argument
2) Implicit assumptions behind a general linear programming problem
3) Matrix algebra review
4) Fundamental theory of linear programming problems
5) Simplex method including initialization details and iteration details
6) Duality
7) Sensitivity analysis
8) Assignment problem
9) Transportation problem
10) Other special cases of linear programming problems as time permits (e.g. transshipment problem, upper-bounded transshipment problem, two-person games, Lp optimization problems)

COURSE OBJECTIVE:
Students should be able to identify and appropriately model real-world problems as linear programming problems and, with the aide of software, find the optimal solution(s).

PROFESSIONAL COMPONENT:
Mathematics: 3 credits

OUTCOMES:
A student who successfully completes this should, at a minimum, be able to:

1. Solve two-variable linear programming problems graphically.
2. Implement the simplex method on small problems by hand.
3. Identify and appropriately model problems as linear programming problems and, with the aide of the appropriate software, solve them.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
Math 353, Linear Optimization, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering

PREPARED BY: Roger Johnson May 2004
PHYS 211/211A UNIVERSITY PHYSICS I
(Required Course)

CATALOG DATA:
PHYS 211/211A UNIVERSITY PHYSICS I
(3-0) 3 credits. Prerequisite: MATH 123 or permission of instructor. This is the first course in a two (2) semester calculus-level sequence, covering fundamental concepts of physics. This is the preferred sequence for students majoring in physical science or engineering. Topics include classical mechanics and thermodynamics. Credit will not be allowed in both Phys 111-113 and Phys 211-213

TEXTBOOK:
University Physics by Halliday and Resnick

INSTRUCTOR:
Dr. M. Foygel, EEP 219 (394-1227)
E-mail: michael.foygel@sdsmt.edu
Office Hours: 2:00 – 4:00 p.m. MW

EXPECTATIONS:
Students are expected to have a fundamental understanding of:
- Areas and volumes of simple geometric figures (example: circle, triangle, cylinder and sphere).
- Pythagorean Theorem.
- Solution of quadratic equations.
- Solution of simultaneous linear equations.
- Finding x and y components of a given vector.
- Find the magnitude and direction of a vector from the x and y component.
- Vector addition and subtraction.
- Scalar and vector products of two vectors.
- Integration and differentiation of linear equations.

Generally, most material from algebra, geometry, trigonometry, and calculus should be known thoroughly.

COURSE OBJECTIVES:
1. To present the basic concepts and principles of mechanics;
2. To strengthen an understanding of the concepts and principles through a broad range of interesting applications in the real world.

To meet these objectives, emphasis is placed on sound physical arguments and problem-solving methodology.

CLASS SCHEDULE:
C-228 Monday & Wednesday, 11:00 – 11:50 a.m.

PROFESSIONAL COMPONENT:
Basic Science: 3 credits or 100%

TOPICS:
The basic physical principles of Newton’s laws of motion.
The conservation laws concerning momentum, energy and angular momentum are applied to the linear and curvilinear motion of particles, simple harmonic motion and the rotation of rigid bodies.

COMPUTER USAGE:
None

COURSE OUTCOMES:
Upon completion of this course, students should demonstrate the ability to:
1. Use SI units and convert units from one system to another.
2. Perform basic operations on vectors such as adding and subtracting vectors geometrically and by components in the unit-vector notation; converting components into polar coordinates; multiplying a vector by a scalar and performing the dot and cross multiplication of vectors.
3. Given a position vector of a particle calculate its displacement, average and instantaneous velocity and acceleration; describe projectile motion and uniform circular motion; relate velocities in different frames of reference.
4. Use the free-body diagrams in solving dynamics problems; apply Newton’s laws to a system of several interacting bodies in order to find their accelerations.
5. Calculate work done by a constant or general variable force; calculate power given the force and instant velocity; use the work-energy theorem to relate a change in kinetic energy to the net work done on a system.
6. Calculate gravitational and elastic potential energy; apply energy conservation principle to systems involving gravity, springs, and friction.
7. Find the center of mass of a system of several particles; apply Newton’s second law to a system of particles in order to relate the net external force and the acceleration of the system’s center of mass.
8. Use conservation of linear momentum and of energy to relate velocities of colliding bodies before and after collision for the cases of elastic and purely inelastic collisions in one and two dimensions.
9. Calculate angular displacement, velocity and acceleration; relate angular and linear variables; calculate rotational kinetic energy; use the parallel-axis theorem to find the rotational inertia of a body; calculate torque; apply the Newton’s second law in angular form to relate the net torque and the angular acceleration.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
PHYS 211/211A University Physics I, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

LABORATORY:
None

ASSESSMENT AND EVALUATION:
Quizzes
Homework
Special Projects
Exams

PREPARED BY:
Michael Foygel, Fall 2003
PHYS 213/213A UNIVERSITY PHYSICS II
(Required Course)

CATALOG DATA:
PHYS 213/213A UNIVERSITY PHYSICS II
(3-0) 3 credits. Prerequisite: PHYS 211. This course is the second course in a two (2) semester calculus-level sequence, covering fundamental concepts of physics. This is the preferred sequence for students majoring in physical science or engineering. Topics include electricity and magnetism, sound, light, and optics.

TEXTBOOK:

INSTRUCTOR:
Dr. Vladimir Sobolev, EEP 220 (394-1225)
E-mail: vladimir.sobolev@sdsmt.edu
Office Hours: open

EXPECTATIONS:
Students are expected to have a fundamental understanding of:

- Areas and volumes of simple geometric figures (example: circle, triangle, cylinder and sphere).
- Pythagorean Theorem.
- Solution of quadratic equations.
- Solution of simultaneous linear equations.
- Finding x and y components of a given vector.
- Find the magnitude and direction of a vector from the x and y components.
- Vector addition and subtraction.
- Scalar and vector products of two vectors.
- Integration and differentiation of linear equations.
- Knowledge of polar coordinate systems and its relation to Cartesian coordinate system.
- Ability to calculate indefinite and definite integrals of power and rational functions, and ability to use table of integrals

Generally, most material from algebra, geometry, trigonometry, and calculus should be known thoroughly.

COURSE OBJECTIVES:
As a result of this course students will be familiar with basic terminology, processes and fundamental laws in electricity and magnetism. Students will have an understanding of how the mathematical techniques of complex numbers, vector analysis, differentiation and integration can assist in formulating and solving physical problems and will then be able to use these techniques when studying other more-advanced courses in Physics. Student will have also further developed generic problem-solving skills, and scientific world-view.

CLASS SCHEDULE:
EP 252 Monday & Wednesday, 11:00 – 11:50 a.m.

PROFESSIONAL COMPONENT:
Basic Science: 3 credits or 100%

TOPICS:
- Electric Charge
- Electric Fields
- Gauss’ Law
- Electric Potential
- Capacitance
- Current and Resistance
• Circuits
• Magnetic Fields
• Magnetic Fields Due to Currents
• Induction and Inductance
• Magnetism of Matter; Maxwell’s Equations
• Electromagnetic Oscillations and Alternating Current

COMPUTER USAGE:
None

COURSE OUTCOMES:
Upon completion of this course, students should demonstrate the ability to:
• use SI units for electric and magnetic physical quantities; know non-system units used in electricity and magnetism;
• understand the basic concepts and laws of classical electrostatics and electrodynamics;
• quantitatively describe the forces between point charges; know major application of electrostatics and electrodynamics in modern technology;
• calculate the electric fields and electric potentials due to point charges and simple continuous charge distributions;
• understand the notions of capacitance and resistance, to find equivalent capacitances and resistances for capacitors and resistors connected in series and in parallel; know major application of capacitors and resistors in electric circuits;
• to apply the Kirchhoff’s laws for calculations of multi-loop circuits;
• understand the phenomena taking place in circuits contain resistor and capacitor and how these phenomena are described by corresponding equations;
• calculate magnetic fields due to electric currents;
• understand the laws of motion of charged particles in uniform electric and magnetic fields or combined electric and magnetic fields and applications of these phenomena in modern science and technology;
• understand the laws of electromagnetic induction and their role in modern technology;
• improve ability to use mathematics and problem solving skills

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
PHY 213/213A University Physics II, meets part of ABET Criterion 3, outcome (a):
  (a) Ability to apply knowledge of mathematics, science, and engineering.

LABORATORY:
None

ASSESSMENT AND EVALUATION:
Quizzes
Homework
Exams

PREPARED BY:
Vladimir Sobolev, Fall 2003
PHYS 213L UNIVERSITY PHYSICS II LABORATORY
(Required Course)

CATALOG DATA:
PHYS 213L UNIVERSITY PHYSICS II LABORATORY
(0-1) 1 credit. Corequisite: PHYS 213. This laboratory accompanies PHYS 213. Introduction to physical phenomena and measurements. Recording and processing data, determining uncertainties, reporting results. The experiments supplement the work in PHYS 211 and PHYS 213.

TEXTBOOK:
Experimentation, Third Edition, by D. C. Baird

INSTRUCTOR:
Dr. Vladimir Sobolev with TA’s, EEP 220 (394-1225)
E-mail: robert.corey@sdsmt.edu
Office Hours: posted on EEP 218

EXPECTATIONS:
Students are expected to have a fundamental understanding of:
- Algebra
- Trigonometry
- Differential and integral calculus
- Calculus based classical mechanics (PHYS 211)

COURSE OBJECTIVES:
The broad objective of this laboratory course is to reinforce student’s understanding of the fundamental physical laws in classical mechanics, electricity, and magnetism.

CLASS SCHEDULE:
Tuesday/Thursday, 8-10:50 a.m. or 1-3:50 p.m.

PROFESSIONAL COMPONENT:
Basic Science: 1 credit or 100%

TOPICS:
- Introduction to Motion Detectors
- Human Reaction Time
- Simple Pendulum
- Kinematics
- Ballistic Pendulum
- Newton’s Laws #1
- Hooke’s Law
- Work Energy Theorem
- Motion of Inertia
- Collisions #1
- Kirchhoff’s Rules
- Wheatstone Bridge
- RC Circuits: Intro to Oscilloscope

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
PHYS 213L University Physics II Laboratory, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.
**COMPUTER USAGE:**
Microsoft Word
Excel
Data Studio

**COURSE OUTCOMES:**
Upon completion of this course, students should demonstrate the ability to:
- gather experimental data both manually and with various computer controlled detectors;
- graphically represent the data both manually and using standard data manipulation software;
- evaluate and interpret the data in the context of physical laws and theory and draw reasonable conclusions from the data.

**LABORATORY:**
100%

**ASSESSMENT AND EVALUATION:**
- Lab Notebooks
- Experiments
- Pre-Labs

**PREPARED BY:**
Robert Corey, May 2004