Appendix I
(Continued)

B. Course Syllabi

B-1 Mechanical Engineering Required Courses

DEPARTMENT: MECHANICAL ENGINEERING	
COURSE #: EML 3002C, 4 credits http://www.eng.fsu.edu/~hollis/eml3002c-f01/index.html	**COURSE TITLE**: Mechanical Engineering Tools
TYPE COURSE: Required	**TERMS OFFERED:** Fall, Spring
CATALOG DESCRIPTION: Course covers communication and data handling, computer-aided design, object oriented programming, and machine shop practice.	**PREREQUISITES**: PHY 2048C, Physics I; MAC 2311, Calculus I
AREA COORDINATOR: Dr. Patrick Hollis **RESPONSIBLE FACULTY:** Dr. P. Hollis, Dr. G. Buzyna **INSTRUCTOR OF RECORD:** Dr. G. Buzyna **DATE OF PREPARATION:** 5/30/01 (Hollis)	**CLASS SCHEDULE:** Three times weekly for 50 min. **LABORATORY SCHEDULE:** Once weekly for 2 hrs. and 45 min.
TEXTBOOKS/REQUIRED MATERIAL: • Stirling Engine Kit • *Introduction to Mathcad*, Larsen, R., Prentice Hall, 2001 • Class Notes	**SCIENCE/DESIGN (%):** 100 / 0 **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:** 100% Engineering Science
COURSE TOPICS: 1. Communication Skills: • Word, Excel, PowerPoint 2. Basic Thermo-Fluids 3. Pro-Engineer 4. MathCAD and Programming 5. Stirling Engine	**ASSESSMENT TOOLS:** (see syllabus: http://www.eng.fsu.edu/~hollis/eml3002c-f01/syllabus-fall_2001.htm) 1. Daily in-class problems 2. Weekly lab group assignments 3. Group project reports 4. Group presentation 5. Section test

COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) 1. To explain and demonstrate the use of a word processor and spreadsheet program [1, 7, 10] 2. To explain and demonstrate the use of presentation software [7, 10] 3. To show the use of MathCAD for solving problems and for simple programming concepts [1, 10] 4. To build a simple Stirling engine [10] 5. To explain basic concepts from the thermal fluid science sufficient to explain the operation of the Stirling engine [1] 6. To introduce a typical CAD software package for generating solid models and engineering drawings [10]
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Write a simple technical report, letter, memo, etc. [1] 2. Use Excel to analyze data [1] 3. Use MathCAD to analyze data and perform simple calculations [3] 4. Present the results of some research to an audience [2] 5. Operate basic shop equipment to build a Stirling engine [4] 6. Demonstrate and explain how a Stirling engine works [5] 7. Produce engineering and computer models of the Stirling engine [6]

<table>
<tr><td colspan="2">DEPARTMENT: MECHANICAL ENGINEERING</td></tr>
<tr><td>COURSE #: EML 3004C 4 credits
http://www.eng.fsu.edu/~chandra/courses/eml3004c/ABET.html</td><td>COURSE TITLE: Introduction to Mechanical Engineering</td></tr>
<tr><td>TYPE COURSE: Required</td><td>TERMS OFFERED: Fall, Spring</td></tr>
<tr><td>CATALOG DESCRIPTION (revised):

Course covers the role of mechanical engineering profession, engineering design process, interaction of engineering sciences (statics, dynamics, materials, thermodynamics and mechanics) and mechanical engineering design, design tools, introduction to vectors, forces, moments and free body diagrams as applied to design.</td><td>PREREQUISITES: PHY 2048C (PHY 2048 & PHY2048L), Physics I; MAC 2312, Calculus II</td></tr>
<tr><td>AREA COORDINATOR:: Dr. Namas Chandra
RESPONSIBLE FACULTY: Dr. Namas Chandra

INSTRUCTOR OF RECORD: Dr. Namas Chandra
DATE OF PREPARATION: 5/30/01 (Hollis)</td><td>CLASS SCHEDULE:
Three times weekly for 50 min.

LABORATORY SCHEDULE:
Once weekly for 2 hrs. and 45 min.</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
• Introduction to Mechanical Engineering: Design and Analysis, Ebook edited by Namas Chandra, Prentice Hall, 2002
• Statics and Mechanics of Mateials, R. C. Hibbler Prentice-Hall, 1993</td><td>SCIENCE/DESIGN (%): 75 / 25

CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
75%: engineering science
25%: engineering standards, ethics, professionalism, preliminary design concept</td></tr>
<tr><td>COURSE TOPICS:
1. Mathematics and Physics in the Cumulative learning of engineering
2. Engineering and Mechanical engineering as a profession
3. Engineers and Ethics, Failures and Real World
4. Design, and design tools
5. Role of Analysis in Engineering
6. Units, conversions and Numerical Calculations
7. Role of statics, dynamics, solid mechanics, materials and thermodynamics in mechanical engineering
8. Vector Analysis, including forces and resultants
9. Free-body diagrams
10. Equilibrium in two and three dimensions
11. Geometric properties in Design</td><td>ASSESSMENT TOOLS:
1. Periodic homework problems
2. Periodic group assignments and projects
3. Tests
4. Final Exam</td></tr>
<tr><td>COURSE OBJECTIVES*</td><td>(Numbers shown in brackets are links to program outcomes)
1. To inculcate the concept of "cumulative learning" in engineering profession as opposed to "just-in-time" or "learn/forget as you go" philosophy [9].
2. To demonstrate the "cumulative learning" concept through the use of competency test in the pre-requisite mathematics and physics courses.[9]
3. To understand the true of a profession and the role of engineers in general and mechanical</td></tr>
</table>

	engineers in particular in meeting the every day needs of the society *[6,8]* 4. To distinguish the difference between well-posed analysis problems and open-ended design problems through real world examples *[1]* 5. To introduce statics, dynamics, thermodynamics, mechanics, materials and their relationship to mechanical engineering *[1,5]* 6. To teach the concepts of scalar and vector quantities, vector algebra, forces, moments and free-body diagrams.*[1]*
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Able to distinguish the difference between a profession and work [3] 2. Able to identify the role of engineers (and in specific mechanical engineers) in relation to societal needs. [3] 3. Able to develop the concept of cumulative learning [1, 2] 4. Able to formulate open-ended design problems and arrive at solutions [4] 5. Able to work in teams [3] 6. Able to apply the principles of engineering sciences to solving simple engineering design problems [4,5] 7. Able to resolve forces/vectors into Cartesian and polar components; to identify and calculate the unit vector and magnitude for a given vector. [6] 8. Able to perform vector addition, scalar product (dot product), vector product (cross product) and vector triple product. [6] 9. Able to draw free-body diagrams [6] 10. Able to apply equilibrium equations in three-dimensions and solve for forces. [6] 11. Able to compute center of gravity and moments of inertia of bodies of revolutions. [6]

DEPARTMENT: MECHANICAL ENGINEERING	
COURSE #: EML 3011C, 4 credits	**COURSE TITLE**: Mechanics and Materials I
TYPE COURSE: Required	**TERMS OFFERED:** Spring, Summer
CATALOG DESCRIPTION: First of a two-part sequence presenting an integrated treatment of traditional topics on Statics and Mechanics of materials together with topics in materials science and engineering. The essential role of each of these related elements and their connections is examined in the context of real-world systems and structures. Materials covered include: Forces and force equilibrium, Modeling of Structures - Trusses, Cables, Composite bodies, Resultant forces. The course introduces the idea of stresses and strains (deformation) to incorporate materials design and selection within the framework of mechanics.	**PREREQUISITES**: PHY 2048, Physics I; MAC 3313, Calculus III; EML3002C, ME tools, EML 3004C, Intro to ME.
AREA COORDINATOR: Dr. Namas Chandra **RESPONSIBLE FACULTY:** **INSTRUCTOR OF RECORD:** **DATE OF PREPARATION:** 2/16/01 (Shih)	**CLASS SCHEDULE:** Twice weekly for 1 hour and 15 min. **LABORATORY SCHEDULE:** Once weekly for 3 hrs
TEXTBOOKS/REQUIRED MATERIAL: • *Statics and Mechanics of Materials*, R. C. Hibbeler, Prentice-Hall (1993)	**SCIENCE/DESIGN (%):** 70 / 30 **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:** 70% engineering science 30% engineering design in materials and mechanics
COURSE TOPICS: 1. Units: 2. Vectors: 3. Force Equilibrium: 4. Free Body Diagrams (FBD) for rigid bodies, beams, 2-D and 3-D structures, frames and machines. 5. Centroid and Moment of Inertia of a, 2-D and 3-D structures. 6. Internal Forces and Bending Moments (axial forces, shears, moments, & torque) in a structural member. 7. Stress and Strain (true strain and true stress), shear and normal components of strain and their relation to deformation vectors and displacements. 8. Materials Properties: Ductile and Brittle materials, Elastic modulus, yield stress, ultimate tensile strength, ductility, and toughness. 9. Statically Indeterminate structure. 10. Torsion. 11. Internal bending moment for thin walled pressure vessel. 12. Combined loading. 13. Transformations and Mohr's Circle	**ASSESSMENT TOOLS:** 1. Weekly quizzes 2. Weekly homework problems 3. Weekly workshop group assignments 4. Individual Computer projects and project reports 5. Group project reports and final oral presentations 6. Three exams and one final.

COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) 1. To provide an overview of traditional disciplines in statistics and mechanics of materials and emphasize their inter-connectivity through various real-world examples. Provide a comprehensive review and reference of the state-of-the-art structural applications and technology *[5, 8]*. 2. To introduce basic force equilibrium concepts, including Free body diagrams, in machines, trusses and real structures *[5]* 3. To introduce resultant force concept for a distributed loading condition and perform shear moment diagram for a beam of distributed load *[5]*. 4. To introduce materials properties in terms of ductility, strength, stiffness. Introduce the concept of materials design and materials selection for a set of structural and mechanics applications *[1, 2, 3, 5]* 5. To analyze friction, work, temperature effect, efficiency and power transfer. *[1, 3]* 6. To introduce the concept of principle stresses in a combined loading configuration and perform Mohr's circle analysis and link these concepts to failure criteria. *[1, 3, 5, 7, 11]* 7. To introduce the concepts of tension, compression, torsion, transverse loading and the distribution of stress and strain through a section of a material *[1, 3, 5,10]* 8. To analyze a real structure using mathematical and computational tools (MatLab, Ms Solid) to apply the force equilibrium and design concepts to a real structure. [*1, 3, 5, 7, 10, 11]*
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Understand and apply the mathematical, physical and computer sciences to reason scientifically, solve quantitative problems, and use technology**.** [6] 1. Use the engineering design process by which mathematical and scientific facts and principles are applied [1, 2, 4, 6] 2. Be able to recognize the relevancy of principles of force equilibrium and its importance in the analysis of a complete structural system [1, 2] 3. Given a structure or machine, be able to apply Free Body Diagram and Force Equilibrium to analyze internal force balance [1, 2] 4. Given a combined loading condition, be able to apply Mohr's circle to analyze the principle stresses [1, 6, 7, 8] 5. Be able to determine mechanical properties of a simple structure using experimental load versus deformation data [2, 3, 4] 6. Be able to function in a group to design and analyze a complete structural system applying one or more mechanics principles. Present final results both in a formal report and through oral presentation [1, 2, 3, 4, 5, 8]

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<tr><td colspan="2">DEPARTMENT: MECHANICAL ENGINEERING</td></tr>
<tr><td>COURSE #: EML 3012C, 3 credits</td><td>COURSE TITLE: Mechanics and Materials II</td></tr>
<tr><td>TYPE COURSE: Required</td><td>TERMS OFFERED: Fall</td></tr>
<tr><td>CATALOG DESCRIPTION:
This course is the second part of a two-part sequence, integrating mechanics and the principles of materials science. Emphasis is on measurement techniques and experimental methods in Solid Mechanics and Materials Science. Topics covered include tensile, impact, torsion, fatigue and combined loading; beams in bending; structures of steel and other concepts learned in mechanics of materials and materials science. This course also gives the students an insight into technical report writing techniques.</td><td>PREREQUISITES:
EML 3011C, Mechanics and Materials I, PHY 2049C, Physics II with lab

COREQUISITE:
EML 3234, Materials Science and Engineering</td></tr>
<tr><td>AREA RESPONSIBLE FACULTY: Dr. Namas Chandra
RESPONSIBLE FACULTY:

INSTRUCTOR OF RECORD: Dr. Peter Kalu
DATE OF PREPARATION: 6/13/03 (AHS)</td><td>CLASS SCHEDULE:
Twice weekly for 1 hour and 15 min.

LABORATORY SCHEDULE:
Once weekly for 2 hrs. and 45 min.</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
• Fundamentals of Materials Science and Engineering, William D. Callister, Jr.
• Mechanics of Materials, Hibbeler
• Handouts posted on the Web

SUGGESTED REFERENCES:
• Mechanics of Materials, 2nd Edition, F.P. Beer and E.R. Johnston, McGraw-Hill, 1992.
• Materials Science and Engineering, W.F. Smith, McGraw Hill Book Company, 1990.
• Materials Science and Engineering, 3rd ed., W.D. Callister, Jr., John Wiley and Sons, 1994.
• Mechanical Testing, <u>Metals Handbook,</u> vol. VII, ASM.
• Metallography and Microstructure: <u>Metals Handbook,</u> vol. IX, ASM</td><td>SCIENCE/DESIGN (%): 80 / 20

CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
80% engineering science, laboratory experience
20% engineering design in materials and mechanics</td></tr>
<tr><td>COURSE TOPICS:
1. Lab or Technical Reports
2. Fundamentals of Measurement and Uncertainty
3. Error / Uncertainty
4. Experimentals in Solid Mechanics; Experiment #1 Impact Test
5. Tensile Test
6. Torsion Test
7. Recrystallization
8. Hardness
9. Strain
10. Thin Wall Vessel
11. Mohr's Circle</td><td>ASSESSMENT TOOLS:
1. Class Attendance/Quizzes 10%
2. Design and Presentation 20%
3. Two Exams- 15% each: 30%
4. LAB REPORTS 40%</td></tr>
</table>

COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) 1. To provide an overview of Experimental Techniques in Mechanics and Materials through a number of laboratory experiments and projects *[3, 5, 8]* 2. To provide an overview of report writing and the ability to write effective technical papers *[7]* 3. To introduce basic error analysis and statistical techniques *[5, 11]* 4. To introduce materials properties in terms of Elasticity, Fracture, Fatigue, Ductility, Strength, Stiffness and to introduce the concept of materials design and materials selection for a set of structural and mechanics applications *[1, 2, 3, 5]* 5. To introduce the concept of principal stresses in a combined loading configuration and perform Mohr's circle analysis and link these concepts to failure criteria *[1, 3, 5, 7, 11]*
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. To prepare effective technical reports and analyze real life experimental data [1, 2] 2. Perform experimental set-up for mechanics and materials and perform data analysis [1, 3] 3. Be able to relate mechanical and materials properties to experimental analysis and real life situations [1, 4] 4. Given a structure or machine, be able to apply Free Body Diagram and Force Equilibrium to analyze force balance [5]

DEPARTMENT: MECHANICAL ENGINEERING	
COURSE #: EML 3013C, 4 credits http://www.eng.fsu.edu/~ecollins/dynamics/	**COURSE TITLE**: Dynamic Systems I
TYPE COURSE: Required	**TERMS OFFERED:** Spring, Summer
CATALOG DESCRIPTION: This course is the first part of an integrated sequence in dynamics, vibrations and controls. Material in this first course includes the following: absolute and relative motion of particles and rigid bodies in inertial, translating and rotating coordinate frames; derivation and computer solution of differential equations of motion; single degree of freedom vibrations, and elementary feedback control.	**PREREQUISITES**: EML 3002C, Mechanical Engineering Tools; EML 3004C, Introduction to Mechanical Engineering **COREQUISITE:** MAP 3305, Engineering Math I
AREA COORDINATOR: Dr. Emmanuel Collins **RESPONSIBLE FACULTY:** **INSTRUCTOR OF RECORD:** Dr. Emmanuel Collins **DATE OF PREPARATION:** 5-24-01(Collins)	**CLASS SCHEDULE:** Twice weekly for 1 hour and 30 min. **LABORATORY SCHEDULE:** Once weekly for 2 hrs. and 30 min.
TEXTBOOKS/REQUIRED MATERIAL: • *Engineering Mechanics, Dynamics: Eight Edition,* R. C. Hibbeler, Prentice Hall, 1997 • *Reading Journal for Engineering Mechanics, Dynamics:* Eighth Edition, Emmanuel G. Collins and Majura Selekwa	**SCIENCE/DESIGN (%):** 85 / 15 **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:** 85% engineering science, laboratory experience 15% engineering design
COURSE TOPICS: 1. Kinematics of a Particle 2. Kinetics of a Particle: Newton's 2nd Law 3. Kinetics of a Particle: Energy Methods 4. Kinetics of a Particle: Momentum Methods 5. Mechanical Vibrations 6. Elementary Feedback Control 7. Rigid Body Kinematics 8. Rigid Body Dynamics: Newton's 2nd Law 9. Rigid Body Dynamics: Energy Methods 10. Rigid Body Dynamics: Momentum Methods	**ASSESSMENT TOOLS:** 1. Weekly Homework Problems 2. Weekly Quizzes Based on the Reading Journal 3. Weekly Lab Reports 4. Exams
COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) 1. To teach dynamic analysis based on Newton's second method, momentum methods and energy methods. [*1, 5*] 2. To introduce the use of differential equation models for analyzing and designing dynamic systems. [*1, 3*] 3. To teach the kinematic analysis of systems consisting of interconnected links. [*1, 5*] 4. To teach the application of dynamic concepts to the analysis of laboratory experiments, representing real-world systems. [*1, 5, 7*] 5. To teach the use of Mathcad as an engineering tool for dynamic system analysis. [*10*] 6. To teach students to learn basic engineering principles from reading. [*9*]
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Be able to recognize which coordinate system is appropriate for a given problem in dynamic analysis and understand the use of the appropriate formula for that coordinate system. [1]

	2. Given a kinetic analysis problem, be able to determine and apply the most efficient method for its analysis. [1] 3. Be able to derive a differential equation model of a dynamic system. [2] 4. Be able to solve for the solutions of simple unforced and forced vibrational systems. [2] 5. Be able to design a proportional feedback control law for a first or second order dynamic system. [2] 6. Be able to analyze the kinematic behavior of four-bar linkages. [3] 7. Be able to perform kinematic analysis using moving reference frames. [3] 8. Complete and provide a report on several dynamic system labs. [4,5] 9. Be able to write simple Mathcad programs for dynamic analysis. [5] 10. Completion of the assignments in a reading journal based on the course text. [6]

DEPARTMENT: MECHANICAL ENGINEERING	
COURSE #: EML 3014C, 4 credits	**COURSE TITLE:** Dynamic Systems II
TYPE COURSE: Required	**TERMS OFFERED:** Spring
CATALOG DESCRIPTION: This course is the second part of an integrated sequence in dynamics, vibrations and controls. Material in the second course includes the development of the equations of motion for translational and rotational mechanical systems, electrical systems, and electromechanical systems; system response using standard differential equation solution techniques and Laplace transforms; frequency response and impedances; linearization of nonlinear system models, and block diagram and feedback control strategies.	**PREREQUISITES**: EML 3013C, Dynamic Systems I **COREQUISITE:** MAP 3306, Engineering Math II
AREA COORDINATOR: Dr. Emmanuel Collins **RESPONSIBLE FACULTY:** **INSTRUCTOR(S) OF RECORD:** Dr. Emmanuel Collins, Dr. Dave Cartes **DATE OF PREPARATION:** 5-24-01(Collins)	**CLASS SCHEDULE:** Twice weekly for 1 hr. and 15 min. **LABORATORY SCHEDULE:** Once weekly for 2 hrs and 45 min.
TEXTBOOKS/REQUIRED MATERIAL: • *Modeling, Analysis, and Control of Dynamic Systems: 2nd Edition* by William J. Palm III, Wiley, 1999 • *Reading Journal for Modeling, Analysis, and Control of Dynamic Systems: 2nd Edition* by Emmanuel G. Collins	**SCIENCE/DESIGN %):** 70 / 30 **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:** 70% engineering science, laboratory experience 30% engineering design
COURSE TOPICS: 1. Basic Dynamic System Concepts 2. Laplace Transform Solution of Differential Equations 3. Plane Motion 4. Nonlinear Models and Linearization 5. Numerical Methods for Differential Equations 6. Electrical Circuit Models 7. Transfer Functions and Block Diagram 8. Impedance and Operational Amplifiers; 9. Electromechanical Systems 10. State-Variable Models 11. Mechanical Systems 12. Predictors and Measures of Performance 13. Modes and System Response 14. Frequency Response 15. Vibration Isolation 16. Vibration Absorption	**ASSESSMENT TOOLS:** 1. Weekly Homework Problems 2. Weekly Quizzes Based on the Reading Journal 3. Weekly Lab Reports 4. Exams
COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) 1. To teach dynamic analysis based on Newton's second method, momentum methods and energy methods. [*1*,*5*] 2. To introduce the use of differential equation models for analyzing and designing dynamic systems. [*1*,*3*] 3. To teach the kinematic analysis of systems consisting of interconnected links. [*1*,*5*]

	4. To teach the application of dynamic concepts to the analysis of laboratory experiments, representing real-world systems. [*1,5,7*] 5. To teach the use of MathCAD as an engineering tool for dynamic system analysis. [*10*] 6. To teach students to learn basic engineering principles from reading. [*9*]
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Be able to recognize which coordinate system is appropriate for a given problem in dynamic analysis and understand the use of the appropriate formula for that coordinate system. [1] 2. Given a kinetic analysis problem, be able to determine and apply the most efficient method for its analysis. [1] 3. Be able to derive a differential equation model of a dynamic system. [2] 4. Be able to solve for the solutions of simple unforced and forced vibrational systems. [2] 5. Be able to design a proportional feedback control law for a first or second order dynamic system. [2] 6. Be able to analyze the kinematic behavior of four-bar linkages. [3] 7. Be able to perform kinematic analysis using moving reference frames. [3] 8. Complete and provide a report on several dynamic system labs. [4,5] 9. Be able to write simple Mathcad programs for dynamic analysis. [5] 10. Completion of the assignments in a reading journal based on the course text. [6]

DEPARTMENT: MECHANICAL ENGINEERING	
COURSE #: EML 3015C, 4 credits http://www.eng.fsu.edu/~shih/eml3015/index.htm	**COURSE TITLE:** Thermal Fluids I
TYPE COURSE: Required	**TERMS OFFERED:** Fall
CATALOG DESCRIPTION: First of a two-part sequence presenting an integrated treatment of traditional topics on thermodynamics, fluid mechanics and heat transfer. The essential role of each of these related elements and their connections is examined in the context of real-world systems. Materials covered include: first and second laws of thermodynamics; power and refrigeration cycles; heat transfer modes including steady and time dependent conduction, convection and radiation; fluid statics; mass momentum and energy conservation; Bernoullis equation; internal and external flows.	**PREREQUISITES**: PHY 2048, Physics I; MAC 2313, Calculus III; EML 3013, Dynamic Systems I
AREA COORDINATOR: Dr. Chiang Shih **RESPONSIBLE FACULTY:** **INSTRUCTOR OF RECORD:** Dr. Chiang Shih **DATE OF PREPARATION:** 2/16/01(Shih)	**CLASS SCHEDULE:** Three times weekly for 50 min. **LABORATORY SCHEDULE:** Once weekly for 3 hrs
TEXTBOOKS/REQUIRED MATERIAL: • *Introduction to Thermodynamics and Heat Transfer*, Yunus Cengel • http://www.eng.fsu.edu/~shih/succeed-2000/roadmap/map.htm • Lecture Note Packet from Target	**SCIENCE/DESIGN (%):** 85 / 15 **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:** 85% engineering science 15% engineering design of thermal systems, components
COURSE TOPICS: http://www.eng.fsu.edu/~shih/eml3015/syllabus.html 1. Introduction to thermal sciences; a brief overview of thermodynamics, fluid mechanics and heat transfer and their interconnection 2. Thermodynamic properties and thermal system analysis 3. Conservation principles for mass, momentum, and energy 4. The First law of Thermodynamics, work and heat in thermal processes 5. The Second law of Thermodynamics, Entropy, and irreversibilities 6. Vapor and gas power cycles 7. Heat engines and refrigeration cycles 8. 1-D Conduction heat transfer 9. Heat exchangers	**ASSESSMENT TOOLS:** http://www.eng.fsu.edu/~shih/eml3015/syllabus.html 1. Weekly quizzes 2. Weekly homework problems 3. Weekly workshop group assignments 4. Group project reports and final oral presentations
COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) 1. To provide an overview of traditional thermal disciplines in thermodynamics, heat transfer and fluid mechanics and emphasize their inter-connectivity through various real-world examples. Provide a comprehensive review and reference of the state-of-the-art thermal-related applications and technology *[5, 8]*. 2. To introduce basic thermodynamic concepts, including thermo properties, equation of state, ideal gases, open and closed system analysis, thermal flow devices *[5]*

	3. To teach the conservation principles of mass, momentum, and energy (the first law of thermodynamics). Analyze work, heat and power transfer in both idealized thermodynamic cycles and in practical thermal systems *[1]* 4. To introduce the second law of thermodynamics, entropy, efficiency, and irreversibilities *[3]* 5. To introduce the application of relevant thermal principles for the analysis/design of a complete thermal system *[1, 3, 5, 7,10]* 6. To teach basic processes of conduction heat transfer, heat diffusion equation, thermal resistance concept *[1, 5]*
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Be able to recognize the relevancy of all the three thermal principles (thermo, heat transfer and fluid mechanics) and their importance in the analysis of a complete thermal system [1, 3] 2. Given a flow device, be able to apply the mass conservation and the Bernoulli equation to analyze the mechanical energy balance [3] 3. Given a simple heat device and a set of physical conditions, be able to apply various modes of heat transfer to analyze the heat transfer process [1] 4. Be able to determine thermodynamic properties of a simple substance using both tabulated and graphical data [2] 5. Given a thermo device and conditions, be able to compute the work and heat transfer using conservation principles and relevant thermodynamic tables (with or without phase transition) [2, 3] 6. Be able to model a simplified thermo device using idealized thermodynamic cycles/processes and be able to analyze the device performance using both the conservation laws, thermodynamic property tables/relations [2, 3, 4] 7. Be able to apply the second law and the entropy concept in the analysis of the thermal efficiency of a practical system [4, 5] 8. Be able to analyze idealized cycles: Carnot, Rankine, Brayton, Otto, Diesel, and refrigeration. Also be able to identify their relevancy to actual thermal devices [2, 3, 4, 5] 9. Understand the heat diffusion equation and the energy balance concept. Be able to apply thermal resistance concept to simplify 1-D heat transfer problems [6] 10. Be able to function in a group to design and analyze a complete thermal system applying one or more thermal principles. Present final results both in a formal report and through oral presentation [1, 2, 3, 4, 5, 6]

DEPARTMENT: MECHANICAL ENGINEERING	
COURSE #: EML 3016C, 4 credits	**COURSE TITLE:** Thermal Fluids II
TYPE COURSE: Required	**TERMS OFFERED:** Spring
CATALOG DESCRIPTION: Second of a two-part sequence presenting an integrated treatment of traditional topics on thermodynamics, fluid mechanics and heat transfer. The essential role of each of these related elements and their connections is examined in the context of real-world systems. Materials covered include: first and second laws of thermodynamics; power and refrigeration cycles; heat transfer modes including steady and time dependent conduction, convection and radiation; fluid statics; mass momentum and energy conservation; Bernoulli's equation; internal and external flows.	**PREREQUISITES**: EML 3015C, Thermal Fluids I **COREQUISITE:** EML 4304L, Experiments in Thermal and Fluid Sciences
AREA COORDINATOR: Dr. Chiang Shih **RESPONSIBLE FACULTY:** **INSTRUCTOR(S) OF RECORD:** Dr. Chiang Shih **DATE OF PREPARATION:** 2/16/01(Shih)	**CLASS SCHEDULE:** Three times weekly for 50 min. **LABORATORY SCHEDULE:** Once weekly for 2 hrs and 45 min.
TEXTBOOKS/REQUIRED MATERIAL: • *Introduction to Fluid Mechanics*, Fox & McDonald • http://www.eng.fsu.edu/~shih/succeed-2000/roadmap/map.htm • Lecture Note Packet from Target	**SCIENCE/DESIGN (%):** 85 / 15 **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:** 85% engineering science 15% engineering design of thermal systems, components
COURSE TOPICS: 1. 1-D and 2-D steady heat transfer, fin analysis, shape factors 2. Unsteady heat transfers 3. Numerical Methods (finite difference formulation) for heat transfer 4. General fluid concepts, fluid statics, forces on submerged surfaces 5. Governing equations, both integral and differential formulations for mass, momentum, and energy conservation 6. Similitude and dimensional analysis 7. Internal and external flow configurations, lift and drag, boundary layer concept 8. Free and forced convective heat transfer modes	**ASSESSMENT TOOLS:** http://www.eng.fsu.edu/~shih/eml3016/syllabus.html 1. Weekly quizzes 2. Weekly homework problems 3. Weekly workshop group works 4. Group project reports and final oral presentations 5. Three exams and a final
COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) 1. To teach the 1-D and 2-D steady heat transfer, fin analysis, 1-D unsteady heat transfer, and thermal radiation concept *[1, 5]* 2. To teach numerical analysis concept (finite difference formulation) and its application to both steady and unsteady heat transfers *[1, 3, 10, 11(linear algebra)]* 3. To introduce concepts of fluid statics and hydrostatic force *[1, 5]* 4. To teach conservation principles of mass, momentum and energy of a fluid system using both integral and differential formulations *[1, 5]*

	5. To introduce concepts of dimensional analysis and similitude in flow and heat analysis *[5]* 6. To teach momentum (lift & drag) and heat transports (convection) for both internal and external flow configurations *[1, 5]* 7. To teach the application of thermal principles to the analysis/design of a complete thermal system. *[1, 2, 3, 5,10]*
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Be able to recognize the relevancy of all the three thermal principles (thermodynamics, heat transfer and fluid mechanics) and their importance in the analysis/design of a complete thermal system [7] 2. Be able to model 1-D heat transfer using shape factor, thermal resistance network with and without heat generation. Be able to apply extended surface analysis to fin design and other relevant configurations [1] 3. Be able to derive 2-D nodal equations (both steady and unsteady) for given physical configurations. Be able to solve a system of algebraic equations using linear algebra (matrix inversion) or iterative methods [1, 2] 4. Be able to calculate forces (magnitude and line of action) on submerged plane and curved surfaces [3] 5. Given flow condition, be able to assign control volume to the system and apply all three conservation principles to evaluate the integral fluid properties of interest [4] 6. Be able to apply the mass conservation and the Bernoulli's equation (by also recognizing its limitations) to relate the fluid velocity, system elevation and pressure for a given flow condition [4] 7. Capable of applying dimensional analysis to determine the dimensionless groups and their relationship for given flow/heat configurations. Understand the importance of various dimensionless parameters (Reynolds number, Nusselt number, etc). [5] 8. Be able to apply governing flow/heat equations to a pipe flow system (both circular and noncircular). Calculate the velocity distribution, wall shear stress (frictional factor), wall convective heat transfer (Nusselt number), temperature/pressure distribution, etc.[4, 6] 9. Be able to analyze external flow/heat problems (flow over objects). Estimate the boundary layer development, lift and drag forces, and convective heat transfer.[4, 6] 10. Be able to analyze free, forced, and combined convective heat transfer processes for given flow/heat configurations [4, 6] 11. Understand fundamentals of radiation heat transfer, including blackbody emission, radiation properties, spectral distribution, green house effect, etc. [1] 12. Be able to function in a group to design and construct a complete thermal system (could be subscaled model of a system or a lab-style thermal experiment) by applying one or more thermal principles. Present final results both in a formal report and through an oral presentation [1, 2, 3, 4, 5, 6, 7]

<table>
<tr><td colspan="2">DEPARTMENT: MECHANICAL ENGINEERING</td></tr>
<tr><td>COURSE #: EML 3017C, 4 credits
http://www.eng.fsu.edu/~hollis/eml3017c-f00/eml3017c_web/index.htm</td><td>COURSE TITLE: Mechanical Systems I</td></tr>
<tr><td>TYPE COURSE: Required</td><td>TERMS OFFERED: Fall</td></tr>
<tr><td>CATALOG DESCRIPTION:
This is the first course in a sequence of two courses intended to provide the essential tools for the design and analysis of mechanical systems. Emphasis is on linkages; constraints and degrees of freedom; position, velocity, and acceleration analysis; cams, gears and gear trains, static and dynamic analysis; computer simulations and models of components and systems; team class projects involving dissection of existing machines, and design and manufacture of new mechanical systems.</td><td>PREREQUISITES:
EML3011C, Mechanics and Materials I; EML3013C, Dynamical Systems I; MAP3305, Engineering Math I</td></tr>
<tr><td>AREA COORDINATOR: Dr. Patrick Hollis
RESPONSIBLE FACULTY: Dr. Patrick Hollis

INSTRUCTOR OF RECORD: Dr. Patrick Hollis
DATE OF PREPARATION: 6/1/01(Hollis)</td><td>CLASS SCHEDULE:
Three times weekly for 50 min.

LABORATORY SCHEDULE:
Once weekly for 3 hrs</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
• Design of Machinery, Norton, R. L., 2nd Edition, McGraw-Hill, 1999</td><td>SCIENCE/DESIGN (%): 85 / 15

CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
85% engineering science
15% engineering design of mechanical systems, components</td></tr>
<tr><td>COURSE TOPICS:
1. Constraints and Degrees of Freedom
2. Linkages
3. Linkage Synthesis
4. Position, Velocity and Acceleration analysis
5. Cams
6. Gears and Gear Trains
7. Dynamics Fundamentals
8. Force analysis
9. Mechanical System Simulation
10. Synthesis of Mechanical Systems</td><td>ASSESSMENT TOOLS:
1. Weekly homework problems
2. Weekly lab group assignments
3. Group project reports
4. Two midterm tests and one final examination</td></tr>
<tr><td>COURSE OBJECTIVES*</td><td>(Numbers shown in brackets are links to program outcomes)
1. To explain and demonstrate the constraints and degrees of freedom in a linkage [1]
2. To show how to find analytically and computationally the position, velocity, and acceleration in various linkages [1, 5]
3. To show how to analyze and design compound and planetary gear trains [1, 3, 5, 7, 10]
4. To show how to design cam linkages for specified motion requirements [1, 3, 5, 7, 10]
5. To provide tools to design linkages to meet simple motion requirements [1, 3, 5, 7, 10]
6. To introduce computational tools for the simulation and design of linkages [3, 5, 7, 10]</td></tr>
<tr><td>COURSE OUTCOMES*</td><td>(Numbers shown in brackets are links to course objectives listed above)
1. Determine the number of degrees of freedom in a mechanism [1]</td></tr>
</table>

	2. Perform position, velocity, acceleration, and force analysis of simple linkages [2] 3. Synthesize simple gear trains to achieve specified speed ratios [3] 4. Synthesize simple mechanisms to meet given performance characteristics [1, 2, 3, 4, 5, 6] 5. Generate computer models of mechanisms to perform dynamic simulations [2, 6] 6. Generate engineering drawings of components for manufacture [6] 7. Design and analyze simple cams to meet specified performance [4]

<table>
<tr><td colspan="2">DEPARTMENT: MECHANICAL ENGINEERING</td></tr>
<tr><td>COURSE #: EML 3018C, 4 credits
http://www.eng.fsu.edu/~hollis/eml3018c-s01/eml3018c_web/index.htm</td><td>COURSE TITLE: Mechanical Systems II</td></tr>
<tr><td>TYPE COURSE: Required</td><td>TERMS OFFERED: Spring</td></tr>
<tr><td>CATALOG DESCRIPTION:
This is the second course in a sequence of two courses intended to provide the essential tools for the design and analysis of mechanical systems. Emphasis is on materials; stress analysis; shaft design; bearings and lubrication; fasteners and connectors; joints; clutches, brakes, couplings and flywheels; flexible elements; shafts; computer simulations and models of components and systems; team class projects involving dissection of existing machines and design and manufacture of new mechanical systems.</td><td>PREREQUISITES:
EML3012C, Mechanics and Materials II; EML3017C, Mechanical Systems I</td></tr>
<tr><td>AREA COORDINATOR: Dr. Patrick Hollis
RESPONSIBLE FACULTY: Dr. Patrick Hollis

INSTRUCTOR(S) OF RECORD: Dr. Patrick Hollis
DATE OF PREPARATION: 6/1/01(Hollis)</td><td>CLASS SCHEDULE:
Three times weekly for 50 min.

LABORATORY SCHEDULE:
Once weekly for 3 hrs.</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
• Machine Design, An Integrated Approach, Norton, R. L., 2nd Edition, Prentice-Hall, 2000</td><td>SCIENCE/DESIGN (%): 85 / 15

CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
85% engineering science
15% engineering design of mechanical systems, components</td></tr>
<tr><td>COURSE TOPICS:
1. Design
2. Constraints and Degrees of Freedom
3. Gears and Gear Trains
4. Shafts, Keys, Couplings
5. Bearings
6. Fasteners and Connectors
7. Clutches and Brakes
8. Flexible Elements
9. Stress and Deflection
10. Static Failure
11. Dynamic Failure and Fatigue</td><td>ASSESSMENT TOOLS:
1. Weekly homework problems
2. Weekly lab group assignments
3. Group project reports
4. 2 midterm tests and 1 final examination</td></tr>
</table>

<table>
<tr><td>COURSE OBJECTIVES*</td><td>(Numbers shown in brackets are links to program outcomes)
1. To explain and demonstrate the failure analysis of various materials under static and dynamic loading conditions [1, 5, 10]
2. To introduce standards and formulae for the analysis and design of various mechanical components (gears, bearings, shafts, fasteners, etc.)[1, 3, 5, 10]
3. To introduce techniques to assemble components into simple mechanical systems[1, 3, 5, 10]
4. To introduce computer software for the analysis and design of components and systems [3, 5, 10]
5. To provide tools and examples for the design of various mechanical systems [1, 3, 5, 7, 10]</td></tr>
</table>

COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Determine when a component will fail statically given loading [1] 2. Determine when a component will fail under dynamic conditions given loading and life requirements [1] 3. Design and analyze simple gear trains to transmit power and motion [2, 3, 4] 4. Design and analyze simple shafts for given loading conditions and other design requirements [2, 3,4] 5. Calculate deflection and slope for loaded shafts [2, 4] 6. Select suitable bearings for a particular application [2, 3, 4] 7. Select appropriate fasteners for a system given design requirements [2, 3, 4] 8. Generate computer models of components and systems of machine components [2, 3, 4, 5] 9. Generate engineering drawings of components and systems for manufacture [3, 4, 5]

<table>
<tr><td colspan="2">DEPARTMENT: MECHANICAL ENGINEERING</td></tr>
<tr><td>COURSE #: EML 3050, 3 credits</td><td>COURSE TITLE: Analytical Tools in Mechanical Engineering</td></tr>
<tr><td>TYPE COURSE: Optional (to be Required)</td><td>TERMS OFFERED: Fall and Spring</td></tr>
<tr><td>CATALOG DESCRIPTION:
Mathematical and numerical tools relevant to practical applications in mechanical engineering. Modeling of real physical systems using mathematical formulation. Subjects include: Fourier Series and Integrals; Fourier Transform and energy spectrum; solution of partial differential equations using separation of variables, finite difference methods, and finite element methods; numerical interpolation and integration.</td><td>PREREQUISIES: MAP 3305, Engr. Math I; EML 3002C, ME Tools; EML 3004C, Intro. to ME

CO- or PRE-REQUISITES: EML 3013C, Dynamic Systems I, EML 3011C, Mechanics & Materials I</td></tr>
<tr><td>AREA COORDINATOR: Dr. Chiang Shih
RESPONSIBLE FACULTY: Dr. Chiang Shih

INSTRUCTOR OF RECORD: Dr. Chiang Shih
DATE OF REPARATION: 2/16/02 (Shih)</td><td>CLASS SCHEDULE:
Twice a week for 1 hour and 15 minutes

LABORATORY SCHEDULE:
Once weekly for 2 hours</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
• Advanced Engineering Mathematics, E. Kreyszig, Wiley, Inc.
• Supplementary Notes</td><td>SCIENCE/DESIGN (%): 100 / 0

CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
100% engineering science, relating mathematics and physics</td></tr>
<tr><td>COURSE TOPICS:
1. Fourier Series analysis of periodic functions
2. Fourier Integral and Fourier Transform of arbitrary functions
3. Partial differentiation equations (PDE): 1-D and 2-D wave equations, 1-D unsteady and 2-D steady heat transfer equations
4. Solution of PDE using separation of variables
5. Finite Difference Method (FDM): Overview, discretization and nodal network
6. Solution of linear system of difference equations: Gauss elimination, Gauss-Seidel iteration, Explicit and Implicit schemes
7. Numerical analysis: interpolation, splines, numerical differentiation and integration
8. Finite Element Method (FEM): Overview and ALGOR FEM package
9. Laboratory practices and demonstrations of corresponding physical phenomena
10. Direct comparison of mathematical, numerical, and experimental results of selected physical problems</td><td>ASSESSMENT TOOLS:
1. Weekly quizzes
2. Weekly homework problems
3. Weekly workshop group assignments
4. Projects
5. Final exam</td></tr>
<tr><td>COURSE OBJECTIVES*</td><td>(Numbers shown in brackets are links to program outcomes)

1. To familiarize students with mathematical and numerical tools commonly used in</td></tr>
</table>

	the field of Mechanical Engineering [10]. 2. Emphasize on modeling of real physical systems using mathematical formulations; present a clear connection between the mathematics and the underlying physics [1,5] 3. To introduce Fourier analysis and separation of variables for the analysis and solving of ordinary and partial differentiation equations [1] 4. To introduce both theoretical concepts and applications of modern numerical approximation methods of finite difference and finite element formulations: discretization, matrix formation, boundary conditions, and numerical solver [10,11] 5. Analyze and compare results of selected physical problems using mathematical, numerical, and experimental methods [1,2] 6. Introduce fundamentals of modern numerical analysis schemes, such as interpolation, splines, Fast Fourier Transform (FFT) [10] 7. Prepare students with necessary tools and skills useful for their senior capstone design projects and other higher-level classes (in particular, Thermal-Fluids II and Dynamic Systems II) [1,5,10]
COURSE OUTCOMES*	**(Numbers shown in brackets are links to course objectives listed above)** 1. Be able to decompose various functions (periodic or aperiodic) into Fourier components using proper Fourier analysis [1, 3] 2. Be able to model a simplified physical system (such as a vibrating string, or a simple spring-damper system) and derive the corresponding mathematical formulation; solve the mathematical equation using either Fourier analysis or separation of variables [1,2,3] 3. Be able to formulate an engineering problem using numerical formulations (FDM and FEM); solve the system of difference equations using proper schemes [4] 4. Be able to conduct experiments (vibration and heat transfer); as well as interpret and compare data to analytical and numerical solutions obtained, respectively, using mathematical and numerical schemes [1,5,6] 5. Be able to analyze experimental data using interpolation, splines, numerical integration (curve-fitting and pressure field integration); be able to analyze experimental data in frequency domain using FFT [6] 6. Be able to use ALGOR FEM package to analyze simple physical systems, such as trusses, beams, plates, and 2-D heat conduction [1,7] 7. Be able to analyze the numerical results and compare them to experimental data and present the comparison both in written and oral formats [5,7]

DEPARTMENT: MECHANICAL ENGINEERING	
COURSE #: EML 3234, 3 credits	**COURSE TITLE**: Materials Science and Engineering
TYPE COURSE: Required	**TERMS OFFERED:** Fall, Spring
CATALOG DESCRIPTION: Includes concepts of materials science and their relevance to engineering design. Recent advances in engineering materials science. This course introduces concepts of the structure of materials, long and short range order, and their micro and macro nature. Students will gain understanding in materials response to loadings their departure from ideality, strengthening mechanisms, and phase diagrams. The properties of the different classes of materials along with methods of materials characterization will also be covered.	**PREREQUISITES**: CHM 1045C, General Chemistry I with lab, PHY 2048C, Physics I with lab
AREA COORDINATOR: Dr. Namas Chandra **RESPONSIBLE FACULTY:** Dr. Peter Gielisse **INSTRUCTOR OF RECORD:** Dr. Peter Gielisse **DATE OF PREPARATION:** 7/17/03 (Gielisse)	**CLASS SCHEDULE:** Twice weekly for 1 hr. and 15 min.
TEXTBOOKS/REQUIRED MATERIAL: • William D. Callister, Jr. "Materials Science and Engineering, An Introduction, Latest Edition", John Wiley & Sons, Inc., New York, 1999.	**SCIENCE/DESIGN (%):** 90 / 10 **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:** 90% engineering science 10% engineering design of materials
COURSE TOPICS: 1. The concept of Structure in Materials 2. Micro- and Macroscopic Nature of Materials. 3. Micro- and Macrostructural Response of Materials to Loading in Tension, Compression, Shear and Torsion. 4. The Imperfect (Real) Solid State. 5. Mechanical Behavior (Mechanics) of Materials. 6. Strengthening Mechanisms. 7. Phase Equilibria Diagrams. 8. Materials Characterization: Principles and Techniques. 9. Non-Structural Materials and Properties 10. Magnetic, Superconducting, Dielectric, and Semiconducting Materials and their Applications.	**ASSESSMENT TOOLS:** 1. Weekly Homework and/or Assignments 2. Non-Scheduled Quizzes as Appropriate 3. Two Exams 4. Final Examination
COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) This course teaches students: 1. The meaning of structure from the submicron to the macro level and how it relates to the properties of a material. [1] 2. How and why the atomic building blocks of matter arrange themselves into materials at the macro level. [1] 3. The restrictions and limitations in building atomic structures (materials) as influenced by space filling concepts, equilibrium requirements, bond types, and charge levels. [1] 4. How (structural) materials behave in response to the four principal modes of loading: tension, compression, torsion, and shear. [1, 5, 10]

	5. The difference between perfect materials and imperfect (engineering) structural materials and why the latter are preferred in (most) engineering applications. [1] 6. The ways in which engineering materials depart from ideality: imperfections, dislocations, porosity, purity, and how they effect property values. [1] 7. The principal mechanisms that influence strength and stiffness and improve structural properties in general. [1] 8. The importance of understanding how materials behave (react with each other) as a function of temperature as exemplified in unary and binary phase equilibria diagrams. [1, 10] 9. What makes materials magnetic, superconducting, dielectric, or semiconducting, and how these properties can be used in engineering products and applications. [1, 5, 7, 8] 10. The principal techniques to determine the properties of a material from a physical mechanical, electrical, and chemical point of view. [2, 9, 10]
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) Upon course completion, students should be able to: 1. Recognize, in both qualitative and quantitative ways the physical and chemical reasons that endow materials with a wide range of property values useful in engineering practice. [1, 2, 3, 8, 9] 2. Deduce through reasoning what properties, in first instance, are likely to be critical in the design and manufacture of a successful engineering product. [1, 2, 3, 4, 5, 6, 7, 8, 9] 3. Extract the essential thermal, compositional, and microstructural information from various types of binary phase diagrams. [8] 4. Show how properties of materials can be improved through processing, thermal treatments, and alloying. [5, 6, 7, 8] 5. Interpret mechanical test data, particularly those contained in stress-strain curves for the principal types of materials and the four primary types of loading from onset of loading to failure. [4, 5, 6, 7] 6. Use simple calculations that will explain why the presence of dislocations and other defects in materials can be essential in engineering practice.[5, 6, 7] 7. Calculate the theoretical and actual engineering strength of materials for cases where either dislocation or crack parameters determine type and level of failure. [4, 5, 6, 7] 8. Support the notion that arrangements of points in space (lattices) when populated by atomic or molecular matter (structures) is limited, yielding six crystallographic systems. [1, 2, 3, 10] 9. Determine the directional indicies for planes and directions in crystalline materials. [1, 2, 3] 10. Use magnetic materials in engineering applications. [9, 10] 11. Select dielectric materials for applications as resistors and capacitors. [9, 10] 12. Choose certain semiconducting materials for use in simple device applications. [9, 10] 13. Give examples of present and future applications of low and high temperature superconducting materials. [9, 10]

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<tr><td colspan="2">DEPARTMENT: MECHANICAL ENGINEERING</td></tr>
<tr><td>COURSE #: EML 4304L, 2 credits
http://www.eng.fsu.edu/~alvi/EML4304L/webpage/</td><td>COURSE TITLE: Experiments in Thermal and Fluid Sciences</td></tr>
<tr><td>TYPE COURSE: Required</td><td>TERMS OFFERED: Spring</td></tr>
<tr><td>CATALOG DESCRIPTION:
Engineering laboratory measurements in fluid and thermal applications, including basic concepts for design of experiments, measurement devices, and their performance characteristics; measurement of fluid and thermal properties, pressure, velocity, and temperature; calibration procedures; experiments in fluid flow and heat transfer; design of engineering experimental systems; laboratory work, report writing.</td><td>PREREQUISITES:
EML 3015C, Thermal-Fluids I; EML 3012C, Mechanics & Materials II

COREQUISITES: EML 3016C, Thermal-Fluids II</td></tr>
<tr><td>AREA COORDINATOR: Dr. Chiang Shih
RESPONSIBLE FACULTY:

INSTRUCTOR(S) OF RECORD: Dr. Farrukh Alvi
DATE OF PREPARATION: 2/20/01(Alvi)</td><td>CLASS SCHEDULE:
Twice weekly for 1 hr. and 15 min.

LABORATORY SCHEDULE:
Once weekly for 2 hrs. an 45 min.</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
• Laboratory Manual, available on the Web.</td><td>SCIENCE/DESIGN (%): 80 / 20

CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
80% engineering science, laboratory experience, data analysis
20% engineering design, design thermal experiments</td></tr>
<tr><td>COURSE TOPICS:
1. Laboratory rules and regulations including safety procedures.
2. Planning & conducting experiments.
3. Measurement and error analysis.
4. Writing technical reports.
5. Properties of thermal radiation
6. Extended surface (fins) heat transfer measurements
7. Measurements of thermal conductivity and contact resistance.
8. Static and Dynamic responses of temperature measuring devices.
9. Measurement of major & minor losses in pipe flows.
10. Velocity field measurements in a rectangular jet.
11. Flow around a circular cylinder.
12. Forced convection on a flat disk.
13. Flow Visualization</td><td>ASSESSMENT TOOLS:
1. Written formal lab reports in the standard technical report format including an abstract, introduction & background, experimental procedures, results and discussion and conclusions. Some full-length reports written as a team, others by each individual student.
2. Short written reports emphasizing the results and a discussion of the results.
3. Oral reports presented by teams.
4. Self and peer-evaluations of group reports and presentations by team members.
5. Tests and quizzes based on experimental methods and practices and lab projects.</td></tr>
<tr><td>COURSE OBJECTIVES*</td><td>(Numbers shown in brackets are links to program outcomes)
1. To reinforce and enhance the students' understanding of the fundamentals of thermals sciences through practical illustrations making the link between theory and practice and the uncertainties introduced in practical applications. [1,2,5,10]
2. To introduce a variety of classical and modern experimental and diagnostic techniques, and the principles behind these techniques. [2,10]</td></tr>
</table>

	3. To familiarize the students in the use of computer hardware and software for data acquisition and analysis. [2,10] 4. To provide practice in organizing, analyzing and interpreting engineering data, making engineering judgments, estimates and assessing the reliability of measurements. [1,2,5,7,10,11] 5. To improve the students' *oral* and *written* communication skills through written lab reports and presentations. [4, 7, 10]. 6. To expose the students to a *group-learning environment*. [4].
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Measure various thermo-fluid properties and behavior, e.g. fin efficiencies, convective heat transfer coefficients, thermal conductivities, drag and lift coefficients and compare them to theory. [1,2] 2. Analyze trends in the thermo-fluid properties and behavior as a function of important parameters. [1] 3. Discuss reasons for discrepancies between measured values and those predicted by theory. [1, 4] 4. Learn to use various transducers, e.g. pressure sensors, hot-wires, thermocouples, thermistors and RTD sensors and the relative merits and drawbacks of different devices. [2] 5. Learn the use of static and stagnation pressure probes and their use in fluid measurements. [2] 6. Understand the difference between static and dynamic calibration and how to perform and evaluate each type of calibration. [2] 7. Use computer controlled, digital data acquisition cards and acquisition software to acquire, process and store data and to control external processes [3] 8. Learn the basics of analog-to-digital conversion in data acquisition cards and the factors which determine the accuracy of such measurements [3,4] 9. Process and analyze experimental data, including the associated uncertainties. [4] 10. Present results in a clear, succinct graphical format to convey the essential results. [4, 5] 11. Present the results and conclusions of an experimental project in a concise and informative written format as a technical report [5] 12. Present the results of experimental projects in group oral presentations in a limited time. [5,6] 13. Learn effective teamwork by delegating responsibilities among team members [6].

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<tr><td colspan="2">DEPARTMENT: MECHANICAL ENGINEERING</td></tr>
<tr><td>COURSE #: EML 4551, 4 credits
http://www.eng.fsu.edu/~luongo/design/</td><td>COURSE TITLE: Engineering Design Systems I</td></tr>
<tr><td>TYPE COURSE: Required</td><td>TERMS OFFERED: Fall</td></tr>
<tr><td>CATALOG DESCRIPTION:
The first in a two-part course sequence presenting an integrated system design approach for engineering product realization. Course blends the perspectives of market research and planning, design, manufacturing, testing and life cycle support of a product. Material covered includes: systems engineering for product design, concept generation, economics of product development, probabilistic consideration in design, concept selection, project planning, decision making, optimum design and tolerance design.</td><td>PREREQUISITES:
EML 3012C, Mechanics and Materials II; 3014C, Dynamic Systems II; 3016C, Thermal-Fluids II; 3018C, Mechanical Systems II</td></tr>
<tr><td>AREA COORDINATOR: Dr. Cesar Luongo
RESPONSIBLE FACULTY:

INSTRUCTOR(S) OF RECORD: Dr. Cesar Luongo
DATE OF PREPARATION: 5/12/01(Luongo)</td><td>CLASS SCHEDULE:
Twice weekly for 1 hr. and 15 min.

LABORATORY SCHEDULE:
Once weekly for 2 hrs. and 45 min.</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
Required:
• Barry Hyman, “Fundamentals of Engineering Design”, Prentice Hall
• Karl A. Smith, “Project Management and Teamwork”, McGraw-Hill
• William Pfeiffer, “Pocket Guide to Technical Writing”, Prentice Hall
• W. Strunk Jr. and E.B. White, “Elements of Style”, Allyn & Bacon</td><td>SCIENCE/DESIGN (%): 0 / 100

CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:
100% engineering design, culmination into a major design experience with all engineering standards and constraints</td></tr>
<tr><td>COURSE TOPICS:

1. Introduction
2. Product Specifications
3. Conceptual (Preliminary) Design
4. Concept Selection
5. Project Planning, Control, and Management
6. Detailed Design
7. Technical Writing and Communications</td><td>ASSESSMENT TOOLS:

1. Written Deliverables:
2. Oral Presentations:
3. Tests
4. Additionally, the students must complete periodic self and team evaluation forms to assess the degree of teamwork achieved by the group. Faculty or industrial sponsors of the projects also fill out evaluation forms at the end of each semester which are used as one more input in the assignment of grades</td></tr>
<tr><td>COURSE OBJECTIVES*</td><td>(Numbers shown in brackets are links to program outcomes)
1. Introduce students to the formal product design cycle, including customer needs assessment, product specification, concept generation and selection, product architecture, detailed design, and prototyping and manufacturing [3, 5]
2. Afford students an opportunity to carry out a significant design project being sponsored by industry or other faculty, so that they are directly exposed to the product design cycle in the context of a project organization [1, 5]
3. To have the students work in teams in order to accomplish the design project objectives.</td></tr>
</table>

	Departmental provincialism at the College level does not allow for all the ME students to work in multi-disciplinary teams; however students are assigned to these multi-disciplinary teams at every opportunity that materializes (through the Center for Multi-Disciplinary Design or other industrial contacts). Teach fundamentals of team dynamics and interpersonal skills. [4, 6] 4. To train the students in basic skills of project management and control, such as preparing work breakdown structures (WBS), design package definition, scheduling, budgeting, etc. Present management techniques to keep projects on track, and team members on a highly motivated state. [4, 10] 5. Teach the difference between customer needs and product specification. Present techniques to elicit, organize, evaluate, and rank customer needs. To teach the importance of a product specification and show students how to prepare an engineering spec. [3] 6. To teach techniques to generate design concepts, and to present ways to classify and evaluate pros and cons (including functional analysis) so that the concept selection process leads to the best solution. [2, 3] 7. Discuss issues related to product architecture including considerations of design analysis, assembly, maintenance, and operation [1, 3] 8. Expose students to best practices in detailed design, including how to conduct and prepare engineering calculations (drawing from a variety of disciplines learned during the course of their education), how to prepare design and manufacturing drawings, and how to pull together a complete design package. [1, 3, 5] 9. Present a variety of standards and how they are generated and incorporated in the design process, how to prepare a Design Criteria Document (DCD). Discuss ethics in the context of design and engineering practice.[6]
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Ability to function in a team environment, taking managements responsibilities when needed, and supporting the team effort when required. Be able to productively participate in technical meetings [3, 15] 2. Capable of eliciting customer needs, and translating these into an engineering specification [1, 2, 5] 3. Able to be prepare a project plan: work breakdown structure, design packages, and schedule, and organize the team for maximum performance [4] 4. Ability to prepare a Design Criteria Document, including identification of all applicable standards [9] 5. Demonstrate ability to conduct the necessary research and engage in creative design so as to generate multiple concepts to fulfill the required functionality. Be able to downselect to a best concept thus arriving to a desired product architecture [6, 7] 6. Ability to produce engineering calculations in support of the design [8] 7. Ability to generate design and manufacturing drawings to describe the system [8] 8. To conduct a manufacturability review for simple or moderately complex systems, calculate an assembly efficiency index. Be able to manufacture parts and assemble system or prototype for the product under consideration [10, 14] 9. To estimate system reliability from individual component reliability data [11] 10. Able to identify design trade-offs and determine optimization technique or decision rule to determine the best option [12] 11. Able to conduct economic analyses in support of design or purchase decisions (e.g., lease-buy, life-cycle cost analysis, etc.) [13] 12. Capability to produce high-quality written documents [15] 13. Capability to be effective presenters [15] 14. Demonstrate capability to operate under sometimes shifting requirements and under severe time pressure [2, 4, 16] 15. Capability to be effective team members and managers, in summary, to demonstrate they are ready to transition to industry and be impact players [3, 16]

DEPARTMENT: MECHANICAL ENGINEERING	
COURSE #: EML 4552, 4 credits http://www.eng.fsu.edu/~luongo/design/	**COURSE TITLE**: Engineering Design Systems II
TYPE COURSE: Required	**TERMS OFFERED:** Spring
CATALOG DESCRIPTION: The second part of the engineering design systems course. The material covered is a continuation of topics in the first part and the completion of a student designed product.	**PREREQUISITES**: EML 4551, Engineering Design Systems I (which must be taken in the Fall immediately preceding)
AREA COORDINATOR: Dr. Cesar Luongo **RESPONSIBLE FACULTY:** Dr. Cesar Luongo **INSTRUCTOR OF RECORD:** Dr. Cesar Luongo **DATE OF PREPARATION:** 5/22/01(Luongo)	**CLASS SCHEDULE:** Twice weekly for 1 hr. and 15 min. **LABORATORY SCHEDULE:** Once weekly for 2 hrs. and 45 min.
TEXTBOOKS/REQUIRED MATERIAL: **Required:** • Barry Hyman, "Fundamentals of Engineering Design", Prentice Hall • Karl A. Smith, "Project Management and Teamwork", McGraw-Hill • William Pfeiffer, "Pocket Guide to Technical Writing", Prentice Hall • W. Strunk Jr. and E.B. White, "Elements of Style", Allyn & Bacon	**SCIENCE/DESIGN (%):** 0 / 100 **CONTRIBUTION TO MEETING THE PROFESSIONAL COMPONENT:** 100% engineering design, culmination into a major design experience with all engineering standards and constraints
COURSE TOPICS: 1. Technical Writing and Communications 2. Design for Manufacturing 3. Probabilistic Considerations in Design 4. Engineering Economics 5. Optimum Design 6. Decision Making	**ASSESSMENT TOOLS:** **1.** Written Deliverables: **2.** Oral Presentations: 3. Tests: 4. Additionally, the students must complete periodic self and team evaluation forms to assess the degree of teamwork achieved by the group. Faculty or industrial sponsors of the projects also fill out evaluation forms at the end of each semester which are used as one more input in the assignment of grades
COURSE OBJECTIVES*	(Numbers shown in brackets are links to program outcomes) 1. Present the most common techniques to evaluate manufacturing and assembly efficiency of a design (Boothroyd-Dewhurst method), and ways to improve manufacturability of the product (DFMA). Teach basic statistical concepts and how they apply to determination of tolerances in parts and finished products, present traditional tolerancing techniques as well as more modern approaches (e.g., Taguchi method). [10, 11] 2. Expose students to other applications of statistical analysis in design: system availability and reliability. Teach basic concepts of reliability analysis, fault tree analysis, and failure mode effects and cause analysis (FMECA) [11] 3. Introduction to optimization theory and its application to design. Linear programming, dynamic programming, Lagrange multipliers, non-linear search methods, etc. Introduction to decision theory (decision under uncertainty, decision trees, etc.) [1] 4. Expose students to economic analysis in engineering, applications to product design, project

	funding, and investment. Teach methodology to employ compound interest and net present value analysis to evaluate design and purchasing options. Application to life-cycle cost analysis. Present variations and issues of economic analysis, such as different life expectancies, inflation and escalating operational costs, etc. Lease vs. but analysis, implications of the macro-economy on project and product economic viability.[8] 5. Teams must complete implementation and testing of a working model or prototype of the system they designed (product delivery) [2] 6. Impress on the students the importance of technical communications as permeating every aspect of the design process as well as every aspect of an engineer's career. Cover techniques for effective writing and conduct specialized session for writing different types of documents: letters and memos, e-mails, resumes, proposals, feasibility studies, specifications, calculations, user manuals, web pages, final reports, etc. Coach students (through in-class sessions and design reviews) to become effective presenters, teach techniques to conduct effective technical and business meetings. [7] 7. Through teamwork and project flow, encourage students to become effective time managers and to develop the aggressive and winning attitude needed to succeed in the professional world [4, 5, 9]
COURSE OUTCOMES*	(Numbers shown in brackets are links to course objectives listed above) 1. Ability to function in a team environment, taking managements responsibilities when needed, and supporting the team effort when required. Be able to productively participate in technical meetings [3, 15] 2. Capable of eliciting customer needs, and translating these into an engineering specification [1, 2, 5] 3. Able to be prepare a project plan: work breakdown structure, design packages, and schedule, and organize the team for maximum performance [4] 4. Ability to prepare a Design Criteria Document, including identification of all applicable standards [9] 5. Demonstrate ability to conduct the necessary research and engage in creative design so as to generate multiple concepts to fulfill the required functionality. Be able to downselect to a best concept thus arriving to a desired product architecture [6, 7] 6. Ability to produce engineering calculations in support of the design [8] 7. Ability to generate design and manufacturing drawings to describe the system [8] 8. To conduct a manufacturability review for simple or moderately complex systems, calculate an assembly efficiency index. Be able to manufacture parts and assemble system or prototype for the product under consideration [10, 14] 9. To estimate system reliability from individual component reliability data [11] 10. Able to identify design trade-offs and determine optimization technique or decision rule to determine the best option [12] 11. Able to conduct economic analyses in support of design or purchase decisions (e.g., lease-buy, life-cycle cost analysis, etc.) [13] 12. Capability to produce high-quality written documents [15] 13. Capability to be effective presenters [15] 14. Demonstrate capability to operate under sometimes shifting requirements and under severe time pressure [2, 4, 16] 15. Capability to be effective team members and managers, in summary, to demonstrate they are ready to transition to industry and be impact players [3, 16]