Department, number and title of course: Mechanical Engineering, ME001A – Introduction to Mechanical Engineering.

Required/Elective course: Required Course

Catalog description: Laboratory, 3 hours. An introduction to mechanical engineering as a field of study and as a profession. Orients students to the curriculum, faculty, and resources in the Department of Mechanical Engineering.

Prerequisite(s): None

Textbook(s) and/or other required material: W.C. Oakes, L.L. Leone and C.J. Gunn, *Engineering Your Future – A Short Course*, Great Lakes Press, Inc., 2003. ISBN 1-881018-51-2.

Course objectives:

1. To increase the students' understanding of mechanical engineering as a field of study and as a profession.
2. To motivate the student through an increased awareness of the value of an education and the opportunities and rewards of a career in mechanical engineering.
3. To increase the students understanding of engineering design and the role of mathematics and basic sciences in engineering.
4. To develop the students understanding of the professional and ethical responsibilities of engineers.
5. To make students aware of the purpose and importance of engineering societies and the code of ethics that protects the integrity of the profession.
6. To develop the students problem solving skills, specifically the ability to perform and present engineering calculations.
7. To enhance the student's academic skills including time management, study techniques and examination strategies.
8. To develop the student's ability to work effectively as a team member.
9. To develop a peer network that will enhance the student's academic experience.
10. To orientate the student to the faculty, environment, and resources of the ME Department, the College of Engineering and the University.

Topics covered: An introduction to the field of mechanical engineering, the curriculum, faculty and resources in the Mechanical Engineering Department and the College of Engineering at UCR. Engineering design, analysis and ethics are introduced with an emphasis on the role of mathematics and basic sciences in engineering.

Class/laboratory schedule: Laboratory, 3 hours.

Assessment methods: Lab assignments (60%), quizzes (20%), homework assignments (20%). This course is graded "Satisfactory" (S) or "No Credit" (NC). A total score of 70% or better is required to receive a passing grade.

Contribution of course to meeting the professional component: This course serves as an introduction to the engineering profession, engineering design, analysis and ethics. Through various lab activities and projects, the role of mathematics and basic sciences in engineering and in the engineering design process is demonstrated.

Relationship of course to program outcomes: The contribution of ME001A to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
To increase the students understanding of mechanical engineering as a field of study and as a profession.						2		2	1		
To motivate the student through an increased awareness of the value of an education and the opportunities and rewards of a career in mechanical engineering.								1	2		
To increase the students understanding of engineering design and the role of mathematics and basic sciences in engineering.	1		3		2						
To develop the students understanding of the professional and ethical responsibilities of engineers.						3		1			
To make students aware of the purpose and importance of engineering societies and the code of ethics that protects the integrity of the profession.						3		1	2		
To develop the students problem solving skills, specifically the ability to perform and present engineering calculations.	2		1		3						2
To enhance the student's academic skills including time management, study techniques and examination strategies.									2		
To develop the student's ability to work effectively as a team member.			1	3			3				
To develop a peer network that will enhance the student's academic experience.							2		1		
To orientate the student to the faculty, environment, and resources of the ME Department, the College of Engineering and the University.											

Prepared by and date of preparation: J. Sawyer, April 7, 2006

Department, number and title of course: Mechanical Engineering, ME001B – Introduction to Mechanical Engineering.

Required/Elective course: Required Course

Catalog description: Laboratory, 3 hours. Prerequisite(s): none. An introduction to mechanical-engineering and computer-aided design. Students design, analyze, prototype, and test a mechanical device using modern methods.

Prerequisite(s): None

Textbook(s) and/or other required material: None

Course objectives: Upon completing of this course, students will have gained:

1. An introductory understanding of the process of engineering design.
2. An understanding of the role of analysis in engineering design.
3. Exposure to current technologies and modern design tools used in mechanical engineering.
4. Practical introductory experience in using solid-modeling and analysis software.
5. An understanding of the importance of design verification through prototyping and testing procedures.
6. The ability to measure components using basic tools of precision metrology.
7. Knowledge of various rapid prototyping processes.
8. Team skills through the practical experience of working in a design team.

Topics covered: Mechanical engineering design, solid modeling of parts and assemblies using SolidWorks, strength based design and analysis, metrology, rapid prototyping and design verification.

Class/laboratory schedule: Laboratory, 3 hours.

Assessment methods: Lab assignments (80%), homework assignments (20%). This course is graded "Satisfactory" (S) or "No Credit" (NC). A total score of 70% or better is required to receive a passing grade.

Contribution of course to meeting the professional component: This course serves as an introduction to engineering design and the design process using modern design tools. The opportunity to develop team skills is provided as the students complete several team projects that involve the design of mechanical devices.

Relationship of course to program outcomes: The contribution of ME001B to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
To increase the students understanding of the engineering design process.	1		3		2	1	2		1	1	2
To introduce students to current technologies and modern design tools.	1		3				2		2	1	3
To develop the student's ability to model parts using 3D solid modeling CAD software.	3		3				2				3
To develop the student's ability to model assemblies using 3D solid modeling CAD software.	3		3				1				3
To increase the students understanding of various prototyping and manufacturing processes.	1		3				1				3
To develop the student's understanding of metrology and the ability to measure components.	2	2	3								3
To develop the student's understanding of design verification and testing.	1	3	3		1	2					2
To develop the student's ability to work effectively as a team member.			2	2			2				2

Prepared by and date of preparation: J. Sawyer, April 7, 2006

Department, number and title of course: Mechanical Engineering, ME001C – Introduction to Mechanical Engineering.

Required/Elective course: Required Course

Catalog description: Laboratory, 3 hours. An introduction to engineering problem solving and computations using MATLAB. Topics include the MATLAB environment, functions, scalar and matrix computations, graphics, linear algebra, and symbolic mathematical operations with applications in mechanical engineering.

Prerequisite(s): MATH 009A or MATH 09HA

Textbook(s) and/or other required material: Amos Gilat, *MATLAB – An Introduction With Applications*, 2nd Ed., John Wiley & Sons, 2005, ISBN 0-471-69420-7.

Course objectives: Upon completing of this course, students will have gained:

1. An understanding of a process for solving engineering problems.
2. The ability to navigate the Excel environment.
3. The ability to enter data and create formulas in an Excel worksheet.
4. The ability to build different types of charts in Excel.
5. An understanding of the interactive environment of MATLAB.
6. The ability to use MATLAB to perform scalar and vector operations.
7. The ability to apply a variety of the mathematical functions available in MATLAB.
8. The ability to plot data and functions, and format graphs in MATLAB.
9. The ability to perform matrix operations and solve simultaneous equations using MATLAB.
10. The ability to perform symbolic math operations using MATLAB.

Topics covered: General problem solving methods, Excel basics, an introduction to the MATLAB environment and functions, scalar and matrix computations, graphics, and symbolic math operations.

Class/laboratory schedule: Laboratory, 3 hours.

Assessment methods: Lab assignments (80%), quizzes (10%), project (10%).

Contribution of course to meeting the professional component: This course serves as an introduction to engineering problem solving and computations using contemporary tools used in the engineering profession.. It provides the foundation in the curriculum for computational methods and software used in subsequent courses.

Relationship of course to program outcomes: The contribution of ME001C to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Create formulas in Excel worksheet	2	1	2	1	2			1	1		3
Create different types of charts using Excel.	1	2		1	1		2	1			2
Perform scalar operations using MATLAB	2	1	1	1	2			1	1		2
Create arrays and perform array operations using MATLAB	2	1	2	1	2			1	1		3
Creating and run script files using MATLAB.	2	1	1	1	1				2		3
Learn two-dimensional plotting with MATLAB	2	2		1	1		2	1			3
Learn how to use polynomials in MATLAB.	1	1	1	1	2			1			1
Learn how to do curve fitting with MATLAB	2	2	2	1	2		2	1	1		2
Learn three-dimensional plotting with MATLAB	2	2		1	1		2	1			3
Perform symbolic operations using MATLAB	2	2	1	1	2				2	1	3

Prepared by and date of preparation: J. Sawyer, April 7, 2006

Department, number and title of course: Mechanical Engineering, ME009 – Engineering Graphics and Design

Required/Elective course: Required Course

Catalog description: Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): none. Graphical concepts and projective geometry relating to spatial visualization and communication in design, including technical sketching, instrument drawing, and computer-aided drafting and design.

Prerequisite(s): None

Textbook(s) and/or other required material: *Engineering Design Graphics*, James H. Earle, 11th Edition, Prentice-Hall, 2004; **ISBN : 0-13-142573-0**

Course objectives: Upon completion of this course, students should be able to:
1. Engineer and Design a product
2. Communicate the design through written reports and 2-D and 3-D drawings
3. Analyze, design and draw gears
4. Design a cam-follower systems for a given application
5. Understand thread terminology and draw threaded fasteners
6. Understand welding symbols
7. Do spatial analysis

Topics covered: Free hand lettering and technical sketching, 2-D orthographic and 3-D isometric sketching, Dimensioning and Tolerancing, Threaded fasteners, Welding, Gears and Cams, Design Feasibility Study, Descriptive Geometry and Spatial Analysis, Design Presentation, and 3-D geometric modeling techniques.

Class/laboratory schedule: Lecture, 3 hours; laboratory, 3 hours.

Assessment methods: Homework (10%), Design Project and Laboratory assignments (20%), two midterm exams (35%), final examination (35%). Final letter grade will be curved

Contribution of course to meeting the professional component:
This course teaches the major concepts of engineering graphics and design including; descriptive geometry, visualization and communication in design, technical sketching, 2-D and 3-D geometric modeling, dimensioning and tolerancing, and the design of threaded fasteners, gears and cams. Another objective of the course is to familiarize students with all the stages of a typical industrial design process. The course also involves a computer design project in which students use SOLIDWORKS to complete a design from start to the final product.

Relationship of course to program outcomes: The contribution of ME009 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Learn the design process and the steps involved in the process	1	2	3	1	1	1	2	1	2	2	1
Learn the features of the design implementation stage including free-hand lettering and sketching		1	1				2				2
Learn how to communicate system and product design through 2-D orthographic and 3-D pictorials	1	2	1		1		2			1	2
Apply the rules for dimensioning and tolerancing	1	1	1		1		2	1		1	2
Learn the nomenclature, pictorial representation, and complete designation of threaded fasteners		1	2		1		2	1		1	1
Learn the various types of welding processes, types of weld joints, and the application of weld symbols		1	2		1		2	1		1	1
Design and analysis of different types of gears, and to design displacement diagrams using cam-follower systems		1	2		1		2	1		1	1
The complete design process, the design feasibility study, and development of the decision matrix	1	2	3	1	1	1	2	1	1	2	2
Descriptive geometry and spatial analysis	1	2	2		2		2				2
Design presentation and 3-D geometric modeling techniques	1	3	2		2		2	1	1	2	2

Prepared by and date of preparation: Ram Hariharan, April 5, 2006

Department, number and title of course: Mechanical Engineering, ME010 - Statics

Required/Elective course: Required Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Equilibrium of coplanar force systems; analysis of frames and trusses; noncoplanar force systems; friction; distributed loads.

Prerequisite(s): PHYS 040B, MATH 009C

Textbook(s) and/or other required material: J.L. Meriam and L.G. Kraige, *Engineering Mechanics - Statics*, 6th Ed., John Wiley & Sons, Inc., 2002. ISBN 0-471-73932-4.

Course objectives: Upon completion of this course, students should be able to:

1. Replace a given general system of forces with a resultant force and couple.
2. Construct two- and three-dimensional free body diagrams.
3. Apply the principles of equilibrium to determine the reactions at supports for two and three-dimensional problems.
4. Determine the forces acting in plane trusses, frames and machine components.
5. Determine the location of the centroid of lines, areas and volumes in the analysis of distributed forces.
6. Formulate and solve static problems involving dry frictional forces.

Topics covered: This course introduces students to the fundamental principles of mechanics and static equilibrium analysis of bodies under the action of forces. Topics covered include force systems, rigid body static equilibrium, the analysis of structures and machines, distributed forces and problems involving dry friction.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Problem sets (10%), quizzes (10%), design project (10%), two midterm exams (20% each), final exam (30%).

Contribution of course to meeting the professional component:
This course addresses mechanical engineering science principles relevant to engineering mechanics, it includes application of fundamentals in the analysis of structures and machines, and it enables engineering practice through an open-ended design project that requires application of course topics in the design of a structure or machine. The project includes a written design report.

Relationship of course to program outcomes: The contribution of ME010 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Express a force as a vector given its magnitude and information about its line of action.	3				1						2
Resolve a force vector into components along given directions and express the vector in terms of unit vectors along a set of axes.	3				1						2
Compute the magnitude of a moment using the moment-arm rule, compute a moment vector using the vector cross product, and use the triple scalar product to compute the moment about a given axis through a given point.	3				1						2
Compute the magnitude, direction and line of action of a resultant force or the moment of a result couple for a given system of coplanar forces.	3				1						2
Replace a given general system of forces by a resultant force and couple.	3				1						2
Construct two and three-dimensional free-body diagrams.	3				3						3
Apply the principles of equilibrium to determine the reactions at the supports of loaded structures.	3				3						3
Apply the principles of equilibrium to determine the forces acting in plane trusses, frames and machine components.	3		3		3	2					3
Determine the location of the centroid of lines, areas and volumes in the analysis of distributed forces.	3				1						2
Formulate and solve static problems involving dry frictional forces.	3				3						3

Prepared by and date of preparation: J. Sawyer, April 13, 2006

Department, number and title of course: Mechanical Engineering, ME 18 Introduction to Engineering Computation

Required/Elective course: Required Course, 2 units

Catalog description: Lecture, 1 hour; laboratory, 3 hours. Prerequisite(s): ME 001C. An introduction to the use of MATLAB in engineering computation. Covers scripts and functions, programming, input/output, two- and three- dimensional graphics, and elementary numerical analysis.

Prerequisite(s): ME 1C

Textbook(s) and/or other required material: MATLAB An Introduction with Applications by Amos Gilat, John Wiley, 2003. Mastering MATLAB 7 by Duane Hanselman and Bruce Littlefield, Pearson Printice Hall

Course objectives: The objective of this class is to help students master MATLAB programming so that they can use it effectively to do engineering modeling and analysis.

Topics covered:

1. **Introduction to Programming using MATLAB**
2. **Script Files**
3. **Functions and Function Files**
4. **Data Type and Format**
5. **Input and Output**
6. **Mathematical Operations**
7. **Debugging and Profiling**
8. **Structured Programming**
9. **Plotting**
10. **Elementary Engineering Analysis**

Class/laboratory schedule:

M 11:10-1:00PM	SPTHW 1037
W 8:10-11:00AM	BRNHL 207

Assessment methods:

8 assignments	40%
1 midterm	20%
1 final exam	40%

Contribution of course to meeting the professional component:
The lecture of this course emphasizes the basic concepts and issues of modern programming. Students learn to master effective programming skills by accomplishing a variety of projects through lab sections.

Relationship of course to program outcomes: The contribution of ME 18 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Objective 1 **programming using MATLAB**	**2**		**3**		**3**	**1**		**1**	**2**	**1**	**1**
Objective 2 **script M-files and functions**			**3**		**3**						
Objective 3 **data type and format**	**1**										
Objective 4 **mathematical operations**	**2**										
Objective 5 **I/O management**										**2**	**1**
Objective 6 **debuging and profiling**		**2**	**2**								
Objective 7 **Plotting**										**2**	
Objective 8 **elementary numerical analysis**	**3**				**3**						

Prepared by and date of preparation: Guanshui Xu, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME100B – Thermodynamics

Required/Elective course: Technical Elective Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Topics include additional thermodynamic concepts and applications relevant to mechanical engineering. Topics include the second law of thermodynamics, entropy function, entropy production, analysis of cycles, vapor power systems, gas power systems, refrigeration and heat pump systems, equations of state, thermodynamic property relations, ideal gas mixtures and psychrometrics, multicomponent systems, combustion and reacting mixtures.

Prerequisite(s): Prerequisite(s): ME 100A or consent of instructor.

Textbook(s) and/or other required material: M. J. Moran and H. N. Shapiro, *Fundamentals of Engineering Thermodynamics*, Wiley, latest edition, also supplemental references and notes.

Course objectives: Upon completion of this course, students should be able to:
1. Demonstrate vapor power systems
2. Demonstrate gas power systems
3. Describe internal combustion engines and gas turbine power plants
4. Utilize vapor-compression refrigeration systems
5. Display cascade and multistage vapor-compression systems
6. Demonstrate heat pump systems and gas refrigeration systems
7. Develop general property relationships
8. Evaluate changes in entropy, internal energy, and enthalpy for real gases
9. Define ideal gas mixtures and demonstrate general considerations related to mixtures
10. Describe psychometric applications

Topics covered: Vapor Power Systems, Gas Power Systems, Internal Combustion Engines/Gas Turbine Power Plants, Refrigeration and Heat Pump Systems, Vapor-Compression Refrigeration Systems, Cascade and Multistage Vapor-Compression Systems, Heat Pump Systems/Gas Refrigeration Systems, Thermodynamic Relations, Ideal Gas Mixtures and Psychrometrics, Reacting Mixtures and Preliminary Aspects of Combustion, Conservation of Energy-Reacting Systems, Determining the Adiabatic Flame Temperature

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: The course grade will be based on two exams during the quarter (15% each), Quizzes (15%) a final exam (30%), Project(s) (10%) and selected graded homework problems (15%).

Contribution of course to meeting the professional component:
This course addresses mechanical engineering concepts relevant to thermal sciences, includes application of fundamentals of thermodynamics, it enables engineering practice through open-ended team project that requires application of course topics.

Relationship of course to program outcomes: The contribution of ME100B to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Demonstrate vapor power systems	1	1	3	2	3	1	3	3	2	2	3
Demonstrate gas power systems	1	1	3	2	3	1	3	3	2	2	3
Describe internal combustion engines and gas turbine power plants	1	1	3	2	3	1	3	3	2	2	3
Utilize vapor-compression refrigeration systems	1	1	3	2	3	1	3	3	2	2	3
Display cascade and multistage vapor-compression systems	1	1	3	2	3	1	3	3	2	2	3
Demonstrate heat pump systems and gas refrigeration systems	1	1	2	2	3	1	3	3	2	2	3
Develop general property relationships	3	/	/	2	3	1	3	1	2	1	3
Evaluate changes in entropy, internal energy, and enthalpy for real gases	1	/	2	2	3	1	3	1	2	2	3
Define ideal gas mixtures and demonstrate general considerations related to mixtures	1	/	2	2	3	1	3	1	2	1	3
Describe psychometric applications	1	2	3	2	3	1	3	3	2	1	2

Prepared by and date of preparation: K. Vafai, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME103– Dynamics

Required/Elective course: Required Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 010A, ME 010, ME 018. Topics include vector representation of kinematics and kinetics of particles; Newton's laws of motion; force-mass-acceleration, work-energy, and impulse-momentum methods; kinetics of systems of particles; and kinematics and kinetics of rigid bodies.

Prerequisite(s): MATH 010A, ME 010, ME 018

Textbook(s) and/or other required material: *Engineering Mechanics: Dynamics, Tenth Edition,* R. C. Hibbeler, Prentice-Hall, 2004.

Course objectives: Upon completion of this course, students should be able to:

1. Choose an appropriate coordinate system and analyze the motion – position, velocity, and acceleration – of a particle.
2. Choose an appropriate coordinate system and analyze the motion – position, velocity, and acceleration – of the parts (rigid bodies) of a device.
3. Derive the equations of motion for a system using the direct momentum method (Newton's Second Law).
4. Derive the equations of motion for a system using the work-energy method.
5. Derive the equations of motion for a system using the impulse-momentum method.
6. Use a variety of graphical representations, including free-body diagrams, kinetic diagrams, and vector polygons, to facilitate the solution of dynamics problems.

Topics covered: Planar kinematics of particles: rectilinear, curvilinear, dependent, and relative motion. Planar kinematics of rigid bodies: fixed axis rotation, curvilinear translation, general planar motion, relative motion. Kinetics of particles and rigid bodies in the plane: direct momentum, work-energy, and impulse momentum approaches. Emphasis on diagrammatic representations: free-body diagrams, kinetic diagrams, and vector polygons for relative motion analysis. The application of dynamics principles to the design of mechanical systems.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Problem sets (20%**),** two midterm exams (20% each)**,** group design project with written report (10%), final exam (30%). Final letter grade is curved.

Contribution of course to meeting the professional component:
This course addresses mechanical engineering science principles related to rigid body mechanics. It includes the application of the fundamentals dynamics to the design of mechanical systems. It enables engineering practice through an open-ended, team-based, design project that requires application of course topics. The project requires the use of modern engineering tools to produce simulations. The project include a written report.

Relationship of course to program outcomes: The contribution of ME 103 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Kinematics of Particles: You will be able choose an appropriate coordinate system and analyze the motion – position, velocity, and acceleration – of a particle.	3		2	1	3		1		1		2
Kinematics of Rigid Bodies: You will be able choose an appropriate coordinate system and analyze the motion – position, velocity, and acceleration – of the parts of a device.	3		2	1	3		1		1		2
Direct Momentum Method: You will be able to derive the equations of motion for a system using the direct momentum method.	3		2	1	3		1		1		2
Work-Energy Method: You will be able to derive the equations of motion for a system using the work-energy method.	3		2	1	3		1		1		2
Impulse Momentum Method: You will be able to derive the equations of motion for a system using the impulse-momentum method.	3		2	1	3		1		1		2
Graphical Techniques: As part of objectives 1 – 3, you will learn how to use a variety of graphical representations that greatly facilitate the solution of dynamics problems including free-body diagrams, kinetic diagrams, and vector polygons. (Assessment of this objective is included with assessment of objectives 1 - 3.	3		2	1	3		1		1		2

Prepared by and date of preparation: T. Stahovich, April 8, 2006

Department, number and title of course: Mechanical Engineering, ME110 – Mechanics of Materials

Required/Elective course: Technical Elective Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 046, ME 010. Topics include mechanics of deformable bodies subjected to axial, torsional, shearing, and bending loads; combined stresses; columns; energy design; and their applications to the design of structures.

Prerequisite(s): CHEM 001A or CHEM 01HA; PHYS 040B (may be taken concurrently)

Textbook(s) and/or other required material: Mechanics of Materials, 6th Edition, J.M. Gere, Brooks/Cole, 2004

Course objectives: Upon completion of this course, students should be able to understand and apply the following concepts:

1. Know the concepts of normal/shear stresses and normal/shear strains
2. Know the relationships between moments, shear forces, deflections and slopes
3. Analysis of structural components subjected to axial loads
4. Analysis of structural components subjected to torsional loads
5. Analysis of structural components subjected to bending loads
6. Analysis of statically determinate and indeterminate structures

Topics covered: Tension, compression and shear loading of materials, elastic and plastic deformation and uniaxial stress-strain curve, analysis of axially loaded members, torsion in shafts and design, shear forces and bending moments in beams, computation of stresses in beams, analysis of statically indeterminate structures.

Class/laboratory schedule: Lecture, 3 hours; discussion, 1 hour.

Assessment methods: Homework assignments (25%), midterm examinations (25% each) and a final examination (25%).

Contribution of course to meeting the professional component:
This course addresses mechanical engineering science principles relevant to analysis of structures subjected to various laods for engineering design. It enables engineering practice through homework assignments and examinations including problems related to design of components subjected to axial, torsional and bending loads and the computation of stresses in these structures.

Relationship of course to program outcomes: The contribution of ME156 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table.

ME 110 - Mechanics of Materials

Objective-Outcome Matrix

Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially												
	Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Objective 1	Know the concepts of normal/shear stresses and normal/shear strains	1				2			1			
Objective 2	Know the relationships between moments, shear forces, deflections and slopes	1				2	3		1			
Objective 3	Analysis of structural components subjected to axial loads	2		2		2		2	1	1		1
Objective 4	Analysis of structural components subjected to torsional loads	2		2	1	3	3	3	1	1		1
Objective 5	Analysis of structural components subjected to bending loads	2		2		3		3	1	1		1
Objective 6	Analysis of statically determinate and indeterminate structures	3		2		3		2	1	1	1	1

Prepared by and date of preparation: C. Ozkan, April 12, 2006

Department, number and title of course: Mechanical Engineering, ME114 – Properties of Engineering Materials

Required/Elective course: Technical Elective Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CHEM 001A or CHEM 01HA; PHYS 040B (may be taken concurrently); upper-division standing. Introduces applications of basic principles of physics and chemistry to the selection and use of engineering materials. Examines the relationship between structure and mechanical and electrical properties of technological materials.

Prerequisite(s): CHEM 001A or CHEM 01HA; PHYS 040B (may be taken concurrently)

Textbook(s) and/or other required material: Materials Science and Engineering: An Introduction, 6th Edition, William D. Callister, Wiley & Sons, New York, 2004.

Course objectives: Upon completion of this course, students should be able to understand and apply the following concepts:

1. The concept of materials science and engineering and materials classification
2. Atomic structure and interatomic bonding
3. Crystal structures and systems
4. Imperfections in solids -- point defects, dislocations, grain boundaries, etc.
5. Diffusion mechanisms and Fick's Laws of diffusion
6. Mechanical properties of materials -- strain, stress, elastic and inelastic deformation, and hardness.
7. Applications and processing of metal alloys
8. Electrical Properties of Materials

Topics covered: Atomic Structure, Bonding Forces and Energies, Crystal Structures, Crystallographic Directions and Planes, Single Crystals and Polycrystalline Materials, Isotropy and Anisotropy, Point Defects, Dislocations, Interfacial Defects, Diffusion Mechanisms in solids, Mechanical Properties of Materials trengthening Mechanisms, Recrystallization and Grain Growth, Structures and Properties of Ceramic Materials, Particle and Fiber Reinforced Composites, Electronic Materials.

Class/laboratory schedule: Lecture, 3 hours; discussion, 1 hour.

Assessment methods: Homework assignments (20%), midterm examinations (25% each) and a final examination (30%).

Contribution of course to meeting the professional component:
This course addresses mechanical engineering science principles relevant to materials properties and selection of materials for engineering design. It enables engineering practice through homework assignments and examinations including research questions on applications of novel materials such as superplastically shaped titanium alloys, thin film diamonds and carbon nanotubes.

Relationship of course to program outcomes: The contribution of ME156 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table.

ME 114: Properties of Engineering Materials

Objective-Outcome Matrix

Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

	Outcome Related Learning Objectives	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7	Outcome 8	Outcome 9	Outcome 10	Outcome 11
Objective 1	The concept of materials science and engineering and materials classification	3	1	1	1	3	1	1	1	1	1	1
Objective 2	Atomic structure and interatomic bonding	3	1	1	1	3	1	1	1	1	1	1
Objective 3	Crystal structures and systems	3	1	1	1	3	1	1	1	1	1	1
Objective 4	Imperfections in solids -- point defects, dislocations, grain boundaries, etc.	3	1	1	1	3	1	1	1	1	1	1
Objective 5	Diffusion mechanisms and Fick's Laws of diffusion	3	1	1	1	3	1	1	1	1	1	1
Objective 6	Mechanical properties of materials -- strain, stress, elastic and inelastic deformation, and hardness.	3	1	3	1	3	1	1	1	1	1	1
Objective 7	Applications and processing of metal alloys	3	1	1	1	3	1	1	1	1	1	1
Objective 8	Electrical Properties of Materials	3	1	3	1	3	1	1	1	1	1	1

Prepared by and date of preparation: C. Ozkan, April 12, 2006

Department, number and title of course: Mechanical Engineering, ME115A – Fluid Mechanics

Required/Elective course: Required Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Introduces principles of fluid mechanics relevant to mechanical engineering. Topics include shear stresses and viscosity, fluid statics, pressure, forces on submerged surfaces, Bernoulli and mechanical energy equation, control volume approach, mass conservation, momentum and energy equations, differential approach, turbulent flow in pipes, lift and drag. Credit is awarded for only one of CHE 114 or ME 115A.

Prerequisite(s): MATH 010A, PHYS 040B, ME 018, or consent of instructor

Textbook(s) and/or other required material: *Fundamentals of Thermal-Fluid Sciences* by Y. A. Cengel, and R. H. Turner, 2nd edition, McGraw-Hill

Course objectives: Upon completion of this course, students should be able to:

1. Distinguish fluids from solids and develop an ability to understand basic fluid properties such as density, viscosity, surface tension, etc.
2. Correctly identify and analyze fluid statics (hydrostatics) problems involving forces and moments on planar and curved surfaces, including concept of centroid, center of pressure, and buoyancy.
3. Identify conditions under which Bernoulli equation may be applied, and correctly apply this principle in problem solving. Demonstrate an understanding of the mechanical energy equation.
4. Apply basic principles of conservation of mass (COM), Newton's second law (NSL), and conservation of energy (COE or I Law of Thermodynamics) to properly identified control mass and control volumes, involving stationary and moving reference frames.
5. Demonstrate some familiarity with differential forms of equations of motion.
6. Carry out calculations involving energy loss in pipe flow, successfully utilizing the Moody diagram.
7. Display an understanding of lift, drag, lift coefficient, and drag coefficient associated with external flow dynamics.

Topics covered: Stresses in fluids, viscosity, fluid hydrostatic, hydrostatic forces on submerged surfaces, stability of floating and submerged objects, Bernoulli equation and its applications, calculation of dynamical forces during interactions of solid bodies and flowing fluid, lift and drag.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Problem sets (10%)**,** two midterm exams (30% each, the lower score will not be taken into account for the final grade)**,** weekly quiz (20%), final exam (40%). Final letter grade will be curved

Contribution of course to meeting the professional component:
This course addresses mechanical engineering science principles relevant to fluid mechanic processes, includes application of fundamentals laws to fluid flows in engineering devices, it enables students to fully comprehend the already introduced fundamental physics laws. The course introduces turbulence, as one of the remaining unsolved problems in physics, pointing students to the need for continuous learning and further research.

Relationship of course to program outcomes: The contribution of ME115A to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Distinguish fluids from solids and develop an ability to understand basic fluid properties such as density, viscosity, surface tension, etc.		1			3						
Correctly identify and analyze fluid statics (hydrostatics) problems involving forces and moments on planar and curved surfaces, including concept of centroid, center of pressure, and buoyancy.	3				3						2
Identify conditions under which Bernoulli equation may be applied, and correctly apply this principle in problem solving. Demonstrate an understanding of the mechanical energy equation.	3				3						2
Apply basic principles of conservation of mass (COM), Newton's second law (NSL), and conservation of energy (COE or I Law of Thermodynamics) to properly identified control mass and control volumes, involving stationary and moving reference frames.		2			3						2
Carry out calculations involving energy loss in pipe flow, successfully utilizing the Moody diagram.		2	1		3						
Display an understanding of lift, drag, lift coefficient, and drag coefficient associated with external flow dynamics.	3		1	1	3				1		1
Demonstrate growing professionalism, integrity, and respect guided by ethical behavior.				1		3	1				1

Prepared by and date of preparation: M. Princevac, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME116A – Heat Transfer

Required/Elective course: Required Course

Catalog description: Lecture 3 hours. Discussion 1 hour. Introduces analysis of steady and transient heat conduction, fin and heat generating systems, two dimensional conduction, internal and external forced convection, natural convection, radiation heat transfer, and preliminary study of heat exchangers and mass transfer.

Prerequisite(s): ME 100A, ME 115A (it can be taken concurrently), or consent of instructor

Textbook(s) and/or other required material: *Fundamentals of Thermal-Fluid Sciences* by Y. A. Cengel, and R. H. Turner, 2nd or latest edition, McGraw-Hill, also supplemental notes and references.

Course objectives: Upon completion of this course, students should be able to:
1. Demonstrate comprehensive derivation of the conduction equation and its ramifications
2. Analyze one dimensional heat generating systems
3. Illustrate enhanced cooling extended surface assemblies
4. Display two-dimensional heat conduction
5. Illustrate the numerical simulation of two dimensional steady state and one dimensional transient conduction problems utilizing finite difference formulation
6. Demonstrate the transient heat transfer and lumped capacitance method as well as the spatial and transient analysis
7. Demonstrate laminar and turbulent external forced convection over a plane external boundary and other body shapes
8. Establish laminar and turbulent internal forced convection with uniform wall temperature and uniform wall heat flux
9. Exhibit the general aspects of radiation interaction: processes for black and gray bodies and radiation properties such as emissivity, absorptivity, reflectivity and transmissivity
10. Learn the engineering use of the view factors and studying radiation exchange between black or diffuse-gray surfaces

Topics covered: steady and transient heat conduction, fin and heat generating systems, two dimensional conduction, internal and external forced convection, natural convection, radiation heat transfer, and preliminary study of heat exchangers and mass transfer.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Homework sets evaluated by quizzes (20%), two midterm exams (20% each), group project (10%), final examination (25%), class participation (5%). Final letter grade will be curved

Contribution of course to meeting the professional component:
The motivation for this course is to expose the undergraduate mechanical engineering students to problems associated with heat transfer and its applications. Many practical engineering problems involve a substantial heat transfer component. Such applications include energy production and conservation, design and analysis of various engineering systems, generation of electrical power, engine components, boilers, condensers, turbines, electronic cooling, biological and environmental

applications, manufacturing applications, nuclear energy production, combustion, geothermal operations, heat exchanger performance and propulsion systems to name a few.
These course objectives are in compliance with Educational Objectives of the Department of Mechanical Engineering for the degree Bachelor of Science in Mechanical Engineering.

Relationship of course to program outcomes: The contribution of ME116A to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Demonstrate comprehensive derivation of the conduction equation and its ramifications	3				3					1	1
Analyze one dimensional heat generating systems	3				3					1	1
Illustrate enhanced cooling extended surface assemblies	3				3					2	1
Display two-dimensional heat conduction	3				3					2	1
Illustrate the numerical simulation of two dimensional steady state and one dimensional transient conduction problems utilizing finite difference formulation	3				3					1	1
Demonstrate the transient heat transfer and lumped capacitance method as well as the spatial and transient analysis	3				3					1	1
Demonstrate laminar and turbulent external forced convection over a plane external boundary and other body shapes	3				3					1	1
Establish laminar and turbulent internal forced convection with uniform wall temperature and uniform wall heat flux	3				3					2	1
Exhibit the general aspects of radiation interaction: processes for black and gray bodies and radiation properties such as emissivity, absorptivity, reflectivity and transmissivity	3				3					1	1
Learn the engineering use of the view factors and studying radiation exchange between black or diffuse-gray surfaces	3				3					1	1

Prepared by and date of preparation: G. Aguilar, April 5, 2006

Department, number and title of course: Mechanical Engineering, ME116B – Heat Transfer

Required/Elective course: Technical Elective Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Covers analytical and numerical methods in heat transfer and fluid mechanics. Topics include heat conduction and convection, gaseous radiation, boiling and condensation, general aspects of phase change, mass transfer principles, multimode heat transfer and the simulation of thermal fields, and the heat transfer process

Prerequisite(s): ME 116A or consent of instructor.

Textbook(s) and/or other required material: F. P. Incropera and D. P. Dewitt, *Fundamentals of Heat and Mass Transfer*, Wiley, Fourth or latest edition, also supplemental notes and references

Course objectives: Upon completion of this course, students should be able to:

1. Demonstrate derivation of the steady conduction equation for extended surfaces with internal heat generation or relative motion
2. Describe general aspects of Phase Change and analyze time-dependent heat conduction equation
3. Utilize numerical investigation of two-dimensional heat conduction
4. Display laminar and turbulent external forced convection over different body shapes
5. Demonstrate general aspects of Film Condensation and analysis laminar and turbulent internal forced convection through a duct with uniform wall temperature and uniform wall heat flux
6. Investigate different flow regimes for film condensation
7. Utilize general aspects of boiling and investigate various boiling regimes and natural convection
8. Display advanced aspects of phase change
9. Apply radiation exchange between surfaces (black and diffuse-gray surfaces) and display practical applications of view factors
10. Investigate the analogy between mass transfer and heat transfer, mass diffusion through a stationery medium, and mass transfer by convection

Topics covered:
Derivation of the steady conduction equation for extended surfaces with internal heat generation or relative motion, General aspects of Phase Change and analysis of time-dependent heat conduction equation, Numerical investigation of two-dimensional heat conduction, Analysis of laminar and turbulent external forced convection over a plane wall and other body shapes, General aspects of Film Condensation and analysis of laminar and turbulent internal forced convection through a duct with uniform wall temperature and uniform wall heat flux, Investigating different flow regimes for film condensation, General aspects of boiling and investigating various boiling regimes and natural convection, Advanced aspects of phase change, Study radiation exchange between surfaces for engineering applications and practical applications of view factors, Investigating the analogy between mass transfer and heat transfer, mass diffusion through a stationery medium, and mass transfer by convection

Class/laboratory schedule: Lecture, 3 hours; discussion, 1 hour

Assessment methods: The course grade will be based on two midterms (25%), mini projects (15%); homeworks (15%), final project (20%) oral presentation (10%) and a Final (15%)

Contribution of course to meeting the professional component:
This course addresses mechanical engineering concepts relevant to thermal sciences, includes application of fundamentals of heat and mass transfer, it enables engineering practice through open-ended team project that requires application of course topics.

Relationship of course to program outcomes: The contribution of ME116B to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix

Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Demonstrate derivation of the steady conduction equation for extended surfaces with internal heat generation or relative motion	2	1	2		2		1	1	1	1	1
Describe general aspects of Phase Change and analyze time-dependent heat conduction equation	2	1	2		2			1	1		
Utilize numerical investigation of two-dimensional heat conduction	2	1	2	3	2			1	1		
Display laminar and turbulent external forced convection over different body shapes	2	1	2		2			1	1	1	
Demonstrate general aspects of Film Condensation and analysis laminar and turbulent internal forced convection through a duct with uniform wall temperature and uniform wall heat flux	2	1	2		2		1	1	1	1	1
Investigate different flow regimes for film condensation	2	1	2	1	2	1	1	1	1	1	1
Utilize general aspects of boiling and investigate various boiling regimes and natural convection	2	1	2	3	2	1	1	1	1	1	1
Display advanced aspects of phase change	2	1	2		2	1	1	1	1	1	1
Apply radiation exchange between surfaces (black and diffuse-gray surfaces) and display practical applications of view factors	2	1	2	1	2	1	1	1	1	1	1
Investigate the analogy between mass transfer and heat transfer, mass diffusion through a stationery medium, and mass transfer by convection	2	1	2		2		1		1	1	1

Prepared by and date of preparation: K. Vafai, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME117 – Combustion and Energy Systems

Required/Elective course: Technical Elective Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Discusses premixed and diffusion flames, fuel-air thermochemistry, combustion-driven engine design and operation, engine cycle analysis, fluid mechanics in engine components, pollutant formation, and gas turbines

Prerequisite(s): ME 100A, ME 115A, ME 118; or consent of instructor

Textbook(s) and/or other required material: *An Introduction to Combustion, Concepts and Applications* by Stephen R. Turns, 2nd edition, McGraw-Hill, 2000

Course objectives: Upon completion of this course, students should be able to:

1. Demonstrate an understanding of combustion fuel structure and fuel properties
2. Describe combustion-related processes in an IC engine including a detailed understanding of key parameters such as brake horse power, mean effective pressure, specific fuel consumption efficiency, air fuel ratio, and emission indices
3. Utilize adiabatic flame temperature concept and compute equilibrium composition of fuel air mixtures
4. Apply chemical kinetic principles including reaction rate constant and equilibrium constant, and develop an appreciation of global versus elementary chemical reactions
5. Define and utilize laminar burning velocity and its relationship to fuel-air equivalence ratio, flammability limits. Distinguish laminar from turbulent premixed flames. Display an understanding of laminar non-premixed flames, including flame height/length
6. Demonstrate a qualitative and quantitative understanding of primary and secondary pollutants from IC engines, including fundamentals of exhaust gas treatment
7. Display an understanding of fire propagation in a wildland fire, including issues related to fuels management, and fire fighting

Topics covered: Combustion fundamentals, fuels and their properties relevant to combustion, chemical kinetics, chemical equilibrium of reacting mixtures, adiabatic flame temperature, premixed and non premixed flame structure and properties, turbulent combustion, IC engine fundamentals, primary and secondary pollutants from IC engines, exhaust gas treatment, introduction to wildland fire focusing on the role of combustion

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Problem sets (30%), two midterm exams (20% each), term group project, individual written report and oral presentation scheduled during University final examination period (30%). Final letter grade will be curved

Contribution of course to meeting the professional component:
This course addresses mechanical engineering science principles relevant to thermal sciences, includes application of fundamentals of combustion to engineering devices, it enables engineering practice through open-ended team project that requires application of course topics. Project includes oral presentation and written report

Relationship of course to program outcomes: The contribution of ME117 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Demonstrate an understanding of combustion fuel structure and fuel properties	2	1	1	1	2	1	2	1	2	3	2
Describe combustion-related processes in an IC engine including a detailed understanding of key parameters such as brake horse power, mean effective pressure, specific fuel consumption efficiency, air fuel ratio, and emission indices	2	1	1	1	3	1	1	1	1	3	2
Utilize adiabatic flame temperature concept and compute equilibrium composition of fuel air mixtures	3	1	1	1	3	1	1	1	1	2	3
Apply chemical kinetic principles including reaction rate constant and equilibrium constant, and develop an appreciation of global versus elementary chemical reactions	3	1	1	1	2	1	1	1	1	2	2
Define and utilize laminar burning velocity and its relationship to fuel-air equivalence ratio, flammability limits. Distinguish laminar from turbulent premixed flames. Display an understanding of laminar non-premixed flames, including flame height/length	2	1	1	1	2	1	1	1	1	2	2
Demonstrate a qualitative and quantitative understanding of primary and secondary pollutants from IC engines, including fundamentals of exhaust gas treatment	2	1	1	3	2	2	3	3	2	3	1
Display an understanding of fire propagation in a wildland fire, including issues related to fuels management, and fire fighting	1	1	1	3	2	2	3	3	2	3	1

Prepared by and date of preparation: S. Mahalingam, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME118 – Mechanical Engineering Modeling and Analysis

Required/Elective course: Required Course

Catalog description: Introduces data analysis and modeling used in engineering through the software package MATLAB. Numerical methods include descriptive and inferential statistics, sampling and bootstrapping, fitting linear and non-linear models to observed data, interpolation, numerical differentiation and integration, and solution of systems of differential equations.

Prerequisite(s): CHEM 001C, MATH 46, PHYS 040B

Textbook(s) and/or other required material: ***Applied Numerical Methods with MATLAB for Engineers and Scientists*** by Chapra, McGraw Hill

Course objectives: Upon completion of this course, students should be able to:

1. Manipulate data sets using MATLAB and explore their properties using MATLAB plotting/analysis routines
2. Formulate mechanistic models for simple mechanical engineering systems
3. Solve model equations using analytical and numerical methods
4. Evaluate models with data and improve formulation based on evaluation results
5. Fit semi-empirical models to data
6. Work in teams to develop a model for a complete system by integrating models for components of system
7. Write report summarizing results from the application of the model and make oral presentation summarizing model formulation and major results

Topics covered: Formulation of empirical and mechanistic models, Newton-Raphson and Bisection methods, Lagrange and cubic spline interpolation, Gaussian elimination and LU decomposition, linear regression, normal distribution, trapezoidal rule and Gaussian quadrature, Runge-Kutta methods.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Homework (15%), one midterm examination (20%), term group project, individual written report and oral presentation scheduled during final week of classes (15%), Final examination (50%).

Raw scores from all quizzes, homework, exams, and projects will be adjusted using the following formula:

Adjusted Score = Raw Score + (74-Median of Class Scores)/2.

No adjustment will be made if the class median score exceeds 74.
The final weighted scores will be assigned to letter grades using the following table:

A+	Score>=94
A	90<=Score<94
A-	86<=Score<90
B+	82<=Score<86
B	78<=Score<82
B-	74<=Score<78

C+	70<=Score<74
C	66<=Score<70
C-	62<=Score<66
D+	58<=Score<62
D	54<=Score<58
D-	50<=Score<54
F	Score<50

Contribution of course to meeting the professional component:

The course introduces students to the formulation and application of semi-empirical and mechanistic models in understanding and predicting the behavior of engineering systems. Engineering design is addressed through a project that requires students to work in a team to design and cost a hybrid automobile with specified performance characteristics. The project includes oral presentation and written report.

Relationship of course to program outcomes: The contribution of ME118 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

	Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Objective 1	Manipulate data sets using MATLAB and explore their properties using MATLAB plotting/analyis routines		2			1		2				3
Objective 2	Formulate mechanistic models for simple mechanical engineering systems	3	1	1		3						2
Objective 3	Solve model equations using analytical and numerical methods	2	1			1		1	1			3
Objective 6	Evaluate model with data and improve formulation based on evaluation results	2	2		1	2						2
Objective 4	Fit semi-empirical models to data	1	2			1		2				2
Objective 5	Work in team to develop model for a complete system by integrating models for components of system	2		2	3	2	1	2			1	2
Objective 7	Write report summarizing results from the application of the model and make an oral presentation summarizing model formulation and major results				2	2		3	2		1	2

Prepared by and date of preparation: Akula Venkatram, April 4, 2006

Department, number and title of course: Mechanical Engineering, **ME 120 – Dynamic Analysis of Linear Systems and Controls**

Required/Elective course: Required Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): ME 118. An introduction to modeling the dynamics of mechanical, electrical and electro-mechanically coupled systems, including time-domain and frequency-domain analysis of linear system models, using Laplace transforms, inverse Laplace transforms, transfer functions, and analogies between mechanical and electrical systems as well as automatic controllers. The emphasis will be placed on the common features of mechanical, electrical, and electromechanical systems.

Prerequisite(s): EE-001A, EE-01LA, Engr-115, ME-103

Textbook(s) and/or other required material: System Dynamics, 4th Edition, by K. Ogata, Prentice Hall, New Jersey, 2004

Course objectives: Upon completion of this course, students should be able to:

1. Model a mechanical system with different damping characteristics
2. Identify a mechanical system with system parameters
3. Analyze an electric circuit with system parameters
4. Analyze an electric system using the complex impedance method
5. Model an electromechanically coupled system
6. Analyze a mechanical system using the mechanical/electrical analogies
7. Analyze a linear system using the transfer function method
8. Obtain the steady-state solution using the sinusoidal transfer function

Topics covered: Laplace transform, mechanical systems with different damping characteristics, electrical systems analysis with complex impedances, electrical and mechanical systems analogies, electro-mechanically coupled system analysis, time domain and frequency domain analysis of linear systems, and mechanical controllers

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Problem sets (25%)**,** two midterm exams (20% each)**,** term group project, and written report and final exam (35%).

Contribution of course to meeting the professional component:
This course addresses mechanical engineering science principles, includes application of fundamentals of dynamics and electric circuits to engineering devices and systems, it enables engineering practice through open-ended team project that requires application of course topics.

Relationship of course to program outcomes: The contribution of ME120 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Model a mechanical system with different damping characteristics	3				3	1	1	1	1		
Identify a mechanical system with system parameters	2	1	3		2		3				
Analyze an electric circuit with system parameters	2			1	1						
Analyze an electric system using the complex impedance method	2			1	1						
Model an electromechanically coupled system	3			1	3		1			2	
Analyze a mechanical system using the mechanical/electrical analogies	3			2						2	
Analyze a linear system using the transfer function method	3			2		2				2	
Obtain the steady-state solution using the sinusoidal transfer function											

Prepared by and date of preparation: Q. Jiang, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME121-Systemd Dynamics and Controls.

Required/Elective course: Technical Elective Course

Catalog description: Lecture 3-hours; discussion 1 hour. This is an introductory control course to acquaint the students with the notion of control system design, synthesis and analysis. Topics covered include mathematical modeling of physical system, state variable representation of systems, as well as mathematical tools used in time and frequency domain analysis. Root locus and frequency domain control system design techniques will be studied. Extensive use of Matlab & Simulink as control system design tools. A control system design project is required and is an integral part of this class.

Prerequisite(s): ME118, ME120; or consent of instructor.

Textbook(s) and/or other required material: and ``Modern Control Systems'', R. Dorf and R. Bishop, published by Pearson-Prentice Hall (www.prenhall.com), ISBN # 0-13-145733-0.

Course objectives: Upon completion of this course, students should be able to:

1. Generate and simplify block diagram representations of control systems and determine associated transfer functions
2. Determine the time-domain response of a system and identify transient and steady-state performance characteristics.
3. Explain the relationship between system pole/zero locations and system performance (damping & settling time) and stability.
4. Determine the stability of a closed-loop system using Routh Hurwitz criteria
5. Generate the root loci of a system manually and using matlab
6. Design feedback-control systems (pole placement) using root-locus methods to achieve specified transient and steady-state performance characteristics.
7. Sketch the Bode plot manually and using matlab. Interpret the resulting plot to determine system frequency response characteristics.
8. Understand frequency response compensation techniques: lead, lag, lead-lag and their use in the design feedback-control systems using Bode plots (concepts of phase and gain margins).
9. Generate a state-space model of a system and use MATLAB for transient response analysis of systems in state-space.
10. Translate customer control system requirements (settling time, steady-state error) into root locus or Bode plot parameters

Topics covered: Concept of block diagram, feedback, closed loop control, control system design process, Laplace transform, transfer function, block diagram and signal flow graph, state space representation of dynamic system, control system characteristics and performance, system stability, root locus and bode plot techniques.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour.

Assessment methods: Problem sets (25%), midterm exam (25%), term project (20%), final exam 30%. Final letter grade will be curved.

Contribution of course to meeting the professional component:

This course addresses mechanical engineering science principles relevant to control system design, analysis and synthesis. It includes the use of state space representation, block diagram, signal flow graph, root locus and bode plot techniques to assess the stability and the performance of control system. This class enables engineering practice through open-ended team project that requires application of course topics. Project includes oral presentation and written report.

Relationship of course to program outcomes: The contribution of ME121 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix

Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Objective 1 Generate and simplify block diagram representations of control systems and determine associagted transfer functions	2			1	2						2
Objective 2 Determine the time-domain response of a system and identify transient and steady-state performance characgteristics	2				2						3
Objective 3 Explain the relationship between sysemd pole/zero locations and system performance (damping & settling time) and stability.	2										2
Objective 4 Determine the stability of a closed-loop system using Routh Hurwitz criteria	2				2						3
Objective 5 Generate the root loci of a system manually and using matlab	2										3
Objective 6 Design feedback-control systems (pole placement) using root-locus methods to achieve specified transient and steady-state peformance characteristics.	2		3		3		1				3
Objective 7 Sketch the Bode plot manually and using matlab. Interpret the resulting plot to determine system frequency response characteristics.	2				1						3
Objective 8 Frequency response compensation techniques: lead, lag, lead-lag and tgheir use in the design feedback-control systems using Bode plots (concepts of phase and gain margins).	2		3		3		1				3
Objective 9 Generate a state-space model of a system and use MATLAB for transient response analysis of systems in state-space	2				1						3
Objective 10 The ability to translate customer control system requirements (settling time, steady-state error) into root locus or Bode plot parameters	3				2						3

Prepared by and date of preparation: S. Feteih, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME122 – Mechanical Vibrations

Required/Elective course: Technical Elective Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Free and forced vibrations of lumped parameter systems with and without damping; resonance. Matrix methods for multidimensional systems. Normal modes, coupling, and normal coordinates. Use of conservation principles. Lagrange's equation. Electromechanical analogues.

Prerequisite(s): ME 120 or consent of instructor

Textbook(s) and/or other required material: Thomson, W. T., *Theory of Vibration With Applications*, 5th edition, Prentice Hall, 1998.

Course objectives: Upon completion of this course, students should be able to:

1. Apply techniques for determining the motion of free vibrations with and without damping.
2. Apply conservation principles.
3. Apply techniques for determining the motion of forced vibrations with and without damping.
4. Understand issues related to resonance.
5. Apply matrix methods to multidimensional systems.
6. Understand normal modes of vibration, coupling, and normal coordinates.
7. Apply computational techniques to solving vibrations problems.
8. Work in teams to develop and validate system models.
9. Use system models and numerical methods as part of a design process.
10. Write a report summarizing approach, results, and conclusions of design task.

Topics covered: The behavior of many mechanical systems can be modeled as combinations of linear springs and dampers connecting rigid masses. Single-mass systems, having one degree of freedom, give rise to second-order linear differential equations. Once the behavior of these systems is understood, an important but straightforward extension allows for the analysis of systems of many (finite) degrees of freedom. The student is then in a position to analyze and understand any linear system with finite degrees of freedom. Computation methods are key to modern analysis of vibrating systems and are a key element of the course as well.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Problem sets (20%), one midterm exam (25%), term group project with written report (25%), comprehensive final exam (30%). Final letter grade will be curved.

Contribution of course to meeting the professional component:
This course addresses analytical and computational methods for characterizing the response of second-order mechanical systems. The application of engineering principles, the derivation of solutions to equations of motion, and the effects of certain non-linearities are addressed.

Relationship of course to program outcomes: The contribution of ME 122 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

Outcome Related Learning Objectives	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outocme 7	Outcome 8	Outcome 9	Outcome 10	Outcome 11
Apply techniques for determining the motion of free vibrations with and without damping	3		1		2						3
Apply conservation principles	3		1		2						3
Apply techniques for determining the motion of forced vibrations with and without damping	3		1		2						3
Understand issues related to resonance	2		1		1						2
Apply matrix methods to multidimensional systems	3	2	2		2				1		3
Understand normal modes of vibration, coupling, and normal coordinates	3		2		2				1		3
Apply computational techniques to solving vibrations problems	3	3	2	1	3	2	2	2	1	1	3
Work in teams to develop and validate system models	3	3	3	3	3	2	2	2	1	1	3
Use system models and numerical methods as part of a design process	2	3	3	3	3	1	2	2	1	1	3
Write a report summarizing approach, results, and conclusions of design task			1	3	1	2	3	2		1	2

Prepared by and date of preparation: J. J. Dougherty, 5 April 2006

Department, number and title of course: Mechanical Engineering, ME130 – Kinematic Analysis and Design of Mechanisms

Required/Elective course: Required Course

Catalog description: Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): ME 009, ME 018, ME 103, ME 110. Explores the synthesis and analysis of mechanisms and machinery with a focus on the kinematic analysis of planar mechanisms and rigid bodies and the design of cams and gear trains. Introduces concepts of multi-body kinematics and dynamics. Covers the process of mechanism design and software tools. Requires a final design project.

Prerequisite(s): ME 009, ME 018, ME 103, ME 110.

Textbook(s) and/or other required material: *Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, Robert L. Norton, 3rd Edition, McGraw Hill, 2004.*

Course objectives: Upon completion of this course, students should be able to:

1. Synthesize mechanisms with a given degree of freedom
2. Apply principles of linkage transformation to synthesize a wider variety of mechanisms
3. Determine the position, velocity and acceleration of the links of the mechanism both graphically and analytically.
4. Use Matlab to solve the analytical equations to determine position, velocity and acceleration of linkages
5. Design a cam-follower system for a given displacement diagram. Use DYNACAM software program to design cams
6. Design simple and compound gear trains for specific applications
7. Analyze and find dynamic forces on links of a mechanism

Topics covered: Kinematic fundamentals, Number synthesis of mechanisms, linkage transformations, position analysis of mechanisms, velocity analysis, acceleration analysis, cam design, analysis of gear trains, dynamics fundamentals, and dynamic force analysis.

Class/laboratory schedule: Lecture, 3 hours; discussion, 1 hour.

Assessment methods: Homework (15%), Design Project (15%), two midterm exams (35%), final examination (35%). Final letter grade will be curved

Contribution of course to meeting the professional component:
This course addresses kinematic and dynamic principles relevant to the design of mechanisms, and includes application of computer programs to synthesize and design mechanisms. Open ended design project allows students to apply the various topics studied in the course. The open ended project requires a written report as well.

Relationship of course to program outcomes: The contribution of ME130 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Introduce & acquaint the students with principles of planar kinematics	3	1	2	1	3	1	2	1	2	2	3
Introduce & acquaint the students with design steps, processes, and methodology	3	2	2	2	3	2	3	1	1	1	3
Introduce & acquaint the students with analytical formulation of position, velocity, and acceleration planar kinematics problems.	2	1	3	1	3	1	2	1	2	1	3
Train the student in the area of kinematically driven mechanisms, their motion and animation	2	2	2	1	2	1	2	1	2	2	3
Train the student on the use of Matlab to solve planar kinematics problems	2	1	2	2	3	1	2	2	2	2	3
Introduce the students to the concepts and techniques related to multi-body kinematics and dynamics	3	1	2	1	3	1	2	1	2	2	3
Introduce the students to the concepts and techniques related to Cam design, synthesis, and analysis	3	2	3	2	3	1	2	1	2	2	3
Introduce the students to the concepts and techniques related to gear train design, synthesis, and analysis.	3	2	2	1	3	1	2	1	2	1	3
Conduct projects and write reports to simulate response to a customer request to design a mechanism from broad requirements.	2	2	3	2	3	2	3	2	2	1	3
Introduce the student to the concepts related to linear systems, matrix algebra, and non-linear polynomial solving.	3	1	1	2	2	1	1	1	1	3	3

Prepared by and date of preparation: Ram Hariharan, April 4, 2006

Department, number and title of course: Mechanical Engineering, ME136 – Environmental Impacts of Energy Production and Conversion

Required/Elective course: Technical Elective Course

Catalog description: Covers thermodynamics, heat transfer, and fluid mechanics as applied to the examination of the environmental impacts of energy production.

Prerequisite(s): ME 100A, ME 115A, ME 116A

Textbook(s) and/or other required material: ***Energy and the Environment***, by J. A. Fay and D. S. Golomb, Oxford, 2002

Course objectives: Upon completion of this course, students should be able to:

1. Estimate energy needs associated with human activities in industrial societies.
2. Explain and choose between alternative methods of energy production and storage.
3. Explain the environmental impacts of different energy production methods.
4. Estimate pollutant emissions from energy production activities.
5. Estimate the impact of pollutant emissions on water and air quality.
6. Select pollution control equipment and provide preliminary designs.
7. Write and present position papers on environmental issues related to energy production and use.
8. Work in team to estimate the environmental impact of specified energy production plant, and design methods to reduce the impact.

Topics covered: Resource consumption, principles of energy conversion, Electrical energy generation and transmission, nuclear energy, renewable energy, transportation, fossil-powered power plants, pollution control, environmental impacts.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Homework (15%), one midterm examination (20%), term group project, individual written report and oral presentation scheduled during final week of classes (15%), Final examination (50%). Raw scores from all quizzes, homework, exams, and projects will be adjusted using the following formula:

Adjusted Score = Raw Score + (74-Median of Class Scores)/2.

No adjustment will be made if the class median score exceeds 74.
The final weighted scores will be assigned to letter grades using the following table:

A+	Score>=94
A	90<=Score<94
A-	86<=Score<90
B+	82<=Score<86
B	78<=Score<82
B-	74<=Score<78
C+	70<=Score<74
C	66<=Score<70
C-	62<=Score<66

D+ 58<=Score<62
D 54<=Score<58
D- 50<=Score<54
F Score<50

Contribution of course to meeting the professional component:

This course deals with application of the thermal sciences, thermodynamics, fluid mechanics, and heat transfer to the examination of alternative energy production methods, their environmental impact, and design of air pollution control equipment. Engineering design is addressed through a project that requires students to work in a team to design and cost the pollution control system for a fossil fueled power plant. The project includes oral presentation and written report.

Relationship of course to program outcomes: The contribution of ME136 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

	Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Objective 1	Estimate energy needs assciated with human activities in industrial socities	2				2			2	1	2	2
Objective 2	Explain and choose between alternative methods of energy production and storage	2				2	1	2	2	1	1	2
Objective 3	Explain the environmental impacts of different energy production methods	2				2		3		2	2	2
Objective 4	Estimate pollutant emissions from energy production activities	2		2		2	1	1	1	1	1	2
Objective 5	Estimate the impact of pollutant emissions on water and air quality	3				2	1		2		2	2
Objective 6	Select pollution control equipment and provide preliminary designs	2		3	2							3
Objective 7	Write and present position papers on environmental issues related to energy production and use	1				1	1	3	3	3	3	1
Objective 8	Work in team to estimate the environmental impact of specified energy production plant, and design methods to reduce impact	2	2	3	3	2	3			2	1	2

Prepared by and date of preparation: Akula Venkatram, April 4, 2006

Department, number and title of course: Mechanical Engineering, ME138 – Transport Phenomena in Living Systems

Required/Elective course: Technical Elective Course

Catalog description: Lecture 3 hours. Discussion 1 hour. This engineering course focuses on the application of the basic conservation laws of mechanics (mass, linear momentum, and energy) to the modeling of complex biological systems. This introductory course emphasizes how these fundamentals concepts of mechanical engineering analysis may be applied to explain and predict the function of living systems and processes.

Prerequisite(s): ME 100A, ME 116A (it can be taken concurrently), or consent of instructor

Textbook(s) and/or other required material: (A) *Basic Transport Phenomena, R. L. Fournier, Taylor & Francis, 1998*. 50-60% of the course will be based on this textbook; (B) *Biomedical Engineering Principles, D.O. Cooney, Marcel Dekker, 1976*; *(C)* For the 2nd half of the course we will rely on *notes* from various sources.

Course objectives: Upon completion of this course, students should be able to:

1. Learn about the physical properties of body fluids and how diverse solutes are transported across cell membranes and capillaries.
2. Understand the mechanisms of blood flow and oxygen transport in biological systems
3. Understand the mechanisms of heat transfer within the human body and use the Pennes bioheat transport equation to pose and solve simple problems of tissue heating, freezing and thawing.
4. Learn what the relevant optical properties of biological tissues are and understand the mechanisms of light transport within the human body (e.g. Beer's law)
5. Learn how to estimate the overall thermal damage induced on human tissues based on a 1st order kinetic model (Arrhenius)
6. Learn to pose, simplify and solve pharmacokinetic mathematical equations
7. Develop a basic skill to write short computer codes to solve transport problems in living systems.
8. Learn how to seek cutting-edge research, understand it and explain those topics orally in class.

Topics covered: Physical properties of body fluids and its transport, blood flow and rheology, oxygen transport, cell membrane properties and function, tissue heating and freezing, thermal damage assessment, pharmacokinetics.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Assessment methods: Homework Sets (15%), one or two midterm exams (30%), term group project (20%), final examination (30%), Class Participation (5%). Final letter grade will be curved

Contribution of course to meeting the professional component:
This introductory course emphasizes how these fundamentals concepts of mechanical engineering analysis may be applied to explain and predict the function of living systems and processes. This course objective is in compliance with Educational Objectives of the Department of Mechanical Engineering for the degree Bachelor of Science in Mechanical Engineering.

Relationship of course to program outcomes: The contribution of ME138 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix

Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

Outcome Related Learning Objectives	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7	Outcome 8	Outcome 9	Outcome 10	Outcome 11
Learn about the physical properties of body fluids and how diverse solutes are transported across cell membranes and capillaries	2			3	3					1	
Understand the mechanisms of blood flow and oxygen transport in biological systems	2			2	3					1	
Understand the mechanisms of heat transfer within the human body and use the Pennes bioheat transport equation to pose and solve simple problems of tissue heating, freezing and thawing	3			3	3					2	
Learn what the relevant optical properties of biological tissues are and understand the mechanisms of light transport within the human body (e.g. Beer's law)	3			3	3					2	
Learn how to estimate the overall thermal damage induced on human tissues based on a 1st order kinetic model (Arrhenius)	3			3	3					2	
Learn to pose, simplify and solve pharmacokinetic mathematical equations	3			2	3					2	1
Develop a basic skill to write short computer codes to solve transport problems in living systems.	2			2	2					2	3
Learn how to seek cutting-edge research, understand it and explain those topics orally in class.	3			2			3	1	1	1	3

Prepared by and date of preparation: G. Aguilar, April 5, 2006

Department, number and title of course: Mechanical Engineering, ME 153 Finite Element Method

Required/Elective course: Technical Elective Course

Course Description: Lecture, 3 hours; discussion, 1 hour. Weak form formulation. Galerkin method. Computational implementation of the Galerkin method. Mesh generation. Data visualization. Programming finite element codes for practical engineering applications.

Prerequisite(s): ME 118

Textbook(s) and/or other required material: The Finite Element Method Linear Static and Dynamic Finite Element Analysis by Thomas J. R. Hughes, Prentice Hall, 1987 or Dover, 2000.

Course Objective: The objective of this class is to teach students the fundamental theory of the finite element method and the basic numerical technique to implement it. After taking the class, the students should be able to develop a finite element code to solve differential equations based on the Galerkin method. The students are also expected to be able to run common finite element commercial software. Furthermore, the students should acquire the sufficient basic knowledge of the finite element method so that they are well prepared to learn more advanced subjects of the finite element method in the future.

Topics covered:

1. Basic Concepts of the Finite Element Method
2. Strong and Weak Forms of One-Dimensional Boundary-Value Problems
3. Galerkin Approximation Method
4. Potential Energy and Equilibrium
5. Solving a Finite Element Problem by Hand
6. Computational Implementation of the Finite Element Method
7. Two and Three dimensional Boundary-Value Problems
8. Project of a Practical Engineering Problem

Assessment methods: 5 Homework (20%) 1 Midterm (20%) 1 Final (40%) 1 Project (20%) The final grades may be subjected to 5% adjustment, depending on attendance and classroom discussion involvement.

Class/laboratory schedule: Lecture 3 hours, discussion 1 hour

Contribution of course to meeting the professional component:
The lecture of this course emphasizes the basic theory of the finite element method. Students learn practical technique to develop a finite element program to solve ordinary differential equations. Students are also exposed to commercial software including FEMLAB and SOLIDWORKS so they can use commercial software to solve practical engineering problems.

Relationship of course to program outcomes: The contribution of ME 153 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix

Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outocme 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Objective 1 Strong form and weak form formulation of differential equations	3								1		
Objective 2 Basic theory of the finite element method: Galerkin method	3							2	1	1	
Objective 3 Discretization: Mesh generation and shape functions	2								1		
Objective 4 Computational implementation of the finite element method					3				1	1	3
Objective 5 Program FEM codes to solve engineering problems			2	1	3	1	1		1		
Objective 6 Apply the commercial FEM software to solve engineering problems										2	3

Prepared by and date of preparation: Guanshui Xu, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME156 – Mechanical Behavior of Materials

Required/Elective course: Technical Elective Course

Catalog description: Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): senior standing; ME 010, ME110, ME 114. Introduces the theory and experimental techniques for testing the mechanical behavior of materials and structures. Covers the fundamental mechanisms of deformation and failure of metals, ceramics, polymers, composite materials, and electronic materials as well as structural design and materials selection.

Prerequisite(s): ME010, ME110, ME114; or consent of instructor

Textbook(s) and/or other required material: Mechanics of Materials, 6th Edition, J.M. Gere, Brooks/Cole, 2004; Materials Science and Engineering: An Introduction, 6th Edition, William D. Callister, Wiley & Sons, New York, 2004.

Course objectives: Upon completion of this course, students should be able to understand and apply the following concepts:

1. Understanding the importance of materials properties and materials selection in engineering applications
2. Concepts of Hooke's Law, Yield Stress and Ductility
3. Transformation of Stresses and Mechanical Properties Between Different Coordinate Systems
4. Tensor Definitions of Stress and Strain and Transformations
5. Time Dependent Deformation and Anelastic Behavior of Materials
6. Fiber and Particulate Reinforced Composite Materials
7. Tensile Testing of Materials
8. Nanoindentation Testing and Analysis of Load-Deflection Data
9. Flexure (bending) testing of Materials
10. Photoelasticity Testing and Stress Concentrations
11. High Temperature Compression Testing of Materials

Topics covered: crystal structures, concepts of stress and strain, elastic and plastic deformation, transformations of stress and strain via Mohr's circle and more general three dimensional representation, dislocations and strengthening mechanisms, failure processes in materials, mechanical properties at small length scales (thin films), introduction to time-dependent deformation and anelasticity. Special Topics: Materials for integrated circuits and MEMS: Silicon, properties of carbon nanotubes.

Class/laboratory schedule: Lecture 3 hours, Laboratory 3 hours

Assessment methods: Joint laboratory reports and homework asignments (40%), term group project write-up (25%), project presentation (20%) and Final examination (15%) scheduled during University final examination period. Final letter grade will be curved.

Contribution of course to meeting the professional component:
This course addresses mechanical engineering science principles relevant to materials characterization and properties of materials and selection, includes application of fundamental concepts of –macro and –nano scale mechanical testing of a variety of engineering materials, it enables engineering practice

through laboratory experiments and related reports including assignments from classroom materials, a project that requires application of course topics which includes an oral presentation and a written report.

Relationship of course to program outcomes: The contribution of ME156 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix

Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

	Outcome Related Learning Objectives	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7	Outcome 8	Outcome 9	Outcome 10	Outcome 11
Objective 1	Understanding the importance of materials properties and materials selection in engineering applications	1	1	1	2	3	2	1	2	1	1	1
Objective 2	Concepts of Hooke's Law, Yield Stress and Ductility	3	1	1	2	3	1	1	2	1	1	3
Objective 3	Transformation of Stresses and Mechanical Properties Between Different Coordinate Systems	3	1	1	2	3	1	1	2	1	1	3
Objective 4	Tensor Definitions of Stress and Strain and Transformations	3	1	1	2	3	1	1	2	1	1	3
Objective 5	Time Dependent Deformation and Anelastic Behavior of Materials	3	1	1	2	3	1	1	2	1	1	3
Objective 6	Fiber and Particulate Reinforced Composite Materials	3	1	1	2	3	1	1	2	1	1	3
Objective 7	Tensile Testing of Materials	3	1	1	2	3	1	1	2	1	1	3
Objective 8	Nanoindentation Testing and Analysis of Load-Deflection Data	3	1	1	2	3	1	1	2	1	1	3
Objective 9	Flexure (bending) testing of Materials	3	1	1	2	3	1	1	2	1	1	3
Objective 10	Photoelasticity Testing and Stress Concentrations	3	1	1	2	3	1	1	2	1	1	3
Objective 11	High Temperature Compression Testing of Materials	3	1	1	2	3	1	1	2	1	1	3

Prepared by and date of preparation: C. Ozkan, April 12, 2006

Department, number and title of course: Mechanical Engineering, ME170A Experimental Techniques

Required/Elective course: Required Course

Catalog description: Covers the principles and practice of measurement and control, and the design implementation of experiments. Topics include dimensional analysis, error analysis, signal-to-noise problems, filtering, data acquisition and data reduction, and statistical analysis. Includes experiments on the use of electronic devices and sensors, and practice in technical report writing.

Prerequisite(s): EE 001A, EE 01LA, ME 018, ME 103 or consent of instructor

Textbook(s) and/or other required material: *Theory and Design for Mechanical Measurements*, R. S. Figliola and D. E. Beasley, 3rd Edition, John Wiley and Sons, Inc., 2000

Course objectives: Upon completion of this course, students should be able to:

1. Learn the use and implementation of engineering measurement systems
2. Understand and verify the principles of engineering measurement techniques
3. Select instruments or measurement methods using error analysis and statistical analysis
4. Learn the basic concepts of characterizing experimental measurement results
5. Get familiar with basic data acquisition concepts (sampling frequency, signal conditioning)
6. Construct and perform experiments to measure basic mechanical properties
7. Work in a team with student peers to complete specific experimental tasks
8. Learn the skills of taking lab notes, writing technical memorandum and lab reports
9. Analyze and interpret experimental data
10. Gain a basic skill set (engineering measurement techniques) necessary for more advanced project-orientated experimental training

Topics covered: Fourier analysis, error analysis, sampling theorem (Nyquist criteria), amplification, filtering, data acquisition and data reduction, and statistical analysis. Typical measurement devices are introduced including thermocouples and strain gauges. Communication of experimentally measured data is through report writing is emphasized.

Class/laboratory schedule: Lecture 3 hours, laboratory 3 hours

Assessment methods: Homework problem sets (10%), two midterm exams(12.5% each), Final exam scheduled during University exam period (25%), eight written lab reports (total 40%).

Contribution of course to meeting the professional component:
This course introduces students to concepts essential for making measurements relevant to mechanical engineering, including selection and application of sensor/transducer systems, and data analysis. It enables students to design and conduct reliable experimental measurements. Laboratory work includes writing of technical memoranda and reports.

Relationship of course to program outcomes: The contribution of ME 170A to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix

Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

	Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outocme 6**	**Outcome 7**	**Outcome 8**
Objective 1	Learn the use and implementation of engineering measurement systems	2	2	1	1		1	1	1
Objective 2	Understand and verify the principles of engineering measurement techniques	2	2	1	1			1	1
Objective 3	Select instruments or measurement methods using error analysis and statistical analysis	2		2		1			1
Objective 4	Learn the basic concepts of characterizing experimental measurement results	1	2			1		1	1
Objective 5	Get familiar with basic data acquisition concepts (sampling frequency, signal conditioning)	2	1		1			2	1
Objective 6	Construct and perform experiments to measure basic mechanical properties	2	2	1	1	2			2
Objective 7	Work in a team with student peers to complete specific experimental tasks	1	2				2	1	
Objective 8	Learn the skills of taking lab notes, writing technical memorandum and lab reports		2				3	1	1
Objective 9	Analyze and interpret experimental data	1	2			1	2	1	1
Objective 10	gain a basic skill set (engineering measurement techniques) necessary for more advanced project-orientated experimental training	1	2	1	1	1		1	2

Prepared by and date of preparation: J. Garay, April 4, 2006

Department, number and title of course: Mechanical Engineering, ME170B – Experimental Techniques

Required/Elective course: Required Course

Catalog description: Laboratory, 6 hours; discussion, 2 hours. Analysis and verification of engineering theory using laboratory measurements in advanced, project-oriented experiments involving fluid flow, heat transfer, structural dynamics, thermodynamic systems, and electromechanical systems.

Prerequisite(s): ME 115B, ME 116A, ME 120, ME 170A; or consent of instructor.

Textbook(s) and/or other required material: texts for all previous ME courses

Course objectives: Upon completion of this course, students should be able to:
1. apply gained knowledge of mathematics, science & engineering
2. design a system, component, or process for an engineering project
3. identify, formulate and solve engineering problems
4. communicate effectively through oral presentations and written reports
5. understand the impact of engineering solutions on society and a need for broad education
6. use the techniques, skills and modern engineering tools necessary for engineering practice

Topics covered: Conduction, convection and radiation heat transfer. Heat exchangers. Stress, strain, dynamic load, vibrations, pump performance, major and minor losses in piping systems, and internal combustion engines.

Class/laboratory schedule: Laboratory 6 hours, discussion 2 hours

Assessment methods: Nine laboratory reports (80%)**,** lab participation (20%). Final letter grade will be curved.

Contribution of course to meeting the professional component:
The main objective of this course is to apply the fundamental concepts learnt in fluid mechanics, heat transfer, thermodynamics, strength of materials, and vibration to set up simple laboratory experiments and verify the theories formulated in the various courses. The experiments give students an opportunity to think creatively, apply the skills developed in the course and communicate effectively through written reports.

Relationship of course to program outcomes: The contribution of ME170B to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Understanding of heat conduction	3	2		1	1	1		1	2		3
Understanding of convection - fin effectiveness	3	2		1	1	1		1	2		3
Understanding of heat exchangers	3	2		1	1	1		1	2		3
Understanding of thermal radiation	3	2		1	1	1		1	2		3
Understanding of stress-strain relationship for different materials and difference of static and dynamic loading.	3	2		1	1	1		1	2		3
Vibrations and dumping	3	2		1	1	1		1	2		3
Understanding pumps and learn how to do analysis of pumps	3	2		1	1	1		1	2		3
Calculation of losses in pipes and pipe fittings	3	2		1	1	1		1	2		3
Experimental design and hands-on experience with different instrumentation		3		3	3	3			3	3	3
Technical report writing						3	3	3			

Prepared by and date of preparation: M. Princevac, April 1, 2006

Department, number and title of course: Mechanical Engineering, ME175A – Professional Topics in Engineering

Required/Elective course: Required Course

Catalog description: Lecture, 2 hour. Prerequisite(s): Senior standing in Mechanical Engineering; ME 009, ME 170A. Topics include technical communication, team work, project management, engineering economics, professional ethics, and computer aided design.

Prerequisite(s): Senior standing in Mechanical Engineering; ME 009, ME 170A.

Textbook(s) and/or other required material: Recommended (not-required) textbook: *Principles of Engineering Economic Analysis*, 4th Edition, John A. White, Kenneth E. Case, David B. Pratt, Marvin H. Agee, John Wiley & Sons, 1997.

Course objectives: Upon completion of this course, students should be able to:
1. Design a system or device to meet specific engineering requirements.
2. Work successfully in a team-based environment.
3. Demonstrate good technical communication skills.
4. Apply the principles of engineering economic analysis.
5. Demonstrate an understanding of, and appreciation for, the professional and ethical responsibilities of engineers.

Topics covered: Technical communication: reports and oral presentations. Professional ethics. Team work. Project management. Engineering economic analysis. Computer aided design: geometric modeling and engineering analysis. Stress analysis.

Class/laboratory schedule: Lecture 2 hours.

Assessment methods: Problem sets (55%)**,** quiz (20%)**,** final exam (25%). Problem sets include two small, team-based design projects, one focused on technical writing, the other focused on CAD. Final letter grade will be curved.

Contribution of course to meeting the professional component:
This course focuses on professional skills including technical communication, project management, team work, professional ethics, and engineering economics. It also provides a review of stress analysis and covers modern engineering software tools. Provides skills needed for open-ended, team-based design projects. Includes two design projects with written reports.

Relationship of course to program outcomes: The contribution of ME175A to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Learn the skills necessary for designing a system or device to meet specific engineering requirements.	3		3		3			1	1	1	3
Learn the skills necessary to work successfully in a team-based environment				3							
Learn good technical communication skills.							3				
Develop an understanding of the principles of engineering economics	3							1		2	3
Develop an understanding of, and appreciation for, the professional and ethical responsibilities of engineers.						3		3		2	

Prepared by and date of preparation: T Stahovich, April 8, 2006

Department, number and title of course: Mechanical Engineering, ME175B - Mechanical Engineering Design

Required/Elective course: Required Course

Catalog description: Lecture, 2 hours; laboratory, 3 hours. Prerequisite(s): senior standing in Mechanical Engineering; ME 135 (can be taken concurrently), ME 170B, ME 175A (can be taken concurrently). Team-based design project: students develop a problem definition, conceptual design, and detailed design. Topics include design theory and the design of machine elements. Graded in Progress (IP) until ME 175C is completed, at which time a final, letter grade is assigned.

Prerequisite(s): Senior standing in Mechanical Engineering; ME 135 (can be taken concurrently), ME 170B, ME 175A (can be taken concurrently).

Textbook(s) and/or other required material: *None*

Course objectives: Upon completion of this course, students should be able to:

1. Design a system or device to meet specific engineering requirements.
2. Work successfully in a team-based environment.
3. Demonstrate good technical communication skills.
4. Demonstrate an understanding of, and appreciation for, the professional and ethical responsibilities of engineers.

Topics covered: The design process, conceptual design, detailed design, design for manufacturability, design for reliability, design for safety and human factors, and fatigue failure.

Class/laboratory schedule: Lecture 2 hours, Lab 3 hours

Assessment methods: Weekly progress memos – 10%, project definition report/presentation – 15%, design concept report/presentation – 15%, design review report – 10%, preliminary design report – 30%, individual research paper – 10%, individual project contribution – 10%.

Contribution of course to meeting the professional component:
This course provides a major design experience through a series of lectures and a two-quarter long design project. The design project, which spans 175 B and C, requires students to conduct background research (175B), develop a problem definition (175B), generate and evaluate design concepts (175B), generate a detailed design (175B/C), build a physical prototype (175C), and test and evaluate the design (175C). Includes multiple reports and oral presentations.

Relationship of course to program outcomes: The contribution of ME175B to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Learn the skills necessary for designing a system or device to meet specific engineering requirements	3	1	3		3			1	1	2	3
Learn the skills necessary to work successfully in a team-based environment				3							
Learn good technical communication skills							3				
Develop an understanding of and an appreciation for the professional and ethical responsibilities of engineers						3		1	1	2	

Prepared by and date of preparation: T. Stahovich, April 8, 2006

Department, number and title of course: Mechanical Engineering, ME175C - Mechanical Engineering Design

Required/Elective course: Required Course

Catalog description: Lecture, 2 hours; laboratory, 3 hours. Prerequisite(s): senior standing in Mechanical Engineering; ME 175B. Students create, test and evaluate a prototype based on the project design generated in ME 175B. Lecture topics include design for safety, reliability, manufacture, and assembly. The students discuss their design project in an oral presentation and a written report. Satisfactory (S) or No Credit (NC) grading is not available.

Prerequisite(s): Senior standing in Mechanical Engineering; ME 175B.

Textbook(s) and/or other required material: *None*

Course objectives: Upon completion of this course, students should be able to:
1. Design a system or device to meet specific engineering requirements.
2. Work successfully in a team-based environment.
3. Demonstrate good technical communication skills.
4. Demonstrate an understanding of, and appreciation for, the professional and ethical responsibilities of engineers.

Topics covered: Geometric dimensioning and tolerancing, design of experiments, testing and verification of designs, rapid prototyping methods, intellectual property, professional ethics.

Class/laboratory schedule: Lecture 2 hours, Lab 3 hours

Assessment methods: Weekly progress memos – 10%, prototype plan – 15%, prototype test results – 15%, final design presentation – 10 %, final design report – 40%, individual project contribution – 10%.

Contribution of course to meeting the professional component:
This course provides a major design experience through a series of lectures and a two-quarter long design project. The design project, which spans 175 B and C, requires students to conduct background research (175B), develop a problem definition (175B), generate and evaluate design concepts (175B), generate a detailed design (175B/C), build a physical prototype (175C), and test and evaluate the design (175C). Includes multiple reports and oral presentations. Includes lectures on professional ethics.

Relationship of course to program outcomes: The contribution of ME175C to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix											
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially											
Outcome Related Learning Objectives	**Outcome 1**	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**	**Outcome 6**	**Outcome 7**	**Outcome 8**	**Outcome 9**	**Outcome 10**	**Outcome 11**
Learn the skills necessary for designing a system or device to meet specific engineering requirements	3	1	3		3			1	1	2	3
Learn the skills necessary to work successfully in a team-based environment				3							
Learn good technical communication skills							3				
Develop an understanding of and an appreciation for the professional and ethical responsibilities of engineers						3		1	1	2	

Prepared by and date of preparation: T. Stahovich, April 8, 2006

Department, number and title of course: Mechanical Engineering, ME180 – Optics and Lasers in Engineering

Required/Elective course: Technical Elective Course

Catalog description: Lecture, 3 hours; laboratory, 3 hours. Discuss principles of light and optics, applications of optical methods with coherent and incoherent lights in mechanical engineering deformation and stress analysis, optical data acquisition and image analysis, applications of lasers in material processing and characterization.

Prerequisite(s): ME10, ME110, ME170A or consent of instructor

Textbook(s) and/or other required material: *Experimental Stress Analysis,* J. W. Dally, W. F. Riley, 4th Edition, College House Enterprises, 2005

Course objectives: Upon completion of this course, students should be able to:

1. Demonstrate an understanding of the physical nature of light
2. Have the fundamental knowledge of optics and lasers
3. Apply the wave theory of lights to analyze various optical phenomena
4. Understand the working principles of various optics elements
5. Apply various optical techniques to typical mechanical engineering measurements
6. Evaluate the availability of optical method for solving given engineering problems
7. Understand the fundamental knowledge of laser technology (generation, characteristic, classification and safety)
8. Have general knowledge of the contemporary applications of optics and lasers in state of the art research

Topics covered: Physical nature of light, wave theory of light, reflection and refraction, geometrical optics, interference and diffraction, optical stress measurement using plane and circular polariscope, generation of lasers, laser beam characteristics, laser types, laser safety, optical displacement measurement using laser interferometry, contemporary applications of optics and lasers in state of the art research including geophysics, nanomechanics and MEMS, fiber optics, etc.

Class/laboratory schedule: Lecture 3 hours, laboratories 3 hours

Assessment methods: Problem sets (30%), two midterm exams (15% each), final exam (20%), laboratory work (20%). Final letter grade will be curved

Contribution of course to meeting the professional component:
This course introduces the fundamental knowledge of optics and lasers and how they can be utilized in mechanical engineering applications such as experimental stress, strain and displacement measurements. Students get exposed to various optical metrology and processing techniques and the basic knowledge of laser technology which may be helpful in their future career development.

Relationship of course to program outcomes: The contribution of ME180 to program outcomes (a)-(k) or (1) – (11) is summarized in the objective-outcome matrix table

Objective-Outcome Matrix
Objective Addresses Outcome: 1-Slightly 2-Moderately 3-Substantially

Outcome Related Learning Objectives	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7	Outcome 8	Outcome 9	Outcome 10	Outcome 11
Understand the physical nature of lights	2	1	1					1	1		1
Learn the fundamental knowledge of optics and lasers	1	2	2	1	1			1			1
Learn to use wave theory of lights to analyze optical phenomena	2	1			1						1
Learn the working principles of various optical elements	1	2		1							
Learn the working principles of various optical techniques for typical mechanical engineering measurements	1	3	2	1				1			
To be able to evaluate the availability of optical method for solving given problems	1	2	2		2	1		1		1	2
Understand the fundamentals of laser technology		2			2		1			1	
Learn the contemporary applications of optics and lasers in the state of the art research		2				1	1	1			1

Prepared by and date of preparation: J. Wang, April 5, 2006