CSC 112 Syllabus

Course: CSC 112
Credit Hours: 3
Course Title: Introduction to Computing - FORTRAN
Course Description:

Problem solving through writing FORTRAN programs. Particular elements include: careful development of FORTRAN programs from specifications; documentation and style; appropriate use of control structures, data types and subprograms; abstraction and verification; engineering applications.

Prerequisite(s): E 115, MA 141

Textbook(s) and/or other required material:

Fortran 95/2003 for Scientists and Engineers, Stephen J. Chapman, McGraw-Hill, Third Edition, 2008.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

Upon successful completion of this course, a student will be able to solve problems through writing FORTRAN programs. Students are expected to be able to develop FORTRAN programs from specifications and document those programs in a style permitting the maintaining and altering of the programs by a third party. Students will understand the use of control structures, data types, input and output processes, and both recursive and nonrecursive subprograms, and the use of modules. Students will know how to verify that programs are running correctly, and will be equipped to write FORTRAN programs for engineering applications.

Students will comprehend some of the theory that underpins computation and the FORTRAN family of programming languages including number systems and representations in the computer, machine language protocols (e.g., floating point representations), program correctness, automata theory (e.g., Turing machines), formal languages (e.g., Chomsky hierarchy) and recursion.

Topics covered:

Programming structures, variable/data types, read/write/print statements, debugging/error corrections
IF Statements
DO Loops
Formatting
File Input and Output
Arrays
Subroutines and Functions
Modules
Recursive Functions and Subroutines

CSC 112 Syllabus

Class/laboratory schedule (sessions per week and duration of each session):

Two 50 minute lectures twice a week
Three 1 hour laboratory sessions each week

Contribution of course to meeting the requirements of Criterion 5 - other:

3 hours - Other - programming

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

N/A

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

N/A

Contribution of course to meeting the requirements of Criterion 5 - general education:

N/A

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	N/A	
Outcome B	N/A	
Outcome C	N/A	
Outcome D	N/A	
Outcome E	N/A	
Outcome F	N/A	
Outcome G	N/A	
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	Students solve problems by writing various FORTRAN programs.

Person who last prepared this description and date of preparation:

- Raubenheimer, Dr. Dianne Carol (cdrauben) - Mar 2nd, 2010 (11:42am)

MAE 206 Syllabus

Course: MAE 206
Credit Hours: 3
Course Title: Engineering Statics
Course Description:

Basic concepts of forces in equilibrium. Distributed forces, fluid forces, frictional forces. Inertial properties. Application to machines, structures, and systems.

Prerequisite(s): Prerequisite: C- or better in MA 241 and PY 205. Co requisite: MA 242

Textbook(s) and/or other required material:

Engineering Mechanics: Statics, 8th Edition, R. C. Hibbeler, Prentice-Hall, 1998.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 206 through their mastery of the following course objectives. Through the study of MAE 206 the student will be able to:
1. Model physical systems using free body diagrams;
2. Comprehend static equilibrium for particles, rigid bodies, trusses, and frames/machines;
3. Solve for reaction forces and moments;
4. Understand and apply friction and fluid pressures;
5. Calculate and graph internal forces and moments;
7. Calculate centroids and moments of inertia;

Topics covered:

1. Math and Physics Review (2)
2. Particle Equilibrium (4)
3. Force Resultants (2)
4. 2-D Equilibrium (4)
5. 3-D Equilibrium (4)
6. Distributed Forces (1)
7. Centroids (2)
8. Moments of Inertia (2)
9. Friction (4)
10. Fluid Statics (2)
11. Beams (2)
12. Beams: Shear and Bending (3)
13. Trusses (3)
14. Frames & Machines (3)
15. Review (2)
16. Exams (2)

MAE 206 Syllabus

Class/laboratory schedule (sessions per week and duration of each session):

MAE 206 is offered in both a T/TH and a MWF format. The T/TH format includes 25 lectures and 3 exams (14 weeks), 2 days per week, 75 minute lectures. The MWF format includes 39 lectures and 4 exams (14 weeks), 3 days per week, 50 minute lectures.

Contribution of course to meeting the requirements of Criterion 5 - other:

N/A

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

N/A

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3hrs, Engineering Science.

Contribution of course to meeting the requirements of Criterion 5 - general education:

N/A

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Vector algebra, linear algebra, some calculus
Outcome B	N/A	
Outcome C	Basic	Calculate internal forces and moments
Outcome D	N/A	
Outcome E	N/A	
Outcome F	Major	Force and moment calculations for typical engineering structures
Outcome G	Major	Free body diagrams, sample calculations
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	Systematic and structured approach to problem solving

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content

Person who last prepared this description and date of preparation:

- Raubenheimer, Dr. Dianne Carol (cdrauben) - Feb 17th, 2011 (02:09pm)

MAE 208 Syllabus

Course: MAE 208
Credit Hours: 3
Course Title: Engineering Dynamics
Course Description:

Kinematics and kinetics of particles in rectangular, cylindrical and curvilinear coordinate systems; energy and momentum methods for particles; kinetics of systems of particles; kinematics and kinetics of rigid bodies in two and three dimensions; motion relative to rotating coordinate systems.

Prerequisite(s): 2.5 GPA or higher, MA 242, C- or better in MAE 206 or CE 214

Textbook(s) and/or other required material:

Hibbeler, R.C., Engineering Mechanics: Dynamics, 11th Edition, Pearson Prentice Hall, 2007. Reference: J. L. Meriam and L. G. Kraige, 6th Edition, Engineering Mechanics: Dynamics, John Wiley & Sons, 2007.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 208 through their mastery of the following course objectives. Through the study of MAE 208 the student will be able to:
1. Analyze the motion (displacement, velocity and acceleration) of particles in rectangular, cylindrical and curvilinear coordinate systems using vector mechanics; calculate relative motion relationships between translating particles;
2. Apply Newton's 2nd law of motion to relate the forces acting on a particle to the resulting motion of the particle; use the work-energy method to predict particle motion; use impulse-momentum equations to solve impact problems involving particles;
3. Analyze the motion of rigid bodies undergoing both translation and rotation; compute the derivatives of vectors resulting from both changes in magnitude as well as direction; analyze motion relative to rotating reference frames in two and three dimensions;
4. Determine the inertia descriptions of a rigid body relative to a coordinate system; analyze the plane motion of a rigid body using Euler's equations.

Topics covered:

1. Particle kinematics (9) 2. Particle dynamics (5)
3. Work-energy, momentum methods (6) 4. Rigid body kinematics (9)
5. Rigid body dynamics (9) 6. Review and tests (4)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week for 50 minute lectures (or 2 days per week for 75 minute lectures)

MAE 208 Syllabus

Contribution of course to meeting the requirements of Criterion 5 - other:

N/A

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

N/A

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3 hrs, Engineering Science.

Contribution of course to meeting the requirements of Criterion 5 - general education:

N/A

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	N/A	
Outcome B	N/A	
Outcome C	N/A	
Outcome D	N/A	
Outcome E	N/A	
Outcome F	N/A	
Outcome G	N/A	
Outcome H	Major	***FILL IN
Outcome I	Major	***FILL IN
Outcome J	Major	***FILL IN
Outcome K	N/A	

Person who last prepared this description and date of preparation:

- Crystal Hanson (cmhanso2) - Apr 22nd, 2010 (04:24pm)

MAE 261 Syllabus

Course: MAE 261
Credit Hours: 3
Course Title: Aerospace Vehicle Performance
Course Description:

Introduction to the problem of performance analysis in aerospace engineering. Aircraft performance in gliding, climbing, level, and turning flight. Calculation of vehicle take-off and landing distance, range and endurance. Elementary performance design problems.

Prerequisite(s): CSC 112, C- or better in both MA 241 and PY 205

Textbook(s) and/or other required material:

Anderson, J. D., Introduction to Flight, 4th edition, McGraw-Hill, New York, 2000

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 261 through their mastery of the following course objectives:
1. Determine properties of the standard atmosphere.
2. Analyze subsonic wind tunnels, airspeed indicators and airfoils.
3. Determine lift, drag and pitching moments on wings and aircraft
4. Analyze thrust required and available to determine maximum speed, rate of climb, and absolute and service ceilings
5. Determination of range, endurance, take-off and landing distances and turning radius
6. Work as a team member on an aircraft design
7. Analyze space orbits and atmospheric and ballistic entries

Topics covered:

1. History and Fundamental Thoughts (2)
2. Standard Atmosphere (2)
3. Basic Aerodynamics (4)
4. Airfoils and Wings (4)
5. Elements of Airplane Performance (10)
6. Space Flight (4)
7. Review and Tests (2)

Class/laboratory schedule (sessions per week and duration of each session):

14-week semesters, class meets twice per week for 75-minute lectures for a total of 26 classes

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

MAE 261 Syllabus

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply these principles in solving problems
Outcome B	N/A	
Outcome C	Intermediate	Team design of modification to a Component of a vehicle
Outcome D	Basic	Perform as team member on an aircraft Performance design
Outcome E	Major	Define, formulate and solve problems associated with aircraft and spacecraft performance
Outcome F	N/A	
Outcome G	Intermediate	Demonstrate by written and oral reports
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	Apply Xcel, C or Fortran in computer solutions

Person who last prepared this description and date of preparation:

- DeJarnette, Dr. Fred R (dejar) - Apr 29th, 2009 (04:51pm)

MAE 301 Syllabus

Course:	MAE 301
Credit Hours:	3
Course Title:	Engineering Thermodynamics I

Course Description:

Introduction to the concept of energy and the laws governing the transfers and transformations of energy. Emphasis on thermodynamic properties and the First and Second Law analysis of systems and control volumes. Integration of these concepts into the analysis of basic power cycles is introduced.

Prerequisite(s): MA 242, PY 208 or PY202

Textbook(s) and/or other required material:

Cengel, Y. A. and Boles, M. A., Thermodynamics: an Engineering Approach, 6th ed., The McGraw-Hill Companies, New York, 2008.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 301 through their mastery of the following course objectives. Through the study of MAE 301 the student will be able to:

1. Determine properties of real substances, such as steam and refrigerant 134-a, and ideal gases from either tabular data or equations of state.
2. Analyze processes involving ideal gases and real substances as working fluids in both closed systems and open systems or control volumes to determine process diagrams, apply the first law of thermodynamics to perform energy balances, and determine heat and work transfers.
3. Analyze systems and control volumes through the application of the second law.
4. Analyze the basic Otto and Rankine cycles

Topics covered:

Based on 3 classes per week:
1. Basic Concepts (4) 2. Properties of pure substances (4)
3. Energy transfer by heat, work, and mass (4) 4. The first law of thermodynamics (9)
5. The second law of thermodynamics (5) 6. Entropy and 1st & 2nd law applications (9)
7. Introduction to power cycles (2) 8. Review and tests (5)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week for 50 minute lectures or 2 days per week for 75 minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

N/A

Contribution of course to meeting the requirements of Criterion 5 - math and basic

MAE 301 Syllabus

sciences:

N/A

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3 hrs, Engineering Science.

Contribution of course to meeting the requirements of Criterion 5 - general education:

N/A

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	apply principles of math, science and engineering in solving MAE 301 problems
Outcome B	N/A	
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Major	identify, formulate, and solve engineering problems associated closed and open systems using both ideal gases and real substances as working fluids
Outcome F	Major	***FILL IN
Outcome G	N/A	
Outcome H	Major	***FILL IN
Outcome I	Major	***FILL IN
Outcome J	Major	***FILL IN
Outcome K	N/A	

Person who last prepared this description and date of preparation:

- Crystal Hanson (cmhanso2) - Apr 22nd, 2010 (04:25pm)

MAE 314 Syllabus

Course: MAE 314
Credit Hours: 3
Course Title: Solid Mechanics
Course Description:

Concepts and theories of internal force, stress, strain, and strength of structural element under static loading conditions. Constitutive behavior for linear elastic structures. Deflection and stress analysis procedures for bars, beams, and shafts. Stability of columns.

Prerequisite(s): MA 242 with a grade of C- or better MAE 206 or CE 214; Co requisite: MSE 200, MSE 201, BME 203 or BAE 315

Textbook(s) and/or other required material:

Craig, R.R., Mechanics of Materials, 2nd ed., Wiley

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 314 through their mastery of the following course objectives. Through the study of MAE 314 the student will be able to:
1. Apply linear elastic material laws to calculate deformations of deformable bodies;
2. Integrate deformable body concepts with static equilibrium to solve statically indeterminate problems;
3. Model simple beams;
4. Design a structural component including the concept of factor of safety;
5. Interpret two dimensional stresses and strains using coordinate transformations;
6. Calculate maximum normal/shear stresses and strains;
7. Model thin walled pressure vessels.

Topics covered:

1. Introduction to Solid Mechanics (1) 7. Deflection of Beams (3)
2. Tension, Compression and Shear (3) 8. Analysis of Stress and Strain (3)
3. Axially Loaded Members (3) 9. Pressure Vessels (2)
4. Torsion (2) 10. Column Analysis (1)
5. Advanced Shear Force, Bending Moments (5) 11. Exams (2)
6. Stresses in Beams (3)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 2 days per week for 75 minute lectures (or 3 days per week for 50 minute lectures)

Contribution of course to meeting the requirements of Criterion 5 - other:

N/A

MAE 314 Syllabus

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

N/A

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

This course is designed to provide the student engineering practice in the theories of stress, strain and strength of structural elements. Extensive analysis procedures are practiced to determine the deflection and stress for bars, beams, and shafts.3hrs, Engineering Science.

Contribution of course to meeting the requirements of Criterion 5 - general education:

N/A

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Solve ordinary differential equations and solve problems in the area of solid mechanics, vector algebra
Outcome B	N/A	
Outcome C	N/A	
Outcome D	N/A	
Outcome E	N/A	
Outcome F	N/A	
Outcome G	N/A	
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	N/A	

Person who last prepared this description and date of preparation:

- Crystal Hanson (cmhanso2) - Apr 23rd, 2010 (09:35am)

MAE 355 Syllabus

Course: MAE 355
Credit Hours: 3
Course Title: Aerodynamics I
Course Description:

Fundamentals of perfect fluid theory with applications to incompressible flows over airfoils, wings, and flight vehicle configurations.

Prerequisite(s): MAE 261, MA 341

Textbook(s) and/or other required material:

John D. Anderson, Jr., Fundamentals of Aerodynamics, Third Edition, McGraw Hill.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

Through the study of MAE 355, Aerodynamics I, the student will be able to:

1. Explain the generation of lift, drag and pitching moment on a body from pressure and shear stresses. Integrate the pressures on an airfoil to compute the lift and pitching moment. Explain the connection between center of pressure and pitching moment. Discuss the difference between form drag and skin friction drag.
2. Explain and write down the continuity, and momentum equations. Apply the momentum equation to compute the drag of a two-dimensional body from wake measurements. Define streamlines, pathlines, and streaklines. Define vorticity, rotational/irrotational flows, and circulation. Define Bernoulli s equation for rotational and irrotational flows. Associate pressure and velocity in incompressible flow. Discuss the conditions on streamfunction and velocity potential for potential flow.
3. Describe the elementary flows in the textbook (uniform flow, source, doublet, vortex) and combine them to generate different simple physical flows. Explain the Kutta-Joukowski theorem of lift.
4. Discuss the lift, drag, and pitching moment coefficients for an airfoil. Use a computational method (such as the XFOIL code) to analyze an airfoil. Explain Kutta condition. Derive the thin-airfoil theory (TAT) equations using the Fourier-series method. Write a computer program for analysis of camber lines using TAT.
5. Explain the fundamental differences between airfoil and wing flows. Explain the evolution of trailing vortices. Describe the use of lifting-line theory for analysis of finite wings.

Topics covered:

Based on 2 classes per week:

1. Introductory Concepts (4)
2. Fundamental Principles, Review of Vector Relations (4)
3. Continuity and Momentum Equations (5)
4. Elementary Flows and Superposition of Flow Solutions (5)
5. Airfoil Aerodynamics (4)

MAE 355 Syllabus

6. Introduction to Finite Wing Flows (3)
7. Review and tests (3)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week for 50 minute lectures or 2 days per week for 75 minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

2 credit hours of engineering science, 1 credit hour of Math. This course requires one project in use of a modern airfoil code (XFOIL) for analysis of airfoils and a second programming assignment project for studying the effect of superposing different elementary flow solutions using a numerical approach with visualization using modern software (Matlab).

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of math, science, and engineering in solving problems in aerodynamics
Outcome B	N/A	
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Major	Define, formulate, and solve engineering problems associated with incompressible aerodynamics
Outcome F	N/A	
Outcome G	Basic	Demonstrate effective solution procedures to communicate solutions to engineering problems

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome H	N/A	
Outcome I	N/A	
Outcome J	Basic	Demonstrate awareness of some recent developments in aerodynamics
Outcome K	Basic	Use computer code XFOIL to analyze airfoils, Write computer programs to solve aerodynamic problems

Person who last prepared this description and date of preparation:

- Luo, Hong (hluo2) - Jan 25th, 2010 (10:23am)

MAE 356 Syllabus

Course: MAE 356
Credit Hours: 3
Course Title: Aerodynamics II
Course Description:

Concepts of thermodynamics, compressible fluid flow, and shock waves with application to computing the aerodynamic characteristics of airfoils, wings and flight configurations at high speed.

Prerequisite(s): MAE 355 and a grade of C or better in MAE 301
Textbook(s) and/or other required material:

Anderson, J. D., Modern Compressible Flow with Historical Perspective, 3rd edition, McGraw-Hill, New York, 2003

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 356 through their ability to:
1. Analyze one-dimensional flow of compressible gases, including effects of friction, heat transfer, and normal shock waves.
2. Analyze isentropic or adiabatic compressible flow in ducts with area variation
3. Calculate thermodynamic and flow variables in steady supersonic flow including shock waves and expansion waves
4. Apply shock-expansion theory and linearized potential theory to determine the aerodynamic characteristics of high-speed airfoils
5. Understand and apply classical numerical methods for computer solution of high-speed aerodynamics problems.

Topics covered:

Based on 3 classes per week
1. Review of Thermodynamics and Fluid Mechanics (5)
2. Isentropic Flow (3)
3. Normal Shock waves (3)
4. One Dimensional Flow with Friction and Heat Transfer (3)
5. One Dimensional Flow with Area Change (3)
6. Operating Characteristics of Converging and Converging-Diverging Nozzles(4)
7. Oblique Shock Waves (3)
8. Shock Interactions (4)
9. Prandtl-Meyer Expansion /Compression Waves (3)
10. Shock-Expansion Theory (4)
11. Linearized Potential Theory (4)
12. Review and Tests (3)

MAE 356 Syllabus

Class/laboratory schedule (sessions per week and duration of each session):

14-week semesters, class meets three times per week for 50-minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

3 hrs total: 3 hrs Engineering Science. This course will prepare the student to conduct hand- and computer-based analyses of basic compressible gas-dynamic problems. These skills will allow the student to conduct preliminary analysis and design studies for high-speed aerospace configurations, such as airfoils, engine inlets, and engine nozzles.

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply these principles in solving problems
Outcome B	N/A	
Outcome C	Basic	Apply compressible gas dynamics concepts in simple design problems
Outcome D	N/A	
Outcome E	Major	Define, formulate and solve problems associated with compressible internal and external flow
Outcome F	N/A	
Outcome G	Basic	Demonstrate by written reports
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Basic	Apply C or Fortran in computer solutions of compressible flow

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
		problems

Person who last prepared this description and date of preparation:

- Edwards, Dr. Jack R Jr. (jredward) - Nov 23rd, 2009 (10:19pm)

MAE 357 Syllabus

Course: MAE 357
Credit Hours: 1
Course Title: Experimental Aerodynamics I
Course Description:

Students are introduced to the fundmentals of low-speed wind tunnel testing and to basic aerodynamic problems through experimentation in the NCSU Subsonic Wind Tunnel. Experiments are chosen which reinforce theory learned in MAE355 - Aerodynamics I. During the first half of the course students use traditional physical measurement devices, later experiments introduce students to modern solid state transducers and digital data aquisition.

Prerequisite(s): MAE261, MA341 Co requisite: MAE 355

Textbook(s) and/or other required material:

N/A

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1. Use the NCSU Subsonic Wind Tunnel for model testing
2. Use traditional and modern data-acquisition hardware
3. Evaluate is data for outliers, blunders, and curve fit quality
4. Prepare technical reports in industry supported formats

Topics covered:

1. Bernoulli's Equation
2. Tunnel Turbulence
4. 2D Cylinder and Airfoil Flow
5. Wing and Aircraft Performance
6. Traditional and Modern Data Acquisition
7. Transducer Selection
8. Data Fitting and Uncertainty

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, 1 hour lectures and 2 hour laboratory sessions meet on alternating weeks. Semester schedule posted online each semester.

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Students must make wide use of numerical techniques, including curve fitting, numerical integration, and statistical data reduction.

MAE 357 Syllabus

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Students evaluate experiment data to determine implications to aerospace engineering problems.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	**Level of Instruction**	**Related Course Content**
Outcome A	Major	Student must use math and previous engineering coursework to reduce and interpret lab data.
Outcome B	Basic	Student must conceptualize lab experiment and data acquisition before performance the experiment.
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Major	The student must demonstrate the impact of lab findings on engineering problems through the required lab report.
Outcome F	N/A	
Outcome G	Major	The student must prepare numerous reports in industry-accepted format.
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	The students must use modern lab equipment for data acquisition and interpretation.

Person who last prepared this description and date of preparation:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content

- Heinzen, Stearns Beamon (snheinze) - Jan 25th, 2010 (09:54pm)

MAE 358 Syllabus

Course: MAE 358
Credit Hours: 1
Course Title: Experimental Aerodynamics II
Course Description:

Students are introduced to the fundamentals of compressible flow through nozzles and supersonic tunnel tests. Experiments are chosen which reinforce theory learned in MAE356 - Aerodynamics II. Early experiments focus on isentropic flow through various nozzles, later experiments include fanno flow and shock visualization.

Prerequisite(s): MAE357

Textbook(s) and/or other required material:

N/A

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1. Comprehend basic compressible aerodynamic theory of nozzles and pipes
2. Understand and use Schlieren system for shock visualization
3. Use modern data-acquisition hardware
4. Prepare technical reports in industry supported formats

Topics covered:

1. Converging and CD Nozzle Flow
2. Fanno Flow
3. Supersonic Tunnel Calibration for Mach Number
4. Supersonic Tunnel Operation
5. Shock Visualization on a 2D Wedge and Various Shapes

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, 1 hour lectures and 2 hour laboratory sessions meet on alternating weeks.

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Students must make wide use of numerical techniques, including curve fitting, numerical integration, and statistical data reduction.

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Students evaluate experiment data to determine implications to aerospace engineering problems.

MAE 358 Syllabus

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Student must use math and previous engineering coursework to reduce and interpret lab data.
Outcome B	Basic	Student must conceptualize lab experiment and data acquisition before performance the experiment.
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Major	The student must demonstrate the impact of lab findings on engineering problems through the required lab report.
Outcome F	N/A	
Outcome G	Major	The student must prepare numerous reports in industry accepted format.
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	The students must use modern lab equipment for data acquisition and interpretation.

Person who last prepared this description and date of preparation:

- Heinzen, Stearns Beamon (snheinze) - Jan 25th, 2010 (10:09pm)

MAE 371 Syllabus

Course: MAE 371
Credit Hours: 3
Course Title: Aerospace Structures I
Course Description:

Determination of appropriate analysis techniques for Aerospace Structures. Introduction of governing equations and selected solutions for typical structures. Use of these concepts in the design of a representative structural component.

Prerequisite(s): MAE 216, MAE314 with a grade C or better.

Textbook(s) and/or other required material:

Allen, D. H. and Haisler, W. E., Introduction to Aerospace Structural Analysis, John Wiley and Sons Inc., 1985. (Also used in MAE 472)

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 216 and MAE314 through their mastery of the following course objectives. Through the study of MAE 371 the student will be able to:
1. Comprehend the traction vectors, Cauchy equations, equilibrium equations, stress invariants, 3-D Mohr circle, strain-displacement relations, strain transformation, and Saint-Venant principles;
2. Introduce constitutive equations for material behavior including anisotropic and isotropic solids and yield criteria for metallic materials under combined loading;
3. Integrate the field equations to determine the internal stresses and deformation;
4. Introduce theory and analysis of advanced beams and model internal forces and moments in the beam structures;
5. Determine shear center and shear flow of open and closed sections under torsion and shear load.

Topics covered:

1. Introduction to structural analysis (1) 2. Traction and equilibrium (2)
3. Stress invariants and 3-D Mohr circle (3) 4. Strain-displacement relations (1)
5. Strain transformation and 6. Constitutive equations (2)
Saint-Venant principle (1)
7. Yield criteria (2) 8. Analysis of internal stresses
and deformation (1)
9. Analysis of internal forces and moments (3) 10. Axial stresses of advanced beams (3)
11. Torsion of thin-walled beams (2) 12. Shear center (2)
13. Shear of open and closed sections (3) 14. Exams (2)

Class/laboratory schedule (sessions per week and duration of each session):

MAE 371 Syllabus

14 week semesters, classes meet 2 days per week for 75 minutes.

Contribution of course to meeting the requirements of Criterion 5 - other:

1 credit hours of basic science, 2 credit hours of engineering science. This course requires homework assignment and design and assessment of a structure using different yield criteria under combined loading. A written report for the final assignment is required.

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Solve ordinary differential equations and apply principles of math, science and engineering in the calculation of the response of aerospace structures
Outcome B	N/A	
Outcome C	Major	Comprehend strength of engineering materials and use this information to design aerospace structural components
Outcome D	N/A	
Outcome E	Major	Tension, bending, torsion, shear of single- and multi-cell structural components
Outcome F	N/A	
Outcome G	Major	Demonstrate effective solution procedures to communicate solutions to real aerospace

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
		structural problems
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Basic	Systematic and structured approach to problem solving

Person who last prepared this description and date of preparation:

- Yuan, Fuh-Gwo (yuan) - Jan 25th, 2010 (01:10pm)

MAE 452 Syllabus

Course: MAE 452
Credit Hours: 3
Course Title: Aerodynamics and V/STOL Vehicles
Course Description:

Introduction to the aerodynamics and performance of vertical and short take-off and landing vehicles. Aerodynamics of propellers, rotors and high lift devices.

Prerequisite(s): MAE 356

Textbook(s) and/or other required material:

J. Gordon Leishman, Principles of Helicopter Aerodynamics, 2nd Ed, Cambridge University Press 2006 ISBN-13 978-0-521-85860

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The student will be able to:
1. Explain the fundamentals of various high lift devices from a momentum theory approach.
2. Understand the fundamentals of rotor aerodynamics.
3. Recognize and explain the use of control mechanisms unique to VSTOL aircraft
4. Calculate Helicopter performance for a variety of flight conditions.
5. Explain and do minor calculations concerning a variety of rotor craft issues such as rotor dynamics, noise and vortices

Topics covered:

Based on 2 classes per week- #classes
1. Momentum theory (2)
2. Loading & coefficients (2)
3. Hover, climb & Descent (2)
4. Forward flight (2)
5. Exam (1)
6. Flight controls (2)
6. Flapping, lead-lag, pitch, tailrotors (3)
7. Performance (4)
8. Exam 2 (1)
9. Special topics including: Auto Gyros, Rotor Dynamics, High Lift Devices, Rotor noise, Tilt rotors, BVI, & Tip vortices, (8)
10. Review (1)

Class/laboratory schedule (sessions per week and duration of each session):

MAE 452 Syllabus

14 week semesters, classes meet 2 days per week for 75minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

2 hr Engineering Science, 1 hr Engineering Design. This course requires homework assignments and a design and analysis of a vertical or short take-off vehicle or subsystem. A written report for the design project is required.

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of math, science and engineering in solving aspects of a V/STOL aircraft design.
Outcome B	N/A	
Outcome C	Basic	Design components or subsystems of a V/STOL aircraft.
Outcome D	N/A	
Outcome E	Major	Identify, formulate, and solve engineering problems associated with the design or subsystem of a V/STOL aircraft.
Outcome F	Basic	Understand the relationship of the design of components or subsystems of a V/STOL aircraft to safety of flight.
Outcome G	Basic	Demonstrate effective communications to explain solutions to

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
		engineering problems
Outcome H	N/A	
Outcome I	Basic	Search for information in books, journal papers and other sources, and understand that their knowledge is not complete.
Outcome J	N/A	
Outcome K	Major	Solve problems using computer codes

Person who last prepared this description and date of preparation:

- Nagel, Dr. Robert T (nagel) - Nov 24th, 2009 (01:50pm)

MAE 453 Syllabus

Course: MAE 453
Credit Hours: 3
Course Title: Introduction to Space Flight
Course Description:

This course introduces the students to fundamental aspects of space flight including two-body orbital mechanics, earth satellites, interplanetary trajectories, and special topics as time permits.

Prerequisite(s): MAE 208, MAE 355

Textbook(s) and/or other required material:

Curtis, Howard D., 2010, Orbital Mechanics for Engineering Students, Second Edition. Elsevier, ISBN 978-0-12-374778-5.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

Upon completion of this course, students will have the foundation needed to:
*Analyze different types of satellite orbits and determine orbital position as a function of time
*Understand orbits in three dimensions and use classical approaches of determining the orbit of a satellite from earth-bound observations
*Determine the advantages / disadvantages of different orbital transfer maneuvers and transfers necessary for interplanetary trajectories
*Construct computer simulations (most likely in Matlab) to analyze system orbits
Understand the terminology and design issues related to spaccraft design

Topics covered:

Based on 2 classes per week - () = number of classes:
1. Dynamics of point masses (3)
2. Two body orbital mechanics (4)
3. Orbital position as a function of time (5)
4. Orbits in three dimensions (3)
5. Preliminary orbit determination from earth-based observations (3)
6. Orbital maneuvers (4)
7. Interplanetary trajectories (3)
8. Special topics - design foundation (3)
9. Tests (2)

Class/laboratory schedule (sessions per week and duration of each session):

16 week semesters, classes meet 2 days per week for 75 minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

1 hr, Engineering Design; 2 hrs, Engineering Science. This course covers the fundamentals and various factors responsible for successful space exploration, suitable launch vehicles,space

worthy spacecraft and accurate trajectories.

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	apply principles of math, science and engineering in solving MAE 453 problems
Outcome B	N/A	
Outcome C	Major	design a trajectory and mission
Outcome D	Basic	small teams will work on simple design problems
Outcome E	Major	identify, formulate, and solve engineering problems associated with missions to outer planets and return to Earth
Outcome F	N/A	
Outcome G	Basic	demonstrate effective solution procedures to communicate solutions to engineering problems
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Basic	solve problems using modern computational tools

Person who last prepared this description and date of preparation:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content

- Ferguson, Scott M (smfergu2) - Jan 28th, 2010 (02:11pm)

MAE 455 Syllabus

Course: MAE 455
Credit Hours: 3
Course Title: Boundary Layer theory
Course Description:

Introduction to the Navier-Stokes Equations and boundary layer approximations for incompressible flow. Calculation techniques for laminar and turbulent boundary layer parameters which affect lift, drag, and heat transfer on aerospace vehicles. Discussions of compressible flows.

Prerequisite(s): MAE 355
Textbook(s) and/or other required material:

Schetz, Joseph A., Boundary Layer Analysis, Prentice -Hall Inc., New Jersey, 07458

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

Through the study of MAE 455, Boundary Layer Theory, the student will be able to:
1. Reduce the Navier Stokes equations to the relevant form for simple flows.
2. Determine integral parameters of laminar boundary layers for Falkner -Skan flows.
3. Determine boundary layer characteristics for arbitrary pressure gradient laminar boundary layers and estimate transition to turbulence.
4. Understand the composite nature of a turbulent boundary layer
5. Run integral methods for both laminar and turbulent boundary layers
6. Understand and use the reference temperature method for compressible boundary layers.

Topics covered:

Based on 3 classes per week:
1. Basic Concepts (4) 2. Integral Equations and solutions (4)
3. Navier Stokes Equations (3) 4. Solutions for Laminar constant property (9)
5. Compressible Laminar B. L.(6) 6. Transition to Turbulence (2)
7. Incompressible turbulent BL(8) 8. Review and tests (6)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week for 50 minute lectures or 2 days per week for 75 minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

2 hr, Engineering topics and 1 hr, Math & Basic Science. This course will prepare the student to estimate and calculate boundary layer properties and characteristics for laminar and turbulent boundary layers and associated heat transfer effects. The course contains some design material.

Contribution of course to meeting the requirements of Criterion 5 - math and basic

MAE 455 Syllabus

sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of math, science and engineering in solving MAE 455 problems
Outcome B	N/A	
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Major	Identify, formulate, and solve engineering problems associated with boundary layers, both laminar ands turbulent
Outcome F	N/A	
Outcome G	Basic	Demonstrate effective solution procedures to communicate solutions to engineering problems
Outcome H	Basic	Identify the broad impact of boundary layer theory on the betterment of humankind.
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Basic	Solve boundary layer problems using computer codes

Person who last prepared this description and date of preparation:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content

- DeJarnette, Dr. Fred R (dejar) - Mar 9th, 2010 (04:43pm)

MAE 456 Syllabus

Course: MAE 456
Credit Hours: 3
Course Title: Computational Methods in Aerodynamics
Course Description:

Introduction to computational methods for solving exact fluid equations. Emphasis on development of the fundamentals of finite difference methods and their application to viscous and inviscid flows

Prerequisite(s): MAE 356, Co-requisite MAE 455
Textbook(s) and/or other required material:

Computational Fluid Dynamics: The Basics with Applications, J. D. Anderson, Jr., The McGraw-Hill Companies, New York, 1995.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

This course will prepare the student for use of modern computational methods/techniques employed in the aerodynamic design and analysis of aerospace vehicles. Specifically, the student will be required to:

1. Identify, determine the mathematical character of, and approximate by standard numerical techniques, the governing partial differential equations of fluid flow.
2. Determine the stability bounds for the numerical equations by analysis.
3. Write computer codes and obtain solutions for the numerical techniques applied to model equations and to the nonlinear potential equations.

Topics covered:

Based on 3 classes per week:

1. Fluid-flow models -- Navier-Stokes, Euler, Potential Equations (3)
2. Mathematical classification of partial differential equations -- hyperbolic, parabolic, elliptic (4)
3. Finite-difference methods for each class of PDE (5)
4. Stability of finite-difference approximations(3)
5. Explicit and implicit integration methods (7)
6. Solution of linear wave equation (2)
7. Solution of Poisson's equation over rectangular domains (4)
8. Grids and coordinate transformations (5)
9. Solution of the nonlinear velocity potential equation for subsonic / transonic flow over an airfoil and within a channel (5)
10. Review and tests (4).

MAE 456 Syllabus

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week for 50 minute lectures or 2 days per week for 75 minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

: 3 hrs, Engineering Science. Current aircraft design practice uses computational methods to assess the aerodynamics of the design. The basic equations, numerical techniques and coding issues for these assessment codes are covered in this course. Basic codes are written, results are analyzed and reports prepared.

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply theory and mathematics from previous coursework to develop computational tools
Outcome B	N/A	
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Major	Write computer codes to solve the equations of fluid flow
Outcome F	N/A	
Outcome G	Basic	Write reports detailing the solution techniques and the results.
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	Develop computational tools for use in engineering design and

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
		analysis

Person who last prepared this description and date of preparation:

- Edwards, Dr. Jack R Jr. (jredward) - Jan 25th, 2010 (09:16am)

MAE 461 Syllabus

Course: MAE 461
Credit Hours: 3
Course Title: Dynamics and Controls
Course Description:

Dynamics and linear feedback control of aerospace and mechanical systems. Concepts from linear system theory, kinematics, particle dynamics, first- and second-order systems, system dynamics, vibrations, and computational techniques. Feedback control by root-locus, Nyquist, Bode plots, servo-mechanisms, gain and phase margin, and compensation. Control system design emphasized.

Prerequisite(s): C or better in MA 341 and MAE 208

Textbook(s) and/or other required material:

"Feedback Control of Dynamic Systems," G. F. Franklin, J. D. Powell, A. Emani-Naemi, Prentice Hall, 2002;
On-line Class Handouts (110 pages)

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The course objective is to build on the foundations of mathematics (MA 341) and dynamics (MAE 208) and to develop a broad foundation in dynamics and controls, both theoretical and applied. Through the study of the material taught in this course, the students are able to:
1. Analyze nonlinear dynamical systems. Know how to represent systems in the state-space; determine the equilibrium states; know how to linearize the system about an equilibrium state; analyze stability around an equilibrium state; perform numerical integration.
2. Analyze behavior of linearized dynamical systems. Know how to determine the transient/steady-state response; know how to evaluate a dynamical system, to classify the associated control problem, and to identify the appropriate control approach to use.
3. PID control. Know when and how to use PID control. Understand how to use each of the components of the PID controller. Know how to use the root-locus method, Bode plots, and Nyquist criteria.
4. Nonlinear control. Know how and when to use fuel-optimal (impulsive) and time-optimal (bang-bang) control.
5. Special Topics. Know how to examine parameter sensitivity, to solve linear algebraic equations that are underdetermined, uniquely determined, and over-determined, to solve the over-determined problem, to analyze stability, to construct closed-loop observers.

Topics covered:

Based on three 50 minute classes per week:
1. Nonlinear systems (4) 8. Full-dimensional Linear Feedback (4)
2. Numerical/analytical response (3) 9. Linear feed-forward (tuned absorbers) (3)
3. Performance and cost (tracking) (3) 10. Sensitivity analyses (3)

MAE 461 Syllabus

4. Linear feedback (3) 11. Recursive least squares (2)
5. Nonlinear feedback (3) 12. Parameter identification (1)
6. Linear algebraic equations (2) 13. Observers (4)
7. Modal analysis, design (4) 14. Review (3)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week, 50 minute lectures.

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3 hrs, Engineering topics. This course teaches the student how to analyze and design dynamical systems and controllers. The course contains significant design material.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	apply math, science, engineering in analysis, design, and control.
Outcome B	N/A	
Outcome C	Major	design components of control systems, complete final examination which is a design problem.
Outcome D	N/A	
Outcome E	Major	solve engineering control problems for regulation and tracking of state variables.
Outcome F	N/A	
Outcome G	N/A	
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome K	Major	solve problems that demonstrate mastery of skills, techniques, and modern tools.

Person who last prepared this description and date of preparation:

- Silverberg, Dr. Larry M. (lmsilver) - Nov 12th, 2009 (02:11pm)

MAE 462 Syllabus

Course: MAE 462
Credit Hours: 3
Course Title: Flight Vehicle Stability and Control
Course Description:

Longitudinal, directional and lateral static stability and control of aerospace vehicles. Linearized dynamic analysis of the motion of a six degree-of-freedom flight vehicle in response to control inputs and disturbance through use of the transfer function concept. Control of static and dynamic behavior by vehicle design (stability derivatives) and/or flight control systems.

Prerequisite(s): MAE 261, 461

Textbook(s) and/or other required material:

Etkin, B. and Reid, L. D., "Dynamics of Flight: Stability and Control," 3rd edition, John Wiley & Sons, Inc.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

Through the study of MAE 462, Flight Vehicle Stability and Control, the student should:
1. Be able to explain the need for Equilibrium, Stability, and Control
2. Be able to compute static and dynamic longitudinal, lateral, and directional stability and control characteristics for a rigid, fixed-wing airplane
3. Have an introduction to closed-loop control systems for aircraft
4. Be able to synthesize stability and control information for aircraft design

Topics covered:

Based on 2 classes per week:
1. Introductory Concepts (1)
2. Static Stability and Control (10)
3. Rigid Body Equations of Motion (6)
4. Dynamic Longitudinal Motion (4)
5. Dynamic Lateral/Directional Motion (4)
6. Review and tests (3)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week for 50 minute lectures or 2 days per week for 75 minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

MAE 462 Syllabus

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3 credit hours of engineering science. This course introduces the student to aircraft stability and control (S&C) and provides knowledge of S&C for use in aircraft design and the solution of the dynamic stability characteristics using a modern engineering approach (state-space approach).

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of math, science, and engineering in solving problems in aircraft stability and control
Outcome B	N/A	
Outcome C	Basic	Apply knowledge of aircraft static stability in the design of an aircraft (balsa-wood glider).
Outcome D	N/A	
Outcome E	Major	Define, formulate, and solve engineering problems associated with aircraft stability and control
Outcome F	N/A	
Outcome G	Basic	Demonstrate effective solution procedures to communicate solutions to engineering problems
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	N/A	

Person who last prepared this description and date of preparation:

- Gopalarathnam, Dr. Ashok (agopalar) - Jan 25th, 2010 (08:34am)

MAE 466 Syllabus

Course: MAE 466
Credit Hours: 1
Course Title: Experimental Aerodynamics III
Course Description:

Students use skills learned in the previous two experimental aerodynamics courses to examine complex engineering problems. Student designed experiments are used to resolve technical issues encountered in senior design courses.

Prerequisite(s): MAE358 Co Requisite MAE455, MAE475

Textbook(s) and/or other required material:

N/A

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1. Apply experimental results to actual engineering problems to improve design or resolve issues.
1. Perform experiment planning and scheduling
2. Model fabrication and equipment selection to achieve experimental objectives.
3. Understand data acquisition issues
4. Prepare technical reports in industry supported formats

Topics covered:

1. Aircraft Propeller Performance
2. Reciprocating Engine Performance
3. Airframe / Engine / Propeller Matching
4. Turbine Engine Performance
5. Turbine Installation Issues
6. Student Designed and Conducted Experiments

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, 1 hour lectures and 2 hour laboratory sessions meet on alternating weeks.

Contribution of course to meeting the requirements of Criterion 5 - other:

3hrs, Engineering Science. The student will apply engineering knowledge to the material investigated in lab and relate lab findings and issues to real-world engineering problems. Many topics covered in the senior level lab are directly related to the design problem concurrently being investigated in the senior design course, conclusions drawn in the course of lab experiments are used to make engineering design decisions on the senior design project.

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

MAE 466 Syllabus

Students must make wide use of numerical techniques, including curve fitting, numerical integration, and statistical data reduction.

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

Students evaluate experiment data to determine implications to aerospace engineering problems.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Student must use math and previous engineering coursework to reduce and interpret lab data.
Outcome B	Major	Student must design and conduct an open-ended experiment approved by the instructor.
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Basic	The student must demonstrate the impact of lab findings on engineering problems through the required lab report.
Outcome F	N/A	
Outcome G	Major	The student must prepare numerous reports in industry accepted format.
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	The students must use modern lab equipment for data acquisition and interpretation.

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content

Person who last prepared this description and date of preparation:

- Heinzen, Stearns Beamon (snheinze) - Jan 25th, 2010 (10:45pm)

MAE 469 Syllabus

Course: MAE 469
Credit Hours: 1
Course Title: Controls Laboratory
Course Description:

Laboratory experiments demonstrate the essential features of classical and modern control theory for single-input, single-output systems.

Prerequisite(s): MAE 306 or MAE 261 Co-req MAE 461 or MAE 435

Textbook(s) and/or other required material:

Basic Experiments in Analog Control, L. Silverberg (50 pages);
Lab Session Handouts (50 pages).

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

For most students, the controls laboratory MAE 469 is taken during the same semester as Dynamics and Controls MAE 435. The objective of the controls laboratory MAE 469 is to show how the concepts covered in MAE 461 or MAE 435 are applied. An important part of MAE 469 is directed toward developing the tools and methods in electronics necessary in the application of controls. The students are taught through self-paced, hands-on, experiments that are performed in teams of 3. Through the experiments offered in this course, the students are able to:
1. Experience and perform basic analyses in the areas of dynamics and vibrations. Examine relationships between parameters associated with nutation, precession, and vibration (frequencies, damping rates, externally applied tension, initial conditions, modes of vibration, nodal lines, attenuation, homogeneity, etc.).
2. Experience and perform basic experiments in the areas of analog electronics: Students learn how to analyze, breadboard, and test an analog circuit, build buffers, multipliers, differentiators, integrators, PID controllers, filters, transistors, and motor control.
3. Experience and perform experiments in digital control. Learn about real-time programming, microprocessors, programming a Basic-XTM stamp, how to interface sensors, system design and integration.

Topics covered:

1. Vibrations (1)
2. 3D Dynamic (1)
3. Circuit Analysis (1)
4. Analog Filtering (1)
5. Analog Control (3)
6. Transistors and Motors (2)
7. Microprocessors (3)

Class/laboratory schedule (sessions per week and duration of each session):

MAE 469 Syllabus

14 week semesters, lab meets 1 day per week, 3 hours per lab

Contribution of course to meeting the requirements of Criterion 5 - other:

N/A

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

N/A

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

1 hr, Engineering Topics.
In this course the student learn how to design, build and test various electronic control components. They also receive hands on experience with dynamics and vibration test instrumentation in which they design and conduct the necessary experiments.

Contribution of course to meeting the requirements of Criterion 5 - general education:

N/A

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	N/A	
Outcome B	Major	perform 14 laboratory experiments
Outcome C	N/A	
Outcome D	N/A	
Outcome E	N/A	
Outcome F	N/A	
Outcome G	N/A	
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	N/A	

Person who last prepared this description and date of preparation:

- Crystal Hanson (cmhanso2) - Apr 23rd, 2010 (02:08pm)

MAE 472 Syllabus

Course: MAE 472
Credit Hours: 3
Course Title: Aerospace Structures II
Course Description:

Determination of energy-based analysis techniques for Aerospace Structures. Introduction of work and energy principles for deformation and force analysis of typical structures. Use of finite element method in the design of a representative structural component.

Prerequisite(s): MAE 371

Textbook(s) and/or other required material:

Megson, T. H. G., Aircraft Structures for Engineering Students, 4rth edition, Elsevier, 2007

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 371 through their mastery of the following course objectives. Through the study of MAE 472 the student will be able to:
1. Comprehend the concept of work and potential and virtual work and equilibrium for deformable body;
2. Introduce complementary virtual work and strain energy in a deformable body;
3. Analyze the deformation and stress field using principle of minimum potential energy, Castigliano's theorems, and unit load method;
4. Introduce flexibility method, Raleigh-Ritz method, and stiffness method to analyze deterministic and nondeterministic structures;
5. Introduce finite element method to solve beam and in-plane problems.

Topics covered:

1. Introduction to work and potential (2) 2. Virtual work and equilibrium (3)
3. Complementary virtual work and 4. Castigliano's theorems and
strain energy (3) unit load method (3)
5. Minimum potential energy (3) 6. Flexibility method (3)
7. Rayleigh-Ritz method and 8. Finite element method (5)
and stiffness method (3)
9. Review(1) 10. Exams (2)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 2 days per week for 75 minutes

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic

sciences:

1 credit hours of basic science, 2 credit hours of engineering science. The course requires homework assignments and design and assessment of a space structure using a finite element method. A written report for the final assignment is required.

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

1 credit hours of basic science, 2 credit hours of engineering science. The course requires homework assignments and design and assessment of a space structure using a finite element method. A written report for the final assignment is required.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of energy, math, science and engineering in the calculation of the response of aerospace structures
Outcome B	N/A	
Outcome C	Major	Comprehend strength of engineering materials and use this information to design aerospace structural components
Outcome D	N/A	
Outcome E	Major	Tension, bending, torsion, shear of frame structural components
Outcome F	N/A	
Outcome G	Major	Demonstrate effective solution procedures to communicate solutions to real aerospace structural problems
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome K	Basic	Systematic and structured approach to problem solving

Person who last prepared this description and date of preparation:

- Peters, Kara (kjpeters) - Nov 17th, 2009 (09:05am)

MAE 473 Syllabus

Course: MAE 473
Credit Hours: 1
Course Title: Aerospace Structures II Laboratory
Course Description:

Demonstration and application of the concepts that have been presented in MAE 371 and MAE 472. Fabrication techniques and the design and construction of a structural component will be emphasized

Prerequisite(s): MAE 371, Corequisites: MAE 472

Textbook(s) and/or other required material:

Megson T. H. G., Aircraft Structures for Engineering Students, Elsevier, 4th edition, 2007. (Also used in MAE 371 and 472)

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The students will be asked to demonstrate their knowledge of the material covered in MAE 473 through their mastery of the following course objectives. Through the study of MAE 473 the student will be able to:
1. Install strain gauges correctly on a structure and apply appropriate electronics to measure strain with the gauges.
2. Experimentally determine the load-displacement behavior of common aerospace thin-walled structures.
3. Design and construct a force measurement device based upon strain measurements.
4. Fabricate orthotropic composite materials and predict their material properties.

Topics covered:

Based on 1 laboratory session per week:
1. Basic Concepts and Strain Measurements (2) 2. Thin-walled structure testing (3)
3. Force Measurements (2)
5. Composite fabrication and testing (6) 6. Review and testing (1)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 1 day per week for 2 hour and 50 minute laboratory session

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

1 credit hr, Engineering Science. This course requires students to measure material properties of

isotropic and orthotropic materials. A focus is placed on identifying proper test procedures and data analysis to determine these properties. All results must be presented through written reports.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	**Level of Instruction**	**Related Course Content**
Outcome A	Basic	Apply principles of math, science and engineering in the calculation of the response of aerospace structures and comparison with experimental data.
Outcome B	Major	Design and conduct experiments to measure the response of structural components of isotropic and orthotropic materials to loading.
Outcome C	N/A	
Outcome D	N/A	
Outcome E	N/A	
Outcome F	N/A	
Outcome G	Major	Demonstrate effective written reporting of experimental procedures and results, and communication of critical evaluation of these results.
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	Perform measurements of structural parameters using modern sensing and data acquisition techniques.

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content

Person who last prepared this description and date of preparation:

- Peters, Kara (kjpeters) - Nov 17th, 2009 (09:07am)

MAE 475 Syllabus

Course: MAE 475
Credit Hours: 3
Course Title: Propulsion
Course Description:

One-dimensional, internal, compressible flow including: isentropic flow, normal shocks, flow with friction and simple heat addition. Applications to air-breathing aircraft propulsion systems. Performance, analysis and design of components and overall performance of air-breathing engines.

Prerequisite(s): MAE 356 (Aerodynamics II) and MAE 301 (Thermodynamics I)

Textbook(s) and/or other required material:

Mechanics and Thermodynamics of Propulsion, 2nd edition, by Hill and Peterson

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

Determine the composition and adiabatic flame temperature for typical hydrocarbon-air combustion. Predict the exit velocity and Mach number of a one-dimensional flow with heat transfer (Rayleigh-line flow). Analyze the efficiencies (thermodynamic, propulsive, and overall) of various propulsive devices (ramjet, turbojet, turboprop, turbofan, and rocket). Model the one-dimensional flow through various subsonic and supersonic inlets and nozzles. Analyze axial flow compressors and turbines. Design and optimize a turbofan engine design for a high performance aircraft. Determine performance characteristics of rockets, including optimal staging.

Topics covered:

Topic # of lectures
Introduction 1
Thermo review, combustion 3
1-D flow, shocks, nozzle flow 2
Thermodynamic cycles 2
Exam 1 1
Gas turbines (inlets, comb, and nozzles) 5
Gas turbines (compressors) 4
Gas turbines (turbines) 2
Exam 2 1
Fighter engine analysis and design 3
Rockets 4

Class/laboratory schedule (sessions per week and duration of each session):

Two 75 minute sessions per week, for 14 week term.

Contribution of course to meeting the requirements of Criterion 5 - other:

MAE 475 Syllabus

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

1 hr, Engineering Design; 2 hrs, Engineering Science. This is the essential course in propulsion, both air-breathing and rocket based, providing them with both fundamental and practical knowledge of propulsive devices. Students use trade-off studies to determine the optimal combination of compressor pressure ratio, by-pass ratio, and turbine inlet temperature to optimize an engine for a high-performance aircraft.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of math, science and engineering in solving MAE 475 problems
Outcome B	N/A	
Outcome C	Basic	Successfully design gas turbine from components (diffuser/inlet, compressor, combustor, turbine, nozzle) to achieve desired performance
Outcome D	N/A	
Outcome E	Major	Identify, formulate, and solve engineering problems associated with boundary layers, both laminar ands turbulent
Outcome F	N/A	
Outcome G	Basic	Demonstrate effective solution procedures to communicate solutions to engineering problems

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome H	Basic	
Outcome I	N/A	
Outcome J	Basic	
Outcome K	Basic	Solve problems using computer codes

Person who last prepared this description and date of preparation:

- Roberts, Prof. William L. IV (wlrobert) - Nov 25th, 2009 (08:25am)

MAE 476 Syllabus

Course: MAE 476
Credit Hours: 3
Course Title: Rocket Propulsion
Course Description:

Study of chemical rockets. This includes nozzle theory, flight performance, thermochemical calculations, and component and system analysis and design. Both liquid engines and solid motors will be discussed and analyzed.

Prerequisite(s): MA 356 or MAE 302

Textbook(s) and/or other required material:

G. P. Sutton and O. Biblarz, Rocket Propulsion Elements, 7th edition, Wiley, New York,2001.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

The objective of this course is to provide the student with an introduction to rocket propulsion , an understanding of the basic principles involved, and an appreciation of component and system design. As a result of this course the student should be able to:
1. Understand rocket nozzle operations under a wide range of altitudes.
2. Carry out propellant combustion calculations and determine from that relevant performance parameters.
3. Understand the roles of the various rocket components.
4. Develop an understanding for the design process.
5. Be able to design a thrust chamber or a solid engine motor to meet certain mission requirements.

Topics covered:

Based on 3 classes per week:
1. Rocket Classification (1) 2. Flight Performance (2)
3. Nozzle Theory (6) 4. Thermochemical Calculations(8)
5. Liquid Propellant Engines and Propellants (4) 6. Thrust Chamber Analysis and Design (5)
7. Solid Propellant Motors and Propellants (3) 8. Grain Performance Analysis and Design (3)
9. Selection Criteria of Propulsion Systems (3) 10. Problem Solving and Tests (7)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week for 50 minute lectures or 2 days per week for 75 minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic

MAE 476 Syllabus

sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3 hr, Engineering Topics. This course prepares the student for problem solving and design associated with rocket motors

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of math, science and engineering in solving propulsion problems
Outcome B	N/A	
Outcome C	Major	Design a thrust chamber and a solid engine motor
Outcome D	Major	Small teams will work on design problems
Outcome E	Major	Identify, formulate, and solve engineering problems associated with performance and design of chemical rockets.
Outcome F	N/A	
Outcome G	Basic	Demonstrate effective solution procedures to communicate solutions to engineering problems
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	Solve problems using modern computational tools

Person who last prepared this description and date of preparation:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content

- Roberts, Prof. William L. IV (wlrobert) - Nov 25th, 2009 (08:24am)

MAE 478 Syllabus

Course: MAE 478

Credit Hours: 3

Course Title: Aerospace Vehicle Design I

Course Description:

A synthesis of previously acquired theoretical and empirical knowledge and application to the design of a practical aerospace vehicle systems.

Prerequisite(s): MAE 356, MAE462, MAE465, MAE 472

Textbook(s) and/or other required material:

Daniel P. Raymer, Aircraft Design:A Conceptual Approach, 3rd Edition, American Institute of Aeronautics and Astronautics, c1999

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1.Prioritize customer requirements into a engineering design goals. 2.Resolve conflicts arising from the different areas of the design (ie. Aerodynamics, Manufacturing, Maintenance, Operations, Performance, Propulsion, Structures , Stability and Control). 3.Have a design that will satisfy the customer requirements.
4.Have their design to meet specified schedule and budget constraints. 5.Design experiments to obtain data that are not available form standard sources.6.Conduct experiments to obtain data for incorporation into their design. 7.Document their design. 8.Make technical presentations.

Topics covered:

Based on 2 classes per week: 1. Initial Design Problem(1) 2. Concurrent Engineering (6) 3. Ethics in Teamwork and Design (1) 4. Preliminary Sizing (2)
5. Materials and Techniques(2) 6. Aerodynamic Panel Methods (3) 7. Structural Design (2) 8. Stability and Control (2) 9. Performance (2) 10. Student presentations (7)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 2 days per week for 75 minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3 hr, Engineering Design. The multidisciplinary teams function as independent companies which are contracted to design an aerospace vehicle that will satisfy given set of customer requirements which include budget and time constraints. Each team submits a proposal (written proposal and oral presentation) for their design. The teams also submit material (written report and oral

presentation) for a Preliminary Design Review and a Critical Design Review. The Critical Design Review documents that the customer requirements are satisfied. Oral update presentations are required biweekly.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of math, science and engineering in solving all aspects of an aircraft design
Outcome B	Major	Apply of math & engineering to design and conduct experiments required to support their design.
Outcome C	Major	Generate a design that will satisfy the customer requirements.
Outcome D	Major	Function as a member of a team & highlight problems associated with the design.
Outcome E	Major	Identify, formulate, and solve engineering problems associated with the design of an aircraft.
Outcome F	Major	Resolve conflicting goals of the different disciplines of the aircraft design.
Outcome G	Major	Demonstrate effective communications to explain solutions to engineering problems
Outcome H	Basic	Demonstrate an appreciation of the effects of engineering advances on society

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome I	Basic	Search for information in books, journal papers and other sources, and understand that their knowledge is not complete.
Outcome J	Basic	Explain contemporary problems & issues associated with their design
Outcome K	Major	Solve problems using computer codes

Person who last prepared this description and date of preparation:

- Crystal Hanson (cmhanso2) - Jun 4th, 2009 (02:23pm)

MAE 479 Syllabus

Course: MAE 479
Credit Hours: 4
Course Title: Aerospace Vehicle Design II
Course Description:

Designs are refined and the vehicles constructed and instrumented by the students. A ground and flight test program is designed and carried out in cooperation with MAE525 students.

Prerequisite(s): MAE 478
Textbook(s) and/or other required material:

Daniel P. Raymer, Aircraft Design:A Conceptual Approach, 3rd Edition, American Institute of Aeronautics and Astronautics, c1999

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1. Construct their aircraft design. 2. Redesign components of their aircraft as problems are found during construction. 3.Design and conduct ground tests and compare the results to those of their design to demonstrate that their aircraft is safe to fly. Examples of the required tests are static loading of the wing, performance of the power plant, moment of inertia measurements and others. 4.Maintain their aircraft. 5.Generate checklists, standard operating procedures and aircraft limitations. 6. Design flight tests to obtain data to compare with their design data and to demonstrate meeting the customer requirements. 7.Communicate with MAE525 students to inform them of changes in the aircraft models so that the MAE525 students can incorporate them into their autopilot design. 8. Document their design. 9.Make technical presentations.

Topics covered:

Based on 2 classes per week: 1. Construction Techniques (7) 2. Ground Tests (4) 3. Ethics (1) 4. Checklists, Standard Operating Procedures Safety (2)
5. Flight Tests (5) 6. Student Presentations (9)

Class/laboratory schedule (sessions per week and duration of each session):

14 week semesters, classes meet 3 days per week for 75minute lectures

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

4 hr, Engineering Design. The student teams of MAE478 construct the aerospace vehicles documented in the Critical Design Review of MAE478. Changes of their designs that are required to construct their vehicles are analyzed, documented and presented to a Configuration

Change Board. The teams design, conduct, and analyze both ground and flight tests to validate their design predictions.

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Apply principles of math, science and engineering in solving all aspects of an aircraft design
Outcome B	Major	Apply principles of math & science to design and conduct experiments required to verify their design.
Outcome C	Major	Redesign components and systems that fail to meet the design requirements during the construction, ground and flight testing phases.
Outcome D	Major	Function as a member of a team, highlight problems associated with the design to satisfy requirements.
Outcome E	Major	Identify, formulate, and solve engineering problems associated with the design, manufacturing and operation of an aircraft.
Outcome F	Major	Resolve conflicting goals of the different disciplines of the aircraft design in an ethical manner.
Outcome G	Major	Demonstrate effective communications to

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
		explain solutions to engineering problems
Outcome H	Basic	Demonstrate an appreciation of the effects of engineering advances on society
Outcome I	Basic	Search for information in books, journal papers and other sources, and understand that their knowledge is not complete.
Outcome J	Basic	Explain contemporary problems & issues associated with their design
Outcome K	Major	Solve problems using computer codes

Person who last prepared this description and date of preparation:

- Crystal Hanson (cmhanso2) - Jun 4th, 2009 (02:26pm)

MSE 201 Syllabus

Course: MSE 201

Credit Hours: 3

Course Title: Structure and Properties of Engineering Materials

Course Description:

Introduction to the fundamental physical principles governing the structure and constitution of metallic and nonmetallic materials and the relationships among these principles and the mechanical, physical and chemical properties of engineering materials.

Prerequisite(s): CH 101

Textbook(s) and/or other required material:

Fundamentals of Materials Science and Engineering: An Introduction, 7th ed., W.J. Callister, Jr., Wiley & Sons, 2007.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1) Describe the chemical bonding in metals, ceramics and polymers, 2) Draw unit cells showing atomic positions for simple crystalline metals and ceramics,3) Describe defects in metallic and ceramic crystals and the roles they play in diffusion and mechanical properties, 4) Analyze binary phase diagrams, determine the amounts and compositions of phases present at a given temperature and alloy composition, and sketch the equilibrium microstructure present at any temperature and composition, 5) Describe the development of microstructure with time during a phase transformation, 6) Describe basic structure-property relationships for metallic, ceramic, polymeric, semiconducting and composite materials

Topics covered:

Bonding and crystal structures, Defects
Diffusion and Fick's laws
Mechanical properties
Dislocations and strengthening, Failure
Phase diagrams, lever law, Iron-carbon phase diagram
Kinetics of phase transformations
Ceramics and glasses
Polymers and composites
Electrical conductivity, semiconductors, Magnetism

Class/laboratory schedule (sessions per week and duration of each session):

Classes meet for two 75-minute or three 50-minute sessions per week

Contribution of course to meeting the requirements of Criterion 5 - other:

N/A

Contribution of course to meeting the requirements of Criterion 5 - math and basic

MSE 201 Syllabus

sciences:

N/A

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3 hours engineering topics - introductory coverage of crystallography, phase diagrams, mechanical, thermal, electrical, and magnetic properties of materials

Contribution of course to meeting the requirements of Criterion 5 - general education:

N/A

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Describe the periodic table, chemical bonding, electronic band structure in solids, electrical and magnetic principles, stress/strain principles, structure-property relationships in metals, ceramics, polymers, and semiconducting materials.
Outcome B	Major	Analyze and compare mechanical testing data for metals, ceramics and polymers, including stress-strain, hardness, fatigue, fracture, creep and impact tests.
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Major	Solve elementary problems in mechanical behavior and fracture mechanics, microstructural design of alloys from phase diagrams and kinetic

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
		considerations, factors controlling conductivity in metals and semiconductors.
Outcome F	N/A	
Outcome G	N/A	
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	Describe mechanical testing procedures such as tensile, creep, hardness, fatigue and impact tests, describe the properties obtained from these tests and relate them to specific applications. Use phase diagrams to determine qualitatively and quantitatively the microstructural development which occurs during the processing of selected materials and relate that microstructure to properties such as strength and ductility.

Person who last prepared this description and date of preparation:

- Raubenheimer, Dr. Dianne Carol (cdrauben) - May 6th, 2010 (01:33pm)