New Courses
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

1. This request is submitted by the Department of Aerospace Engineering

2. Course prefix, number and complete title of course: AERO 621 Aeromechanics of Wind Turbines

3. Catalog course description (not to exceed 50 words): Solid and fluid mechanics concepts applied to aerodynamics and aeroelasticity of wind turbine blades; failure analysis and structural design; composites and hybrid materials.

4. Prerequisite(s): Graduate classification

   Cross-listed with:

   Cross-listed courses require the signature of both department heads.

5. Is this a variable credit course? ☐ Yes ☒ No If yes, from ________ to ________

6. Is this a repeatable course? ☐ Yes ☒ No If yes, this course may be taken ________ times.
   Will this course be repeated within the same semester? ☐ Yes ☒ No

7. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

   MS, MEng, PhD in aerospace engineering or related fields

8. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

9. Prefix Course # Title (excluding punctuation)

   AERO 621 Aeromechanics of Wind Turbines

   Lect. Lab SCH CIP and Fund Code Admin. Unit Acad. Year HICE Code
   0 3 0 0 0 3 1 4 2 7 0 1 0 0 6 0 1 0 0 1 4 - 1 5 0 0 3 6 3 2

   Approval recommended by: 

   Rodney D. Bowerson
   Department Head - Type Name & Sign John E. Harbide Date 3/16/13
   Date

   Department Head - Type Name & Sign (if cross-listed course) Date

   Submitted to Coordinating Board by:

   Associate Director, Curricular Services

   Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
   Curricular Services – 3/09
AEROSPACE ENGINEERING

Course title and number  AERO 621 – Aeromechanics of Wind Turbines
Term  Fall 2014
Credit/Hours  3.0
Meeting times/location  TBA

Course Description and Prerequisites

Concepts, analyses and methods in solid and fluid mechanics applied to aerodynamics and aeroelasticity of wind turbine blades; stress and failure analysis of composites and hybrid material systems for blade structures; tradeoffs between manufacturing cost and long term performance of turbine structural elements.

Prerequisite: Graduate Classification.

Learning Outcomes or Course Objectives

Students will gain understanding of the complexities in aerodynamics and structural dynamics of wind turbine blades. They will learn how to apply the fundamentals of solid and fluid mechanics to analyzing deflections, vibrations, and performance of blade structures. They will appreciate use of advance material systems in design of large turbines such as for offshore wind energy.

Instructor Information

Name  Ramesh Talreja (lead instructor); Paul Cizmas; Mohammad Naraghi; Thomas Strganac; Ed White
Telephone number  979.458.3256 (Talreja)
Email address  Talreja@aero.tamu.edu
Office hours  TBA
Office location  HRBB 736A (Talreja)

Textbook and/or Resource Material

Handout notes and copies of selected articles.

Grading Policies

Midterm project report  30 percent
Final project report and presentation  70 percent

A 90 – 100%
B 80 – 89%
C 70 – 79%
D 60 – 69%
F below 60%
# Course Topics

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<tr>
<th>Week</th>
<th>Topic</th>
<th>Hours</th>
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<tr>
<td>1</td>
<td>Introduction, basics of wind energy generation, energy sustainability</td>
<td>3</td>
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<tr>
<td>2</td>
<td>Aerodynamics of wind turbines</td>
<td>3</td>
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<tr>
<td>3</td>
<td>Experimental aerodynamics</td>
<td>3</td>
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<tr>
<td>4-5</td>
<td>Computational aeromechanics</td>
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<tr>
<td>6-7</td>
<td>Aeroelasticity of turbine blades</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Materials and structural configurations for turbine blades</td>
<td>3</td>
</tr>
<tr>
<td>9-10</td>
<td>Deformation, fatigue and failure of blade structures</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Performance assessment by advanced, hybrid materials</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>Project preparation, presentations</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>Total hrs</strong></td>
<td><strong>45</strong></td>
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## Other Pertinent Course Information

Students are expected to attend class. For additional information visit the student rules website on attendance: [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

## Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu).

## Academic Integrity

For additional information please visit: [http://www.tamu.edu/aggiehonor](http://www.tamu.edu/aggiehonor).

"An Aggie does not lie, cheat, or steal, or tolerate those who do."
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

Form Instructions

1. Request submitted by (Department or Program Name): Electrical and Computer Engineering

2. Course prefix, number and complete title of course: ECEN 735 Electromagnetic Field Theory

3. Catalog course description (not to exceed 50 words): Methods in wave propagation, diffraction and scattering analysis, including surface waves, creeping waves, surface plasmons and complex environments; applications to macroscopic and nano technology such as optical wave propagation in materials and wireless device wave propagation.

4. Prerequisite(s): ECEN 635 or equivalent

5. Is this a variable credit course? ☒ Yes ☐ No
   If yes, from _______ to _______

6. Is this a repeatable course? ☐ Yes ☒ No
   Will this course be repeated within the same semester? ☐ Yes ☒ No
   If yes, this course may be taken _______ times.

7. This course will be:
   a. required for students enrolled in the following degree programs(s) (e.g., B.A. in history)

   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

   MS, PhD in Electrical and Computer Engineering

8. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

9. 

<table>
<thead>
<tr>
<th>Preux</th>
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<th>Title (excluding punctuation)</th>
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<td>735</td>
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<td>Lect.</td>
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<td>SCH</td>
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<td>Admin. Unit</td>
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</tbody>
</table>

   Approval recommended by:

   Chanan Singh
   Department Head or Program Chair (Type Name & Sign) Date 4/10/13

   Krishna Narayanan 4/21/13
   Department Head or Program Chair (Type Name & Sign) (if cross-listed course)

   Submitted to Coordinating Board by:

   Associate Director, Curricular Services

   Chair, College Review Committee Date 4/10/13

   Dean of College Date 5-15-13

   Chair, GC or UCC Date

   Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandbox-williams@tamu.edu.
Curricular Services – 3/10
Syllabus

ECEN 735 Electromagnetic Field Theory

Term: Fall 2013

Instructor: Robert Nevels, Rm. 235A Zachry

Course Description: Methods in wave propagation, diffraction and scattering analysis, including surface waves, creeping waves, surface plasmons and complex environments. Applications to macroscopic and nano technology such as optical wave propagation in materials and wireless device wave propagation.

Prerequisite: ECEN 351 or equivalent, ECEN 635 highly recommended

Book: *Time Harmonic Electromagnetic Fields*, R. Harrington and *Handbook of Mathematical Functions*, Abramowitz and Stegun

Reference Books on reserve (overnight checkout allowed):

<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Homogeneous Wave Equation Solutions</td>
<td>Modal expansions and wave functions Eigenfunction expansion methods</td>
</tr>
<tr>
<td>2</td>
<td>Rectangular waveguide</td>
<td>Dielectric Waveguides</td>
</tr>
<tr>
<td>3</td>
<td>Circular Cylinders and Wedges</td>
<td>Spherical objects</td>
</tr>
<tr>
<td>4</td>
<td>Non-spherical objects</td>
<td>Watson transformation</td>
</tr>
<tr>
<td>5</td>
<td>Surface plasmons</td>
<td>Metamaterials</td>
</tr>
<tr>
<td>6</td>
<td>Exam Review</td>
<td>Exam 1</td>
</tr>
<tr>
<td>7</td>
<td>Propagation</td>
<td>Fourier transform methods</td>
</tr>
<tr>
<td>8</td>
<td>Dispersive media</td>
<td>Laplace transformation</td>
</tr>
<tr>
<td>9</td>
<td>Saddle point integration</td>
<td>Stationary Phase and Steepest Descents</td>
</tr>
<tr>
<td>10</td>
<td>WKB in Atmospheric Propagation</td>
<td>WKB related methods in Propagation</td>
</tr>
<tr>
<td>11</td>
<td>Precursor in homogeneous material (a)</td>
<td>Precursor in homogeneous material (b)</td>
</tr>
<tr>
<td>12</td>
<td>Creeping Waves</td>
<td>Leaky Waves</td>
</tr>
<tr>
<td>13</td>
<td>Fourier Optics</td>
<td>Geometrical optics</td>
</tr>
<tr>
<td>14</td>
<td>Course review for Final Exam</td>
<td>Final exam</td>
</tr>
</tbody>
</table>

Grading System:
Final 50%
Homework 50%
TOTAL 100%

If you have a university excused absence for missing the first exam, the final will be doubled.
**Makeup Homework:** After class late homework will be accepted until 4:30 PM the day it is due, but with a 15% penalty. It will be accepted the following day until 11:00AM, with a penalty of 25%. For planned university excused absences it is expected that you will turn in the homework before the absence. If the absence is unplanned there will be no penalty.

**Grades** will be calculated on the basis of total earned points according to the following standard: A (90-100%), B (80-89%), C (70-79%), D(60-69%), F (59% and lower).

**Attendance Policy:**

http://student-rules.tamu.edu/rule07

**Exam Dates**

TBA

**Learning Outcomes or Course Objectives**

**Course Objectives:** To provide students with the essence of wave propagation, waveguiding systems, antenna radiation and elements of electromagnetic theory.

1. Methods for solving wave propagation and scattering from canonical shaped objects in rectangular cylindrical and spherical coordinates.
2. Methods for solving wave propagation in dispersive media, such as Noble metals, and inhomogeneous media, such as the ionospheric layers.
3. Techniques for calculating fields scattered from objects that a large in terms of wavelengths and associated asymptotic methods.
4. Special wave groups including surface, leaky and creeping waves, surface plasmons and floquet modes.
5. Mathematical methods for field analysis including complex plane integration, saddle point, steepest descent and stationary phase evaluation of integrals, as well as Laplace and Fourier Transform methods.
6. Common techniques in field analysis such as WKB, geometrical optics and the geometrical theory of diffraction.

**Academic Integrity**

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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

Form Instructions

1. Request submitted by (Department or Program Name): Electrical and Computer Engineering

2. Course prefix, number and complete title of course: ECEN 754 Optimization for Electrical and Computer Engineering Applications

3. Catalog course description (not to exceed 50 words): Principles of optimization, including linear and nonlinear optimization, as well as Electrical and Computer Engineering applications in signal estimation, routing in communication networks, flows in wireless networks, wafer fabrication plants, and economic dispatch in power systems.

4. Prerequisite(s): Math 304 or 309 or 311; Math 251 or Graduate Classification

Cross-listed with: Stacked with: ECEN 434

Cross-listed courses require the signature of both department heads.

5. Is this a variable credit course? Yes ☐ No ☑ If yes, from _______ to _______

6. Is this a repeatable course? Yes ☐ No ☑ If yes, this course may be taken _______ times.

Will this course be repeated within the same semester? Yes ☐ No ☑

7. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)

   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

   MS and PHD, ELEN and CEEN

8. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

9. Prefix   Course #   Title (excluding punctuation)

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Approval recommended by: 3/22/13

C. Singh
Department Head or Program Chair (Type Name & Sign) Date

Chair, College Review Committee 4/10/13

Department Head or Program Chair (Type Name & Sign) Date
(if cross-listed course)

Dean of College 4/10/13

Chair, GC or UG 5-15-13

Submitted to Coordinating Board by:

Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services – 3/10
Course Title: ECEN 754 Optimization for Electrical and Computer Engineering Applications

Term: Fall 2014

Meeting Times & Location: TBA

Course Description:
Principles of optimization, including linear and nonlinear optimization, as well as Electrical and Computer Engineering applications in signal estimation, routing in communication networks, flows in wireless networks, wafer fabrication plants, and economic dispatch in power systems.

Prerequisites:
Math 304 or 309 or 311; and Math 251; and Graduate standing

Class absences: There will be some class absences. Every class absence will be made up by a make-up class. The schedule for class absences and corresponding make-up classes will be announced in class. The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Learning Outcomes or Course Objectives
The students will learn how to formulate optimization problems with application to Electrical and Computer Engineering. They will also learn how to solve optimization methods using a variety of methodologies. Finally they will have experience in writing programs to solve optimization problems in Electrical and Computer Engineering.

Instructor Information
Name: P. R. Kumar
Telephone number: 979-862-3376
Email address: prk@tamu.edu
Office Hours: Wednesdays 10-11am
Office Location: Room 331E WERC

Textbook
Grading

Homeworks:
There is an additional project that is required for graduate students. There will also be additional homework problems assigned to graduate students.
Homeworks: 37.5%, Midterm 18.75%, Project 18.75%, Final 25%

In the Undergraduate version:

Homeworks: 50%, Midterm 25%, Final 25%

Grading scale (will be adjusted according to student performance distribution):
90-100 A, 80-89 B, 70-79 C, 60-69 D, below 59 F.

Course Schedule

1. Linear Programming and ECE Applications (14 hours)
   a. Introduction to linear programming and graphical solution 1 hour
   b. The Simplex algorithm 2 hours
   c. Sensitivity to constraint relaxation 1 hour
   d. Reduction to standard form 2 hours
   e. Multiple optimal solutions, unboundedness, and infeasibility 1 hour
   f. Duality and complementary slackness 3 hours
   g. Optimization of Communication Networks 2 hours
   h. Duality of performance and optimization in Semiconductor Wafer Fabrication Plants 2 hours

2. Nonlinear Optimization and ECE Applications (22 hours)
   a. Necessary conditions and sufficient conditions for unconstrained local optimality 1 hour
   b. Necessary conditions and sufficient conditions for constrained local optimality 1 hour
   c. Optimality conditions for convex functions on convex sets 1 hour
   d. Projection onto a convex set 2 hours
   e. Optimization with inequality and equality constraints Kuhn-Tucker Conditions 2 hours
   f. Lagrange dual function and strong duality 3 hours
   g. Separating hyperplanes 2 hour
   h. Convex duality and Slater's condition 3 hours
   i. Complementary slackness and sensitivity 3 hours
   j. Minimum Delay Slackness and Sensitivity Routing in the Internet 1 hour
k. Economic Dispatch in Electric Power Networks 1 hour
l. Signal Estimation 1 hour
m. Congestion Control in Wired and Wireless Networks 1 hour

3. Numerical methods (6 hours)
   a. Order of convergence 1 hour
   b. Newton's method and quadratic convergence 1 hour
   c. Steepest descent and linear convergence 1 hour
   d. Subgradient method 1 hour
   e. Penalty and barrier methods 1 hour
   f. Augmented Lagrangian methods 1 hour

TOTAL 42 hours

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Academic Integrity
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Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. Aggie Honor Code and Honor Council Rules and Procedures are available at http://aggiehonor.tamu.edu
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

1. Request submitted by (Department or Program Name): Department of Industrial and Systems Engineering
   ISEN 631 Cognitive Systems Engineering

2. Course prefix, number and complete title of course:
   ISEN 631 Cognitive Systems Engineering

3. Catalog course description (not to exceed 50 words):
   Analyze how artifacts, displays, social interaction, and factors such as stress, time pressure, compelling demands, and uncertainty affect human cognitive functions such as perception, attention, memory, decision-making, and problem-solving in joint human-machine systems. User-centered design techniques, research and evaluation methods introduced and applied to a design project.

4. Prerequisite(s):
   Cross-listed with:
   Stacked with:
   Cross listed courses require the signature of both department heads.

5. Is this a variable credit course? □ Yes ☑ No
   If yes, from _______ to _______

6. Is this a repeatable course? □ Yes- ☑ No
   Will this course be repeated within the same semester? □ Yes ☑ No
   If yes, this course may be taken _______ times.

7. This course will be:
   a. required for students enrolled in the following degree programs(s) (e.g., B.A. in history)
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

   M.Eng., M.S., Ph.D. in Engineering

8. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

9. Prefix Course # Title (excluding punctuation)

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<th>Lab</th>
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<th>Admin. Unit</th>
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Approval recommended by:

Cesar O. Malave
Department Head or Program Chair (Type Name & Sign) Date

Chair, College Review Committee Date

Dean of College Date

Chair, OCE or UCE Date

Submitted to Coordinating Board by:

Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 945-8201 or sandra-williams@tamu.edu.
Curricular Services – 3/10
AREN 631: Cognitive Systems Engineering
Fall 2014

Lectures: 2:20 – 3:35, Tuesdays and Thursdays
1013 ETB

Instructor: Thomas Ferris, PhD
4081 ETB
tferris@tamu.edu (preferred), 979-458-2340
Office Hours: 3:45 – 5:00 Tuesdays, or by request

Text: All course readings will be posted on the course eLearning site:
http://elearning.tamu.edu/

Scope and Objectives:
This course will provide an overview of the fields of Cognitive Systems Engineering (CSE) and Cognitive Ergonomics (CE), which are concerned with studying the role of humans in engineered systems and designing processes, tools, and technologies to support cognitive functions such as communication, planning, decision-making, and problem-solving in complex work domains. It will analyze how artifacts, displays, social interactions, and factors such as time pressure, competing demands, and uncertainty affect performance in joint human-machine cognitive systems. Examples of ongoing CSE and CE research will be discussed. Research and evaluation methods will be presented and applied to a group project throughout the semester. Prerequisites for this course are AREN 430/630, AREN 635, or approval of instructor.

Grade Determination:
20% Reading responses
50% Exams: midterm (25%) and final exam (25%)
30% Semester project

Grades will be calculated on the basis of total points earned. The points can be curved based on class average and may be lower than the following standard (out of a total of 100 points).

A 90-100
B 80-89
C 70-79
D 60-69
F 59 and lower
Reading Responses:

With few exceptions, there will be an assigned reading related to the lecture material for each class. The readings will be posted on eLearning. As a way to jump-start class discussion, you will need to submit a reading response for each assigned reading via eLearning by 12:00 noon on the day of the associated lecture, unless otherwise specified. These responses must be one page in length (strictly enforced; 11 point font, single spacing) and must include:

1) A summary of the reading, in your own words (anything copied verbatim from text or other sources will result in no credit given for the response, and potentially an honor system violation)

2) Clearly separated from the summary, at least one of the following:
   A) An insightful question about the reading. Time permitting, I will address as many of these questions as I can in lecture.
   B) A comment about how the reading relates to other course concepts or to an example/anecdote from your own life experience.

The reading response exercises are designed to support assimilation and retention of the course material, and also to identify emphases for me to cover in lecture. Please be prepared to expand on, and discuss, your comment or question.

Generally, late submissions for any responses will not receive any credit. Exceptions can be made in case of sickness, military service, jury duty, presentation at a professional conference, or family emergencies. In all of these cases, some form of documentation will be required.

Exams:

There will be two written exams: a midterm which is tentatively scheduled for October 10th, and a comprehensive final exam (TBD), each of which account for 25% of your final grade. The exams are closed-book and will emphasize material discussed in lecture, but can include any material from the assigned readings. Each exam will consist primarily of short answer essay questions. Make-up exams will be offered only in case of sickness, military service, jury duty, presentation at a professional conference, or family emergency (documentation required in all cases).

Re-grading Policy:

Students have 1 week after grades are released for an assignment or exam to submit a re-grade request in writing. This request must not exceed 1 page (11 point font, single spacing), and must clearly indicate the relevant problem(s) and justification for why you think re-grading is warranted. Note that a requested re-grade may result in further point deductions if new errors are discovered.

Semester Project:

Teams of 2 – 4 students (formed by the instructor) will collaborate on a project analyzing the cognitive work in a sociotechnical system, tentatively planned to be a local Neonatal Intensive Care Unit (NICU). This project will take part in 3 phases, each with its own deliverables. Note that the 3-phase plan
below is tentative and may change due to the availability of NICU personnel and other resources. Changes in the plan could also lead to redistribution of project grade percentages for each deliverable.

- **Phase 1:** Students will perform a literature review and reasonable front end analysis regarding a project focus that involves some subset of operations within the NICU system. This will serve to inform the in situ data collection and guide the task analysis in Phase 2.
  - Deliverable: Literature review and front end analysis report (30% of project grade)

- **Phase 2:** Students will apply task analysis techniques to formally describe the NICU system tasks/functions that were selected for the project focus. In addition to a task analysis, the report deliverable will include identification of subtasks that are problematic or could likely be improved with different technology, training, or procedures.
  - Deliverable: Hierarchical Task Analysis, task description report (30% of project grade)

- **Phase 3:** Students will design a “solution” to improve the effectiveness of the NICU system according to shortcomings that were identified in phase 2. This solution may take several forms, for example, it may involve the development of technology the nurses can use (e.g., software tool, external memory aid, information visualization), a procedural change, or a training method. An additional requirement may be for the solution to be evaluated using techniques discussed in class (e.g., usability study, focus groups/interviews/surveys, mini-experiments). Project groups will work with Dr. Ferris to determine the appropriate scope for this activity.
  - Deliverables: Solution and evaluation report (30% of project grade), in-class presentation (10% of project grade)

  Each team member is expected to contribute to each phase of the project and each deliverable. Students will be required to submit peer evaluation forms for the members of their team, and individual grades will be adjusted up/down based on the combined evaluation forms from all team members. Students are strongly encouraged to contact Dr. Ferris early on if there are any problems with/between team members that require attention.

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"An Aggie does not lie, cheat, or steal, or tolerate those who do."

For additional information please visit: [http://www.tamu.edu/aggiehonor](http://www.tamu.edu/aggiehonor)

**Lecture Topics and Tentative Schedule (Subject to Change)**
Changes will be announced in class/via email and an updated schedule will be available on eLearning. **Note:** reading responses (RR’s) must be submitted by 12:00 noon on the day of the associated lecture.

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Topic</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>26-Aug</td>
<td>Introduction, Cognitive Systems, Human-Centered design</td>
<td>Read Norman, 1986 (no RR required, but know the reading material for exams)</td>
</tr>
<tr>
<td>2-Sep</td>
<td>more CSE, human-centered design</td>
<td>RR2: Wickens et al., 2004 (Ch. 3)</td>
</tr>
<tr>
<td>4-Sep</td>
<td>CE methods</td>
<td>RR3: Stanton, 2006</td>
</tr>
<tr>
<td>9-Sep</td>
<td>HTA</td>
<td>RR4: Ferris essay and Carayon et al.</td>
</tr>
<tr>
<td>11-Sep</td>
<td>project intro</td>
<td></td>
</tr>
<tr>
<td>16-Sep</td>
<td>Human-automation interaction part 1: models and key concepts</td>
<td>RR5: Wickens et al., 2004 (Ch. 16)</td>
</tr>
<tr>
<td>18-Sep</td>
<td>Human-automation interaction part 2: Breakdowns and ironies of automation</td>
<td>RR6: Ferris et al., 2010; <strong>Project proposal due</strong></td>
</tr>
<tr>
<td>25-Sep</td>
<td>Human error/human-machine mismatches</td>
<td>RR8: Reason, 1990 (Ch. 3)</td>
</tr>
<tr>
<td>30-Sep</td>
<td>Error and disturbance management</td>
<td>RR9: Reason, 1990 (Ch. 7)</td>
</tr>
<tr>
<td>2-Oct</td>
<td>TBD/Midterm review: Concept mapping</td>
<td><strong>Project phase 1 deliverable due</strong></td>
</tr>
<tr>
<td>7-Oct</td>
<td>Concept mapping continued</td>
<td></td>
</tr>
<tr>
<td>9-Oct</td>
<td>Midterm</td>
<td></td>
</tr>
<tr>
<td>14-Oct</td>
<td>Ecological Interface Design</td>
<td>RR10: Vicente, 2002</td>
</tr>
<tr>
<td>16-Oct</td>
<td>Bridging the Gulf of Execution: Natural mappings, DMIs, and other techniques</td>
<td>RR11: Norman, 1993 (Ch. 3)</td>
</tr>
<tr>
<td>21-Oct</td>
<td>TBD (No class: HFES conference)</td>
<td>TBD</td>
</tr>
<tr>
<td>23-Oct</td>
<td>TBD (No class: HFES conference)</td>
<td>TBD</td>
</tr>
<tr>
<td>Date</td>
<td>Topic</td>
<td>References</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>30-Oct</td>
<td>Interface design to support attention and task management</td>
<td>RR13: Ferris &amp; Sarter, 2011;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project phase 2 deliverable due</td>
</tr>
<tr>
<td>4-Nov</td>
<td>Interface design continued</td>
<td>RR14: TBD</td>
</tr>
<tr>
<td>6-Nov</td>
<td>Interruption management</td>
<td>RR15: Trafton &amp; Monk, 2008</td>
</tr>
<tr>
<td>11-Nov</td>
<td>Naturalistic Decision Making, heuristics and biases</td>
<td>RR16: Wickens et al., 2004 (Ch. 7)</td>
</tr>
<tr>
<td>13-Nov</td>
<td>Design of intelligent decision support systems</td>
<td>RR17: Mosier, 1997</td>
</tr>
<tr>
<td>18-Nov</td>
<td>Emotion and Stress factors</td>
<td>RR18: Eccles et al., 2011</td>
</tr>
<tr>
<td>20-Nov</td>
<td>Cultural factors/TBD/slack...</td>
<td>RR19: TBD</td>
</tr>
<tr>
<td>25-Nov</td>
<td>Project presentations</td>
<td>Project phase 3 deliverable due</td>
</tr>
<tr>
<td>27-Nov</td>
<td>Thanksgiving Break</td>
<td></td>
</tr>
<tr>
<td>2-Dec</td>
<td>Project Presentations/TBD (redefined day...?)</td>
<td></td>
</tr>
</tbody>
</table>

Final exam date/time TBD
Texas A&M University

Departmental Request for a New Course

Undergraduate * Graduate * Professional

Submit original form and attach a course syllabus.

Form Instructions

1. Request submitted by (Department or Program Name): Materials Science and Engineering

2. Course prefix, number and complete title of course: MSEN 620 Kinetic Processes in Materials Science

3. Catalog course description (not to exceed 50 words): Atomistic and mesoscale levels; foundation for microstructural evolution and behavior of materials; basic and irreversible thermodynamics; diffusion equations solutions; atomistic diffusion, nucleation; phase transformations: gas-solid, liquid-solid, and solid-solid reactions; FiPy (finite volume solver for PDE) to simulate kinetic processes.

4. Prerequisite(s): MEEN 222 or equivalent materials science course; preliminary general thermodynamics course is not necessary.

Cross-listed with: MEEN 620

Stacked with:

Cross-listed courses require the signature of both department heads.

5. Is this a variable credit course? □ Yes ☒ No

If yes, from _______ to _______

6. Is this a repeatable course? □ Yes ☒ No

If yes, this course may be taken _______ times.

Will this course be repeated within the same semester? □ Yes ☒ No

7. This course will be:

a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)

b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

M.S., Ph.D., Materials Science and Engineering, Mechanical Engineering, Aerospace Engineering

8. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

9. 

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Course #</th>
<th>Title (excluding punctuation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSEN</td>
<td>620</td>
<td>KINETIC PROC MATT SCI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lect.</th>
<th>Lab</th>
<th>SCH</th>
<th>CIP and Fund Code</th>
<th>Admin. Unit</th>
<th>Acad. Year</th>
<th>FCE Code</th>
</tr>
</thead>
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<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Approval recommended by:

[Signatures and dates]

Submitted to Coordinating Board by:

[Signature and date]

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.

Curricular Services – 3/10
# MEEN/MSEN 620
## Kinetic Processes in Materials Science
### Spring 2013

**Instructor:** Raymundo Arróyave  
**email:** rarroyave@tamu.edu  
**Phone:** (979) 845-5416  
**Office hours:**  
- Tuesday 10–11 AM  
- Thursday 10–11 AM  
- By appointment (e-mail)**

**Office:** 119 MEOB

**Description of this Course:**
This graduate course offers a comprehensive overview of kinetic processes in materials at the atomistic and mesoscale levels. The course will provide a foundation for the advanced understanding of processing, microstructural evolution and behavior for a broad spectrum of materials classes. Topics included are: basic thermodynamics, irreversible thermodynamics, solution to diffusion equations, atomistic diffusion, nucleation, phase transformations, gas-solid, liquid-solid and solid-solid reactions. In addition, the course will provide the students with an introductory overview of the use of FiPy (a sophisticated finite volume solver for partial differential equations) to simulate complex kinetic processes in materials such as multi-component diffusion, dendrite formation during solidification and solid-solid phase transformations.

**Class Credits:** Three credits (3-0).

**Prerequisites:** MEEN 222 or equivalent materials science course. Preliminary general thermo course is not necessary.

**Textbook:**  
*Kinetic Processes in Materials Science* by Ballufi, Allen, and Carter

**Learning Outcomes:**
At the end of this course, students will be able to:
- Recognize that most materials are not at thermodynamic equilibrium in their usable forms and it is necessary to understand their kinetic behavior in order to predict their evolution towards equilibrium, during synthesis as well as operation  
- To understand the fundamental connection between thermodynamics and kinetics  
- To apply irreversible thermodynamics to the understanding of kinetic processes related to the transport of mass and energy through materials  
- To understand the basic mechanisms for atomic diffusion  
- To understand the processes by which new phases nucleate, form and grow from metastable matrices  
- To be able to simulate simple materials kinetic processes through the use of advanced computational techniques based on the Phase Field Method  
- To relate the material covered in class to actual research
**Expectations:**

**What you can expect from me:**
- To make sure that the quizzes, homework and exams will be graded within a week of being turned in.
- To come prepared to class.
- To treat you with respect.
- To begin and end the class on time.
- To admit to not knowing something, but to search for an answer promptly.
- To make myself available to you for both course and career advice.
- To maintain confidentiality concerning your performance.
- To assign a grade that will reflect the quality of your work and nothing else.
- To be honest with you.

**What I expect from you:**
- To treat everyone in the class, including the instructor, sponsors, and visitors with respect.
- To do the work on time.
- To accept that previous academic preparation (e.g., mathematics, lower engineering courses) will affect your performance in this course.
- To not plagiarize or otherwise steal the work of others and be true to the Aggie Honor Code.

### Grading Policy

<table>
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<tr>
<th>Homework</th>
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<tbody>
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</tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Final/FiPy Project</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Final Exam</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

The final weighted average of each student will be calculated based on the indicated grade distribution. The letter grade will be assigned by the following criterion:
- **A:** ≥ 85
- **B:** 70 – 84
- **C:** <70

**Note on Grading:** Homework and individual Take-home exams will be graded and then normalized according to level of difficulty/class performance.

### Final Grade:
At any time during the semester, you will be able to know how many points you have accumulated.

### GUIDELINES

**Homework:**
- *Homework is to be submitted with cover page. It is requested that the work is stapled. No loose sheets.*
- *You may ask for help from other classmates. However, everyone is required to submit an individual HW.*
- Solutions to the homework will be posted online within a week of the due date.
- *Homework assignments are to be submitted on time (due date and time will be defined in each homework):*
  - For each day of late submission, an automatic 10% penalty will be assigned.
  - Homework handed in after the solutions are posted will be assigned a zero.
  - For University-excused absences, homework may be submitted the day after the student returns to campus.
- If homework is to be discussed during office hours, it is required that at least a rough effort is presented to the instructor.
- Graded homework will be circulated for pick up during class. To satisfy FERPA requirements, the students must sign a grade release form or inform the instructor if they wish to pick up graded homework in any
other form.

Examinations:
- There will be two midterm examinations.
- **Missed midterms require a written University excuse; otherwise a zero will be assigned.**
- Study guides for each exam will be provided. These guides have a detailed description of the knowledge required to obtain a good grade. It is recommended to review, notes, quizzes and homework solutions to verify that all the points listed are understood.

Grading disputes:
- If you wish to dispute the grading of a homework, first contact the grader and explain the problem. If you are not able to resolve the problem with the grader, then please approach the instructor **within 1 week** of the paper being handed back to the class, thereafter the grade will not be changed.
- If you want to dispute the final, you will need to quickly see the instructor before the final grades are submitted at the end of the semester.

University-Approved Absences:
- Work missed due to absences will only be excused for University-approved activities in accordance with **TEXAS A&M UNIVERSITY STUDENT RULES** (see [http://student-rules.tamu.edu/rule7.htm](http://student-rules.tamu.edu/rule7.htm)). Specific arrangements for make-up work in such instances will be handled on a case-by-case basis. **This will only be possible if the student lets the instructor know about this absence with at least a week in advance.** (Obviously this restriction does not apply to medical or personal emergencies).
- “**University-Approved Absences**” are for activities formally scheduled with the Department of Student Activities (see: 7. Attendance, [http://student-rules.tamu.edu](http://student-rules.tamu.edu)). There are two kinds of activities: Authorized Activities (associated with classes), and Sponsored Activities (generally student organization activities). Just because an activity is suggested by a faculty member, it does not necessarily mean it is a “University-Approved Activity.” Additional details are available at: [http://stuaact.tamu.edu/activitylist/letter.html](http://stuaact.tamu.edu/activitylist/letter.html).
- In accordance with recent changes to Rule 7, please be aware that in this class any "injury or illness that is too severe or contagious for the student to attend class" will require "a medical confirmation note from his or her medical provider" even if the absence is for less than 3 days.

Academic Misconduct:
- You are not allowed to use any resource (internet, solution manuals) to answer HW and Exams. You may collaborate with other students but you must explicitly acknowledge this in the HW. Use of unauthorized resources constitutes academic misconduct.
- Academic misconduct (see [http://aggiehonor.tamu.edu/Descriptions/](http://aggiehonor.tamu.edu/Descriptions/)) will not be tolerated.
- Academic misconduct will be dealt with according to University Regulations.
- Academic misconduct in ANY Quiz, Homework or Exam will automatically imply a grade reduction of 30 points.
- A second violation receives an F* in the course and an “Honor Violation Probation”
- Academic misconduct in the extra credit group project means an automatic F* in the course and an “Honor Violation Probation”.

**Aggie Honor Code:**
“An Aggie does not lie, cheat, or steal, or tolerate those who do.” It is the responsibility of students and instructors to help maintain scholastic integrity at the university by refusing to participate in or tolerate scholastic dishonesty. Conduct contradicting to this policy will be punished according to the current rules and regulations. For details, see [http://aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

The following statement should be printed and signed on all assignments and examination cover pages:

"**On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work**"
**ADA Policy:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu).

---

**Syllabus**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to Thermodynamics: First, Second, Third Laws</td>
</tr>
<tr>
<td>2.</td>
<td>Gibbs Free Energies and Chemical Potentials</td>
</tr>
<tr>
<td>3.</td>
<td>Fields and Gradients; Fluxes; Continuity Equation; Irreversible Thermodynamics</td>
</tr>
<tr>
<td>4.</td>
<td>Driving Forces and Fluxes for Diffusion; Self-Diffusion and Interdiffusion</td>
</tr>
<tr>
<td>5.</td>
<td>Interdiffusion; Effects of Electrical Potential, Capillarity, and Stress on Diffusion Potential</td>
</tr>
<tr>
<td>6.</td>
<td>Effects of Capillarity; Stress on Diffusion</td>
</tr>
<tr>
<td>7.</td>
<td>The Diffusion Equation and Solutions; Activated Jump Processes</td>
</tr>
<tr>
<td>8.</td>
<td>Atomic Models for Diffusivities; Diffusion in Crystals</td>
</tr>
<tr>
<td>9.</td>
<td>Diffusion in Noncrystalline Materials</td>
</tr>
<tr>
<td>10.</td>
<td>Particle Coarsening and grain growth</td>
</tr>
<tr>
<td>11.</td>
<td>General Features of Phase Transformations</td>
</tr>
<tr>
<td>12.</td>
<td>Spinodal Decomposition and Continuous Ordering and Spinodal Decomposition Kinetics</td>
</tr>
<tr>
<td>13.</td>
<td>Nucleation; Diffusional Growth</td>
</tr>
<tr>
<td>14.</td>
<td>Kinetics of Nucleation and Growth Transformations</td>
</tr>
</tbody>
</table>
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

Form Instructions

1. Request submitted by (Department or Program Name): Mechanical Engineering

2. Course prefix, number and complete title of course: MEEN 620 Kinetic Processes in Materials Science

3. Catalog course description (not to exceed 50 words): Atomic and mesoscale levels; foundation for microstructural evolution and behavior of materials; basic and irreversible thermodynamics; diffusion equations solutions; atomistic diffusion, nucleation; phase transformations: gas-solid, liquid-solid, and solid-solid reactions; FIPy (finite volume solver for PDE) to simulate kinetic processes.

4. Prerequisite(s): MEEN 222 or equivalent materials science course. Preliminary general thermodynamics course is not necessary.

Cross-listed with: MSEN 620

5. Is this a variable credit course? □ Yes □ No If yes, from _______ to _______

6. Is this a repeatable course? □ Yes □ No If yes, this course may be taken _______ times.

Will this course be repeated within the same semester? □ Yes □ No

7. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)

   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

M.S., Ph.D., Materials Science and Engineering, Mechanical Engineering, Aerospace Engineering

8. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

9. Prefix Course # Title (excluding punctuation)

<table>
<thead>
<tr>
<th>MEEN 620</th>
<th>Kinetic Processes in Materials Science</th>
</tr>
</thead>
</table>

Level: 6

Approval recommended by:

Sal C. Bau
Department Head of Program Chair (Type Name & Sign) Date

Ibrahim Karanfil
Department Head of Program Chair (Type Name & Sign) Date

Submit to Coordinating Board by:

Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@camu.edu.
Curricular Services – 3/10
MEEN/MSEN 620
Kinetic Processes in Materials Science
Spring 2013

Instructor: Raymundo Arróyave
email: rivalroye@tamu.edu
Phone: (979) 845-5416
Office hours: Tuesday 10–11 AM
Thursday 10–11 AM
By appointment (e-mail)

TA: e-mail:
Class schedule: Classroom:

Description of this Course:
This graduate course offers a comprehensive overview of kinetic processes in materials at the atomistic and mesoscale levels. The course will provide a foundation for the advanced understanding of processing, microstructural evolution and behavior for a broad spectrum of materials classes. Topics included are: basic thermodynamics, irreversible thermodynamics, solution to diffusion equations, atomistic diffusion, nucleation, phase transformations, gas-solid, liquid-solid and solid-solid reactions. In addition, the course will provide the students with an introductory overview of the use of FiPy (a sophisticated finite volume solver for partial differential equations) to simulate complex kinetic processes in materials such as multi-component diffusion, dendrite formation during solidification and solid-solid phase transformations.

Class Credits: Three credits (3-0).

Prerequisites: MEEN 222 or equivalent materials science course. Preliminary general thermo course is not necessary.

Textbook:
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Learning Outcomes:
At the end of this course, students will be able to:
- Recognize that most materials are not at thermodynamic equilibrium in their usable forms and it is necessary to understand their kinetic behavior in order to predict their evolution towards equilibrium, during synthesis as well as operation
- To understand the fundamental connection between thermodynamics and kinetics
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- To be able to simulate simple materials kinetic processes through the use of advanced computational techniques based on the Phase Field Method
- To relate the material covered in class to actual research
Expectations:

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- To begin and end the class on time.
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- To maintain confidentiality concerning your performance.
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</tr>
</tbody>
</table>

Homework usually due on Fridays (you will have a week to complete). Students are encouraged to consult other classmates but they will present individual homework.

There will be two midterm Exams.

Students will be required to perform a kinetics simulation using the FiPy code. There will be no final exam for this class.

The final weighed average of each student will be calculated based on the indicated grade distribution. The letter grade will be assigned by the following criterion:
- A: ≥ 85
- B: 70 – 84
- C: <70

Note on Grading: Homework and individual Take-home exams will be graded and then normalized according to level of difficulty/class performance.

Final Grade:
At any time during the semester, you will be able to know how many points you have accumulated.

GUIDELINES

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- *Homework is to be submitted with cover page. It is requested that the work is stapled. No loose sheets.*
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- In accordance with recent changes to Rule 7, please be aware that in this class any "injury or illness that is too severe or contagious for the student to attend class" will require "a medical confirmation note from his or her medical provider" even if the absence is for less than 3 days.

Academic Misconduct:
- You are not allowed to use any resource (internet, solution manuals) to answer HW and Exams. You may collaborate with other students but you must explicitly acknowledge this in the HW. Use of unauthorized resources constitutes academic misconduct.
- Academic misconduct (see http://aggiehonor.tamu.edu/Descriptions/ for definitions) will not be tolerated.
- Academic misconduct will be dealt with according to University Regulations.
- Academic misconduct in ANY Quiz, Homework or Exam will automatically imply a grade reduction of 30 points.
- A second violation receives an F* in the course and an “Honor Violation Probation”
- Academic misconduct in the extra credit group project means an automatic F* in the course and an “Honor Violation Probation”.

Aggie Honor Code:
“An Aggie does not lie, cheat, or steal, or tolerate those who do.” It is the responsibility of students and instructors to help maintain scholastic integrity at the university by refusing to participate in or tolerate scholastic dishonesty. Conduct contradicting to this policy will be punished according to the current rules and regulations. For details, see http://aggiehonor.tamu.edu.

The following statement should be printed and signed on all assignments and examination cover pages:

“On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work”
**ADA Policy:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu).

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**Syllabus**

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<th>Week</th>
<th>Topics:</th>
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<td>1.</td>
<td>Introduction to Thermodynamics: First, Second, Third Laws</td>
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<td>2.</td>
<td>Gibbs Free Energies and Chemical Potentials</td>
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<td>3.</td>
<td>Fields and Gradients; Fluxes; Continuity Equation; Irreversible Thermodynamics</td>
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<td>4.</td>
<td>Driving Forces and Fluxes for Diffusion; Self-Diffusion and Interdiffusion</td>
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<td>5.</td>
<td>Interdiffusion; Effects of Electrical Potential, Capillarity, and Stress on Diffusion Potential</td>
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<td>6.</td>
<td>Effects of Capillarity; Stress on Diffusion</td>
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<td>7.</td>
<td>The Diffusion Equation and Solutions; Activated Jump Processes</td>
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<td>8.</td>
<td>Atomic Models for Diffusivities; Diffusion in Crystals</td>
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<td>9.</td>
<td>Diffusion in Noncrystalline Materials</td>
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<td>10.</td>
<td>Particle Coarsening and grain growth</td>
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<td>11.</td>
<td>General Features of Phase Transformations</td>
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<td>12.</td>
<td>Spinodal Decomposition and Continuous Ordering and Spinodal Decomposition Kinetics</td>
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<td>13.</td>
<td>Nucleation; Diffusional Growth</td>
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<td>14.</td>
<td>Kinetics of Nucleation and Growth Transformations</td>
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