# Course Changes

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# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 604- FDA Good Laboratory and Clinical Practices

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: BMEN 430 or BMEN 630 and graduate classification, or approval of instructor. To: Graduate classification or approval of instructor.
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: BMEN 404
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 604 | FDA GOOD LAB/CLINIC PRACT |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| | | |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | | - | 003632 | |

**Approval recommended by:**

Kristen Maitland 10/15/15
Department Head or Program Chair *(Type Name & Sign)* Date

Chair, College Review Committee 11/14/2015 Date

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

Dean of College 11/17/2015 Date

12-15-15
Chair, GC or UCC Date

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

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# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 608- Optical Diagnostic and Monitoring Principles

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: MATH 308; PHYS 208. To: BMEN 625 or approval of instructor
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course:
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

Optical Diagnostic and Monitoring Principles. Principles of optical spectroscopy, including absorption, fluorescence and scattering spectroscopy; emphasis on understanding how light interacts with biological samples and how these interactions can be optically measured, quantified and used for medical diagnosis and sensing. Prerequisites: MATH 308; PHYS 208.

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

BIOPHOTONICS II: Photon transport in tissue; photon scattering and absorption; Mie scattering; Monte Carlo; optical spectroscopy, including absorption, fluorescence, and Raman scattering; multiphoton processes; and plasmonics.

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 608 | OPT DIAG MONITOR PRIN |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 608 | BIOPHOTONICS II |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | 0.00 | 3.00 | 1405010006 | 0450 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Kristen Maitland 11/5/15
Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services Date

Chair, College Review Committee 11/17/2015 Date

Dean of College 11/19/2015 Date

Chair, GC or UCC 12-15-15 Date

Effective Date

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

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

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Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 631 - Thermodynamics of Biomolecular Systems

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: BMEN 240, PHYS 208, and MATH 308 To: Graduate classification or approval of instructor
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: BMEN 431
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

THERMODYNAMICS OF BIOMOLECULAR SYSTEMS - Introduces equilibrium and non-equilibrium statistical mechanics and applies them to understand various biomolecular systems; including ensemble theory, reaction kinetics, non-linear dynamics, and stochastic processes; with applied examples such as enzyme-ligand binding kinetics, conformational dynamic of proteins and nucleic acids, population dynamics, and noise in biological signals.

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

BIOENGINEERING THERMODYNAMICS - Biothermodynamics; quantitative framework for describing materials behavior and processes as they relate to the properties and interactions of microscopic constituents; application to bioengineering and biomedicine problems.

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 631 | THERMODYN BIOMOLECULAR SYS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | 0.00 | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 631 | BIOENGR THERMODYNAMICS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | 0.00 | 3.00 | 1405010006 | 0450 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Kristen Maitland 11/5/15
Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services

T E Taylor 11/17/2015
Chair, College Review Committee Date

T E Taylor 11/17/2015
Dean of College Date

12-15-15
Chair, GC or UCC Date

Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

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Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 641- Numerical Methods in Biomedical Engineering

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: BMEN 207, BIOL 213 and VTPP 435; graduate classification or approval of instructor. To: Graduate classification or approval of instructor.
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: BMEN 471
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 670 | Numerical Methods in Biomedica |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| | | |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | | - | 003632 | |

**Approval recommended by:**

Kristen Maitland 10/15/15
Department Head or Program Chair *(Type Name & Sign)* Date

Chair, College Review Committee 11/17/2015 Date

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

Dean of College 11/17/2015 Date

12-15-15
Chair, GC or UCC Date

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services Date Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

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Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 650 - Biomedical Optics Laboratory

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: MATH 308; PHYS 208 To: Graduate classification or approval of instructor.
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: BMEN 402
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 650 | BIOMEDICAL OPTICS LAB |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 2.00 | 3.00 | 0.00 | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| | | |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | | - | 003632 | |

**Approval recommended by:**

Kristen Maitland 11/5/15
Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services

Chair, College Review Committee 11/17/2015 Date

Dean of College 11/17/2015 Date

Chair, GC or UCC 12-15-15 Date

Date Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# Texas A&M University
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Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 652- Cell Mechanobiology

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: BMEN 282/CHEN 282. To: Graduate classification or approval of instructor.
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: BMEN 451
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 651 | CELL MECHANOBIOLOGY |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| | | |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | | - | 003632 | |

**Approval recommended by:**

Kristen Maitland 10/15/15
Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services

W E Taylor 11/17/2015
Chair, College Review Committee Date

W E Taylor 11/17/2015
Dean of College Date

12-15-15
Chair, GC or UCC Date

Date

Effective Date

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

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 661- Cardiac Mechanics

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: BMEN 240 and BMEN 602; MEMA 467; or equivalents. To: Graduate classification or approval of instructor.
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: BMEN 461
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 661 | CARDIAC MECHANICS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| | | |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | | - | 003632 | |

**Approval recommended by:**

Kristin Maitland 10/15/15
Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services

Chair, College Review Committee 11/17/2015 Date

Dean of College 11/17/2015 Date

Chair, GC or UCC 12-15-15 Date

Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
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# Texas A&M University
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Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 663- Soft Tissue Mechanics and Finite Element Methods

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: BMEN 240 or equivalent. To: Graduate classification or approval of instructor.
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: BMEN 463
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 663 | SOFT TISSUE MECHANICS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| | | |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | | - | 003632 | |

**Approval recommended by:**

Kristen Maitland 10/15/15
Department Head or Program Chair *(Type Name & Sign)* Date

Chair, College Review Committee 11/17/2015
Date

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

Dean of College 11/17/2015
Date

12-15-15
Chair, GC or UCC Date

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services Date Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

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Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Biomedical Engineering
3. Course prefix, number and complete title of course: BMEN 682- Polymeric Biomaterials

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: BMEN 342, or approval of instructor. To: Graduate classification or approval of instructor.
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: BMEN 482
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| BMEN | 682 | POLYMERIC BIOMATERIALS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 1405010006 | 0450 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| | | |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | | - | 003632 | |

**Approval recommended by:**

Kristen Maitland 10/15/15
Department Head or Program Chair *(Type Name & Sign)* Date

Chair, College Review Committee 11/17/2015 Date

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

Dean of College 11/17/2015 Date

12-15-15
Chair, GC or UCC Date

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services Date Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

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GRADUATE STUDIES

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☒ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Education for Healthcare Professionals
3. Course prefix, number and complete title of course: EDHP 504: Teaching Practicum

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☐ No
6. If grade type is changing for existing course, indicate the new grade type: ☒ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EDHP | 504 | TEACHING PRAC | | | | | | | | | | | |
| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | | | | | | Level | |
| | | 1-2 | 1-2 | 1313270014 | 1935 | 0 | 0 | 3 | 6 | 3 | 2 | 5 | |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | | | FICE Code | | | | |
| | | | | | | | - | | 0 | 0 | 3 | 6 | 3 | 2 |
| | | | | | | | | | | | | Level | 5 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* — Date: 10/13/15

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

Chair, College Review Committee HSC LEO — Date

Dean of College — Date: 10/13/15

Chair, GC or UCC — Date: 12-15-15

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services — Date — Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

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GRADUATE STUDIES

**Form Instructions**

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Select or Type Department/Program Name
3. Course prefix, number and complete title of course: EDHP 505: Thesis

Attach a brief supporting statement for changes made to items 4a thru 4d and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.
5. Is this an existing core curriculum course? ☐ Yes ☐ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| EDHP | 505 | PROJECT/THESIS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 1-3 | | 1-3 | | 1313270014 | 1935 | 003632 | 5 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| EDHP | 505 | THESIS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | 3.00 | 3.00 | 1313270014 | 1935 | 15 - 16 | 003632 | 5 |

**Approval recommended by:**

Van G. Wilson VAN WILSON 10/2/15
Department Head or Program Chair *(Type Name & Sign)* Date

A. E. Ogden M.D 10/5/15
(Type Name & Sign) Date

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

Dean of College 10-2-15
Date

**Submitted to Coordinating Board by:**

Chair, GC or UCC 12-15-15
Date

Associate Director, Curricular Services Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

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GRADUATE STUDIES

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Education for Healthcare Professionals
3. Course prefix, number and complete title of course: EDHP 506: PROJECT

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☐ No
6. If grade type is changing for existing course, indicate the new grade type: ☒ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
   ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
8. 
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

    This course will guide students through the process of conducting a clinical or educational research project. Coursework will include development of a proposal from topic and title selection to citing the significance of the project, reviewing related literature, explaining the methodology and conducting research to the degree appropriate. The culminating action will be an oral presentation.

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| EDHP | 506 | PROJECT/THESIS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 1-3 | | | 1-3 | 1313270014 | 1935 | 003632 | 5 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| EDHP | 506 | PROJECT |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | 3.00 | 3.00 | 1313270014 | 1935 | 15 - 16 | 003632 | 5 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* — Date: 10/13/15

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services — Date

Chair, College Review Committee — Date

Dean of College — Date: 10/13/15

Chair, GC or UCC — Date: 12-15-15

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

After separating EDHP 505: Thesis and the EDHP 506: Project course we realized the course description did not aptly illustrate what the EDHP 506: Project course will actually entail. The new course description for the EDHP 506: Project course should now clearly depict the course.

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

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GRADUATE STUDIES

Form Instructions

1. Course request type: ☐ Undergraduate ☒ Graduate ☐ First Professional
2. Request submitted by *(Department or Program Name)*: Mays Business School Master of Science in Business
3. Course prefix, number and complete title of course: FINC 705 Corporate Finance

Attach a brief supporting statement for changes made to items 4a thru 4d. and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☒ No
6. If grade type is changing for existing course, indicate the new grade type: ☒ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☒ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description: FINC 705. Corporate Finance. Investment and financing decisions in corporations; principles, techniques, and applications in corporate finance; time value of money; risk and return; capital budgeting; role of debt and equity; discounted cash flow valuation, capital structure, and payout policy.
10. Complete proposed course title and proposed catalog course description (not to exceed 50 words): FINC 705. Corporate Financial Decisions. Investment and financing decisions in corporations; principles, techniques, and applications in corporate finance; time value of money; risk and return; capital budgeting; role of debt and equity; discounted cash flow valuation, capital structure, and payout policy.
11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| FINC | 705 | CORPORATE FINANCE |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 2.00 | | | 2.00 | 5208010016 | 1110 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| FINC | 705 | CORPORATE FINANCIAL DECISIONS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 2.00 | | | 2.00 | 5208010016 | 1110 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

RJ Le — 10/16/15
Department Head or Program Chair *(Type Name & Sign)* — Date

Bala Shetty — 10/20/15
Department Head or Program Chair *(Type Name & Sign)* — Date
*(if cross-listed course)*

Bala Shetty — 10-20-15
Chair, College Review Committee — Date

Dean of College — 10/20/15 — Date

12-15-15
Chair, GC or UCC — Date

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services — Date — Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

10/21/2015

Please find the attached form "Departmental Request for a Change in Course" submitted in relation to a 700 level course setup in conjunction with the new MS Business degree plan. Course code 705 "Corporate Finance" was inadvertently duplicated through passage of the new course process earlier this year (2015).

This accidental duplication has now been identified and resolution is being sought through submission of this form. The new and corrected course name for the new MS Business curriculum is FINC 705 "Corporate Financial Decisions."

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Geography
3. Course prefix, number and complete title of course: GEOG 651 Remote Sensing for Geographical Analysis

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: GEOG 361
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 651 | REMOTE SENSING GEOG ANL |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 45070100 | 1250 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 651 | REMOTE SENSING GEOG ANL |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 1.00 | | 3.00 | | 1250 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services

Chair, College Review Committee 10/15/2015 Date

Dean of College 10/15/2015 Date

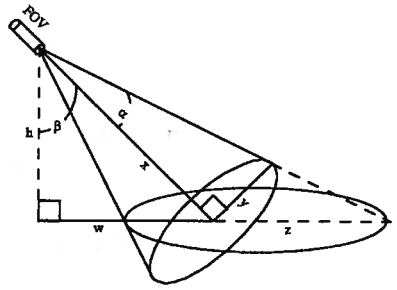
Chair, GC or UCC 12-15-15 Date

Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# Syllabus: Remote Sensing for Geographical Analysis
# GEOG 651
# Fall 2015
## Department of Geography
## Texas A&M University




**Time:** TR 02:20 pm-03:35 pm (Sect. 600)
**Room:** CSA 303
**Prerequisite:** Graduate classification
**Credit Hours:** 3

---

**Instructor: Dr. Anthony M. Filippi**, Associate Professor, 3147 TAMU, Department of Geography, Texas A&M University
**Office:** 707B Eller O&M Bldg.
**Office Hours:** TR 3:45-5:15 pm and by appointment
**Phone:** (979) 845-5744
**Fax:** (979) 862-4487
**Email:** filippi@tamu.edu

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### Course Description

*Catalog Description*: "Provides an introduction to remote sensing fundamentals. Discussion of past, present and planned earth-observing sensors as well as technical issues involved in the collection, processing and interpretation of remote sensing images with emphasis on application to geographic problems, including geomorphology, hydrology and coastal oceanography. Prerequisite: Graduate classification."

This course covers various fundamental and some more advanced remote-sensing topics. The nature and physics of the interaction of electromagnetic radiation (EMR) with various Earth surface materials and the intervening atmosphere will be emphasized, along with a discussion of remote-sensor systems for Earth-observation. Students will also become proficient with fundamental remote-sensing digital image processing operations using a state-of-the-art remote-sensing software package.

The lecture meeting time may be apportioned to both lecture/seminar and lab issues. The time devoted to each component may vary week-by-week as required.

---

**Learning Objectives**

The material covered in this course is aligned with learning objectives in the Geographic Information Science & Technology Body of Knowledge, which was produced by the University Consortium for Geographic Information Science (UCGIS) and published by the Association of American Geographers (AAG).

The primary learning objectives of this course are as follows:

--Students will be able to articulate the fundamental knowledge base of how electromagnetic radiation (EMR) interacts with various Earth surface materials and the intervening atmosphere, and how these EMR interactions affect the facilitation of remote sensing. Thus, students will be able to describe for which remote-sensing purposes different wavelength regions of the electromagnetic spectrum are useful, as well as which wavelength regions are not useful for certain remote-sensing analyses.

--Following from the objective above, students will be able to explain the concept of spectral signatures and why they are important in the field of remote sensing.

--Students will be able to conceptually describe the various types of resolution that are important in remote sensing (i.e., spatial, spectral, radiometric, and temporal resolution), as well as how such resolutions affect selection of the most appropriate data source(s) (i.e., from which sensor(s)) for a given remote-sensing objective.

--Students will be able to describe the historical development of the field of remote sensing.

--Students will be able to explain the rudimentary elements of manual/visual image analysis/interpretation, and they will be able to effectively interpret remote-sensor images.

--Students will be able to make quantitative measurements of features/objects/entities in remote-sensor images.

--Students will be able to explain and perform fundamental digital image-processing procedures.

---

**Required Texts:**

1) Jensen, J. R., 2007, *Remote Sensing of the Environment: An Earth Resource Perspective*, 2nd Ed., Upper Saddle River, NJ: Prentice Hall, 592 pp., ISBN 0-13-188950-8.

2) Schott, J. R., 2007, *Remote Sensing: The Image Chain Approach*, 2nd Ed., New York: Oxford University Press, 688 pp., ISBN13: 978-0-19-517817-3, ISBN10: 0-19-517817-3.

**Recommended Readings (Optional):**
The Remote Sensing Core Curriculum: http://www.r-s-c-c.org/
Remote Sensing Tutorials: http://landsat.gsfc.nasa.gov/education/tutorials.html

---

**Grading Policy**

Grades are assigned based on student performance on two (2) exams, laboratory exercises, and a final paper/project and presentation. Examinations will be based on the material from the lectures, textbooks and other readings, and the laboratory exercises. Make-up exams will only be available for University excused absences. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu), Section 7.1. If you know *a priori* (i.e., ahead of time) that you will be unable to take an exam on the scheduled date, consult the instructor prior to the exam to make alternative arrangements. An unexcused absence from an exam will yield a score of zero for that exam. Further information regarding the laboratory exercises is given below. Requirements for the final paper/project and associated presentation will be forthcoming. For each paper/project, a 10-minute presentation to the class will be required near the end of the semester. The weights for the grading schedule are as follows:

| | |
|---|---|
| 1) Midterm Exam: | 25% |
| 2) Final Exam: | 30% |
| 3) Laboratory Exercises: | 25% of total grade for the course |
| 4) Final Project/Paper: | 20% |

Grades will be assigned according to following scale:

A (≥90%); B (80-89%); C (70-79%); D (60-69%); and F (<60%)

---

**Attendance**

The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. As the lectures will often contain material that is not explicitly covered in the textbook, it is particularly in your interest to attend class. If you miss an exam for a University-approved reason, follow the procedures listed in Section 7.5 of the Student Rules to have your absence excused.

Please familiarize yourself with these procedures. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 (see Student Rule 7).

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**Laboratory Exercises**

Students will work on assigned laboratory exercises in the Dept. of Geography GIS Labs, located in **Teague B009A and B009C**, as well as the other student-computing labs in the Department. There will be approximately 9-10 laboratory assignments, though due to the structure of the course, there is not a separate laboratory meeting time for this course. The laboratory exercises are intended to introduce fundamental remote-sensing concepts in a practical environment, including image interpretation and digital image processing, and they are designed to reinforce the lecture material. The functionality of the ENVI (The Environment for Visualizing Images) remote-sensing digital image processing software package will be emphasized. ENVI software (http://www.exelisvis.com/ProductsServices/ENVIProducts/ENVI.aspx) is available on all computers in the Dept. of Geography GIS lab rooms (Teague B009A and B009C). In general, approximately each week a laboratory assignment will be assigned and due the following week in class (unless specified otherwise). Scores for late labs will be deducted 10% per day they are late. If there are questions regarding the laboratory exercises, students may consult with the TA, as this course is stacked with GEOG 361:

**Eric Guenther**
**Office:** 803B Eller O&M Bldg.
**Office Hours:** W: 3:00-4:00 pm; Thurs: 10:00 am-12:00 pm (noon); and by appointment
**Phone:** 979-845-0543; **Email:** ericg9@tamu.edu

---

**Tentative Lecture Schedule*:**

| Week | Topic |
|---|---|
| 01 | Course Introduction and Introduction to Remote Sensing; Electromagnetic Radiation Principles (Jensen, Chpt 1, 2; Schott, Chpt 1) |
| 02 | EMR Principles (continued); History of Aerial Photography and Aerial Platforms (Jensen Chpt 2, 3; Schott, Chpt 2, 3, 4) [Specific pages in Schott: Chpt 2: pp. 23-33 and pp. 47-56; Chpt 3: Sect. 3.1-3.2 (pp. 57-79); Sect. 3.3.3 (p. 85); and Sect. 3.4-3.5 (pp. 93-109); and Chpt 4: Sect. 4.1-4.3 (pp. 111-134)] |
| 03 | Aerial Photography—Vantage Point, Cameras, Filters, and Film; Visual/Manual Image Interpretation (Jensen, Chpt 4 and 5) |
| 04 | Photogrammetry (Jensen, Chpt 6) |
| 05 | Photogrammetry (continued) (Jensen, Chpt 6); Multispectral Remote-Sensing Systems (Jensen, Chpt 7; Schott, Chpt 5) |
| 06 | Multispectral Remote-Sensing Systems (continued) (Jensen, Chpt 7; Schott, Chpt 5); Geometric Correction (Lecture notes) |

| | |
|---|---|
| 07 | **Midterm Exam** and Geometric Correction (continued) (Lecture notes) |
| 08 | Thermal Infrared (TIR) Remote Sensing, Thermal Image Modeling (Jensen, Chpt 8; Schott, Chpt 14) |
| 09 | Active and Passive Microwave RS, and LIDAR (Jensen, Chpt 9 and 10) |
| 10 | Remote Sensing of Vegetation (Jensen, Chpt 11) |
| 11 | Remote Sensing of Water (Jensen, Chpt 12) |
| 12 | Urban Remote Sensing (Jensen, Chpt 13); Remote Sensing of Soils, Minerals, and Geology/Geomorphology (Jensen, Chpt 14) |
| 13 | Image Classification (Lecture notes; Schott, Chpt 9); *No lecture class meeting on Thursday 11/26/15 due to Thanksgiving Holiday* |
| 14 | Field Spectrometry (Jensen, Chpt 15) |
| 15 | **December 08, 2015: Final project/paper presentations; Final Projects/Papers Due;** Review for Final Exam |
| 16 | **Final Exam** |

* *This is a tentative list of topics. I reserve the right to make changes to the course schedule at any time.*

**Exam Dates**

| | |
|---|---|
| **Midterm Exam:** | **Tuesday, October 13 (in class)** |
| **Final Exam:** | **Wednesday, December 16, 1-3 pm** |

**Other Important Dates**

| | |
|---|---|
| Thanksgiving Holiday | November 26-27 (Thursday-Friday), 2015 (no classes) |
| Reading day | December 10 (Thursday), 2015 (no classes) |

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**Tentative Laboratory Topical List*:**

Week 2: Introduction to RS Computing Environment; ENVI Software Overview (no lab assignment)
Week 3: Measurement and Analysis of Target Reflectance
Week 5: Image Interpretation and Analysis of Aerial and Satellite Data
Week 6: Remote-Sensing Images on the Internet
Week 7: No lab assignment (week of midterm exam)
Week 8: Geometric Correction of Remotely-Sensed Imagery
Week 9: Thermal Infrared (TIR) Image Interpretation
Week 10: Analysis and Interpretation of Radar Imagery
Week 11: Remote Sensing of Vegetation
Week 13: Remote Sensing of Water Resources
Week 14: Image Classification

* *This is a tentative list of topics. I reserve the right to make changes to the course/lab schedule at any time.*

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**Email and eCampus**

All Texas A&M students should use their TAMU email accounts when emailing the instructor. I may also send out class announcements via the TAMU email system as well. It is your responsibility to check your TAMU email account regularly. In addition, course materials will be made available on the eCampus site for this course, as well as the Dept. of Geography class server. The TAMU web address for eCampus access is:
http://ecampus.tamu.edu/
For information regarding how to access resources on eCampus, please visit the eCampus Student Help documentation at:
http://ecampus.tamu.edu/Help/Student-Help

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**Student Support**

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

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**Copyright and Plagiarism Policies**

The materials used in this course are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

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If you have any questions regarding plagiarism, please consult the latest issue of the *Texas A&M University Student Rules*, http://student-rules.tamu.edu, under the section "Scholastic Dishonesty." For the Academic Integrity Statement and Policy and additional information, please visit: http://aggiehonor.tamu.edu
"An Aggie does not lie, cheat, or steal, or tolerate those who do."

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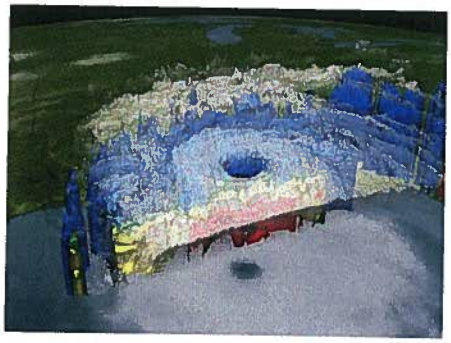
# Syllabus: Remote Sensing in Geosciences
# GEOG 361
# Fall 2015
## Department of Geography
## Texas A&M University



**Time:** TR 02:20 pm-03:35 pm
**Rooms:** CSA 303 (sect. 501 and 502) and CSA 302 (sect. 503)
**Prerequisite:** GEOG 332 or approval of instructor
**Credit Hours:** 4

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**Instructor: Dr. Anthony M. Filippi**, Associate Professor, 3147 TAMU, Department of Geography, Texas A&M University
**Office:** 707B Eller O&M Bldg.
**Office Hours:** TR 3:45-5:15 pm and by appointment
**Phone:** (979) 845-5744
**Fax:** (979) 862-4487
**Email:** filippi@tamu.edu

**Teaching Assistant/Lab Instructor:**
**Eric Guenther (sect. 501, 502, and 503)**
**Office:** 803B Eller O&M Bldg.
**Office Hours:** W: 3:00-4:00 pm; Thurs: 10:00 am-12:00 pm (noon); and by appointment
**Phone:** 979-845-0543; **Email:** ericg9@tamu.edu

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**Laboratory Schedule:**

**Time (Section 501):** R 03:55 pm-05:55 pm; **Lab Room:** TEAG B009A
**Time (Section 502):** W 12:40 pm-02:40 pm; **Lab Room:** TEAG B009C
**Time (Section 503):** M 04:10 pm-06:10 pm; **Lab Room:** TEAG B009C

**Location:** Department of Geography GIS Laboratory (Teague B009 suite)

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## Course Description

*Catalog Description*: "Introduction to the principles, techniques and applications of remote sensing technology in geosciences including the analysis and interpretation of airborne and spaceborne remote sensing data for studying key earth system processes. Prerequisite: GEOG 332 or approval of instructor."

This course provides and introduction to various fundamental remote sensing topics. The nature and physics of the interaction of electromagnetic radiation (EMR) with various Earth surface materials and the intervening atmosphere will be emphasized, along with a discussion of remote sensor systems for Earth-observation. Students will also become proficient with fundamental remote sensing digital image processing operations using a state-of-the-art remote sensing software package.

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## Learning Objectives

The material covered in this course is aligned with learning objectives in the Geographic Information Science & Technology Body of Knowledge, which was produced by the University Consortium for Geographic Information Science (UCGIS) and published by the Association of American Geographers (AAG).

The primary learning objectives of this course are as follows:

--Students will be able to articulate the fundamental knowledge base of how electromagnetic radiation (EMR) interacts with various Earth surface materials and the intervening atmosphere, and how these EMR interactions affect the facilitation of remote sensing. Thus, students will be able to describe for which remote-sensing purposes different wavelength regions of the electromagnetic spectrum are useful, as well as which wavelength regions are not useful for certain remote-sensing analyses.

--Following from the objective above, students will be able to explain the concept of spectral signatures and why they are important in the field of remote sensing.

--Students will be able to conceptually describe the various types of resolution that are important in remote sensing (i.e., spatial, spectral, radiometric, and temporal resolution), as well as how such resolutions affect selection of the most appropriate data source(s) (i.e., from which sensor(s)) for a given remote-sensing objective.

--Students will be able to describe the historical development of the field of remote sensing.

--Students will be able to explain the rudimentary elements of manual/visual image analysis/interpretation, and they will be able to effectively interpret remote-sensor images.

--Students will be able to make quantitative measurements of features/objects/entities in remote-sensor images.

--Students will be able to explain and perform fundamental digital image-processing procedures.

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**Required Text:**

Jensen, J. R., 2007, *Remote Sensing of the Environment: An Earth Resource Perspective*, 2nd Ed., Upper Saddle River, NJ: Prentice Hall, 592 pp., ISBN 0-13-188950-8.

**Recommended Readings (Optional)**:
The Remote Sensing Core Curriculum: http://www.r-s-c-c.org/
Remote Sensing Tutorials: http://landsat.gsfc.nasa.gov/education/tutorials.html

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**Grading Policy**

This course includes both lecture and laboratory components. The lecture material complements the course readings. Grades are assigned based on student performance on two (2) exams and assigned laboratory exercises. Examinations will be based on the material from the lectures, the textbook and other readings, and the laboratory exercises. Make-up exams will only be available for University excused absences. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu), Section 7.1. If you know *a priori* (i.e., ahead of time) that you will be unable to take an exam on the scheduled date, consult the instructor prior to the exam to make alternative arrangements. An unexcused absence from an exam will yield a score of zero for that exam. Further information regarding the laboratory exercises is given below. The weights for the grading schedule are as follows:

| | |
|---|---|
| 1) Midterm Exam: | 30% |
| 2) Final Exam: | 30% |
| 3) Laboratory Exercises: | 40% of total grade for the course |

Grades will be assigned according to following scale:

A (≥90%); B (80-89%); C (70-79%); D (60-69%); and F (<60%)

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**Attendance**

The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. As the lectures will often contain material that is not explicitly covered in the textbook, it is particularly in your interest to attend class. If you miss an exam for a University-approved reason, follow the

procedures listed in Section 7.5 of the Student Rules to have your absence excused. Please familiarize yourself with these procedures. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 (see Student Rule 7).

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**Laboratory Sections**

Students will receive a separate syllabus for the laboratory section of the course. For the laboratory sections, students will meet and work on assigned laboratory exercises in the Dept. of Geography GIS Labs, located in **Teague B009A and B009C**. There will be approximately 9-10 laboratory assignments throughout the semester. The laboratory exercises are intended to introduce fundamental remote sensing concepts in a practical environment, including image interpretation and basic digital image processing, and they are designed to reinforce the lecture material. The functionality of the ENVI (The Environment for Visualizing Images) remote-sensing digital image processing software package will be emphasized. ENVI software (http://www.exelisvis.com/ProductsServices/ENVIProducts/ENVI.aspx) is available on all computers in the Dept. of Geography GIS lab rooms (Teague B009A and B009C). The teaching assistant will introduce the lab exercise during the scheduled laboratory session and will be available for additional assistance during his/her office hours (and by appointment). Laboratory assignment due dates and policies will be provided by the teaching assistant in lab. In general, approximately each week a laboratory exercise will be assigned and due the following week in class (unless specified otherwise). Scores for late labs will be deducted 10% per day they are late.

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**Tentative Lecture Schedule*:**

| Week | Topic |
|---|---|
| 01 | Course Introduction and Introduction to Remote Sensing; Electromagnetic Radiation Principles (Jensen, Chpt 1, 2) |
| 02 | EMR Principles (continued); History of Aerial Photography and Aerial Platforms (Jensen Chpt 2, 3) |
| 03 | Aerial Photography—Vantage Point, Cameras, Filters, and Film; Visual/Manual Image Interpretation (Jensen, Chpt 4 and 5) |
| 04 | Photogrammetry (Jensen, Chpt 6) |
| 05 | Photogrammetry (continued) (Jensen, Chpt 6); Multispectral Remote-Sensing Systems (Jensen, Chpt 7) |
| 06 | Multispectral Remote-Sensing Systems (continued) (Jensen, Chpt 7); Geometric Correction (Lecture notes) |
| 07 | **Midterm Exam** and Geometric Correction (continued) (Lecture notes) |
| 08 | Thermal Infrared (TIR) Remote Sensing, Thermal Image Modeling (Jensen, Chpt 8) |
| 09 | Active and Passive Microwave RS, and LIDAR (Jensen, Chpt 9 and 10) |
| 10 | Remote Sensing of Vegetation (Jensen, Chpt 11) |

| | |
|---|---|
| 11 | Remote Sensing of Water (Jensen, Chpt 12) |
| 12 | Urban Remote Sensing (Jensen, Chpt 13); Remote Sensing of Soils, Minerals, and Geology/Geomorphology (Jensen, Chpt 14) |
| 13 | Image Classification (Lecture notes); *No lab meetings the week of 11/23/15 due to Thanksgiving Holiday; No lecture class meeting on Thursday 11/26/15* |
| 14 | Field Spectrometry (Jensen, Chpt 15) |
| 15 | **December 08, 2015:** GEOG 651 graduate student final project/paper presentations; Review for Final Exam |
| 16 | **Final Exam** |

* *This is a tentative list of topics. I reserve the right to make changes to the course schedule at any time.*

**Exam Dates**

| | |
|---|---|
| **Midterm Exam:** | **Tuesday, October 13 (in class)** |
| **Final Exam:** | **Wednesday, December 16, 1-3 pm** |

**Other Important Dates**

| | |
|---|---|
| Thanksgiving Holiday | November 26-27 (Thursday-Friday), 2015 (no classes) |
| Reading day | December 10 (Thursday), 2015 (no classes) |

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**Tentative Laboratory Topical List*:**

Week 1: First lab meetings (no lab assignment)
Week 2: Introduction to RS Computing Environment; ENVI Software Overview (no lab assignment)
Week 3: Measurement and Analysis of Target Reflectance
Week 5: Image Interpretation and Analysis of Aerial and Satellite Data
Week 6: Remote-Sensing Images on the Internet
Week 7: No lab meetings (week of midterm exam)
Week 8: Geometric Correction of Remotely-Sensed Imagery
Week 9: Thermal Infrared (TIR) Image Interpretation
Week 10: Analysis and Interpretation of Radar Imagery
Week 11: Remote Sensing of Vegetation
Week 13: Remote Sensing of Water Resources
Week 14: Image Classification

* *This is a tentative list of topics. I reserve the right to make changes to the course/lab schedule at any time.*

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**Email and eCampus**

All Texas A&M students should use their TAMU email accounts when emailing the instructor. I may also send out class announcements via the TAMU email system as well. It is your responsibility to check your TAMU email account regularly. In addition, course materials will be made available on the eCampus site for this course, as well as the Dept. of Geography class server. The TAMU web address for eCampus access is:
http://ecampus.tamu.edu/
For information regarding how to access resources on eCampus, please visit the eCampus Student Help documentation at:
http://ecampus.tamu.edu/Help/Student-Help

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**Student Support**

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

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GEOSCIENCES

DEPARTMENT OF GEOGRAPHY

TEXAS A&M UNIVERSITY

Andrew Klein
Professor

*October 16, 2015*

**TO:** **Roxanna Russell**

**FROM:** **Andrew Klein**

**RE:** **GEOG Course Changes – How graduate versions differ from undergraduate versions**

For staffing and other issues, many of the Geography Department's courses in Geographic Information Science & Technology are taught as stacked undergraduate/graduate courses. In all cases, care has been taken to ensure adequate differentiation of the two versions of the course. This memo summarizes the differences for the following courses

1. GEOG 651/GEOG 361
2. GEOG 660/GEOG 390
3. GEOG 676/GEOG 392

1. GEOG 651/GEOG 361

The main difference between GEOG 651 and GEOG 361 is that the graduate students in GEOG 651 need to do a final project/paper, as well as an in-class presentation of that work, in addition to all of the requirements that GEOG 361 students need to meet. Associated with this additional assignment for GEOG 651 students, the weights for the different components of the respective courses of course differ. For GEOG 361, the weights are as follows: 1) Midterm Exam: 30%; 2) Final Exam: 30%; 3) Laboratory Exercises: 40%. And for GEOG 651, the weights are as follows: 1) Midterm Exam: 25%; 2) Final Exam: 30%; 3) Laboratory Exercises: 25%; 4) Final Project/Paper: 20%. Furthermore, GEOG 651 students are also assigned some additional readings from a more advanced remote-sensing textbook (i.e., the Schott (2007) book); these readings are not assigned to the GEOG 361 students.

2. GEOG 660/GEOG 390

The graduate version of the class GEOG 660 – Applications in GIS – requires all graduate students to complete an independent project and write it up as a research paper following the format of the *International Journal of Geographic Information Science*. This is not simply a literature-based exercise, it requires students to formalize a research question answerable using GIS which they submit as an abstract, locate GIS data sources that will form the basis of the research (also submitted for a grade) and finally completion of a research paper. In

ller O&M Building 810
147 TAMU
College Station, TX 77843-3147

Tel. 979.845.5219 Fax: 979.862.4487
klein@geog.tamu.edu
http://geography.tamu.edu

addition, graduate students are provided some leeway on two labs required by the undergraduates as it is felt that graduate students may not need as much formalized instruction as undergraduate with some of the simpler GIS techniques as they should be more self-sufficient in learning GIS software.

3. GEOG 676/GEOG 392

The graduate version has a greater grading emphasis on the semester projection while the undergraduate version has a larger emphasis on the individual labs. Each graduate student is expected to lead one of the research teams while undergraduates must only participate on a team.

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

RECEIVED
NOV 09 2015
GRADUATE STUDIES

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional (DVM, MD, DDS, OD, JD, PharmD)
2. Request submitted by *(Department or Program Name)*: Department of Geography
3. Course prefix, number and complete title of course: GEOG 659 GeoDatabases

**Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.**

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 659 | GEODATABASES |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 2.00 | | 4.00 | 45070206 | 1250 | 006326 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 659 | GEODATABASES |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 1.00 | | 3.00 | | 1250 | 16 - 17 | 006326 | 6 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* 10/27/15 Date

Chair, College Review Committee 10/15/2015 Date

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

Dean of College 10/15/2015 Date

**Submitted to Coordinating Board by:**

Chair, GC or UCC 12-15-15 Date

Associate Director, Curricular Services Date Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# Geodatabases

## GEOG 659


**Instructor**

**Dr. Daniel Goldberg**
Office: O&M 707F
Tel: 979-845-7141
Email: daniel.goldberg@tamu.edu
Office Hours: TBD
and by appointment

**Teaching Assistants**

**TBD**
Sections 500
Office: TBD
Email: TBD
Office Hours: TBD
Office Hours: TBD


### Meeting Time and Locations

**Lecture**
Time: TBD

Room: TBD

**Labs**
500 – TBD

Room: TBD

### Class web site

Updates to the lecture and lab syllabi as well as other course materials will be made available on the course website. It can be accessed on ELearning at http://ecampus.tamu.edu.

### Course Description

This class is an introduction to spatial data models, spatial database design and management, and the use of spatial databases and models within Geographic Information Systems. This lab-oriented course covers basic data modeling, techniques and best practices for designing spatial databases, and the application in spatial databases in the GIS analysis and modeling. This course introduces students to database setup, management, and utilization in the development data-rich GIS applications and services.

### Email

All Texas A&M students should use their Texas A&M University email accounts when emailing the instructor and teaching assistants. I may also send out class announcements via the University email system as well. It is your responsibility to check your official TAMU email account regularly.

## Learning Outcomes

This course is designed to introduce students to the basics of data modeling within the context of industry-standard spatial database systems. Through hands-on experience, students will learn how to convert a real-world problem into components that can be represented within a spatial database. Students will learn to setup, administer, and utilize industry-standard database platforms such as Microsoft SQL Server in order to design, implement, operationalize, and deploy a Geographic Information System (GIS) data-driven solution to a real-world problem. This course will provide students with a solid foundation in design, population, and maintenance of spatial databases as well as a basic knowledge of how to utilize these data models in GIS applications.

The course will start with an introduction to fundamental data modeling techniques inside and outside a GIS including Entity-Relationship (ER) diagrams and the "Normal Forms" of well-designed databases. The course will next cover hands-on installation of industry-standard spatial database platforms such as SQL Server and the use of these systems within commercial GIS packages such as ArcGIS. Students will learn and employ introductory structure query language (SQL) to access and manipulate data from spatial databases as they obtain the skill necessary to integrate spatial data models and databases within GIS projects. The course will include a lecture component where theoretical issues are covered and lab-based exercises where students have the opportunity to practice setting up, managing, and implementing these techniques and technologies.

**At the end of this class, each student will be able to:**

1) Design well-formed simple database models, using appropriate design techniques, and be able to implement such designs using spatial relational database management systems (RDBMS);
2) Setup and administer industry-standard database servers;
3) Use SQL to establish, connect to, and interrogate spatial databases;
4) Use ArcGIS to create, connect to, populate, and utilize simple geodatabases;
5) Critically assess the limitations of conventional database structures as a means of storing spatial data;
6) Critically assess current advances in database design for geographical phenomena; and
7) Develop data models and accompanying spatial RDBMS implementations necessary for managing spatial data in real-world scenarios.
8) Lead a team of developers in the execution of a customer-driven database project.

## GIS Software

This course will utilize the ArcGIS™ suite of software developed by ESRI including ArcServer. Installable copies may be obtained from the instructor or teaching assistants.

## Database Software

This course will utilize the Microsoft SQL Server™ suite of software. Installable copies may be downloaded from the Microsoft Dream Spark program available to TAMU students.

## Development Software

This course will utilize the SQL programming language which can be developed with basic text editing software as well as within Microsoft SQL Server.

## Lecture Texts

**Required Lecture Texts**

**Required:** Yeung A, Hall G, 2007. **Spatial Database Systems: Design, Implementation and Project Management**. 1st ed, Springer. 554 pp.

**Required:** Zeiler M, 2010. **Modeling Our World**. 2nd ed, Esri Press. 308 pp.

**Additional readings and materials will be drawn from websites, handouts, and online resources.**

## Class Attendance

The university views class attendance as the responsibility of the individual student. Information on University attendance rules can be found at http://student-rules.tamu.edu/rule07. As described below, a portion of each student's grade is based on in-class participation. This will be judged by the instructor as regular attendance and active engagement on a consistent basis that contributes to the class in some manner.

**Lab attendance** is not required, but considered essential for successful completion of the course.

## Grading

Your grade in this class will be based as described below:

| | | |
|---|---|---|
| A. **Lecture** | **30%** | |
| Midterm 1 | | 10% |
| Midterm 2 | | 10% |
| Final Exam | | 10% |
| B. **Lab** | **20%** | |
| Exercises | | 20% |
| B. **Homework** | **5%** | |
| Exercises | | 5% |
| C. **Project** | **40%** | |
| Project Proposal | | 10% |
| Project Status Report 1 | | 2.5% |
| Project Status Report 2 | | 2.5% |
| Final Project | | 25% |
| D. **Participation** | **5%** | |
| Class Participation | | 5% |

The grading scale for this course is as follows:

≥90% A, 80-89% B, 70-79% C, 60-69% D, <60% F

**An average performance in the class will earn a satisfactory grade.**

## Makeups

Makeups for the Exam and other work will be allowed only for University excused absences and will be administered in compliance with university rules. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu)

## Cellular Telephones

As a courtesy to the instructor and other students please turn off all cellular telephones before class.

## Labs

Labs are an important and integral portion of the course. There is simply no way to learn about spatial database setup, programming, or maintenance without spending considerable time in lab working on with these data and services. While the scheduled lab time is two hours, labs will typically require time outside of the scheduled lab hours to complete.

Labs will be due at the beginning of the following lab unless otherwise indicated. Scores for late labs will be deducted 10% per day until they are turned in, up to one week. After one week late, labs will not be accepted for credit. It is your responsibility for keeping up with lab assignments. You should talk to your Teaching Assistant and or the instructor BEFORE late labs become a problem.

## Final Project

Throughout the semester, graduate students lead a team of up to 4 undergraduate students will work in teams of up to 4 to apply the spatial database concepts learned in lectures with the hands-on experience gained in labs to develop a data model and database implementation for a "real-world" problem using spatial databases. Graduate students will be responsible for identifying a "customer" who needs a GIS program developed to extend or automate a commercial GIS platform (e.g., ArcGIS). Graduate students will work with the customer to identify the requirements for the system, supervise the undergraduate team members, and assist in the development of the final product.

### Proposal Pitches

Each graduate student will present a 5 minute presentation of their idea for a project to the class. This will pitch will include enough details to recruit undergraduate students to work on the grad student's project. Undergraduate students will choose project teams based on their willingness to work on the project pitched by the graduate student. Graduate students who receive an insufficient number of students to complete their project will work on another graduate student's project.

### Project Proposal

Each student group will submit a 1-page synopsis of the proposed topic and present a 5 minute description. This synopsis will include the problem the group will attempt to address including a set of requirements, the methods and data that will be used to accomplish their goals, and a development roadmap. The graduate student will be responsible for communicating with the "customer" to ensure that the project can be completed within the timeframe and expertise of the project team, and that the end product will responsive to the needs of the "customer".

### Project Status Reports

Each student group will present two short presentations during the semester that outline project progress. Students will be graded based on progress toward project completion.

### Project Deliverables

Each student group will: a) design a data model sufficient for implementing a spatial database for their real-world problem; b) implement the data model within a spatial database system; c) populate the spatial data model and utilize it within ArcGIS or another GIS; c) deliver a report summarizing the problem they were trying to address, the tools, methods, and data used to accomplish their goals, and reflections on how well their implementation meets the requirements set forth; and d) demonstrate a hands-on working version of their prototype implementation to the class during a project presentation.

### Grading

Each student will be graded on the quality of the team project. In addition, each student's grade will be based in part on a score they receive from their teammates evaluating their contribution to the overall project. Students are advised to consult with the teaching assistant and/or professor in advance if issues of team member performance becomes an issue.

## Student Support

*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 the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall. The phone number is 845-1637.*

**Services for Students with Disabilities**

Room B118 of Cain Hall, 845-1637 or on the web at http://disability.tamu.edu/

*There are numerous other student support organizations on campus including*

**Student Counseling Service**

Cain Hall, 845-4427, http://scs.tamu.edu
Student Counseling Helpline 5:00pm-8:00am: 845-2700

**University Writing Center**

Suite 1.214 of the Evans Library, 458-1455, http://writingcenter.tamu.edu/

## Scholastic Dishonesty

It is our hope that academic dishonesty will not be a problem in this class. Texas A&M does, however, have a *Scholastic Dishonesty* policy to which both students and faculty must comply. If you have any questions about the University's Scholastic Dishonesty policy please review the Student Rules or see me. The Aggie Honor program is the new program that will handle all cases of academic dishonesty. http://www.tamu.edu/aggiehonor

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***"Aggies don't lie, cheat, or steal, nor tolerate those that do"***

**A tentative course schedule follows on the next page.**

## Course Schedule

| Week | Lecture Topics | Exams |
|---|---|---|
| 1 | Introduction to the Class & | |
| | Spatial Databases | |
| 2 | Data Modeling | |
| | | |
| 3 | Data Modeling & | |
| | Geodatabases | |
| 4 | ER Diagrams | **PROPOSAL PITCHES** |
| | | |
| 5 | Database Normal Forms | **PROPOSAL PRESENTATIONS** |
| | | |
| 6 | Structured Query Language (SQL) | **MIDTERM 1** |
| | | |
| 7 | MS SQL Server | |
| | | **PROPOSAL STATUS REPORT I** |

*I reserve the right to make changes to the course schedule*

## Course Schedule Cont.

| Week | Lecture Topics | Exams |
|---|---|---|
| 8 | Indexing & Performance | |
| | | |
| 9 | Enterprise Spatial Databases | |
| | | |
| 10 | Service Oriented Architectures | |
| | | **MIDTERM 2** |
| 11 | Publishing & Consuming | |
| | Spatial Data | **PROPOSAL STATUS REPORT II** |
| 12 | Standards & Metadata | |
| | | |
| 13 | Versioning & Maintenance | |
| | | **NO CLASS (THANKSGIVING)** |
| 14 | Legal Issues, Trends, and the Future of Spatial Databases | |
| | | **PROJECT PRESENTATIONS & REPORT** |
| **TBD** | | **FINAL EXAM** |

*I reserve the right to make changes to the course schedule*

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate ♦ Graduate ♦ Professional

• Submit original form and attachments •

RECEIVED
NOV 12 2015
GRADUATE STUDIES

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional (DDS, MD, JD, PharmD, DVM)
2. Request submitted by *(Department or Program Name)*: Department of Geography
3. Course prefix, number and complete title of course: GEOG 660 Applications in GIS

**Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.**

4. Change requested
   a. Prerequisite(s): From: GEOG 390; STAT 651 and STAT 652 To: Graduate classification
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☐ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: GEOG 390
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:
   Integrates spatial analysis and modeling with GIS for environmental and socio-economic applications
10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
    Basic concepts of design, planning and implementation of geographic information systems.
11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 660 | APPLICATIONS IN GIS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 11040100 | 1250 | 003632 | 6 |

    b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 660 | APPLICATIONS IN GIS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 1.00 | | 3.00 | | 1250 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services

Chair, College Review Committee 10/15/2015 Date

Dean of College 10/15/2015 Date

Chair, GC or UCC 12-15-15 Date

Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

TEXAS A&M UNIVERSITY

SYLLABUS

# Applications in GIS

## GEOG 660


**Instructor**

**Dr. Andrew G. Klein**
Office: O&M 707D
Email: klein@tamu.edu
Tel: 979-845-5219
Office Hours
Tues and Thur 1:30 – 3:30
or by appointment

**Teaching Assistants**

**Ms. Iliyana Dobreva**
Sections 501, 502 & 503
Office: O&M 807
Email: iliyanad@tamu.edu
Office Hours: Wed 12:00 – 3:00*

**Mr. Panshu Zhao**
Sections: 504, 505, & 506
Office: O&M 807
Email: rochesterzhao@tamu.edu
Office Hours: Wed 1:40 – 2:40 Thur 1:30 --3 3:30*

**if you cannot make posted office hours please schedule an appointment*


## Course Description

This class is an introduction to Geographic Information Systems (GIS). This lab-oriented course covers the guiding principles behind the various facets of GIS including spatial data types, database development and management, map projections, spatial analysis, and cartographic production.

## Meeting Time and Locations

**Lecture**
Tuesday and Thursday 3:55-5:10
Halbouty 101

*While there is no scheduled you are encouraged to attend one of the labs scheduled for GEOG 390. There may not be a computer available to you in all sections which are listed to the left*

**Labs**
501 – Mon 5:45 – 7:45 Teague 009 A
502 – Tue 08:30 – 10:50 Teague 009A
503 – Mon 11:30 – 1:30 Teague 009A
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## Class eCampus Site

There are an extensive web-based materials associated with this class. Updates to the syllabus as well as other course materials will be made available on course eCampus site. I strongly urge you to use the resources made available to you.

## GIS Software

This course will utilize the ArcGIS™ suite of software developed by ESRI including both ArcGIS Desktop and ArcGIS online.

## Textbooks and Readings

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Bolstad, P. 2012. **GIS Fundamentals: A First Text on Geographic Information Systems.** 4th ed. Ann Arbor: XanEdu. 688 pp. ISBN: 9780971764736.

**Lab Manual**

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**Additional Readings will be drawn from the following and other sources**

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The *ESRI Virtual Campus* which can be found at http://campus.esri.com/.

*The Geographers Craft* web site developed by Peter Dana found at http://www.colorado.edu/geography/gcraft/contents.html

An excellent introductory GPS website is provided by *Trimble Navigation* and can be found at http://www.trimble.com/gps/

The TAMU library has some good tutorial on common GIS tasks as well at http://guides.library.tamu.edu/adding_xy_data_arcmap

## Class Attendance

The university views class attendance as the responsibility of the individual student. However, as stated in the student rules (http://student-rules.tamu.edu/rule07), students are expected to attend class and to complete all assignments. It has been my experience that failure to attend class, especially labs, is a major cause of poor performance in the class.

## Cellular Telephones

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## Grading

Your grade in this class will be based on equally on the lecture and labs as described below. *Dates and times of examinations are listed on the class schedule at the end of the syllabus. The 3rd examination will be given online via eCampus during the week of December 7th.*

**A. Lecture** **450 pts**

| | |
|---|---|
| Exam 1 | 150 pts |
| Exam 2 | 150 pts |
| Exam 3 | 150 pts |

**B. Lab** **400 pts**

**C. Individual Project Research Paper** **150 pts**

A major portion of the course grade is a written research paper describing your independent project. The paper will be written in a style and length appropriate for a GISci journal. The papers will follow the format of *the International Journal Geographic Information Science.* The due dates are listed in the course schedule at the end of the syllabus.

A breakdown of the grading of the research papers presented below. Detailed grading rubrics for each graded component will be provided during the course of the semester and will provide explicit grading schema for each assignment.

1. ***Abstract*** 15 pts

   Each student will prepare a 250 word abstract detailing you intended research project.

2. ***Data Sources*** 30 pts

   Each student will prepare a comprehensive initial list of the data sources identified for the project. This will help me make sure you have identified suitable and sufficient sources to undertake your proposed research.

3. ***Final Paper*** 105 pts

   Each student will compose a final draft of the manuscript presented as a camera-ready manuscript using a provided Word template.

**D. Attend GIS Day Events** **10 pts extra credit**

Each student can earn 1% extra credit by electronically providing to the instructor a link to a source to GIS data available online. In addition to the link, a short

description of the type of GIS data available from the site should be provided and what audience would be interested in this data. Selected examples will be presented in class and provided as links on the class web site. ***Please provide evidence of attendance by November 27th.***

It the past my grading scheme has approximately followed these cutoffs.
≥90% A, 80-89% B, 70-79% C, 60-69% D, <60% F

An average performance in the class will earn a satisfactory grade

Makeups for the Exam will be allowed only for University excused absences and will be administered in compliance with university rules. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu)

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## Labs

Labs are an important and integral portion of the course. There is simply no way to learn about GISci (Geographic Information Science) without spending considerable time in lab working with on GIS problems. While the scheduled lab time is two hours, labs will typically require time outside of the scheduled lab hours to complete.

It is my expectation that students will attend the full lab session unless your TA instructs differently. This is your scheduled time when the TAs are available to assist with the course. If you do not take advantage of this lab time, it is not reasonable to expect the TAs to assist outside of their scheduled office hours. So please use time in lab to your advantage.

In general, labs will be due one week after they are assigned. Scores for late labs will be deducted 10% per day they are late. Labs turned in one week after the due date will receive no credit. *However, each student will be allowed to turn one lab in late without penalty.*

In past years, failure to complete labs in a timely manner has been the primary cause for poor performance in this class. It is your responsibility for keeping up with lab assignments. You should talk to your Teaching Assistant and or the instructor BEFORE late labs become a problem.

## Learning Objectives

The content of this GIS course is aligned with the Learning Objectives set forth in the ***Geographic Information Science & Technology Body of Knowledge.*** This is a comprehensive document that *"specifies what aspiring geospatial professionals need to know and be able to do."* It was developed by the University Consortium for Geographic Information Science (UCGIS). For more information visit http://www.ucgis.org/priorities/education/modelcurriculaproject.asp.

At the beginning of most lectures, the knowledge areas and specific learning objectives of the ***Body of Knowledge*** addressed in the lecture will be listed. These should help serve as a guide to the concepts presented in that class.

In general, it is my expectation that at the end of the class each student will be able to:

1) Explain the basic properties of vector and raster GIS data models and list examples of each type in common use in the GIS community;
2) Define what is meant by a map projection, describe why they are important in GIS and be able to select an appropriate map projection depending on need;
3) Apply appropriate basic GIS analytical techniques within industry-standard GIS software to solve spatial problems; and
4) Prepare maps that utilize basic cartographic principles to effectively convey the results of GIS analysis to varied audiences.

## Scholastic Dishonesty

It is my hope that academic dishonesty will not be a problem in this class. Texas A&M does, however, have a *Scholastic Dishonesty* policy to which both students and faculty must comply. If you have any questions about the University's Scholastic Dishonesty policy please review the Student Rules or see me. The Aggie Honor program is the new program that will handle all cases of academic dishonesty. http://www.tamu.edu/aggiehonor

All materials used in this class are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even is you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions regarding plagiarism, please consult the latest issue of the Texas A&M University Student Rules, http://student-rules.tamu.edu, under the section "Scholastic Dishonesty."

***"Aggies don't lie, cheat, or steal, nor tolerate those that do"***

## Student Support

*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 the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall. The phone number is 845-1637.*

**Services for Students with Disabilities**

Room B118 of Cain Hall, 845-1637 or on the web at http://disability.tamu.edu/

*There are numerous other student support organizations on campus including*

**Center for Academic Excellence and Academic Assistance Clearinghouse**

525 Blocker, 845-2724, http://www.tamu.edu/cae

**Student Counseling Service**

Cain Hall, 845-4427, http://scs.tamu.edu

Student Counseling Helpline 5:00pm-8:00am: 845-2700

**University Writing Center**

Suite 1.214 of the Evans Library, 458-1455, http://writing.tamu.edu

Please do not hesitate to ask me if you have any problems or if you are having any trouble in the class, see me before it becomes a *problem.*

## Course Schedule

| Week | Lecture and Lab Topics | Readings<br>*optional readings are in italics* |
|---|---|---|
| **1**<br>September 1 & 3<br><br>**An Introduction to Geographic Information Systems** | Introduction to the Class<br>GIS Basics<br>The Nature of Geography Inquiry | **Bolstad**<br>Chapter 1 & 15<br>**NCGIA**<br>*What is GIS?*<br>*http://www.ncgia.ucsb.edu/giscc/units/u002/*<br>*Asking Geographic Questions*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u007/* |
| | Getting to know GIS using ArcGIS and ArcGIS online<br><br>Lab 1: Online Mapping with ArcGIS | **Mastering ArcGIS**<br>Introduction & Chapters 1 & 2 |
| **2**<br>September 8 & 10<br><br>**The Map as a Geographic Information Model** | Map Scale<br>Map Abstraction and Scale<br>The Shape of the Earth<br>Latitude/Longitude<br>Geographic Coordinate Systems | **Bolstad**<br>Chapter 3<br>**NCGIA**<br>*Maps as Representations of the World*<br>*Position on the Earth*<br>*http://www.ncgia.ucsb.edu/giscc/units/u012/*<br>*The Shape of the Earth*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u015/u015_f.html*<br>*Latitude and Longitude*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u014/u014_f.html* |
| | Displaying Data in ArcGIS<br><br>Lab 2: Texas Highway Map | **Mastering ArcGIS**<br>Chapters 2 & 4<br><br>*By the start of the 3rd lab, my expectation is that you can successfully navigate around in ArcGIS and the lab instructors can focus on teaching GISsci concepts rather than ArcGIS button pushing* |
| **3**<br>September 15 & 17<br><br>**Cartography for GIS** | Basic Cartography Concepts<br><br>**Abstract Due Sept. 17th** | **Bolstad**<br>Chapter 4<br>pp. 131-140 & 164-177<br>plus handouts |
| | Employing Good Cartographic Design in ArcGIS<br><br>Optional Lab 2b:<br>Texas Highway Map - Revisited | **Mastering ArcGIS**<br>Chapter 5 |

| | | |
|---|---|---|
| 4<br>September 22 & 24<br><br>**Map Projections Theory and Applications** | Datums<br>Map Projections<br>Coordinate Transformations | **Bolstad**<br>Chapter 3<br>**NCGIA**<br>Coordinate System Overview<br>http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u013/u013_f.html<br>**The Geographer's Craft**<br>Coordinate Systems<br>Geographic Datums<br>Map Projections<br>all at…<br>http://www.colorado.edu/geography/gcraft/notes/coordsys/coordsys_f.html |
| | Map projections in ArcGIS<br><br>Lab 3: Nunavut Mapping | **Mastering ArcGIS**<br>Chapter 3 |
| 5<br>September 29 & October 1<br><br>**GIS Data Models**<br>***Vector*** | A brief raster/vector comparison<br>Fundamentals of vector data models<br>Common vector models in use today<br>Map Digitization<br><br>Guest Lecture from the Map Library on how to Georeference a scanned map | **Bolstad**<br>Chapter 2<br>**NCGIA**<br>*Fundamentals of Data Storage*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u037/*<br>*TINS*<br>*http://www.ncgia.ucsb.edu/giscc/units/u056/*<br><br>**NCGIA**<br>*Handling Uncertainty*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u187/u187_f.html*<br>*Detecting and Evaluating Errors*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u099/u099_f.html* |
| | Georeferencing in ArcGIS<br><br>Lab 4: Georeferencing an aerial photograph | **Bolstad**<br>Chapter 4 pp 140-164<br>Georeferencing Handout and TAMU online tutorial<br>http://guides.library.tamu.edu/georeferencing_arcmap |

| | | |
|---|---|---|
| **6**<br>October 6 & 8<br><br>**GIS Data Models**<br>***Raster*** | Fundamentals of raster data models<br>Representing Continuous Fields<br>Common raster models in use today<br>Digital Elevation Models<br>Raster Imagery<br>Statistical Surfaces<br>**Exam 1 will be on October 8th**<br><br>**Data Sources due on October 6th** | **Bolstad**<br>Chapters 2 & 7<br>**NCGIA**<br>*Representing Fields*<br>*http://www.ncgia.ucsb.edu/giscc/units/u054/*<br>*Rasters*<br>*http://www.ncgia.ucsb.edu/giscc/units/u055/* |
| | Digitizing and Editing a Map<br><br>Lab 5: Ecoregions of Texas | **Bolstad**<br>Chapter 4 pp 140-164<br>14 pp. 565-580<br><br>**Mastering ArcGIS**<br>Chapters 7 & 12 |
| **7**<br>October 13 & 15<br><br>**GIS Databases and Attribute Queries** | An Introduction to Relational Database Theory<br>Attribute Queries | **Bolstad**<br>Chapter 8<br>**NCGIA**<br>*Information Organization*<br>*http://www.ncgia.ucsb.edu/giscc/units/u051/*<br>*Non Spatial Database Models*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u045*<br>**Bolstad**<br>Chapter 9 pp. 347-358<br>**NCGIA** |
| | ☺ No Lab for Graduate Students ☺ | |
| **8**<br>October 20 & 22<br><br>**Basic Spatial Analysis** | Basic Spatial Analysis<br>*Exploratory Data Analysis*<br>*Flowcharting and Modelbuilder*<br>*Spatial Selection*<br>*Set and Boolean Algebra*<br>*Classification/Reclassification*<br>*Buffering*<br>*Cartographic Overlay*<br>*Network Analysis*<br>*Dasymetric Mapping* | **Bolstad**<br>Chapter 9<br>**NCGIA**<br><br>*Exploratory Data Analysis*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u128/u128_f.html*<br>*The Polygon Overlay Option*<br>*http://www.ncgia.ucsb.edu/giscc/units/u186/* |
| | Spatial Joins and Queries<br><br>Lab 6: Hydrocarbons at McMurdo Station II | **Mastering ArcGIS**<br>Chapters 6 & 8<br><br>What is Geoprocessing?<br>http://video.esri.com/watch/634/what-is-geoprocessing_question_ |

| | | |
|---|---|---|
| **9**<br>October 27 & 29<br><br>**Spatial Analysis** | Spatial Analysis<br>*Cartographic Overlay*<br>*Network Analysis*<br>*Dasymetric Mapping* | **Bolstad**<br>Chapter 9 |
| | The Cartographic Overlay Process<br><br>Lab 7: Site Selection in College Station | **Mastering ArcGIS**<br>Chapter 10<br>ModelBuilder – Getting Started<br>http://video.esri.com/watch/1817/modelbuilder_-_dash_-getting-started |
| **10**<br>November 3 & 5<br><br>**Raster Analysis** | Basic Raster Analysis<br>*Map Algebra*<br>*Raster Overlay*<br>*Local, Focal, Zonal and Global Functions* | **Bolstad**<br>Chapter 10 |
| | Lab 8: An Introduction to Python programming and ArcGIS | Handouts<br>and<br>Free ESRI online training<br>Python for Everyone |
| **11**<br>November 10 & 12<br><br>**Terrain Analysis and Visualization** | Terrain Analysis<br>*Slope/Aspect*<br>*Viewsheds*<br>*Hydrologic Functions*<br>**Exam 2 will be November 10th** | **Bolstad**<br>Chapter 11 |
| | Lab 9: Raster Processing using Python | **Mastering ArcGIS**<br>Chapter 11 |
| **12**<br>November 17 & 19<br><br>**Spatial Analysis and Modeling** | Cartographic Modeling<br>Simple Spatial Models<br>Stochastic Models<br>Process-based Models<br>Spatio-Temporal Models | **Bolstad**<br>Chapter 13 |
| | Developing a Cartographic Model<br>Lab 10: Cartographic Modeling | **Mastering ArcGIS**<br>Chapter 10 |
| **13**<br>November 24<br><br>**Spatial Estimation and Interpolation** | Interpolation<br>Kriging<br>Hotspots | **Bolstad**<br>Chapter 12<br>**NCGIA**<br>http://www.ncgia.ucsb.edu/giscc/units/u130/ |
| | ☺ No Lab ☺ | |
| **14**<br>December 1 & 3<br><br>**Wrap Up** | Future Directions in GISci<br><br>**Final Report Due December 4th** | TBD |
| | ☺ No Lab ☺ | |
| December 8th | Class Wrap Up<br>**Exam 3 will be administered online the week of December 7th** | |

*I reserve the right to make changes to the course schedule*

TEXAS A&M UNIVERSITY

# SYLLABUS

# Principles of GIS

## GEOG 390


**Instructor**

**Dr. Andrew G. Klein**
Office: O&M 707D
Email: klein@tamu.edu
Tel: 979-845-5219
Office Hours
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## Course Description

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**A. Lecture** **50%**

| | |
|---|---|
| Exam 1 | 150 pts |
| Exam 2 | 150 pts |
| Exam 3 | 200 pts |

**B. Lab**

**50%**

| | |
|---|---|
| Exercises | 420 pts |
| Lab Final | 80 pts |

**C. GIS Data Source** **10 pts** extra credit

Each student can earn 1% extra credit by electronically providing to the instructor a link to a source to GIS data available online. In addition to the link, a short description of the type of GIS data available from the site should be provided and what audience would be interested in this data. Selected examples will be presented in class and provided as links on the class web site. ***All Data Sources are due by December 4th.***

**D. Attend GIS Day Events** **10 pts** extra credit

Students can earn an additional 1% extra credit by attending a GIS day event and providing evidence of their attendance. ***You must provide evidence you attended GIS day by November 27th.***

It the past my grading scheme has approximately followed these cutoffs.
≥90% A, 80-89% B, 70-79% C, 60-69% D, <60% F

An average performance in the class will earn a satisfactory grade

Makeups for the Exam will be allowed only for University excused absences and will be administered in compliance with university rules. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu)

## Labs

Labs are an important and integral portion of the course. There is simply no way to learn about GISci (Geographic Information Science) without spending considerable time in lab working with on GIS problems. While the scheduled lab time is two hours, labs will typically require time outside of the scheduled lab hours to complete.

It is my expectation that students will attend the full lab session unless your TA instructs differently. This is your scheduled time when the TAs are available to assist with the course. If you do not take advantage of this lab time, it is not reasonable to expect the TAs to assist outside of their scheduled office hours. So please use time in lab to your advantage.

In general, labs will be due one week after they are assigned. Scores for late labs will be deducted 10% per day they are late. Labs turned in one week after the due date will receive no credit. *However, each student will be allowed to turn one lab in late without penalty. If you will be using this "late pass" on an assignment, you must notify your TA by the date that particular the lab would otherwise be due.*

In past years, failure to complete labs in a timely manner has been the primary cause for poor performance in this class. It is your responsibility for keeping up with lab assignments. You should talk to your Teaching Assistant and or the instructor BEFORE late labs become a problem.

## Learning Objectives

The content of this GIS course is aligned with the Learning Objectives set forth in the ***Geographic Information Science & Technology Body of Knowledge.*** This is a comprehensive document that *"specifies what aspiring geospatial professionals need to know and be able to do."* It was developed by the University Consortium for Geographic Information Science (UCGIS). For more information visit http://www.ucgis.org/priorities/education/modelcurriculaproject.asp.

At the beginning of most lectures, the knowledge areas and specific learning objectives of the ***Body of Knowledge*** addressed in the lecture will be listed. These should help serve as a guide to the concepts presented in that class.

In general, it is my expectation that at the end of the class each student will be able to:

1) Explain the basic properties of vector and raster GIS data models and list examples of each type in common use in the GIS community;
2) Define what is meant by a map projection, describe why they are important in GIS and be able to select an appropriate map projection depending on need;
3) Apply appropriate basic GIS analytical techniques within industry-standard GIS software to solve spatial problems; and
4) Prepare maps that utilize basic cartographic principles to effectively convey the results of GIS analysis to varied audiences.

## Scholastic Dishonesty

It is my hope that academic dishonesty will not be a problem in this class. Texas A&M does, however, have a *Scholastic Dishonesty* policy to which both students and faculty must comply. If you have any questions about the University's Scholastic Dishonesty policy please review the Student Rules or see me. The Aggie Honor program is the new program that will handle all cases of academic dishonesty. http://www.tamu.edu/aggiehonor

All materials used in this class are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even is you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions regarding plagiarism, please consult the latest issue of the Texas A&M University Student Rules, http://student-rules.tamu.edu, under the section "Scholastic Dishonesty."

***"Aggies don't lie, cheat, or steal, nor tolerate those that do"***

## Student Support

*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 the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall. The phone number is 845-1637.*

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*There are numerous other student support organizations on campus including*

**Center for Academic Excellence and Academic Assistance Clearinghouse**
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**Student Counseling Service**
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Student Counseling Helpline 5:00pm-8:00am: 845-2700

**University Writing Center**
Suite 1.214 of the Evans Library, 458-1455, http://writing.tamu.edu

Please do not hesitate to ask me if you have any problems or if you are having any trouble in the class, see me before it becomes a *problem.*

# Course Schedule

| Week | Lecture and Lab Topics | Readings<br>*optional readings are in italics* |
|---|---|---|
| **1**<br>September 1 & 3<br><br>**An Introduction to Geographic Information Systems** | Introduction to the Class<br>GIS Basics<br>The Nature of Geography Inquiry | **Bolstad**<br>Chapter 1 & 15<br>**NCGIA**<br>*What is GIS?*<br>*http://www.ncgia.ucsb.edu/giscc/units/u002/*<br>*Asking Geographic Questions*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u007/* |
| | Getting to know GIS using ArcGIS and ArcGIS online<br><br>Lab 1: Online Mapping with ArcGIS | **Mastering ArcGIS**<br>Introduction & Chapters 1 & 2 |
| **2**<br>September 8 & 10<br><br>**The Map as a Geographic Information Model** | Map Scale<br>Map Abstraction and Scale<br>The Shape of the Earth<br>Latitude/Longitude<br>Geographic Coordinate Systems | **Bolstad**<br>Chapter 3<br>**NCGIA**<br>*Maps as Representations of the World*<br>*Position on the Earth*<br>*http://www.ncgia.ucsb.edu/giscc/units/u012/*<br>*The Shape of the Earth*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u015/u015_f.html*<br>*Latitude and Longitude*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u014/u014_f.html* |
| | Displaying Data in ArcGIS<br><br>Lab 2: Texas Highway Map | **Mastering ArcGIS**<br>Chapters 2 & 4<br><br>*By the start of the 3rd lab, my expectation is that you can successfully navigate around in ArcGIS and the lab instructors can focus on teaching GISsci concepts rather than ArcGIS button pushing* |
| **3**<br>September 15 & 17<br><br>**Cartography for GIS** | Basic Cartography Concepts | **Bolstad**<br>Chapter 4<br>pp. 131-140 & 164-177<br>plus handouts |
| | Employing Good Cartographic Design in ArcGIS<br><br>Lab 3: Texas Highway Map - Revisited | **Mastering ArcGIS**<br>Chapter 5 |

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|---|---|---|
| **4**<br>September 22 & 24<br><br>**Map Projections Theory and Applications** | Datums<br>Map Projections<br>Coordinate Transformations | **Bolstad**<br>Chapter 3<br>**NCGIA**<br>Coordinate System Overview<br>http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u013/u013_f.html<br>**The Geographer's Craft**<br>Coordinate Systems<br>Geographic Datums<br>Map Projections<br>all at…<br>http://www.colorado.edu/geography/gcraft/notes/coordsys/coordsys_f.html |
| | Map projections in ArcGIS<br><br>Lab 4: Nunavut Mapping | **Mastering ArcGIS**<br>Chapter 3 |
| **5**<br>September 29 & October 1<br><br>**GIS Data Models**<br>***Vector*** | A brief raster/vector comparison<br>Fundamentals of vector data models<br>Common vector models in use today<br>Map Digitization<br><br>Guest Lecture from the Map Library on how to Georeference a scanned map | **Bolstad**<br>Chapter 2<br>**NCGIA**<br>*Fundamentals of Data Storage*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u037/*<br>*TINS*<br>*http://www.ncgia.ucsb.edu/giscc/units/u056/*<br><br>**NCGIA**<br>*Handling Uncertainty*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u187/u187_f.html*<br>*Detecting and Evaluating Errors*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u099/u099_f.html* |
| | Georeferencing in ArcGIS<br><br>Lab 5: Georeferencing an aerial photograph | **Bolstad**<br>Chapter 4 pp 140-164<br>Georeferencing Handout and TAMU online tutorial<br>http://guides.library.tamu.edu/georeferencing_arcmap |

| | | |
|---|---|---|
| **6**<br>October 6 & 8<br><br>**GIS Data Models**<br>***Raster*** | Fundamentals of raster data models<br>Representing Continuous Fields<br>Common raster models in use today<br>Digital Elevation Models<br>Raster Imagery<br>Statistical Surfaces<br>**Exam 1 will be on October 8th** | **Bolstad**<br>Chapters 2 & 7<br>**NCGIA**<br>*Representing Fields*<br>*http://www.ncgia.ucsb.edu/giscc/units/u054/*<br>*Rasters*<br>*http://www.ncgia.ucsb.edu/giscc/units/u055/* |
| | Digitizing and Editing a Map<br><br>Lab 6: Ecoregions of Texas | **Bolstad**<br>Chapter 4 pp 140-164<br>14 pp. 565-580<br><br>**Mastering ArcGIS**<br>Chapters 7 & 12 |
| **7**<br>October 13 & 15<br><br>**GIS Databases and Attribute Queries** | An Introduction to Relational Database Theory<br>Attribute Queries | **Bolstad**<br>Chapter 8<br>**NCGIA**<br>*Information Organization*<br>*http://www.ncgia.ucsb.edu/giscc/units/u051/*<br>*Non Spatial Database Models*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u045*<br>**Bolstad**<br>Chapter 9 pp. 347-358<br>**NCGIA** |
| | Attribute Tables and Queries<br><br>Lab 7: Hydrocarbons at McMurdo Station I | **Mastering ArcGIS**<br>Chapters 6 & 8<br><br>*Having fun with tables and reports*<br>*http://video.esri.com/watch/1920/fundamentals-having-fun-with-tables-and-reports* |
| **8**<br>October 20 & 22<br><br>**Basic Spatial Analysis** | Basic Spatial Analysis<br>*Exploratory Data Analysis*<br>*Flowcharting and Modelbuilder*<br>*Spatial Selection*<br>*Set and Boolean Algebra*<br>*Classification/Reclassification*<br>*Buffering*<br>*Cartographic Overlay*<br>*Network Analysis*<br>*Dasymetric Mapping* | **Bolstad**<br>Chapter 9<br>**NCGIA**<br><br>*Exploratory Data Analysis*<br>*http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u128/u128_f.html*<br>*The Polygon Overlay Option*<br>*http://www.ncgia.ucsb.edu/giscc/units/u186/* |
| | Spatial Joins and Queries<br><br>Lab 8: Hydrocarbons at McMurdo Station II | **Mastering ArcGIS**<br>Chapters 6 & 8<br><br>What is Geoprocessing?<br>http://video.esri.com/watch/634/what-is-geoprocessing_question |

| | | |
|---|---|---|
| **9**<br>October 27 & 29<br>**Spatial Analysis** | Spatial Analysis<br>*Cartographic Overlay*<br>*Network Analysis*<br>*Dasymetric Mapping* | **Bolstad**<br>Chapter 9 |
| | The Cartographic Overlay Process<br><br>Lab 9: Site Selection in College Station | **Mastering ArcGIS**<br>Chapter 10<br>ModelBuilder – Getting Started<br>http://video.esri.com/watch/1817/modelbuilder_-_dash_-getting-started |
| **10**<br>November 3 & 5<br>**Raster Analysis** | Basic Raster Analysis<br>*Map Algebra*<br>*Raster Overlay*<br>*Local, Focal, Zonal and Global Functions* | **Bolstad**<br>Chapter 10 |
| | Lab 10: An Introduction to Python programming and ArcGIS | Handouts<br>and<br>Free ESRI online training<br>Python for Everyone |
| **11**<br>November 10 & 12<br>**Terrain Analysis and Visualization** | Terrain Analysis<br>*Slope/Aspect*<br>*Viewsheds*<br>*Hydrologic Functions*<br>**Exam 2 will be November 10th** | **Bolstad**<br>Chapter 11 |
| | Lab 11: Raster Processing using Python | **Mastering ArcGIS**<br>Chapter 11 |
| **12**<br>November 17 & 19<br>**Spatial Analysis and Modeling** | Cartographic Modeling<br>Simple Spatial Models<br>Stochastic Models<br>Process-based Models<br>Spatio-Temporal Models | **Bolstad**<br>Chapter 13 |
| | Developing a Cartographic Model<br>Lab 12: Cartographic Modeling | **Mastering ArcGIS**<br>Chapter 10 |
| **13**<br>November 24<br>**Spatial Estimation and Interpolation** | Interpolation<br>Kriging<br>Hotspots | **Bolstad**<br>Chapter 12<br>**NCGIA**<br>*http://www.ncgia.ucsb.edu/giscc/units/u130/* |
| | ☺ No Lab ☺ | |
| **14**<br>December 1 & 3<br>**Wrap Up** | Future Directions in GISci | TBD |
| | **FINAL LAB EXAMINATION** | |
| December 8th | Class Wrap Up<br>**Exam 3 will be administered online the week of December 7th** | |

*I reserve the right to make changes to the course schedule*

GEOSCIENCES

DEPARTMENT OF GEOGRAPHY

TEXAS A&M UNIVERSITY

**Andrew Klein**
Professor



*October 16, 2015*

**TO:** **Roxanna Russell**

**FROM:** **Andrew Klein**

**RE:** **GEOG Course Changes – How graduate versions differ from undergraduate versions**

For staffing and other issues, many of the Geography Department's courses in Geographic Information Science & Technology are taught as stacked undergraduate/graduate courses. In all cases, care has been taken to ensure adequate differentiation of the two versions of the course. This memo summarizes the differences for the following courses

1. GEOG 651/GEOG 361
2. GEOG 660/GEOG 390
3. GEOG 676/GEOG 392

1. GEOG 651/GEOG 361

The main difference between GEOG 651 and GEOG 361 is that the graduate students in GEOG 651 need to do a final project/paper, as well as an in-class presentation of that work, in addition to all of the requirements that GEOG 361 students need to meet. Associated with this additional assignment for GEOG 651 students, the weights for the different components of the respective courses of course differ. For GEOG 361, the weights are as follows: 1) Midterm Exam: 30%; 2) Final Exam: 30%; 3) Laboratory Exercises: 40%. And for GEOG 651, the weights are as follows: 1) Midterm Exam: 25%; 2) Final Exam: 30%; 3) Laboratory Exercises: 25%; 4) Final Project/Paper: 20%. Furthermore, GEOG 651 students are also assigned some additional readings from a more advanced remote-sensing textbook (i.e., the Schott (2007) book); these readings are not assigned to the GEOG 361 students.

2. GEOG 660/GEOG 390

The graduate version of the class GEOG 660 – Applications in GIS – requires all graduate students to complete an independent project and write it up as a research paper following the format of the *International Journal of Geographic Information Science*. This is not simply a literature-based exercise, it requires students to formalize a research question answerable using GIS which they submit as an abstract, locate GIS data sources that will form the basis of the research (also submitted for a grade) and finally completion of a research paper. In

ller O&M Building 810
147 TAMU
College Station, TX 77843-3147

Tel. 979.845.5219 Fax: 979.862.4487
klein@geog.tamu.edu
http://geography.tamu.edu

addition, graduate students are provided some leeway on two labs required by the undergraduates as it is felt that graduate students may not need as much formalized instruction as undergraduate with some of the simpler GIS techniques as they should be more self-sufficient in learning GIS software.

3. GEOG 676/GEOG 392

The graduate version has a greater grading emphasis on the semester projection while the undergraduate version has a larger emphasis on the individual labs. Each graduate student is expected to lead one of the research teams while undergraduates must only participate on a team.

RECEIVED
NOV 09 2015
GRADUATE STUDIES

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Geography
3. Course prefix, number and complete title of course: GEOG 661 Digital Image Processing and Analysis

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: GEOG 332 To: GEOG 651 or equivalent or approval of instructor
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course:
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:
   Principles of georectifying, processing, manipulating and interpreting data collected by nonphotographic sensors concentrating on solid earth resources using Thematic Mapper with supplemental data from the SPOT satellite.
10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
    Principles of georectifying, processing, manipulating and interpreting data collected by nonphotographic sensors concentrating on solid earth resources
11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 661 | DIG IMAGE PROC & ANALY |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 45070200 | 1250 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 661 | DIG IMAGE PROC & ANALY |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 1.00 | | 3.00 | | 1250 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* 10/27/15 Date

Chair, College Review Committee 10/15/2015 Date

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

Dean of College 10/15/2015 Date

**Submitted to Coordinating Board by:**

Chair, GC or UCC 12-15-15 Date

Associate Director, Curricular Services Date Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

TEXAS A&M UNIVERSITY

SYLLABUS

# Digital Image Processing

## GEOG 661


*Instructor*

**Dr. Andrew Klein**

Office: O&M 707D
Tel: 845.5219
Email: klein@geog.tamu.edu
Office Hours: Tues & Thurs 13:30-15:30
and by appointment


## Course Description

This class is an introduction to the processes involved in the processing, manipulation, and interpretation of digital remotely sensed images. Topics covered include radiometric correction, image rectification, spectral and spatial image enhancement and classification.

## Meeting Time and Location

Monday 6-9 pm CSA 303

## Class Website

There is an extensive website associated with this class. Updates to the syllabus as well as other laboratory and course materials will be made available on the course website. Students are strongly urged to use these resources.

**http://geography.tamu.edu/class/aklein/geog661**

## Textbooks and Readings

Jensen, John R. 2005. ***Introductory Image Processing: A Remote Sensing Perspective*** 3rd ed. Prentice Hall Series in Geographic Information Science. Upper Saddle River: Prentice Hall. 526 pp.

Richards, John A. and Xiuping Jia. 1999. ***Remote Sensing Digital Image Analysis: An Introduction*** (4th ed). Berlin: Springer-Verlag. doi: 10.1007/3-540-29711-1. Available online for Texas A&M Students at http://www.springerlink.com/content/xp3t30/

Links to additional readings and resources will be available through the course website.

## Class Attendance

The university views class attendance as the responsibility of the individual student. However, in this course individual participation is important and will account for a significant portion of the course grade. For information, please view Section 7 of the student rules: http://student-rules.tamu.edu.

If you miss a class for any reason, it is your responsibility to find out what material was covered in your absence.

## Mobile Devices

As a courtesy to the instructor and other students please turn off all cellular telephones before the class begins. Interrupting a class because your cell phone goes off is extremely impolite. As a courtesy to other students no texting will be allowed during class.

## Computers

Computer use for class purposes, such as taking notes and viewing lecture materials, is allowed during lectures. However, use of a computer for other purposes (e.g., Facebook, email, online gaming) is prohibited as these activities can be extremely distracting to your fellow Aggies. If you are using a computer during class, please sit in the back row if at all possible. This avoids people behind you being distracted by your activities.

## Email

All Texas A&M students should use their neo email accounts when emailing the instructor and teaching assistants. We may also send out class announcements via the neo email system as well. It is your responsibility to check your neo email account regularly.

## Lab Software

The image processing software used in the course are the **ENVI 4.X or 5.X & IDL 8.X** software packages. In addition some portions of the lab will require use of a spreadsheet (e.g., Microsoft Excel or OpenOffice) in order that students may more fully explore the computations behind various digital image processing operations.

Information on ENVI can be found at http://www.exelisvis.com/language/en-us/productsservices/envi.aspx and software guides and tutorials are also available

## Grading

Student performance in the class will be assessed through examinations that cover the material presented in the lecture portion of the examination and laboratory exercises intended to provide students with practical hands on experience.

**A. Exams** **50%**

1. Midterm 1 15%
2. Midterm 2 15%
3. Final 20%

The dates for all exams are listed in the course schedule. Makeups for examinations will be allowed only for University excused absences which are covered in section 7 of the Texas A&M University Student Rules (http://student-rules.tamu.edu)

**B. Lab Exercises** **50%**

Students are encouraged to turn in all labs. However, I reserve the right to reduce the credit given for labs turned in later than one week past the due date

### Grading Scheme

It the past the grading scheme has followed these cutoffs.

≥90% A, 80-89% B, 70-79% C, 60-69% D, <60% F

An average performance in the class will earn a satisfactory grade

## Copyright and Plagiarism Policy

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## Aggie Honor Code

The Honor Code, based on the long-standing affirmation that An Aggie does not lie, cheat, or steal or tolerate those who do, is fundamental to the value of the A&M experience.

Know the ***Aggie Code of Honor:***
*"Aggies don't lie, cheat, or steal, nor tolerate those that do"*

http://aggiehonor.tamu.edu

## Student Support

## Student Support

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*There are numerous other student support organizations on campus including*

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525 Blocker, 845-2724, http://www.tamu.edu/cae

**Student Counseling Service**

Cain Hall, 845-4427, http://scs.tamu.edu
Student Counseling Helpline 5:00pm-8:00am: 845-2700

**University Writing Center**

Suite 1.214 of the Evans Library, 458-1455, http://writing.tamu.edu

Please do not hesitate to ask me if you have any problems or if you are having any trouble in the class, see me before it becomes a *problem.*

## Learning Outcomes

1. Students will be able to explain how electromagnetic energy enables information to be gathered from objects at a distance and how EMR interacts with surface materials and the atmosphere to produce the signal received at a sensor
2. Students will be able to explain the theory and concepts behind radiometric and geometric preprocessing of remotely sensed images including atmospheric correction and orthorectification and will be able to select and apply appropriate image preprocessing techniques to standard image sources.
3. Students will be able describe the statistical properties of a digital image and use an image's statistical properties to apply appropriate spectral image enhancement techniques to single and multiband images to facilitate qualitative and quantitative analysis.
4. Students will be able to enhance digital images using techniques that operate in the spatial and frequency domains.
5. Students will be select and perform an appropriate image classification technique and able to assess the accuracy of the performed image classification.
6. Students will be able to explain the term hyperspectral remote sensing and be able to successfully preprocess and analyze hyperspectral images.

## Course Schedule

| Week | Lecture Topic | Required Readings Additional readings will be posted on website | Lab Topic |
|---|---|---|---|
| **1** January 13th | **Review of Electromagnetic Radiation Theory** and **Spectral Signatures and BRDF** | Jensen Ch. 1 & 6 pp 175-194 Richards and Jia Ch. 1 *if you feel your remote sensing background could be strengthen read Jensen Ch 2 &3* | Plank Functions and Wavelength Frequency Relationships *Extra credit* |
| January 20th | ☺ No Class Martin Luther King Holiday ☺ | | |
| **2** January 27th | **The Digital Image** Characteristics of Digital Images Sampling Issues Sampling Issues Image Quantization Data Formats | Jensen Ch. 4 & 5 Richards and Jia Ch. 1 | Spatial Sampling |
| **3** February 3rd | **Radiometric Image Preprocessing** Image noise Atmospheric Correction | Jensen Ch. 6. Richards and Jia Ch. 4 | Atmospheric Correction |
| **4** February 10th | **Geometric Image Correction** Image Distortions Image Rectification Techniques | Jensen Ch. 7 Richards and Jia Ch. 2 | Image Rectification Techniques |
| **5** February 17th | **Geometric Image Correction** Map Projections Image Matching and Interpolation Techniques ***Exam 1*** | Same as previous week | No Lab |
| **6** February 24th | ***Spectral Image Enhancement*** Univariate Statistics and Image Histogram Multivariate Statistics and Image Scattergrams Univariate Image Enhancement | Jensen Ch. 4, 5 & 8 pp. 255-275 Richards and Jia Ch. 3 & 4. | Image statistics and enhancement of satellite imagery for visual interpretation |
| **7** March 3rd | **Multivariate Image Enhancement** Band Math Principal Components Kauth-Thomas Tasseled Cap | Jensen Ch. 8 pp. 255-275; 296-322 Richards and Jia Ch. 6 | Spectral enhancements for vegetation remote sensing |

| | | | |
|---|---|---|---|
| | Transformation | | |
| **Week** | **Lecture Topic** | **Required Readings Additional readings will be posted on website** | **Lab Topic** |
| March 10th | ☺ SPRING BREAK ☺ | | |
| **8** March 17th | **Spatial Image Enhancement** Spatial Convolution Filtering Edge and Line Enhancement and Detection Convolution applied to DEMs Texture Analysis | Jensen Ch. 8 pp. 276-287; 322-329 Richards and Jia Ch. 5 | Image enhancement in the spatial and frequency domains |
| **9** March 24th | **Spatial Image Enhancement** Operations in the Frequency Domain Fourier Transform Wavelets ***Exam 2*** | Jensen Ch. 8 pp. 287-295. Richards and Jia Ch. 7 | No Lab |
| **10** March 31st | **Image Classification** Classification Schemes Training Site Selection Supervised Classifiers | Jensen Ch. 9 pp 337-379 Richards and Jia Ch. 8 | Supervised image classification |
| **11** April 7th | **Image Classification** Unsupervised Classification Neural Networks Fuzzy Classification | Jensen Ch. 9 pp. 379-393 & Ch. 10 Richards and Jia Ch. 8, 9 & 10 | Unsupervised image classification |
| **12** April 14th | **Image Classification** Object Oriented Classification | Jensen Ch. 9 pp. 393-401 | Object oriented image classification |
| **13** April 21st | **Image Classification** Accuracy Assessment | Jensen Ch. 13 Richards and Jia Ch 11 | Classification accuracy assessment |
| **14** April 28th | **Hyperspectral Remote Sensing** | Jensen Ch. 11 Richards and Jia Ch 13 | Hyperspectral remote sensing |
| **Final Exam** | Friday May 2nd 7:30-9:30 AM | | |

*I reserve the right to make changes to the course schedule due to unforeseen circumstances*

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

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GRADUATE STUDIES

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional (MD, JD, DDS, DVM, OD, MA, LL.M., Pharm.D., DVM)
2. Request submitted by *(Department or Program Name)*: Department of Geography
3. Course prefix, number and complete title of course: GEOG 662 GIS in Land and Property Management

**Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.**

4. Change requested
   a. Prerequisite(s): From: Enrollment in Master of Land Economics and Real Estate; approval of instructor To: GEOG 660 or equivalent or approval of instructor
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course:
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:
   Introduction to concepts of design, planning and implementation of GISs related to commercial real estate development; case studies for land and property management; laboratory exercises in practical applications for real estate.
10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
    Introduction to concepts of design, planning and implementation of geographic information systems (GISs) for land and property management applications, including those pertaining to rural land and agricultural property, as well as urban and residential land uses and cadastral surveying.
11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 662 | GIS IN LAND & PROP MGMNT |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 2.00 | 2.00 | | 3.00 | 45070100 | 1250 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 662 | GIS IN LAND & PROP MGMNT |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 1.00 | | 3.00 | | 1250 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* Date 10/27/15

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services Date

Chair, College Review Committee Date 10/15/2015

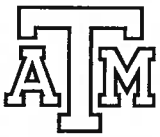
Dean of College Date 10/15/2015

Chair, GC or UCC Date 12-15-15

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# GIS in Land and Property Management
## GEOG 662
## Semester TBA 20xx
## Texas A&M University



**Time:** TBA
**Room:** TBA
**Prerequisite:** GEOG 660 or equivalent or approval of instructor
**Credit Hours:** 3

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**Instructor: Dr. Anthony M. Filippi**, Associate Professor, 3147 TAMU, Department of Geography, Texas A&M University
**Office:** 707B Eller O&M Bldg.
**Office Hours:** TBA
**Phone:** (979) 845-5744
**Fax:** (979) 862-4487
**Email:** filippi@tamu.edu

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### Course Description

*Catalog Description*: "Introduction to concepts of design, planning and implementation of geographic information systems (GISs) for land and property management applications, including those pertaining to rural land and agricultural property, as well as urban and residential land uses and cadastral surveying."

This course introduces students to the concepts and tools of geographic information systems (GISs), including GIS design, planning, and implementation, as they relate to land and property management. Laboratory assignments will provide hands-on experience with GIS software and practical application.

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### Learning Objectives

The material covered in this course is aligned with learning objectives in the Geographic Information Science & Technology Body of Knowledge, which was produced by the University Consortium for Geographic Information Science (UCGIS) and published by the Association of American Geographers (AAG).

The primary learning objectives of this course are as follows:

--Students will be able to articulate the fundamental knowledge base associated with cadastral surveying and GIS, and they will be able to construct and utilize cadastral spatial databases.

--Students will be able to conceptually describe real estate markets and submarkets, as well as urban land use and land value theories, and they will be able to articulate how such theoretical knowledge is applicable to land and property management.

--Students will be able to explain land registration, property marketing, and conveyancing processes, as well as describe use of land information systems.

--Students will be able to describe how GIS can be employed for and various types of property management, including small and large properties, properties involving facilities; and rural and urban lands.

--Students will be able to explain how GIS is utilized for property/real estate market analysis for various land/property types, including residential, office/industrial, and retail properties. Additionally, students will be able to conduct these types of analyses using GIS tools and appropriate spatial/spatio-temporal data sources.

--Students will be able to explain information management issues associated with GIS applications in land and property management, as well as GIS implementation issues.

--Students will be able to describe common geographic errors performed by land and property analysts, so as to ideally avoid such errors in the future.

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**GIS Software**

We will primarily use the ArcGIS™ (version 10.x) software package, but other GIS environments will be briefly introduced, as students may encounter various other GISs in the workplace. The ArcGIS™ 10.x and ArcGIS Business Analyst software will be available for student use in the Department of Geography GIS laboratory. ArcGIS™ is also available on Open Access Lab (OAL) computers throughout campus and the University Libraries.

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**Required Texts:**

1) Ralphs, M. P., and Wyatt, P. 2003. *GIS in Land and Property Management.* 1st Ed. London, New York: Spon Press/Taylor & Francis. ISBN-13: 978-0415240659; ISBN-10: 0415240654.

2) Thrall, G. I. 2002. *Business Geography and New Real Estate Market Analysis*. New York: Oxford University Press. ISBN 0-19-507636-2.

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**Grading Policy**

This course includes lectures, laboratory assignments, exams, and a final project. The course readings complement the lecture material. Grades are assigned based on student performance on two (2) exams, the laboratory exercises, and a final project paper. Examinations will primarily be based on the material from the lectures and the required readings. Make-up exams will only be available for University excused absences. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu), Section 7.1. If you know *a priori* (i.e., ahead of time) that you will be unable to take an exam on the scheduled date, consult the instructor prior to the exam to make alternative arrangements. An unexcused absence from an exam will yield a score of zero for that exam. Further information regarding the laboratory exercises is given below. The final project will enable students to apply concepts learned in lecture and the laboratory exercises to a real-world problem; specific requirements for the final project paper will be forthcoming. The weights for the grading schedule are as follows:

**Deliverables**

| | |
|---|---|
| 1) Exam 1: | 20% |
| 2) Exam 2: | 20% |
| 3) Laboratory Exercises: | 35% |
| 4) Final project: | 25% |

**Grades will be assigned according to following scale:**
A (≥90%); B (80-89%); C (70-79%); D (60-69%); and F (<60%)

**Additional comments regarding selected components/deliverables are given below:**

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**Laboratory Exercises / Due Dates**

There will be eight (8) laboratory assignments, though due to the structure of the course, there is not a separate laboratory meeting time for this course. The laboratory exercises are intended to introduce the student to GIS concepts—particularly as they relate to land and property management—in a practical environment, as well as to GIS software functionality. Lab exercises will be discussed/assigned in class. Lab reports will be due at the beginning of the class period the week after the lab exercise is assigned. A paper copy of each lab report must be turned-in by the due date. Late reports will be assessed a 10% penalty for each day they are overdue.

To complete the laboratory assignments, students may utilize the Dept. of Geography GIS Labs (Teague B009A and B009C) at any time during regular hours (8 am-5 pm, Monday-Friday) whenever there is not a scheduled class meeting in a given lab room,

and as space permits. Lab teaching schedules will be posted next to the lab doors. Both GIS Labs are equipped with all the necessary GIS software.

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**Attendance**

The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. As the lectures will often contain material that is not explicitly covered in the textbook, it is particularly in your interest to attend class. If you miss an exam for a University-approved reason, follow the procedures listed in Section 7.5 of the Student Rules to have your absence excused. Please familiarize yourself with these procedures. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 (see Student Rule 7).

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**Tentative Lecture Schedule*:**

| WEEK | TOPIC | TENTATIVE READINGS / ASSIGNMENTS |
|---|---|---|
| 1 | Introduction, definitions, and course procedures; GIS overview | Ralphs and Wyatt, Chpt 1; Thrall, Chpt 1 |
| 2 | Cadastral GIS/surveying; Case studies: GIS applications in land and property management | Ralphs and Wyatt, Chpt 2, 3; lecture notes |
| 3 | Real estate markets and submarkets; Urban land use and land value theories | Thrall, Chpt 2, 3 |
| 4 | Land registration and land information systems; property marketing and conveyancing | Ralphs and Wyatt, Chpt 4 |
| 5 | GIS and property management (i.e., local authority property management; large landowners; facilities management; rural land management) | Ralphs and Wyatt, Chpt 5 |
| 6 | GIS and development and urban applications | Ralphs and Wyatt, Chpt 6 |
| 7 | **Midterm Exam;** Retail and financial market research | Ralphs and Wyatt, Chpt 7 |
| 8 | Retail and financial market research (continued) | Ralphs and Wyatt, Chpt 7 |
| 9 | GIS and property/real estate market analysis | Ralphs and Wyatt, Chpt 8; Thrall, Chpt 4 |
| 10 | GIS and housing and residential communities | Thrall, Chpt 5 |
| 11 | GIS and office/industrial property | Thrall, Chpt 6 |
| 12 | GIS and retail property/space | Thrall, Chpt 7 |

| | | |
|---|---|---|
| 13 | Information management issues in GIS applications in land and property management; GIS implementation issues (e.g., project-led vs. corporate; national land and property; organizational GIS) | Ralphs and Wyatt, Chpt 9, 10 |
| 14 | Common geographic errors of land and property analysts to avoid; future issues | lecture notes; Ralphs and Wyatt, Chpt 11 |

** This is a tentative list of topics. I reserve the right to make changes to the course schedule at any time.*

**Exam Dates**
**Midterm Exam: TBA**
**Final Exam: TBA**

Exams will be given in the lecture room.

**Final Project Paper Due Date**
**[This date will be specified for a given semester.]** A 10% per day penalty will be assessed for late papers.

**Other Important Dates**
**[Any important dates regarding a given semester will be noted.]**

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**Tentative Laboratory Assignment Topical List*:**
Week 2: Introduction to GIS Computing Environment; GIS Software Overview (*No lab assignment*)
Week 3: Cadastral GIS
Week 4: Land registration and land information systems
Week 5: GIS and property management
Week 6: GIS and development and urban applications
Week 7: *No lab assignment* (week of midterm exam)
Week 9: GIS and property/real estate market analysis
Week 10: GIS and housing and residential communities
Week 11: GIS and office/industrial property
Week 12: GIS and retail property/space

** This is a tentative list of topics. I reserve the right to make changes to the course/lab assignment schedule at any time.*

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**Email and eCampus**

All Texas A&M students should use their TAMU email accounts when emailing the instructor. I may also send out class announcements via the TAMU email system as well.

It is your responsibility to check your TAMU email account regularly. In addition, course materials will be made available on the eCampus site for this course, as well as the Dept. of Geography class server. The TAMU web address for eCampus access is:
http://ecampus.tamu.edu/
For information regarding how to access resources on eCampus, please visit the eCampus Student Help documentation at:
http://ecampus.tamu.edu/Help/Student-Help

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**Student Support**

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

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**Copyright and Plagiarism Policies**

The materials used in this course are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions regarding plagiarism, please consult the latest issue of the *Texas A&M University Student Rules*, http://student-rules.tamu.edu, under the section "Scholastic Dishonesty." For the Academic Integrity Statement and Policy and additional information, please visit: http://aggiehonor.tamu.edu
"An Aggie does not lie, cheat, or steal, or tolerate those who do."

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GRADUATE STUDIES

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Geography
3. Course prefix, number and complete title of course: GEOG 665 GIS-Based Spatial Analysis and Modeling

**Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.**

4. Change requested
   a. Prerequisite(s): From: GEOG 390; STAT 651 or equivalent; approval of instructor To: GEOG 660 or equivalent or approval of instructor
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course:
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 665 | GIS MODELLING |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 45070200 | 1250 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 665 | GIS MODELLING |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 1.00 | | 3.00 | | 1250 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

| | | | |
|---|---|---|---|
| Department Head or Program Chair *(Type Name & Sign)* 10/27/15 | Date | Chair, College Review Committee 10/15/2015 | Date |
| Department Head or Program Chair *(Type Name & Sign)* *(if cross-listed course)* | Date | Dean of College 10/15/2015 | Date |
| **Submitted to Coordinating Board by:** | | Chair, GC or UCC 12-15-15 | Date |
| Associate Director, Curricular Services | Date | | Effective Date |

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# GIS-Based Spatial Analysis and Modeling
## GEOG 665
## Spring 201x
## Texas A&M University

**Time:** TR 12:45 pm-02:00 pm (Sect. 600); **Room:** HECC 202
**Prerequisites:** GEOG 660 or equivalent or approval of instructor
**Credit Hours:** 3

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**Instructor**
**Dr. Anthony M. Filippi**, Associate Professor, 3147 TAMU, Department of Geography, Texas A&M University
**Office:** 707B O&M Bldg.
**Office Hours:** T 4:30-5:00 PM, R 2:30-5:00 PM, and by appointment
**Phone:** 979-845-5744; **Fax:** (979) 862-4487
**Email:** filippi@tamu.edu

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**COURSE DESCRIPTION**

*Catalog Description*: "Investigates methodology of integrating various spatial analysis and modeling techniques with GIS for environmental/socio-economic applications; practical applications; theoretical/technical aspects of related issues in detail. Prerequisites: GEOG 660 or equivalent or approval of instructor."

This course covers how to address spatial and spatio-temporal problems by employing GIS-based analysis and modeling. The emphasis will be on the theoretical and conceptual underpinnings, with practical reinforcement and extension through laboratory exercises and a project. Students will therefore be able to apply GIS-modeling concepts to real-world problems. In the process, exposure to different GIS-modeling environments will be afforded. For practical considerations, raster GIS modeling will be the focus of this course. Given the prerequisite for this course, operationally, basic GIS knowledge is assumed.

Class meeting time for the course may be apportioned to lecture, seminar, final project, and/or lab issues, as needed.

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## LEARNING OBJECTIVES

The material covered in this course is aligned with learning objectives in the Geographic Information Science & Technology Body of Knowledge, which was produced by the University Consortium for Geographic Information Science (UCGIS) and published by the Association of American Geographers (AAG).

The primary learning objectives of this course are as follows:

--Students will be able to conceptually explain the various GIS model types and describe the circumstances under which each should be used.

--Students will be able to describe and utilize map algebra/cartographic modeling operators for addressing spatial problems.

--Students will be able to articulate/discuss the advantages and disadvantages of various forms of GIS-based modeling.

--Students will be able to articulate how GIS-based modeling and spatial analyses are conducted, and they will be able to perform such analyses.

--Students will be able to develop and implement a GIS-based model to address spatial or spatio-temporal problem.

--Students will be able to synthesize technical and application domain knowledge, and interpret the results, to address a spatial or spatio-temporal problem.

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## TEXT AND SUPPLEMENTARY MATERIALS

**Required Text:**
DeMers, M. N. 2002. ***GIS Modeling in Raster***. New York: John Wiley & Sons, 203 p.

**Recommended Ancillary Text (Optional):**
Tomlin, C. D., 1990, ***Geographic Information Systems and Cartographic Modeling***. Englewood Cliffs, NJ: Prentice-Hall, 249 p. (**Note:** this is out-of-print)

There will also be various handouts and assigned journal articles/readings throughout the semester. The articles should be read prior to the relevant class period, as there will be in-class student presentations and discussions concerning the articles.

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## STUDENT EVALUATION/GRADING POLICY

This course includes a lecture component, seminar-style journal article-discussion sessions, laboratory exercises, and a final project. The course readings complement the lecture material. Grades are assigned based on student performance on one (1) exam, the laboratory exercises, the final project and presentation, and class participation. The examination will be based on the material from the lectures, textbook, other readings, and to a lesser extent, the laboratory exercises. Make-up exams will only be available for University-excused absences. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu), Section 7.1. If you know *a priori* (i.e., ahead of time) that you will be unable to take an exam on the scheduled date, consult the instructor prior to the exam to make alternative arrangements. An unexcused absence from an exam will yield a score of zero for that exam. Requirements for the final project and presentation will be forthcoming. Class participation will be assessed according to the student's contribution to the discussion of journal articles and other readings; presentation of articles/readings to the class when assigned; and contributions to general discussions. Students will be assigned to present/co-present one (1) journal article/reading to the class. The grade concerning the presentation of the final project will be included in the final-project grade. The weights for the grading schedule are as follows:

**Deliverables/Course Components**

| | |
|---|---|
| 1) Midterm Exam: | 30% |
| 2) Laboratory Exercises: | 25% |
| 3) Final project and presentation: | 35% |
| 4) Class Participation: | 10% |

**Grades will be assigned according to following scale:**

A (≥90%); B (80-89%); C (70-79%); D (60-69%); and F (<60%)

**Additional comments regarding selected components/deliverables are given below:**

**EXAMS.** There is one (1) exam in this course—a mid-term exam—that will cover the lectures, labs, and reading materials.

**LABS.** There will be five (5) laboratory assignments, though due to the structure of the course, there is not a separate laboratory meeting time for this course. ESRI ArcGIS 10.x and other GIS software packages will be employed, which are available in the Dept. of Geography GIS Labs located in **Teague B009A and B009C**, as well as the other student-computing labs in the department. The laboratories will reinforce and complement lecture/discussion materials. Laboratory assignments will be due in class one week from the date assigned. Late assignments will be assessed a 10% penalty for each day they are overdue. Discussion of laboratory assignments will occur during a portion of some class periods, though labs will require time outside of class to complete. Students may utilize the Dept. of Geography GIS Labs (Teague B009A and B009C) at any time during regular

hours (8 am-5 pm, Monday-Friday) when there is not a laboratory class meeting in a given lab room, and as space permits. Lab teaching schedules will be posted next to the lab doors. Both GIS Labs are equipped with ArcGIS and other GIS/remote-sensing software.

**FINAL PROJECT.** Students will complete a final project, due near the end of the semester. The goal is to design and conduct a project that employs GIS-based modeling to address a geographic/spatial/spatio-temporal conceptual problem. Each student/group will give a ~15-minute presentation (plus time for questions/discussion) on the project to the class toward the end of the semester. Specific guidelines regarding project requirements will be issued.

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## ATTENDANCE

Class attendance is the responsibility of the individual student. Since the lectures/class meetings will often contain material that is not included in the textbook, it is particularly in your interest to attend class. In addition, some class sessions will entail a seminar-type format, including presentation and discussion of articles, which contribute to the class participation grade. If you miss an *exam* for a University-approved reason, follow the procedures listed in Section 7.5 of the student rules to have your absence excused. Please familiarize yourself with these procedures.

---

**TENTATIVE SCHEDULE***

| WEEK | TOPIC | TENTATIVE READINGS / ASSIGNMENTS |
|---|---|---|
| 1 | Introduction to the course, Data Models, GIS modeling, GIS Coupling, and Model Complexity | "Analytical Modeling in GIS" (Heywood et al., 1998) slides; DeMers (2002), Chpt. 1 |
| 2 | Raster models, Continuous Fields; Vector-to-Raster Conversion; Spatial Interpolation | DeMers (2002), Chpt. 2; Burrough and McDonnell (1998)**, pp. 113-118; Handout/Lecture notes |
| 3 | Map Algebra, Boolean Operators, Overview of Cartographic Modeling Operators (Local/Focal/Zonal/Global), Detailed discussion of Local Operations | DeMers (2002), Chpt. 3 and pp. 58-80 in Chpt. 4; Berry (1987)†; Handouts/Lecture notes |
| 4 | Local Operations (continued) Capability/Suitability Modeling | Tomlin (1991)§; Berry (1987); Handouts/Lecture notes |
| 5 | Neighborhood/Focal Operations; Hydrologic Modeling | Burrough and McDonnell (1998), pp. 190-198; DeMers (2002), Chpt. 4 (pp. 81-93); Article Set 1 |
| 6 | Hydrologic Modeling (continued) | Article Set 2 |
| 7 | Zonal Operations | Lecture notes |
| 8 | GIS model types; model conceptualization, formulation, flowcharting, implementation; model verification, validation; **Midterm Exam (March 12)** | DeMers (2002), Chpt. 5, 6, 7, 9; Giudici (2002) (in Article Set 3) |
| 9 | **Spring Break (March 16-20)— No class** | |
| 10 | Temporal (Diffusion) Models; Land-Change Modeling | Lecture notes; Article Set 3 |
| 11 | Land-Change Modeling (continued) | Article Set 3 |
| 12 | Introduction to ModelBuilder; Integration of remote sensing and GIS modeling; Vector GIS modeling; **Student Final Project Presentations** | Lecture notes; Article Set 3 |
| 13 | **Student Final Project Presentations (continued)** | |
| 14 | AAG Conference – **No class** 04/21/2015 and 04/23/2015 | Work on final projects |
| 15 | **Final Project Papers Due (April 30); Student Final Project Presentations (continued)** | |

** This is a tentative list of topics. I reserve the right to make changes to the course schedule at any time.*

**Final Project Paper Due Date:** Thursday, April 30, 2015

** Reference information for the Burrough and McDonnell (1998) reading:

Burrough, P. A., and McDonnell, R. A., 1998, *Principals of Geographical Information Systems*. New York: Oxford University Press, 333 p.

§ Reference information for the Tomlin (1991) reading:

Tomlin, C. D., 1991, Cartographic Modeling, in *Geographic Information Systems: Principles and Applications*. D. J. Maguire, M. F. Goodchild, and D. W. Rhind (Eds.), 1st Ed., Vol. 1: Principles, Harlow, UK: Longman, pp. 361-374. (Text available at the following URL: http://www.wiley.com/legacy/wileychi/gis/Volume1/BB1v1_ch23.pdf). Table of contents available at: http://www.wiley.com/legacy/wileychi/gis/volumes.html).

† Reference information for the Berry (1987) reading:

Berry, J. K. 1987. Fundamental operations in computer-assisted map analysis. *International Journal of Geographical Information Systems* 1(2): 119-136.

**Other Readings**

**Article Set 1 (Hydrologic Modeling I):**

Lovejoy, S. B., 1997, Watershed management for water quality protection: Are GIS and simulation models THE answer? *Journal of Soil and Water Conservation* March-April, p. 103.

Brown, D. G., Bian, L., and Walsh, S. J., 1993, Response of a distributed watershed erosion model to variations in input data aggregation levels, *Computers and Geosciences* 19(4), 499-509.

Mashriqui, H. S., and Cruise, J. F., 1997, Sediment yield modeling by group response units, *Journal of Water Resources Planning and Management* 123(2): 95-104.

Tim, U. S. and Jolly, R., 1994, Evaluating agricultural nonpoint-source pollution using integrated geographic information systems and hydrologic/water quality model, *J. Environ. Qual.*, 23:25-35.

**Article Set 2 (Hydrologic Modeling II):**

Zacharias, I., Dimitriou, E., and Koussouris, T. 2004. Quantifying land-use alterations and associated hydrologic impacts at a wetland area by using remote sensing and modeling techniques. *Environmental Modeling & Assessment* 9(1): 23-32.

Jayakrishnan, R., Srinivasan, R., Santhi, C., and Arnold, J. G. 2005. Advances in the application of the SWAT model for water resources management. *Hydrological Processes* 19(3): 749-762.

Castillo, C. R., Güneralp, İ., and Güneralp, B. 2014. Influences of changes in developed land and precipitation on hydrology of a coastal Texas watershed. *Applied Geography* 47: 154–167, doi: 10.1016/j.apgeog.2013.12.009.

**Article Set 3 (Miscellaneous):**

[Urbanization / Land-Change Modeling]

Seto, K. C., Güneralp, B., and Hutyra, L. R. 2012. Global forecasts of urban expansion to 2030 and impacts on biodiversity and carbon pools. *Proceedings of the National Academy of Sciences of the United States of America* 109(40): 16083-16088. http://www.pnas.org/content/109/40/16083.full.pdf?with-ds=yes

Güneralp, B., Reilly, M., and Seto, K. C. 2012. Capturing multiscalar feedbacks in urban land change: a coupled system dynamics spatial logistic approach. *Environment and Planning B* 39(5): 858-879.

[Population Modeling]

McKee, J. J., Rose, A. N., Bright, E. A., Huynh, T., Bhaduri, B. L. 2015. Locally adaptive, spatially explicit projection of US population for 2030 and 2050. *Proceedings of the National Academy of Sciences of the United States of America* 112(5): 1344–1349. www.pnas.org/cgi/doi/10.1073/pnas.1405713112
Supporting Information available at:
http://www.pnas.org/content/suppl/2015/01/15/1405713112.DCSupplemental/pnas.201405713SI.pdf

[Hazard Modeling]

Cova, T. J., and Church, R. L. 1997. Modelling community evacuation vulnerability using GIS, *Int. J. Geographical Information Science* 8:763-784.

Chakraborty, J., and Armstrong, M. P. 1997. Exploring the use of buffer analysis for the identification of impacted areas in environmental equity assessment, *Cartography and Geographic Information Systems* 24(3): 145-157.

[Disease Modeling]

Perez, L., and Dragicevic, S. 2009. An agent-based approach for modeling dynamics of contagious disease spread. *International Journal of Health Geographics* 8:50. doi:10.1186/1476-072X-8-50

[Archaeology]

Ebert, D. 2004. Applications of Archaeological GIS. *Canadian Journal of Archaeology / Journal Canadien d'Archéologie* 28(2): 319-341.

[Model Calibration and Validation]

Giudici, M. 2002. Development, calibration, and validation of physical models, in *Geographic Information Systems and Environmental Modeling*, K. C. Clarke, B. O. Parks, and M. P. Crane (Eds), Upper Saddle River, NJ: Prentice-Hall, pp. 110-121.

**Other Important Dates**

| | |
|---|---|
| March 16-20 | Spring Break |
| April 3 | Friday. Reading day, no classes. |
| May 5 | Tuesday. Last day of spring semester classes; Redefined day, students attend **Friday** classes; Prep Day, classes meet. No regular course exams. |
| May 6 | Wednesday. Reading day, no classes. |

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**Tentative Laboratory Topical List*:**

Week 2: Introduction to GIS Computing Environment; GIS Software Overview (*No lab assignment*)
Week 3: GIS Coupling
Week 4: Suitability/Capability Modeling
Week 5: Focal Operations
Week 7: *No lab assignment* (week of midterm exam)
Week 10: Diffusion Modeling in Space and Time
Week 11: Land-Use/Land-Cover Change Analysis and Modeling using the IDRISI Land Change Modeler

* *This is a tentative list of topics. I reserve the right to make changes to the course/laboratory assignment schedule at any time.*

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**Email and eCampus**

All Texas A&M students should use their TAMU email accounts when emailing the instructor. I may also send out class announcements via the TAMU email system as well. It is your responsibility to check your TAMU email account regularly. In addition, course materials will be made available on the eCampus site for this course, as well as the Dept. of Geography class server. The TAMU web address for eCampus access is: http://ecampus.tamu.edu/

For information regarding how to access resources on eCampus, please visit the eCampus Student Help documentation at:
http://ecampus.tamu.edu/Help/Student-Help

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**Student Support**

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

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**Copyright and Plagiarism Policy**

The materials used in this course are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions regarding plagiarism, please consult the latest issue of the *Texas A&M University Student Rules*, http://student-rules.tamu.edu, under the section "Scholastic Dishonesty." For the Academic Integrity Statement and Policy and additional information, please visit: http://aggiehonor.tamu.edu
"An Aggie does not lie, cheat, or steal, or tolerate those who do."

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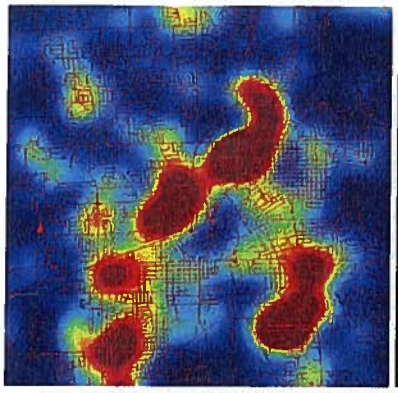
Geographic Information Science and Technology
Department of Geography, Texas A & M University

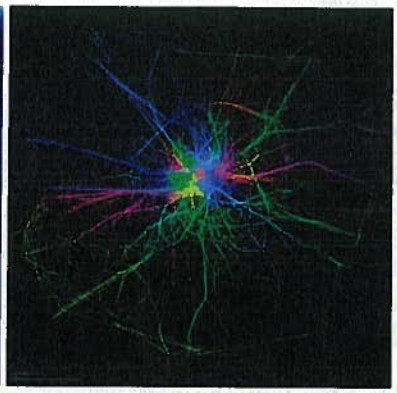
# Geography 665 - 3 Hrs

# Spatial Analysis and Modeling

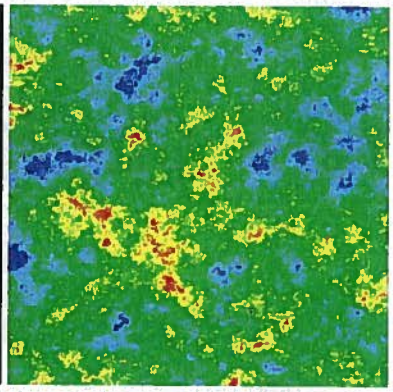




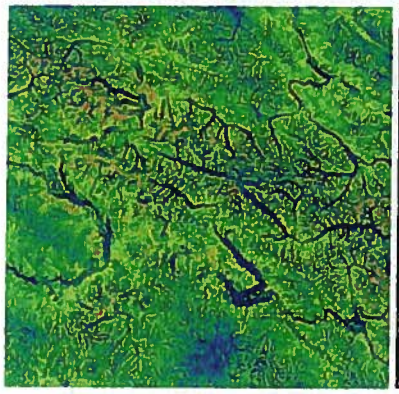
Point Pattern Analysis



Network Analysis



Variogram Analysis

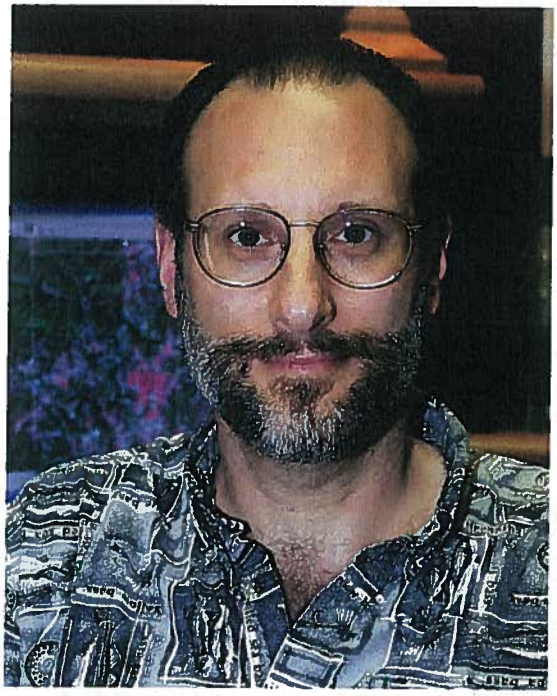


Surface Analysis

Deterministic Modeling

CA Modeling

# 1 Course Instructor



Dr. Michael P. Bishop
Office: O+M 707E
Phone: (979) 845-7998
Email: michael.bishop@tamu.edu
Skype: mpbishop

Schedule, 2014

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| 8:00 am | | | | | |
| 9:00 am | | | | | |
| 10:00 am | | | | | |
| 11:00 am | | | | | |
| 12:00 am | | | | | |
| 1:00 pm | | Geog. 665 HECC 202 | | Geog. 665 HECC 202 | |
| 2:00 pm | | Office Hours O+M 707E | | Office Hours O+M 707E | |
| 3:00 pm | | | Dept. Meetings O+M 712 | | |
| 4:00 pm | | | | | |
| 5:00 pm | | | | | |

## 2 Course Materials

- Bishop, M.P., 2014 . Review and research articles will be made available to students.

## 3 Copyright Policy Statement

All materials used in this class are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, project assignments, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts or data, unless permission is explicitly granted.

## 4 Attendance Policy

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.

## 5 Lectures and Reading

Lectures and discussion will be associated with each topic covered in the course. In addition, students will be responsible for finding literature outside of class using library resources, and reading review and research articles to prepare for each meeting session. Lecture and discussion material frequently consists of information not found in general introductory and intermediate level GI-Science, remote sensing, and terrain analysis textbooks. Consequently, it is essential that students attend all lecture/seminar sessions and read assigned articles before class. This also facilitates classroom participation and student questions. Students not able to attend lecture should contact the professor and/or a student regarding presented information, as this information is necessary to complete project assignments. Students will also be involved in classroom discussions and debate.

Cell-phones and pagers should be turned off in the classroom, as they disrupt students and the professor. Students are required to ask questions and participate in classroom discussions and debate. This must be done with special attention to language and respect for others. Students will be asked to leave the classroom if they disrupt the class. Tape-recording of lectures will not be allowed except in accommodation of a student disability per Student Disability Services advisement.

## 6 Student Projects

There will be two major projects that students must complete during the course of the semester. These are designed to provide students with hands-on training and problem-solving experience

in spatial analysis and modeling techniques and approaches. Students can use any GIS, image processing, statistical or spatial analysis software (e.g., GRASS, ArcGIS, Imagine, Envi, SAGA, R, SPSS, FragStats) that enables spatial analysis and modeling for project completion. Students will write a detailed paper on each project characterizing the nature of the problem, issues and concepts, methodology, results, discussion and conclusions. The semester projects are based upon addressing a problem the student is interested in. Potential application topics include all areas of Earth and social science, as well as applied planning and management issues and problems. Once a topic and the appropriate spatial data to address a problem have been identified and acquired, two analysis components (projects) must be performed:

1. Spatial analysis and information extraction. Each student will engage in a variety of spatial analysis approaches to extract spatial information that can be used to address the problem and facilitate subsequent spatial modeling efforts. Students must conduct different forms of point pattern, network, surface, and scale-dependent analyses to generate unique information from spatial data. The emphasis is on justifying the use of the spatial analysis approach and the algorithm, as well as on the accuracy of the final product. In this way, students will receive practical exposure to different spatial analysis approaches and learn the difference between GIS empiricism and science-based spatial analysis.

2. Spatial modeling. Each student will select a form of spatial modeling that is most suitable to predict a spatial outcome. In general, this may include empirical, stochastic, or deterministic modeling (or hybrid modeling). Examples include spatially weighted regression, suitability site modeling, physics-based numerical modeling, and more advanced geocomputation modeling approaches including analytical reasoning and cellular automata. Modeling outcomes include identifying the most favorable location for a landfill, school, home, or energy facility. Modeling can also be used to identify archeological sites, natural resources, and environmental degradation. Model prediction is also required for urban expansion, wildlife habitat mapping, environmental exposure assessment, hazards assessment and many other physical and social-science applications. Each student must also perform model sensitivity and error and uncertainty analyses.

Regardless of the application problem, each student will identify the most suitable forms of data and incorporate satellite imagery, topographic information, and vector-based GIS layers. Utilization of a variety of spatial analysis approaches will permit the production of unique information to assist in problem solving. Finally, exposure to modeling approaches will permit predictive capabilities that represents a more rigorous attempt to solve a problem. Collectively, the two semester projects will provide students with real-world problem-solving experience.

## 6.1 Project Papers

Each project must result in the production of a paper. Students must follow an approved paper outline that includes all sections, subsections, and subsubsections. The length of the paper will be left to the discretion of the student and should be single spaced, with no graphics inserted in the test. High quality graphics are required but should follow the references. Students will email a WORD document to the professor. Handwritten work will not be accepted. Late papers will not

be accepted unless a student has an excused absence. The first project paper will be due around mid-term, and the final project will be due two weeks before final examinations.

### 6.2 Student Examinations

There will be no student examinations.

## 7 Student Evaluation and Grading

| Assignments | Total Points | Percentage |
|---|---|---|
| Project 1: Spatial Analysis | 500 | 50 |
| Project 2: Spatial Modeling | 500 | 50 |
| Total Points | 1000 | 100.0 |

Students will be graded based upon fulfilling project criteria, project performance, and their ability to effectively communicate project results in written form. Project papers will be graded on overall quality of work and student effort. Final grades will be determined by relative ranking of cumulative point scores. This usually equates to a scale of 90-100%(A), 80-89%(B), 70-79%(C), 60-69%(D), and $\leq$59%(F).

Academic dishonesty is regarded as a serious offense by the University, the Department of Geography, and the faculty. Academic dishonesty will result in a course grade of failure, regardless of the form of dishonesty. These include, but are not limited to, copying of laboratory assignments, copying of exam answers, plagiarism and use of Internet materials (not referenced) in papers.

## 8 Academic Integrity Statement and Policy

All students should be aware of the Aggie Honor Code and refer to the Honor Council Rules and Procedures on the web at http://aggiehonor.tamu.edu.

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

## 9 Student Issues and Questions

Students are encouraged to meet with the professor to discuss their progress in the class. This includes questions regarding any aspect of the course. Students are expected to meet with the professor during scheduled office hours or by appointment. Do not wait until the end of the semester for an evaluation.

Students with disabilities are expected to discuss their situation with the professor as it relates to the course and individual performance issues. Approved accommodations, as defined by disability services, will be followed to assist the student in completing the course.

# 10 Americans with Disabilities Act (ADA) Policy Statement

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.

# 11 Course Description and Prerequisites

Geography 665 is a graduate level course designed to introduce students to the field of GIS-based spatial analysis and modeling, It reviews the fundamental principles of geographic information systems and characterizes basic types of GIS-based analysis. The course primarily focuses on the theory and concepts of spatial analysis and modeling. It introduces various approaches to spatial analysis including point-pattern analysis, network analysis, statistical analysis, semi-variogram analysis, and object-oriented analysis. Spatial modeling approaches include statistical, physics-based and geocomputational methods. Students will learn about spatial analysis and modeling as it relates to information extraction from remotely sensed data, digital elevation models, and typical GIS layers. Students are expected to have the equivalent of GEOG 361 (Remote Sensing in Geosciences), GEOG 390 (Principles of GIS), or approval of the instructor.

# 12 Course Objectives

This course is designed to provide graduate students exposure to spatial analysis and modeling. Students will receive an understanding of how spatial analysis and modeling can be used to extract information from individual GIS layers and entire GIS databases. Specifically, the course will emphasize various topics categorized as principles of geographic information systems, theoretical and conceptual issues, point pattern analysis, spatial analysis, spatial statistical analysis, and spatial modeling. It emphasizes mastering the theoretical and fundamental issues associated with extracting spatial information that can be used to address scientific research and applied problems in a variety of disciplines. Students will receive exposure to the latest issues, information technologies, and application perspectives. Lectures, classroom discussions, reading assignments, and applied projects, will provide students with hands-on and problem-solving experience.

## 12.1 Learning Outcomes

At the end of the course, the student will be able to:

1. Describe the complex issues and concepts associated with spatial analysis and modeling.
2. Conduct spatial analysis on various forms of vector data.

3. Conduct spatial analysis on various forms of raster data.
4. Describe how semi-variogram analysis can be used to assess scale-dependence and anisotropy.
5. Describe how object-oriented analysis can be used in mapping and modeling.
6. Define the advantages and disadvantages of various forms of spatial analysis.
7. Define the advantages and disadvantages of various forms of spatial modeling.
8. Develop and implement a spatial model to solve a problem.
9. Synthesize technical and application domain knowledge to address mapping problems.
10. Compose their own original writing.
11. Interpret results within the context of a problem.
12. Apply technical skills to solve a problem.

# 13 Schedule

| Week | Course Topic | Reading |
|---|---|---|
| 1 | Introduction and GIS | Article(s) to be assigned. |
| 2 | Theory and Concepts | Article(s) to be assigned. |
| 3 | Theory and Concepts | Article(s) to be assigned. |
| 4 | Spatial Data Manipulation | Article(s) to be assigned. |
| 5 | Spatial Data Manipulation | Article(s) to be assigned. |
| 6 | Spatial Data Analysis | Article(s) to be assigned. |
| 7 | Spatial Data Analysis | Article(s) to be assigned. |
| 8 | Spatial Data Analysis | Article(s) to be assigned. |
| 9 | Spatial Statistical Analysis | Article(s) to be assigned. |
| 10 | Spatial Statistical Analysis | Article(s) to be assigned. |
| 11 | Spatial Statistical Analysis | Article(s) to be assigned. |
| 12 | Spatial Modeling | Article(s) to be assigned. |
| 13 | Spatial Modeling | Article(s) to be assigned. |
| 14 | Spatial Modeling | Article(s) to be assigned. |

# 14 Topical Outline

## 14.1 Principles of GIS

### 14.1.1 GIST and GIS

### 14.1.2 Nature of Geospatial Data

- Attributes
- Locational component
- Temporal component
- Metadata
- Scale and representation

### 14.1.3 Data Input and Storage

### 14.1.4 Database Development and Management

### 14.1.5 Data Manipulation

### 14.1.6 Data Analysis and Modeling

- Visual interpretation
- Measurement
- Classification
- Spatial overlay
- Spatial analysis
- Spatial modeling

#### 14.1.7 Display and Geovisualization

## 14.2 Spatial Analysis and Modeling

### 14.2.1 What is Spatial Analysis

### 14.2.2 What is Spatial Modeling

### 14.2.3 Role of Pattern Recognition

## 14.3 Theory and Concepts

### 14.3.1 Representation

- Dimensions
- Spatial concepts
- Temporal concepts
- Process concepts
- Human conceptualization
- Fuzzy membership and representation
- Semantic modeling
- Data modeling

### 14.3.2 Indeterminant Boundaries

### 14.3.3 Scale

- Cartographic
- Measurement
- Observational
- Operational
- Computational
- Scale dependence and independence
- Hierarchical organization

#### 14.3.4 Anisotropy

#### 14.3.5 Homogeneity

#### 14.3.6 Heterogeneity

#### 14.3.7 Error and Uncertainty

#### 14.3.8 Spatial Auto-Correlation

#### 14.3.9 Complexity

#### 14.3.10 Spatial Non-Stationarity

#### 14.3.11 Spatial Variation and Patterns

## 14.4 Spatial Data Manipulation

### 14.4.1 Map Algebra

- Arithmetic operators
- Relational operators
- Boolean operators
- Bitwise operators
- Combinatorial operators
- Logical operators
- Accumulative operators
- Assignment operators
- Functions

#### 14.4.2 Spatial Query

#### 14.4.3 Spatial Overlay

#### 14.4.4 Buffering

#### 14.4.5 Projection Transformations

#### 14.4.6 Measurement-Scale Transformations

#### 14.4.7 Clumping and Seiving

### 14.5 Spatial Data Analysis

#### 14.5.1 Point-Pattern Analysis

#### 14.5.2 Network Analysis

#### 14.5.3 Spatial Statistics

- Global
- Local (cell by cell)
- Zonal (regions)
- Feature Based
- Altitude Based

#### 14.5.4 Texture Analysis

#### 14.5.5 Spatial Auto-Correlation

#### 14.5.6 Fractal Analysis

#### 14.5.7 Surface Analysis

#### 14.5.8 Multi-Resolution Analysis

#### 14.5.9 Spatial Similarity of Multi-Scale variation

#### 14.5.10 Object-Oriented Analysis

- Segmentation
- Object parameters

- Spatial topological analysis

## 14.6 Spatial Statistical Analysis

### 14.6.1 Semi-Variogram Analysis

### 14.6.2 Semi-Variogram Model Fitting

- Circular Model
- Spherical Model
- Penta-spherical Model
- Exponential Model
- Gaussian Model
- Cubic model
- Periodicity

### 14.6.3 Scale-Dependent Anisotropic Analysis

### 14.6.4 Scale-Dependent Self-Similarity

## 14.7 Spatial Modeling

### 14.7.1 Spatial Modeling Approaches

- Empirical statistical modeling
- Statistical Stochastic modeling
- Physics-based numerical modeling
- Geocomputational modeling

### 14.7.2 Types of Models

- Conceptual models
- Descriptive models
- Prescriptive models
- Methodological models

- Empirical models
- Stochastic models
- Deterministic models
- AI models
- Agent-based models

#### 14.7.3 Spatial Interpolation

- Triangulation
- Linear Interpolation
- Bilinear Interpolation
- Inverse Distance Weighted
- Kriging

#### 14.7.4 Geographically Weighted Regression (GWR)

#### 14.7.5 Suitability Site Modeling

#### 14.7.6 Cellular Automata

#### 14.7.7 Analytical Reasoning

#### 14.7.8 Spatio-Temporal Models

#### 14.7.9 Model Coupling

#### 14.7.10 Model Evaluation

- Sensitivity analysis
- Calibration
- Verification
- Validation
- Acceptability

# 15 Books

For the latest in spatial analysis textbooks, go to the following publishers Websites and search using the appropriate key phrases.

htpp://www.crcpress.com

htpp://www.elsevier.com

htpp://www.wiley.com

htpp://www.springer.com

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate ♦ Graduate ♦ Professional

• Submit original form and attachments •

RECEIVED
NOV 12 2015
GRADUATE STUDIES

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Geography
3. Course prefix, number and complete title of course: GEOG 676 GIS Programming

**Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.**

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☐ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: GEOG 392
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 676 | GIS PROGRAMMING |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 2.00 | | 4.00 | 45070206 | 1250 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 676 | GIS PROGRAMMING |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 1.00 | | 3.00 | | 1250 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* Date

Chair, College Review Committee 10/15/2015 Date

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

Dean of College 10/15/2015 Date

**Submitted to Coordinating Board by:**

Chair, GC or UCC 12-15-15 Date

Associate Director, Curricular Services Date Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# GIS Programming

## GEOG 676


**Instructor**

**Dr. Daniel Goldberg**
Office: O&M 707F
Tel: 979-845-7141
Email: daniel.goldberg@tamu.edu
Office Hours: TBD
and by appointment

**Teaching Assistants**

**TBD**
Sections 500
Office: TBD
Email: TBD
Office Hours: TBD
Office Hours: TBD


## Meeting Time and Locations

**Lecture**
Time: TBD

Room: TBD

**Labs**
500 – TBD

Room: TBD

## Class web site

Updates to the lecture and lab syllabi as well as other course materials will be made available on the course website. It can be accessed on ELearning at http://elearning.tamu.edu.

## Course Description

This class is an introduction to programming in general and an introduction to programming for Geographic Information Systems (GIS) in particular. This project-oriented course covers the guiding principles behind programming syntax and data structures, and how to apply these techniques to the development of custom standalone GIS programs and the integration of these into commercial GIS platforms. The course also includes an applied section where the student will identify a real-world "customer" and lead a team of undergraduates to complete a project.

## Learning Outcomes

This course is designed to introduce students to the basics of programming with modern programming languages in the context of development for and with GIS. Students will learn how to apply this knowledge to develop custom GIS applications and extensions that solve real-world problems. This course will provide students with a solid foundation in fundamental programming techniques and the knowledge to apply these techniques within GIS programming domains.

The course will start with an introduction to fundamental programming structures and techniques and quickly advance to programming issues related to developing for GIS platforms including integration of their code into industry standard GIS platforms to extend the capabilities of these systems.

The course will include a lecture component where theoretical issues are covered and lab-based exercises where students have the opportunity to practice implementing these techniques in various programming languages including Python and C#.

This course will also include identification of and interaction with a real-world "customer" who needs GIS programming. Students will learn software project management skills while leading a team of undergraduate students and have the opportunity to interact with a real-world "customer" to experience the identification and translation of customer requirements into application development.

**At the end of this class, each student will be able to:**

1) Identify a set of requirements for the development of a software system;
2) Implement standalone programming projects in Python and C# to solve GIS problems;
3) Integrate custom code into ArcGIS that customizes, automates, and extents its functionality;
4) Programmatically access GIS data and use these data in GIS modeling, computation, visualization, and analysis;
5) Conceptualize, design, plan, implement, and document a custom GIS programming solution to a real-world problem; and
6) Lead a team of developers in the execution of a customer-driven programming project.

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## Textbooks and Readings

**Lecture Texts**

**Required:** Allen D, 2014. **GIS Tutorial for Python Scripting**. 1st ed. Redlands, CA, Esri Press. 288 pp.

**Optional:** Watson K, Hammer JV, Reid J, Skinner M, Kemper D, Nagel C, 2012. **Beginning Visual C# 2012 Programming**. 1st ed. Hoboken, NJ, Wiley. 912 pp.

**Additional readings and materials will be drawn from websites, handouts, and online resources.**

---

## GIS Software

This course will utilize the ArcGIS™ suite of software developed by ESRI. Installable copies may be obtained from the instructor or teaching assistants.

---

## Development Software

This course will utilize the Python which is installed with ArcGIS. This course will also utilize Visual Studio 2012 which can be downloaded as a student education version from Microsoft.

---

## Class Attendance

The university views class attendance as the responsibility of the individual student. Information on University attendance rules can be found at http://student-rules.tamu.edu/rule07. As described below, a portion of each student's grade is based on in-class participation. This will be judged by the instructor as regular attendance and active engagement on a consistent basis that contributes to the class in some manner.

**Lab attendance** is not required, but considered essential for successful completion of the course.

## Cellular Telephones

As a courtesy to the instructor and other students please turn off all cellular telephones before the class begins.

## Email

All Texas A&M students should use their Texas A&M University email accounts when emailing the instructor and teaching assistants. I may also send out class announcements via the University email system as well. It is your responsibility to check your official TAMU email account regularly.

## Grading

Your grade in this class will be based as described below:

| | | |
|---|---|---|
| A. **Lecture** | **30%** | |
| Midterm 1 | | 10% |
| Midterm 2 | | 10% |
| Final Exam | | 10% |
| B. **Lab** | **20%** | |
| Exercises | | 20% |
| B. **Homework** | **5%** | |
| Exercises | | 5% |
| C. **Project** | **40%** | |
| Project Proposal | | 10% |
| Project Status Report 1 | | 2.5% |
| Project Status Report 2 | | 2.5% |
| Final Project | | 25% |
| D. **Participation** | **5%** | |
| Class Participation | | 5% |

## Grading Scale

The grading scale for this course is as follows:

≥90% A, 80-89% B, 70-79% C, 60-69% D, <60% F

An average performance in the class will earn a satisfactory grade.

Makeups for the Exam will be allowed only for University excused absences and will be administered in compliance with university rules. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu)

---

## Final Project

Throughout the semester, graduate students lead a team of up to 4 undergraduate students to apply the GIS programming concepts learned in lectures with the hands-on experience gained in labs to solve a "real-world" problem using GIS programming. Graduate students will be responsible for identifying a "customer" who needs a GIS program developed to extend or automate a commercial GIS platform (e.g., ArcGIS). Graduate students will work with the customer to identify the requirements for the system, supervise the undergraduate team members, and assist in the successful development of the final product.

### Proposal Pitches

Each graduate student will present a 5 minute presentation of their idea for a project to the class. This will pitch will include enough details to recruit undergraduate students to work on the grad student's project. Undergraduate students will choose project teams based on their willingness to work on the project pitched by the graduate student. Graduate students who receive an insufficient number of students to complete their project will work on another graduate student's project.

### Project Proposal

Each student group will submit a 1-page synopsis of the proposed topic and present a 5 minute description. This synopsis will include the problem the group will attempt to address including a set of requirements, the methods and data that will be used to accomplish their goals, and a development roadmap. The graduate student will be responsible for communicating with the "customer" to ensure that the project can be completed within the timeframe and expertise of the project team, and that the end product will responsive to the needs of the "customer".

### Project Status Reports

Each student group will present two short presentations during the semester that outline project progress. Students will be graded based on progress toward project completion.

### Project Deliverables

Each student group will a) deliver their project code and necessary data as an installable program; b) deliver a report summarizing the problem they were trying to address, the tools and data used to accomplish their goals, and reflections on how well their implementation meets the requirements set forth; and c) demonstrate a hands-on working version of their prototype to the class during a project presentation.

### Project Grading

Each graduate student will be graded on the quality of the team project. In addition, each graduate student will provide a score for each of the team members that reflects each team member's contribution to the overall project. Students are advised to consult with the teaching assistant and/or professor in advance if issues of team member performance becomes an issue.

## Labs

Labs are an important and integral portion of the course. There is simply no way to learn about GIS programming without spending considerable time in lab working on GIS programming problems. While the scheduled lab time is two hours, labs will typically require time outside of the scheduled lab hours to complete.

Labs will be due at the beginning of the following lab unless otherwise indicated. Scores for late labs will be deducted 10% per day until they are turned in, up to one week. After one week late, labs will not be accepted for credit. It is your responsibility for keeping up with lab assignments. You should talk to your Teaching Assistant and or the instructor BEFORE late labs become a problem.

## Scholastic Dishonesty

It is our hope that academic dishonesty will not be a problem in this class. Texas A&M does, however, have a *Scholastic Dishonesty* policy to which both students and faculty must comply. If you have any questions about the University's Scholastic Dishonesty policy please review the Student Rules or see me. The Aggie Honor program is the new program that will handle all cases of academic dishonesty. http://www.tamu.edu/aggiehonor

All materials used in this class are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even is you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions regarding plagiarism, please consult the latest issue of the Texas A&M University Student Rules, http://student-rules.tamu.edu, under the section "Scholastic Dishonesty."

***"Aggies don't lie, cheat, or steal, nor tolerate those that do"***

## Student Support

*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 the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall. The phone number is 845-1637.*

## Student Resources

**Services for Students with Disabilities**

Room B118 of Cain Hall, 845-1637 or on the web at http://disability.tamu.edu/

*There are numerous other student support organizations on campus including*

**Student Counseling Service**

Cain Hall, 845-4427, http://scs.tamu.edu

Student Counseling Helpline 5:00pm-8:00am: 845-2700

**University Writing Center**

Suite 1.214 of the Evans Library, 458-1455, http://writingcenter.tamu.edu/

---

## Course Schedule follows on the next page

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## Course Schedule

| Week | Lecture Topics | Exams |
|---|---|---|
| 1 | Introduction to the Class & GIS Programming | |
| 2 | Programming Environments | |
| 3 | Syntax & Data Structures | |
| 4 | Controls & Functions | **PROPOSAL PITCHES** |
| 5 | Object Oriented Programming | **PROPOSAL PRESENTATIONS** |
| 6 | Object Oriented Programming | **MIDTERM 1** |
| 7 | Computing with Data | **PROPOSAL STATUS REPORT I** |

*I reserve the right to make changes to the course schedule*

## Course Schedule Cont.

| Week | Lecture Topics | Exams |
|---|---|---|
| 8 | Programming for GIS | |
| 9 | GIS Automations | |
| 10 | GIS Customizations | |
| 11 | GIS Extensions | **MIDTERM 2** |
| 12 | Consuming & Distributing Code | **PROPOSAL STATUS REPORT II** |
| 13 | Principles and Practices of Software Development | |
| 14 | Future of GIS Programming | **NO CLASS (THANKSGIVING)** |
| TBD | | **PROJECT PRESENTATIONS & REPORT** |
| | | **FINAL EXAM** |

*I reserve the right to make changes to the course schedule*

# GIS Programming

## GEOG 392

**Instructor**
**Dr. Daniel Goldberg**
Office: O&M 707F
Tel: 979-845-7141
Email: daniel.goldberg@tamu.edu
Office Hours: TBD
and by appointment

**Teaching Assistants**
**TBD**
Sections 500
Office: TBD
Email: TBD
Office Hours: TBD
Office Hours: TBD

## Meeting Time and Locations

**Lecture**
Time: TBD

Room: TBD

**Labs**
500 – TBD

Room: TBD

## Class web site

Updates to the lecture and lab syllabi as well as other course materials will be made available on the course website. It can be accessed on ELearning at http://elearning.tamu.edu.

## Course Description

This class is an introduction to programming in general and an introduction to programming for Geographic Information Systems (GIS) in particular. This lab-oriented course covers the guiding principles behind programming syntax and data structures, and how to apply these techniques to the development of custom standalone GIS programs and the integration of these into commercial GIS platforms.

## Learning Outcomes

This course is designed to introduce students to the basics of programming with modern programming languages in the context of development for and with GIS. Students will learn how to apply this knowledge to develop custom GIS applications and extensions that solve real-world problems. This course will provide students with a solid foundation in fundamental programming techniques and the knowledge to apply these techniques within GIS programming domains.

The course will start with an introduction to fundamental programming structures and techniques and quickly advance to programming issues related to developing for GIS platforms including integration of their code into industry standard GIS platforms to extend the capabilities of these systems. The course will include a lecture component where theoretical issues are covered and lab-based exercises where students have the opportunity to practice implementing these techniques in various programming languages including Python and C#.

**At the end of this class, each student will be able to:**

1) Identify a set of requirements for the development of a software system;
2) Implement standalone programming projects in Python and C# to solve GIS problems;
3) Integrate custom code into ArcGIS that customizes, automates, and extents its functionality;
4) Programmatically access GIS data and use these data in GIS modeling, computation, visualization, and analysis; and
5) Conceptualize, design, plan, implement, and document a custom GIS programming solution to a real-world problem.

---

## Textbooks and Readings

**Lecture Texts**

**Required:** Allen D, 2014. **GIS Tutorial for Python Scripting**. 1st ed. Redlands, CA, Esri Press. 288 pp.

**Optional:** Watson K, Hammer JV, Reid J, Skinner M, Kemper D, Nagel C, 2012. **Beginning Visual C# 2012 Programming**. 1st ed. Hoboken, NJ, Wiley. 912 pp.

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---

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---

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---

## Class Attendance

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---

## Cellular Telephones

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|---|---|---|
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| Midterm 2 | | 10% |
| Final Exam | | 10% |
| B. **Lab** | **35%** | |
| Exercises | | 35% |
| C. **Homework** | **10%** | |
| Exercises | | 10% |
| D. **Project** | **20%** | |
| Project Proposal | | 5% |
| Project Status Report 1 | | 2.5% |
| Project Status Report 2 | | 2.5% |
| Final Project | | 10% |
| E. **Participation** | **5%** | |
| Class Participation | | 5% |

The grading scale for this course is as follows:

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Labs are an important and integral portion of the course. There is simply no way to learn about GIS programming without spending considerable time in lab working on GIS programming problems. While the scheduled lab time is two hours, labs will typically require time outside of the scheduled lab hours to complete.

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## Final Project

Throughout the semester, undergraduate students will work in teams of up to 4 along with one or more graduate students to apply the GIS programming concepts learned in lectures with the hands-on experience gained in labs to solve a "real-world" problem using GIS programming.

### Proposal Pitches

Each graduate student will present a 5 minute presentation of their idea for a project to the class. This will pitch will include enough details to recruit undergraduate students to work on the grad student's project. Undergraduate students will choose project teams based on their willingness to work on the project pitched by the graduate student. Graduate students who receive an insufficient number of students to complete their project will work on another graduate student's project.

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### Grading

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## Scholastic Dishonesty

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Student Counseling Helpline 5:00pm-8:00am: 845-2700

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| 3 | Syntax & Data Structures | |
| 4 | Controls & Functions | **PROPOSAL PITCHES** |
| 5 | Object Oriented Programming | **PROPOSAL PRESENTATIONS** |
| 6 | Object Oriented Programming | **MIDTERM 1** |
| 7 | Computing with Data | **PROPOSAL STATUS REPORT I** |
| 8 | Programming for GIS | |
| 9 | GIS Automations | |
| 10 | GIS Customizations | **MIDTERM 2** |
| 11 | GIS Extensions | **PROPOSAL STATUS REPORT II** |
| 12 | Consuming & Distributing Code | |
| 13 | Principles and Practices of Software Development | |
| 14 | Future of GIS Programming | **PROJECT PRESENTATIONS & REPORT** |
| **TBD** | | **FINAL EXAM** |

*I reserve the right to make changes to the course schedule*

GEOSCIENCES

DEPARTMENT OF GEOGRAPHY

TEXAS A&M UNIVERSITY

**Andrew Klein**
Professor



*October 16, 2015*

**TO:** **Roxanna Russell**

**FROM:** **Andrew Klein**

**RE:** **GEOG Course Changes – How graduate versions differ from undergraduate versions**

For staffing and other issues, many of the Geography Department's courses in Geographic Information Science & Technology are taught as stacked undergraduate/graduate courses. In all cases, care has been taken to ensure adequate differentiation of the two versions of the course. This memo summarizes the differences for the following courses

1. GEOG 651/GEOG 361
2. GEOG 660/GEOG 390
3. GEOG 676/GEOG 392

1. GEOG 651/GEOG 361

The main difference between GEOG 651 and GEOG 361 is that the graduate students in GEOG 651 need to do a final project/paper, as well as an in-class presentation of that work, in addition to all of the requirements that GEOG 361 students need to meet. Associated with this additional assignment for GEOG 651 students, the weights for the different components of the respective courses of course differ. For GEOG 361, the weights are as follows: 1) Midterm Exam: 30%; 2) Final Exam: 30%; 3) Laboratory Exercises: 40%. And for GEOG 651, the weights are as follows: 1) Midterm Exam: 25%; 2) Final Exam: 30%; 3) Laboratory Exercises: 25%; 4) Final Project/Paper: 20%. Furthermore, GEOG 651 students are also assigned some additional readings from a more advanced remote-sensing textbook (i.e., the Schott (2007) book); these readings are not assigned to the GEOG 361 students.

2. GEOG 660/GEOG 390

The graduate version of the class GEOG 660 – Applications in GIS – requires all graduate students to complete an independent project and write it up as a research paper following the format of the *International Journal of Geographic Information Science*. This is not simply a literature-based exercise, it requires students to formalize a research question answerable using GIS which they submit as an abstract, locate GIS data sources that will form the basis of the research (also submitted for a grade) and finally completion of a research paper. In

ller O&M Building 810
147 TAMU
College Station, TX 77843-3147

Tel. 979.845.5219 Fax: 979.862.4487
klein@geog.tamu.edu
http://geography.tamu.edu

addition, graduate students are provided some leeway on two labs required by the undergraduates as it is felt that graduate students may not need as much formalized instruction as undergraduate with some of the simpler GIS techniques as they should be more self-sufficient in learning GIS software.

3. GEOG 676/GEOG 392

The graduate version has a greater grading emphasis on the semester projection while the undergraduate version has a larger emphasis on the individual labs. Each graduate student is expected to lead one of the research teams while undergraduates must only participate on a team.

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate ♦ Graduate ♦ Professional

• Submit original form and attachments •

RECEIVED
NOV 09 2015
GRADUATE STUDIES

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Geography
3. Course prefix, number and complete title of course: GEOG 678 WebGIS

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 678 | WEBGIS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 2.00 | | 4.00 | 45070206 | 1250 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| GEOG | 678 | WEBGIS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 1.00 | | 3.00 | | 1250 | 16 17 | 003632 | 6 |

**Approval recommended by:**

Department Head or Program Chair *(Type Name & Sign)* 10/27/15 Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services Date

Chair, College Review Committee 10/15/2015 Date

Dean of College 10/15/2015 Date

Chair, GC or UCC 12-15-15 Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

# WebGIS

## GEOG 678


**Instructor**

**Dr. Daniel Goldberg**
Office: O&M 707F
Tel: 979-845-7141
Email: daniel.goldberg@tamu.edu
Office Hours: TBD
and by appointment

**Teaching Assistants**

**TBD**
Sections 500
Office: TBD
Email: TBD
Office Hours: TBD
Office Hours: TBD


## Meeting Time and Locations

**Lecture**
Time: TBD

Room: TBD

**Labs**
500 – TBD

Room: TBD

## Class web site

Updates to the lecture and lab syllabi as well as other course materials will be made available on the course website. It can be accessed on ELearning at http://ecampus.tamu.edu.

## Course Description

This class is an introduction to web-based Geographic Information Systems (WebGIS). This lab-oriented course covers server-oriented architectures and their application in creating web-based GIS applications and services. This course introduces students to web server, service, and database setup, management and utilization in the development of data-rich WebGIS applications.

## Learning Outcomes

This course is designed to introduce students to the basics of producing, managing, and consuming web-based Geographic Information Systems (WebGIS) in the context of server-oriented architectures (SOA). Through hands-on experience, students will learn to setup, administer, and utilize industry-standard WebGIS platforms including Esri ArcServer and Microsoft SQL Server. This course will provide students with a solid foundation in the installation and use of WebGIS databases and services as well as a basic knowledge of how to utilize these in the development of web maps.

The course will start with an introduction to fundamental Internet architectures used in production-level WebGIS platforms. The course will next cover hands-on installation, publishing, and management of industry-standard WebGIS platforms, services, and data. Finally, students will learn and employ introductory JavaScript programming to integrate their WebGIS databases and services within custom-developed web-based maps using commercially-available and commonly-used web-mapping application programming interfaces (APIs). The course will include a lecture component where theoretical issues are covered and lab-based exercises where students have the opportunity to practice setting up, managing, and implementing these techniques and technologies.

**At the end of this class, each student will be able to:**

1) Identify a set of requirements for implementing WebGIS servers and services;
2) Setup and administer industry-standard WebGIS servers;
3) Publish and consume data and services to and from WebGIS servers;
4) Programmatically access GIS data and services from WebGIS servers and use these in the production of web-based maps; and
5) Critically assess design and implementation patterns for deploying WebGIS systems within a larger CyberGIS environment;
6) Conceptualize, design, plan, implement, and document a custom WebGIS solution to a real-world problem; and
7) Interact with a real-world client to identify a set of requirements for a WebGIS project and lead a team of students in the design, execution, and evaluation of the project.

## Textbooks and Readings

**Lecture Texts**

Fu P, Sun J, 2010. **Web GIS: Principles and Applications.** 1st ed. Redlands, CA, ESRI Press. 312 pp.

**Additional readings and materials will be drawn from websites, handouts, and online resources.**

## GIS Software

This course will utilize the ArcGIS™ suite of software developed by ESRI including ArcServer and Python. Installable copies may be obtained from the instructor or teaching assistants.

## Database Software

This course will utilize the Microsoft SQL Server™ suite of software. Installable copies may be downloaded from the Microsoft Dream Spark program available to TAMU students.

## Development Software

This course will utilize the JavaScript, Python, and C# programming languages which can be developed with basic text editing software and/or with Microsoft Visual Studio which can be downloaded for free from DreamSpark

## Class Attendance

The university views class attendance as the responsibility of the individual student. Information on University attendance rules can be found at http://student-rules.tamu.edu/rule07. As described below, a portion of each student's grade is based on in-class participation. This will be judged by the instructor as regular attendance and active engagement on a consistent basis that contributes to the class in some manner.

**Lab attendance** is considered essential for successful completion of the course.

## Grading

Your grade in this class will be based equally on the lecture and labs as described below

| | | |
|---|---|---|
| A. **Lecture** | **30%** | |
| Midterm 1 | | 10% |
| Midterm 2 | | 10% |
| Final Exam | | 10% |
| B. **Lab** | **20%** | |
| Exercises | | 20% |
| B. **Homework** | **5%** | |
| Exercises | | 5% |
| C. **Project** | **40%** | |
| Project Proposal | | 10% |
| Project Status Report 1 | | 2.5% |
| Project Status Report 2 | | 2.5% |
| Final Project | | 25% |
| D. **Participation** | **5%** | |
| Class Participation | | 5% |

The grading scale for this course is as follows: ≥90% A, 80-89% B, 70-79% C, 60-69% D, <60% F

## Final Project

Throughout the semester, undergraduate students will work in teams of up to 2 along with one or more graduate students to apply the WebGIS concepts learned in lectures with the hands-on experience gained in labs to solve a "real-world" problem using WebGIS. Each project will be based on the needs of a "customer" who will provide a project idea. Groups will be expected to meet with the "customer" regularly throughout the semester.

### Proposal Pitches

Each graduate student will identify a "customer" who will provide a project idea. Each graduate student will present a 5 minute presentation of their idea for a project to the class. This will pitch will include enough details to recruit undergraduate students to work on the grad student's project. Undergraduate students will choose project teams based on their willingness to work on the project pitched by the graduate student. Graduate students who receive an insufficient number of students to complete their project will work on another graduate student's project.

### Project Proposal

Each student group will submit a 1-page synopsis of the proposed topic and present a 5 minute description. This synopsis will include the problem the group will attempt to address including a set of requirements, the methods and data that will be used to accomplish their goals, and a development roadmap for implementing the project.

### Project Presentations

Each student group will present their project three times. The first is the project pitch; the second is a project status presentation; the third is the final project presentation.

### Project Status Reports

Each student group will present two short presentations during the semester that outline project progress. Students will be graded based on progress toward project completion.

### Project Deliverables

Each student group will a) host their project code and necessary data and set of WebGIS services and accompanying online maps, data, and/or services; b) deliver a report summarizing the problem they were trying to address, the tools and data used to accomplish their goals, and reflections on how well their implementation meets the requirements set forth; and c) demonstrate a hands-on working version of their prototype to the class during a project presentation.

### Grading

Each student will be graded on the quality of the team project. In addition, each student's grade will be based in part on a score they receive from their teammates evaluating their contribution to the overall project. Students are advised to consult with the teaching assistant and/or professor in advance if issues of team member performance becomes an issue.

## Labs

Labs are an important and integral portion of the course. There is simply no way to learn about WebGIS setup, programming, or maintenance without spending considerable time in lab working on with these data and services. While the scheduled lab time is two hours, labs will typically require time outside of the scheduled lab hours to complete.

Labs will be due at the beginning of the following lab unless otherwise indicated. **Late labs will not be accepted for credit.** It is your responsibility for keeping up with lab assignments. You should talk to your Teaching Assistant and or the instructor BEFORE late labs become a problem.

## Homework Assignments

Small homework assignments will be assigned each week along with a series of online training documents which supplement the materials presented in class.

Homework assignments will be due as indicated on the homework assignment. **Late homework assignments will not be accepted for credit.** It is your responsibility for keeping up with homework assignments. You should talk to your Teaching Assistant and or the instructor BEFORE late homework assignments become a problem.

## Scholastic Dishonesty

It is our hope that academic dishonesty will not be a problem in this class. Texas A&M does, however, have a *Scholastic Dishonesty* policy to which both students and faculty must comply. If you have any questions about the University's Scholastic Dishonesty policy please review the Student Rules or see me. The Aggie Honor program is the new program that will handle all cases of academic dishonesty. http://aggiehonor.tamu.edu

All materials used in this class are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions regarding plagiarism, please consult the latest issue of the Texas A&M University Student Rules, http://student-rules.tamu.edu, under the section "Scholastic Dishonesty."

***"Aggies don't lie, cheat, or steal, nor tolerate those that do"***

## Cellular Telephones

As a courtesy to the instructor and other students please turn off all cellular telephones before the class begins.

## Email

All Texas A&M students should use their Texas A&M University email accounts when emailing the instructor and teaching assistants. I may also send out class announcements via the University email system as well. It is your responsibility to check your official TAMU email account regularly.

## Student Support

*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 the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall. The phone number is 845-1637.*

**Services for Students with Disabilities**

Room B118 of Cain Hall, 845-1637 or on the web at http://disability.tamu.edu/

*There are numerous other student support organizations on campus including*

**Student Counseling Service**

Cain Hall, 845-4427, http://scs.tamu.edu

Student Counseling Helpline 5:00pm-8:00am: 845-2700

**University Writing Center**

Suite 1.214 of the Evans Library, 458-1455, http://writingcenter.tamu.edu/

## Makeups

Makeups for the Exam and other work will be allowed only for University excused absences and will be administered in compliance with university rules. Excused absences are covered in the Texas A&M University Student Rules (http://student-rules.tamu.edu)

## Course Schedule (Tentative)

| Week | Class Topics | Exam | Project Assignment Due* | Lab | Training | Homework Assignment Due* | Reading |
|---|---|---|---|---|---|---|---|
| 1 | Introduction to the Class & WebGIS | | | | | | |
| | … Continued | | | Computer Forms | Code Academy HTML I | | |
| 2 | WebGIS Environments & Architechtures | | | | | | Fu & Sun 1 - 2 |
| | … Continued | | | Server Connections & Basic HTML & GitHub | Code Academy Javascript I | HTML | Fu & Sun 3 |
| 3 | Languages, Data Structures & Data Types | | | | | | Fu & Sun 4 |
| | **- Proposal Pitches** | | Proposal Pitches | Advanced HTML | Code Academy Javascript II | Javascript | |
| 4 | WebGIS APIs | | | | | | |
| | … Continued | | | HTML & Javascript | Google Maps API | Javascript | |
| 5 | Exam Review | | | | | | |
| | | **Midterm I** | | | | Google Maps | |
| 6 | Exam Solutions, SQL Server & Data Modeling | | | | | | |
| | **- Project Proposals** | | Proposal Presentations | Javascript, JQuery & Data | | | |
| 7 | SQL Server & Data Modeling | | | | | | |
| | … Continued | | | Data-Driven Web Pages | W3Schools SQL | Javascript | |
| 8 | (Arc)GIS Servers, Services, Mapping & ArcGIS.com | | | | | | |
| | … Continued | | | SQL Server Setup & Data Modeling | ArcGIS.com Guides | SQL | Fu & Sun 6 - 7 |

***I reserve the right to make changes to the course schedule***

# Course Schedule (Tentative)

| Week | Class Topics | Exam | Project Assignment Due* | Lab | Training | Homework Assignment Due* | |
|---|---|---|---|---|---|---|---|
| 9 | GeoProcessing Services | | | ArcServer Setup, Data Publishing & Use | ArcGIS.com Guides | ArcGIS.com | |
| | Exam Review | | | | | | |
| 10 | | **Midterm II** | | | | | |
| | Exam Solutions, ArcGIS Web APIs & Services | | | | | | |
| 11 | ArcGIS Web APIs & Services | | | | | | |
| | **- Project Status Presentations** | | Status Presentations | GeoProcessing Services Publishing & Use | | | |
| 12 | - Project Preparation Time | | | | | | |
| | - Project Preparation Time | | | ArcGIS Web APIs | | | |
| 13 | Future of WebGIS | | | | | | |
| | … Continued | | | | | | |
| 14 | **- Project Presentations** | | Final Presentation | | | | Fu & Sun 5 |
| | **- Project Presentations** | | Final Presentation | | | | |
| | | | Final Presentation | | | | |

***I reserve the right to make changes to the course schedule***

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GRADUATE STUDIES

# Texas A&M University
## Departmental Request for a Change in Course
## Undergraduate • Graduate • Professional
• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Aerospace Engineering
3. Course prefix, number and complete title of course: MEMA 613 - Principles of Composite Materials

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: MSEN 610

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| MEMA | 613 | PRINC OF COMPOSITE MTL |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | | 3.00 | 1418010006 | 0100 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| | | |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| | | | | | | - | 003632 | |

**Approval recommended by:**

Vikram K. Kinra -AERO — 11/26/15
Department Head or Program Chair *(Type Name & Sign)* — Date

Miladin Radovic - MSEN — 11/05/15
Department Head or Program Chair *(Type Name & Sign)* — Date
*(if cross-listed course)*

Prasad Enjeti — 11/17/2015
Chair, College Review Committee — Date

Prasad Enjeti — 11/17/2015
Dean of College — Date

Karen Butler-Purry — 12-15-15
Chair, GC or UCC — Date

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services — Date — Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

DWIGHT LOOK COLLEGE OF
ENGINEERING

Department of Materials Science & Engineering

TEXAS A&M UNIVERSITY

November 5, 2015

**MEMORANDUM**

**TO:** Office of Curricular Services

**THROUGH:** Vikram K. Kinra
Professor and Director of Graduate Programs
Department of Aerospace Engineering

**FROM:** Miladin Radovic
Associate Department Head and Graduate Program Director
Department of Materials Science and Engineering

**SUBJECT:** Approval of Cross-listed Courses

We, the undersigned graduate program directors, confirm that we approve the cross-listing of MEMA 613 and the newly formed MSEN 610.

If you have any questions, please feel free to contact me at mradovic@tamu.edu .

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3003 TAMU
College Station, TX 77843-3033

Tel. 979.845.0750 Fax. 979.862.6835
engineering.tamu.edu/materials

Supporting Statement for item 4c

The faculty member teaching "Principles of Composite Materials" is jointly appointed in AERO (Aerospace Engineering) and MSEN (Materials Science and Engineering). It is his intention to provide a course available for students in one of both majors.

TEXAS A&M UNIVERSITY

# Syllabus

| Principles of Composite Materials |
|---|
| MEMA 613/MSEN 610<br>Spring 2017 |

| | |
|---|---|
| **Instructor** | Dr. Ramesh Talreja, Professor, Department of Aerospace Engineering, and Department of Materials Science and Engineering |
| **Instructor contact** | (979) 458-3256; talreja@tamu.edu; 736A HRBB |
| **Text** | Book: Analysis and Performance of Fiber Composites, Third Edition, B.D. Agarwal, L. J. Broutman & K. Chandrashekhara, John Wiley, 2006.<br>Selected papers and handout notes |
| **Course Description** | Introduction to fiber reinforced composite material systems with emphasis on the fundamental principles; introduction to processing and manufacturing of polymer-, metal- and ceramic-matrix composites; introduction to simple micromechanics estimates of elastic properties; elastic behavior of a unidirectional lamina; laminate plate theory; experimental characterization of composites; emerging composites; damage, fatigue, and failure; selected special topics. |
| **Prerequisite:** | Basic courses in mechanics and materials science; graduate classification. |
| **Learning outcomes** | Students will become familiar with the fundamental principles underlying composite material systems; they will understand the criteria for selection of composite constituents for given applications; they will learn how to estimate and characterize elastic behavior of composites with multiple fiber orientations; they will understand the basic mechanisms governing failure of composites; they will gain additional knowledge of composites in selected areas through directed studies. |
| **Grading Assignments** | The course letter grade will be based on homework assignments, and one term paper. Homework will be assigned typically once a week, due the week after, and will carry 60%; the project term paper will have 40%. |
| **Grading scale** | 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:<br>A>=90; 80=<B< 90; 70 =< C< 80; 60=<D<70; F<60. |
| **Copyrights** | The handouts used in this course are copyrighted. By "handouts" we mean all materials generated for this class, which include but are not limited to syllabi, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless the author expressly grants permission. |

| | |
|---|---|
| **Topics to be covered** | |
| Week 1 | Types of fiber and matrix materials. |
| Week 2 | Processing and manufacturing methods |
| Week 3 | Micromechanics estimates of properties |
| Week 4 | Unidirectional composites; orthotropic solids |
| Week 5 | Laminate plate theory |
| Week 6 | Laminate plate theory – contd. |
| Week 7 | Short-fiber composites |
| Week 8 | Experimental characterization |
| Week 9 | Interlaminar stresses and free-edge effects |
| Week 10 | Nonlinear/time-dependent constitutive relations (plasticity/viscoelasticity/viscoplasticity) |
| Week 11 | Failure – static and fatigue |
| Week 12 | Selected applications – emerging composite systems |
| Week 13 | Selected applications, contd. |
| Week 14 | *Project Term Paper Due* |
| **Americans with Disabilities Act (ADA) Policy Statement** | 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 |
| **Academic Integrity Statement and Policy** | "An Aggie does not lie, cheat or steal, or tolerate those who do." For additional information, please visit: http://aggiehonor.tamu.edu.<br><br>As commonly defined, plagiarism consists of passing off as one's own the ideas, work, writings, etc., that belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated. If you have questions regarding plagiarism, please consult the latest issue of the Texas A&M University Student Rules [http://student-rules.tamu.edu/], under the section "Scholastic Dishonesty." |
| **Attendance policy** | 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 . Please come on time. Silence cell-phones and other electronic distractions. |

| | |
|---|---|
| **Make-up Policy** | If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.<br><br>The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07 ). The fact that these are university -excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.<br><br>1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index<br>2. Death or major illness in a student's immediate family.<br>3. Illness of a dependent family member.<br>4. Participation in legal proceedings or administrative procedures that require a student's presence.<br>5. Religious holy day. NOTE: Prior notification is NOT required.<br>6. Injury or illness that is too severe or contagious for the student to attend class.<br>i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)<br>ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:<br>a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or<br>b) Confirmation of visit to a health care professional affirming date and time of visit.<br>7. Required participation in military duties.<br>8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled. |

| | |
|---|---|
| | 9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.<br><br>10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.<br><br>Other absences may be excused at the discretion of the instructor with prior notification and proper documentation<br><br>In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.<br><br>Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence. |

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# Texas A&M University
## Departmental Request for a Change in Course
## Undergraduate • Graduate • Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MSEN 601, Fundamentals of Materials Science and Engineering

**Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.**

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| MSEN | 601 | FNDMTL MATLS SCIENCE ENG |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 4.00 | 0.00 | 0.00 | 4.00 | 4010010002 | 1864 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| MSEN | 601 | FNDMTL MATLS SCIENCE ENG |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | 0.00 | 3.00 | 4010010003 | 1864 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Miladin Radovic — 11/05/2015
Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services

Prasad Enjeti — 11/17/2015
Chair, College Review Committee Date

Prasad Enjeti — 11/17/2015
Dean of College Date

Karen Butler-Purry — 12-15-15
Chair, GC or UCC Date

Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

**SYLLABUS - Fundamentals of Materials Science and Engineering MSEN 601 - 600**
**Fall 2016**
**Credit: (3 – 0)**

**Instructor Information**

Instructor: Xinghang Zhang
Office: ENPH 326
Office Phone: 979-845-2143
E-mail: zhangx@tamu.edu

| Location | Time |
|---|---|
| TBD | TBD |

**The instructor's office hour: M W 3-4 pm or by appointment, in MEOB 224 (office side)**

**TA – Zhe Fan**
Office hour: 1-2:00 pm on Tuesday and Thursday
Location: Doherty 301 L
Phone: 979-587-2957
Email: vanstart2012@gmail.com

**Prerequisite**
In general, you need to be a graduate student to register this class.

**Course Topics & Calendar**

**Topics**

- Provides graduate students with fundamental materials science knowledge used to perform materials related research and development.
- Investigate processing-microstructure (chemistry) – properties relationship. Briefly we will study chemical bonding, crystal structures and microstructure, defects in solids, theory of dislocations, mechanical properties and strengthening, basic thermodynamics for solid materials, phase diagrams and transformations; nucleation and growth. Enables students to predict microstructures and mechanical properties from phase diagrams.
- Introduces laboratory experimentation and presentation of materials test results.

**STUDENT REQUIREMENTS**

- Take responsibility for individual learning
- Take responsibility for other individual's learning through participation in team activities

**Grading Policy (To be determined)**

The table below shows that your grade is 75% individual work and the remainder is team performance. I will assign the teams. Each team will have 3-5 students from hopefully different

department. Teams will work cooperatively on team projects and laboratory reports.

| Activity | Percent of Grade | Work Component | Dates |
|---|---|---|---|
| Midterm | 30 | Individual work in a closed book exam. One formula sheet allowed. | **Oct. 13, Thurs. (tentative)** |
| Final Exam | 40 | Individual work in a closed book exam. One formula sheet allowed. Exam is comprehensive | **Dec., TBD** |
| Homework | 0 | Team work is encouraged. | Spread throughout the semester. |
| In class quizzes About 4 quizzes. | 10 | Test for homework, lectures and reading assignment | Spread throughout the semester. |
| Other team project – term paper | 15 | Term paper and presentation (A materials science topic presented by the team) | |
| Report | 5 | 2-3 page document discussing what you have learned from an assignment to be given by the instructor | TBD |
| **TOTAL** | 100 | | |

Grading scale: 90-100=A, 80-89=B, 70-79 = C, 60-69 = D, < 60 = F.

**Midterm Exam (30%)**

You will take a one-hour exam in the class during the semester which is worth 20% of your grade. One formula sheet is allowed.

**Final Exam (40%)**

The final exam will occur at the scheduled final time. The final will be worth 35% of your grade and it will be comprehensive, that is, any topic covered during the semester might appear on the final. YOU MAY NOT TAKE THE FINAL EXAM EARLY. DO NOT PLAN TO TRAVEL UNTIL YOU HAVE COMPLETED THE EXAM. If you do not make arrangements to take the exam late, I will record a grade of zero for the final and assign your course grade. If you have a significant reason for delaying the completion of the course I might agree to give you an incomplete. I must approve this in advance.

The final exam is a closed book and comprehensive test. We allow one formula sheet of 8.5 x 11 inch paper that is 0.001 to 0.010 inches thick for your notes. All notes and images on the sheet must be hand drawn. No machine reproduced images are allowed. You must attach your note sheet to the final exam or we will not grade it.

**Homework (0%)**

Students are encouraged to work on their homework. However, homework will not be graded.

**In class quizzes (10%)**

A 15 minute closed book quiz will be given at the beginning of class to test a general understanding of the subject matter of a previous lecture and homework assignment. There will be a total of about 5 quizzes.

**Policy for make-up quizzes and exams**

There is no make-up exam for midterm or final. In general there will also be no make-up tests for quizzes and labs. Under special circumstances, such as illness or family emergency etc., we may consider a make-up test for quizzes.

**Other team project – term paper presentation and report (15%)**

Each team will select a topic on materials science from the list suggested by the instructor. A presentation will be 10-15 min long followed by 5 min question and answer. Presentation and term paper will be evaluated and graded. The team can determine the format of presentation. The time of the presentation will spread out during the semester. And the topic will be related to the subject of the course before the presentation time.

**Report – (5%)**

You will be instructed by the instructor with an assignment. After the assignment a report (2-3 pages) must be submitted to describe what you have learned.

**Absences**

I handle absences as required by the student rules.

Excused Absences

7.1. The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for absence. Among the reasons absences are considered excused by the university are the following:

7.1.6 Injury or Illness that is too severe or contagious for the student to attend class.

7.1.6.1 **Injury or illness of three or more days.** For injury or illness that requires a student to be absent from classes for three or more business days (to include classes on Saturday), the student should obtain a medical confirmation note from his or her medical provider. The Student Health Center or an off-campus medical professional can provide a medical confirmation note only if medical professionals are involved in the medical care of the student. The medical confirmation

note must contain the date and time of the illness and medical professional's confirmation of needed absence.

7.1.6.2 **Injury or illness less than three days.** Faculty members may require confirmation of student injury or illness that is serious enough for a student to be absent from class for a period less than three business days (to include classes on Saturday). At the discretion of the faculty member and/or academic department standard, as outlined in the course syllabus, illness confirmation may be obtained by one or both of the following methods:

a. Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu.

b. Confirmation of visit to a health care professional affirming date and time of visit.

7.1.6.3 An absence for a non acute medical service does not constitute an excused absence.

**Course Text materials.**

I will use some chapters of the following textbooks for this class.

1. Structure and bonding in crystalline materials, by Gregory S. Rohrer, 2001, ISBN: 0521663792
2. Introduction to dislocations, by D. Hull and D. J. Bacon, ISBN: 0750646810
3. Mechanical Metallurgy, by George E. Dieter, (1988) ISBN: 007084187X
4. Phase Transformations in Metals and Alloys, by D. A. Porter and K. E. Easterling, ISBN: 0412450305
5. Physical Metallurgy Principles, by Robert E. Reed-Hill and Rezar Abbaschian, ISBN: 0-534-92173-6.
6. Thermodynamics of Solids, by Richard A. Swalin, ISBN: 0-471-83854-3

For students who have very limited materials science background, please use the following text book as a starting point: Materials Science and Engineering: An Introduction 6th or 8th Edition. William D. Callister, Jr., John Wiley & Sons, Inc. ISBN: 0471135763 (8th edition)

Material Covered

See the Calendar table below for details.

**Calendar (Tentative schedule)**

| Dates | Subject | Comments |
|---|---|---|
| Week 1 | Introduction | |
| Week 1,2 | Atomic Structure and Interatomic Bonding | |
| Week 2,3 | Structures of metals and ceramics | |
| Week 3 | Imperfections (defects) in Solids | |
| Week 3,4,5 | Introduction to theory of dislocations<br>Elastic properties of dislocations<br>Dislocation in crystals | |
| Week 5 | Diffusion | |
| Oct. 7 (Wed) | Review for midterm | |
| Week 6 | Mechanical properties | |
| **Oct. 13 (Thurs) (tentative)** | **Midterm exam** | |
| Week 7 | Mechanical properties/strengthening | |
| Week 7 | Solutions for midterm | |
| Week 8 | Strengthening, fracture and failure | |
| Week 8 | Thermodynamics of solid materials | |
| Week 9 | Thermodynamics of solid materials | |
| Week 10, 11 | Phase Diagrams | |
| Week 12 | Nucleation and growth theory | |
| Week 12 | Phase Transformations | |
| Nov. 25-27 | Thanksgiving holidays | No class (Holidays) |
| Nov. 30, Dec. 2, | Term paper presentation week | |
| Dec. 6 (Tuesday) | Last day of class: Review for final exam | |
| **Dec. 13** | **Final exam (comprehensive)** | |

| (Tentative) | | |
|---|---|---|

## Americans with Disabilities Act (ADA) Policy Statement

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

## Academic Integrity Statement

***Aggie Honor Code:*** ***"An Aggie does not lie, cheat, or steal, or tolerate those who do."***

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 Texas A&M University community from the requirements or the processes of the Honor System. For additional information please visit: www.tamu.edu/aggiehonor/

## Supplemental Reading Materials

1. Fundamentals of Ceramics, by Barsoum, Michel W.,
ISBN: 978-0750309028
2. Theory of Dislocations, By John P. Hirth and Jens Lothe (1992)
ISBN: 0894646176
3. Electronic Properties of Materials, Rolf E. Hummel, 3rd edition, (2000)
ISBN: 038795144X

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GRADUATE STUDIES

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EASA

# Texas A&M University
## Departmental Request for a Change in Course
## Undergraduate ♦ Graduate ♦ Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MSEN 602, Advanced Materials Science and Engineering

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:
   ADVANCED MATERIALS SCIENCE AND ENGINEERING, Fundamentals of quantum mechanics, physics of solid state, and physical electronics and photonics for advanced materials. Topics will include: basic quantum mechanical problems, quantum basis for structural and physical properties of solids, lattice vibrational effects in solids, free electron model for magnetism in solids, semiconductor materials and devices, nanostructures and mesoscopic phenomena,superconductivity, recent advances in new materials.
10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
    PHYSICS OF MATERIALS, Understanding of modern molecular level description of underlying physico-chemical behavior and properties of materials: such as thermal, mechanical, kinetic (transport), electronic, magnetic and optical properties and provide them with a rational basis for the synthesis, characterization and processing of such materials, materials systems for engineering applications.
11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| MSEN | 602 | ADVNCD MATLS SCIENCE ENG |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 4.00 | 0.00 | 0.00 | 4.00 | 1418010006 | 1864 | 003632 | 6 |

    b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| MSEN | 602 | PHYSICS OF MATERIALS |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | 0.00 | 3.00 | 1418010006 | 1864 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Miladin Radovic — 11/5/2015
Department Head or Program Chair *(Type Name & Sign)* — Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services — Date

Prasad Enjeti — 11/17/2015
Chair, College Review Committee — Date

Prasad Enjeti — 11/17/2015
Dean of College — Date

Karen Butler-Purry — 12-15-15
Chair, GC or UCC — Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

Supporting Statement for item 4d

Course title and description change were implemented since a portion of the content in the course is being taught in another graduate-level MSEN course. For this reason, the credit hours for the course is being lowered. To reflect those changes, the course content was adjusted to an advanced level.

# MSEN 602 Physics of Materials
# (3.0 credits)

**Spring 2016**

Instructor Dr. Tahir Cagin
MEOB 526
Tel. 979-862-2416
e-mail tcagin@tamu.edu

Textbook

**Assigned Textbook:**

Physics and Chemistry of Materials by J.I. Gersten and F.W. Smith.

**Supplementary textbooks**

Introduction to Solid State Physics, C. Kittel
Elementary Solid State Physics, M. A. Omar

Course Objectives: Arm graduate students in science and engineering disciplines with an understanding of modern molecular level description of underlying physico-chemical behavior and properties of materials: such as thermal, mechanical, kinetic (transport), electronic, magnetic and optical properties and provide them with a rational basis for the synthesis, characterization and processing of such materials, materials systems for engineering applications. This advanced materials science and engineering course will cover the classical and quantum mechanics; and statistical mechanics as they are relevant to material properties. Students will be exposed to the scientific background and foundation of the modern materials science through the lectures which focus on the phenomena.

Grading policy

| | |
|---|---|
| Homeworks and class participation | 20% |
| Midterm exams (2) | 50% |
| Final exam | 30% |

Grading Scale

| | |
|---|---|
| A | 90 - 100 |
| B | 80 – 89 |
| C | 70 – 79 |
| D | 60 – 69 |
| F | <60 |

**Office Hours:**
**Faculty:** 1 hour / week
TA: 2 hours/week

**Homework:**
Students will be assigned homework for each chapter covered. (10-12 homeworks)

**Midterms:**
Each exam will generally consist of problems similar in content and difficulty to the homework; however, they may differ from the homework problems. The entire solution will be graded and partial credit given if merited. Your work must show steps toward the solution; the answer alone is not sufficient.

Course outcome:
Students will

- Identify primitive and conventional cells, Brillouin zones, reciprocal lattice for different lattices
- Understand lattice vibrations: phonons, thermal and dynamic properties of crystals from harmonic/quasiharmonic description of materials
- Understand how electrons are treated, and emergence of band structure, density of states and electronic properties of materials
- Understand relation between different types of band structure and electronic, optical, magnetic and other properties of materials
- Understand the molecular level basis for dielectric, piezoelectric, ferroelectric behavior.
- Understand magnetism, superconductivity and other materials-related phenomena
- Understand the optical properties of materials
- Understand the role of dimensionality and size effects (Nanoscale phenomena)

**Course Outline – MSEN 602:**

1) Introduction to Physics of Materials — 1 h

2) Classical Mechanics and Quantum Mechanics Preliminaries — 3 h

3) Statistical Mechanics and Quantum Mechanics Preliminaries — 3 h

4) Lattice Vibrations in Materials — 7 h
   a. Vibrations, and Lattice Excitations
   b. Phonons and Thermo-mechanical properties
   c. Phonons and dynamic properties; and lattice thermal transport

5) Electrons and Band Structure (Metals & Semiconductors) — 6 h
   a. Free electron model
   b. Band structure
   c. Electronic Transport

6) Electrons, band structure: Bonding associated function in materials — 4 h
   a. Metals revisited
   b. Ionic Materials – polarization, dielectrics, piezoelectrics

c. Covalently bonded materials – semiconductors, conductors, and insulators; the range of electronic function in organic materials.

7) Magnetism in materials — 5 h
   a. Origin of magnetism in materials
   b. Types of magnetic behavior
   c. Phase transformations

8) Optical behavior of materials — 5 h
   a. Classical Electromagnetism
   b. Quantum mechanical treatment of optical behavior materials

9) Dimensionality and size effects in Materials (Emergence of Nanomaterials) 5 h

**Your Responsibilities**
Texas A&M University assumes that all students enroll in its programs with a serious learning purpose and expects them to be responsible individuals who demand of themselves high standards of honesty and personal conduct. All students are expected to behave at all times with respect and courtesy toward their fellow students and instructors and are to have the highest standards of

**Attendance policy:**
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

**Americans with Disabilities Act (ADA) Policy Statement**
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.

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# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate ♦ Graduate ♦ Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Oceanography
3. Course prefix, number and complete title of course: OCNG 615 Numerical Modeling of Ocean Circulation I

**Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.**

4. Change requested
   a. Prerequisite(s): From: OCNG 608 To: Graduate classification or approval of instructor
   b. Withdrawal (reason):
   c. Cross-list with: ATMO 618 and GEOP 618

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course:
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

Numerical Modeling of Ocean Circulation I. Mathematical theory and numerical technique of model development for ocean circulation; concepts of numerical consistency and stability; Lax equivalence theorem; commonly used finite difference schemes in ocean modeling; finite element and spectral methods as alternative means of discretisation; positivity and CFT method; relaxation and direct methods for solving elliptic equations.

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

Numerical Methods for the Geosciences. Mathematical theory and numerical techniques for modeling physical systems and processes in the Geosciences; discretization of continuum equations for solids and fluids; finite difference methods, convergence, consistency, and stability; finite element and spectral methods in fluid dynamics and seismology; iterative solvers; implicit and explicit methods for diffusion and advection.

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| OCNG | 615 | NUMERICAL MODELING I |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 03 | 02 | 00 | 04 | 4006070002 | 2140 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| OCNG | 618 | NUMERICAL METHODS GEOSCIENCES |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 03 | 00 | 00 | 03 | 4006070002 | 2140 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Deborah Thomas — 11/10/15
Department Head or Program Chair *(Type Name & Sign)* Date

Michael C. Pope - Michael C. Pope 11/09/15
Department Head or Program Chair *(Type Name & Sign)* Date
*(if cross-listed course)*

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services — Date

Chair, College Review Committee — 11/11/15 Date

Dean of College — 11/11/15 Date

Chair, GC or UCC — 12-15-15 Date

Effective Date

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

**Supporting statement for changes in OCNG 615**

The following changes are requested for OCNG 615 – Numerical Modeling of Ocean Circulation I to adjust its content and scope for a broader audience and to fulfill the requirements of the upcoming certificate program in Computational Geosciences, which is being developed within the College of Geosciences:

1. **Course syllabus.** A few topics have been added to broaden the original scope of the course from ocean circulation to a larger set of physical processes studied within the disciplines of the Geosciences by using similar mathematical and numerical methods. The resulting course is expected to serve a wider student population and will be one of the required courses in the new Computational Geosciences certificate program.

2. **Course title.** A change in course title is necessary to more accurately reflect its broader content and scope;

3. **Course number.** A new course number is requested in order to cross-list the revised course with identical courses proposed in the Atmospheric Sciences and Geology and Geophysics departments;

4. **Prerequisites.** Original prerequisites are dropped to include a larger and interdisciplinary student base;

5. **Cross-listing.** Cross-listing will improve interdisciplinary exchanges among graduate students and between college programs;

6. **Contact hours and semester credit hours.** The 2 contact lab hours in OCNG 615 will be eliminated since the original lab programming assignments will be covered in greater detail in the proposed new course: Fundaments of High Performance Computing for the Geosciences (ATM/OCNG/GEOP 634). As a result, the number of semester credit hours is requested to change from 4.00 to 3.00.

TEXAS A&M UNIVERSITY

# SYLLABUS

| | |
|---|---|
| Course title and number | **Numerical Methods for the Geosciences, OCNG 618** |
| Term (e.g., Fall 200X) | Fall 201X |
| Meeting times and location | TBD |

## Course Description and Prerequisites

Mathematical theory and numerical techniques for modeling physical systems and processes in the Geosciences; discretization of continuum equations for solids and fluids; finite difference methods, convergence, consistency, and stability; finite element and spectral methods in fluid dynamics and seismology; iterative solvers; implicit and explicit methods for diffusion and advection.

The goal of this course is to provide students with the mathematical and numerical foundations required to understand how to develop numerical models in the various disciplines of the Geosciences that employ the continuum approximation to study systems with a large number of degrees of freedom.

Students in this course are assumed to have a graduate-level working knowledge of and experience with continuum dynamics.

## Learning Outcomes

By the end of this course, students will be able to:

1. Apply fundamental discretization techniques to the continuum partial differential equations (PDEs) used in the Geosciences to describe the physical behavior of solids and fluids;
2. Evaluate convergence, consistency, and stability of numerical solutions of initial value problems obtained by finite difference methods;
3. Identify problems of interest in the Geosciences whose solution may be approximated by using the finite element or spectral method and create a simplified numerical scheme based on the selected method;
4. Apply iterative methods to solve systems of linear equations resulting from discretized PDEs and address convergence issues;
5. Create one or more numerical models for specific physical processes in the Geosciences by identifying and applying the most suitable numerical techniques learned in the course;
6. Write a comprehensive technical report.

## Instructor Information


| | |
|---|---|
| Name | Ping Chang |
| Telephone number | 979-845-8196 |
| Email address | ping@tamu.edu |
| Office hours | Open |
| Office location | O&M 624 |


## Textbook and/or Resource Material

Course material will be provided to the students in the form of lecture notes and handouts.

Students are encouraged, but not required, to read the following:

1. Roache, J.P., Fundamentals of Computational Fluid Dynamics, Hermosa Publishers, 1988
2. Ferziger, J.H., Peric, M., Computational Methods for Fluid Dynamics, 3rd rev. ed., Springer-Verlag

Berlin Heidelberg, 2002
3. Fletcher, C.A.J., Computational Techniques for Fluid Dynamics, Volume 1: Fundamental and General Techniques, Springer-Verlag, Berlin, 1988
4. Fletcher, C.A.J., Computational Techniques for Fluid Dynamics, Volume 2: Specific Techniques for Different Flow Categories, Springer-Verlag, Berlin, 1988
5. Canuto, C., et al., Spectral Methods in Fluid Dynamics, Springer-Verlag, Berlin Heidelberg, 1988
6. Gerya, T., Introduction to Numerical Geodynamic Modelling, Cambridge University Press, 2010
7. Haidvogel, D.B, Beckmann, A., Numerical Ocean Circulation Modeling, Imperial College Press, 1999
8. Griffies, S., Fundamentals of Ocean Climate Models, Princeton University Press, 2004
9. Mesinger, F., Arakawa, A., Numerical Methods Used in Atmospheric Models, Volume 1, GARP Publication Series No. 17, August 1976
10. Haltiner, G.J., Williams, R.T., Numerical Prediction and Dynamic Meteorology, Wiley, 1980
11. Washington, W.M., Parkinson, C.L., An Introduction to Three-Dimensional Climate Modeling, 2nd Ed., University Science Books, 2005
12. Bedford, A., Drumheller, D.S., Introduction to Elastic Wave Propagation, Wiley, 1994
13. Pujol, J., Elastic Wave Propagation and Generation in Seismology, Cambridge University Press, 2003
14. Yanfei Wang, Anatoly G. Yagola, Changchun Yang (Eds.), Computational Methods for Applied Inverse Problems. Higher Education Press, 2012

## Grading Policies

Final grades will be based on the following weights:

1) Assignments (30% of course grade)
2) Midterm exam (20% of course grade)
3) Final project (50% of course grade)

Assignments will be due at the beginning of class on the scheduled week, unless stated otherwise by the instructor. Late homework will be assessed a penalty equal to 20% of its grade per day unless the students submits a university-excused absence (see Attendance and Make-up Policies section). An unexcused delay longer than 4 working days will automatically result in receiving zero points on the assignment.

Midterm. There will be a two-hour long in-class midterm exam.

Final Project. A final modeling project will be due by 5pm on the last day of the university's Final Examination Schedule for the semester, available at http://registrar.tamu.edu/Courses,-Registration,-Scheduling/Final-Exam-Schedule. This final project must include a 10-page written scientific report that comprehensively summarizes foundations, methods, and results of the modeling project in the style of the American Geophysical Union *Geophysical Research Letters* journal (http://agupubs.onlinelibrary.wiley.com/agu/journal/10.1002/(ISSN)1944-8007/).

Final course grades will be posted on http://elearning.tamu.edu

Please consult University Student Rule 10 (Grading) at http://student-rules.tamu.edu/rule10 for additional details on grading policies.

## Grading Scale

A final percentage grade will be calculated based on your total weighted scores as listed above. A final letter grade will be assigned as follows:

A = 90-100%; B = 80-89%; C = 70-79%; D = 60-69%; F = <60%

## Attendance and Make-up Policies

The university views class attendance as an individual student responsibility. You are expected to attend class and to complete all assignments. Attendance is essential to complete the course successfully.

Please consult the University Student Rule 7 at http://student-rules.tamu.edu/rule07 for details on university-excused absences and make-up policies.

## Course Topics, Calendar of Activities, Major Assignment Dates

| Week | Topic | Assignment |
|---|---|---|
| Week 1 | Introduction to fundamental physical systems and processes in Geosciences that can be represented using continuum partial differential equations (PDEs).<br>Basic concepts in numerical modeling. | |
| Week 2 | Mathematical description of continuum media and key physical properties:<br>Fluids – Continuity equation; viscosity; classification of flow regimes; Eulerian and Lagrangian descriptions; advection.<br>Solids – Deformation and stresses; stress and strain tensors; equations of motion; gravity and gravitational potential. | |
| Week 3 | Fundamental equations in the Geosciences.<br>Traditional working approximations.<br>Primitive equations: continuity, momentum, thermal energy.<br>Beta plane approximation in fluid dynamics. | |
| Week 4 | Boundary value problems in the Geosciences.<br>Dynamic and thermodynamic boundary conditions.<br>Elliptic (Laplace's equation), parabolic (diffusion equation), and hyperbolic (wave equation) PDEs.<br>Examples of common transition cases between PDE types in solids (e.g. homogenous to localized deformation) and fluids (e.g. steady, irrotational, isentropic, compressible flow below and above the speed of sound). | |
| Week 5-6 | Discretization techniques for PDEs: Finite Difference Method (FDM), Finite Element Method (FEM), Spectral Method, Pseudospectral Method. | |
| Week 7 | Consistency, convergence, and stability of numerical solutions of initial value problems by FDMs. Equivalence theorem. | |
| Week 8 | Iterative solvers for discretized linear PDEs used in large three-dimensional problems: Jacobi method, Gauss-Seidel (GS) Iteration, Successive Over Relaxation (SOR) method, Conjugate Gradient Method (CGM), Steepest Descent method.<br>Convergence and preconditioning. | |
| Week 8 | | **Midterm Exam** |
| Week 9 | Modeling diffusive processes: explicit and implicit methods. | |

| | | |
|---|---|---|
| Week 10 | Modeling linear advective processes: explicit and implicit methods.<br>Modeling transport. | **Assignment #1 due** |
| Week 11-12 | Modeling nonlinear advective processes: Burger's equation.<br>Positive-definite processes and flux-corrected methods.<br>Nonlinear wave processes: Korteweg-de Vries equation. | **Assignment #2 due** |
| Week 13 | Elliptic boundary-value problems in the Geosciences.<br>Energy- and enstrophy-conserving space finite-difference schemes. | **Assignment #3 due** |
| Week 14 | Basic models of physical systems in the Geosciences:<br>spectral model for a homogeneous, non-divergent, incompressible flow on the surface of a sphere; quasi-geostrophic ocean model; spectral-element model for seismic wave propagation; | |

**Final project due by 5pm on the last day of the university's Final Examination Schedule for the semester.**

**Please note that the above schedule and topics are subject to change.**

## Other Pertinent Course Information

Copyright Policy. All materials used in this class are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

## 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

## Academic Integrity

*For additional information please visit: http://aggiehonor.tamu.edu*

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

Students are encouraged to study together and discuss the information presented in the course lectures and material with other students. However, all coursework submitted to the instructor must be the result of the original work of the student. Intentional or careless appropriation of someone else's work or ideas, even with their explicit consent, violates the Aggie Honor System Rules (Student Rule 20.1.2) and will result in all the students involved automatically receiving zero points for the assignment as well as mandatory reporting of the violation.

Each student is responsible for authenticating all submitted work and, if asked, to produce proof that the item submitted is indeed the work of that student. The inability to authenticate one's work upon the instructor's request is sufficient grounds to initiate an academic dishonesty case.

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate • Graduate • Professional

• Submit original form and attachments •

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GRADUATE STUDIES

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: Department of Oceanography
3. Course prefix, number and complete title of course: OCNG 616 Numerical Modeling of Ocean Circulation II

**Attach a brief supporting statement for changes made to items 4a thru 4d. and 10 below.**

4. Change requested
   a. Prerequisite(s): From: OCNG 615 To: OCNG 618
   b. Withdrawal (reason):
   c. Cross-list with:

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course:
8. ☑ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:

Numerical Modeling of Ocean Circulation II. Quasigeostrophic ocean circulation models; Arakawa's energy and enstrophy conserving scheme; spectral barotropic vorticity model on sphere; shallow water primitive equation models; geostrophic adjustment on different numerical grids; boundary conditions in numerical models; introduction to ocean general circulation models; mixed models and sub-gridscale parameterization; oceanic data assimilation.

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

Numerical Modeling of Ocean Circulation. Quasigeostrophic ocean circulation models; Arakawa's energy and enstrophy conserving scheme; spectral barotropic vorticity model on sphere; shallow water primitive equation models; geostrophic adjustment on different numerical grids; boundary conditions in numerical models; introduction to ocean general circulation models; mixed models and sub-gridscale parameterization; oceanic data assimilation.

11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| OCNG | 616 | NUMERICAL MODELING II |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 03 | 02 | 00 | 04 | 4006070002 | 2140 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| OCNG | 616 | NUMERICAL MODELING OCN CIRC |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 03 | 02 | 00 | 04 | 4006070002 | 2140 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Deborah Thomas — 11/10/15
Department Head or Program Chair *(Type Name & Sign)* Date

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

**Submitted to Coordinating Board by:**

Associate Director, Curricular Services Date

Chair, College Review Committee — 11/11/15 Date

Dean of College — 11/11/15 Date

Chair, GC or UCC — 12-15-15 Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 08/14

**Supporting statement for changes in OCNG 616**

A change in course title is requested for OCNG 616 from "Numerical Modeling of Ocean Circulation II" to "Numerical Modeling of Ocean Circulation" to accompany the course change request from OCNG 615 – Numerical Modeling of Ocean Circulation I to OCNG 618 – Numerical Methods for the Geosciences.

The new name will reflect that OCNG 615 and OCNG 616 are no longer sequential courses.

As a result of the course change request for OCNG 615, a change in prerequisites is also requested from OCNG 615 to OCNG 618.

# Texas A&M University
# Departmental Request for a Change in Course
# Undergraduate ♦ Graduate ♦ Professional

• Submit original form and attachments •

Form Instructions

1. Course request type: ☐ Undergraduate ☑ Graduate ☐ First Professional *(DDS, MD, JD, PharmD, DVM)*
2. Request submitted by *(Department or Program Name)*: George Bush School of Government and Public Service
3. Course prefix, number and complete title of course: PSAA 610: Comparing Domestic and Intl Organizations in Public Administration

Attach a brief supporting statement for changes made to items 4a thru 4d, and 10 below.

4. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

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

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. **Attach a course syllabus.**
5. Is this an existing core curriculum course? ☐ Yes ☑ No
6. If grade type is changing for existing course, indicate the new grade type: ☐ Grade ☐ S/U ☐ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course: _____
8. ☐ I verify that I have reviewed the FAQ for *Export Control Basics for Distance Education* (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
9. Complete current course title and current catalog course description:
   PSAA 610: Comparing Domestic and International Organizations in Public Administration
   Overview of federal, state, and international public organizations; public agencies under the cabinets of the executive branch; universal patterns in organizations that promote the most 'desirable' policy outcomes used nationally and internationally.
10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
    PSAA 610 Comparative Public Administration and Management
    Addresses challenges in policy implementation, public administration and public management; draws on experiences of a wide range of developed and developing countries; explores factors behind variations in institutional and social contexts; utilizes case discussion to help students confront challenges and constraints faced in public organizations and public managers worldwide.
11. a. As currently in course inventory:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| PSAA | 610 | COMPAR DOMESTIC INTL ORG |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | FICE Code | Level |
|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | 0.00 | 3.00 | 4404010001 | 1364 | 003632 | 6 |

b. Change to:

| Prefix | Course # | Title (excluding punctuation) |
|---|---|---|
| PSAA | 610 | COMPAR PUB ADMIN & MGMT |

| Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code | Level |
|---|---|---|---|---|---|---|---|---|
| 3.00 | 0.00 | 0.00 | 3.00 | 4404010001 | 1364 | 16 - 17 | 003632 | 6 |

**Approval recommended by:**

Jeryl Mumpower — Department Head or Program Chair *(Type Name & Sign)* — Date 11-13-15

Arnold Vedlitz — Chair, College Review Committee — Date 11/12/15

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

Arnold Vedlitz — Dean of College — Date 11-13-15

**Submitted to Coordinating Board by:**

Chair, GC or UCC — Date 12-15-15

Associate Director, Curricular Services — Date — Effective Date

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

## Justification for Title and Course Description Changes for PSAA 610

The attached Course Change Form for "PSAA 610: Comparing Domestic and International Organizations in Public Administration" requests changes for both the course description and title to more accurately reflect the course's focus on comparing policy implementation, management and administration and the ensuring challenges that arise in both developed and developing countries.

The new title would be "Comparative Public Administration and Management Addresses" and the new course description would be as follows:
"Addresses challenges in policy implementation, public administration and public management; draws on experiences of a wide range of developed and developing countries; explores factors behind variations in institutional and social contexts; utilizes case discussion to help students confront challenges and constraints faced in public organizations and public managers worldwide.