Remote Sensing for Meteorology (MET 4233)
(Beta version: August 18, 2007)

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Class Hours: 3:30-4:45 pm T/TR: E250
Office Hours: 2:00-3:00 pm T/TR, or by appointment

This course provides the basis for remote sensing methods used in meteorology. Geostationary (GOES) and low-earth polar orbiting (NOAA) weather satellites and the sensors systems are studied. Operational atmospheric data and applications to numerical weather prediction are presented. Ground-based meteorological radar systems and applications are also covered.

No textbooks required:

Additional reference texts:

5. Doviak and Zrnic, 2006: Doppler Radar and Weather Observations. 2nd

The website for this course can be found at:
FIT’s blackboard system

The website includes important information related to the course which You will need to access during the semester. The most recent class schedule, and web-related references needed for homework assignments will be also found there.
Class Schedule:

This schedule gives the topics and reading assignments for each lecture. Please do the reading before class. Dates of exam and assignment due dates will be given. This is a tentative schedule. I reserve the right to change this schedule if there is a need.

<table>
<thead>
<tr>
<th>DATE</th>
<th>LECTURE TOPICS</th>
<th>READINGS</th>
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</thead>
<tbody>
<tr>
<td>August 21:</td>
<td>Course overview and policies</td>
<td>Available online</td>
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<tr>
<td></td>
<td>What is remote sensing?</td>
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<tr>
<td></td>
<td>History of satellite meteorology</td>
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<tr>
<td>August 23:</td>
<td>No Class.</td>
<td>Kidder: 1-11</td>
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<td></td>
<td>Lab#1: COMET Module.</td>
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<td>August 28:</td>
<td>Orbital Considerations:</td>
<td>Kidder: Ch2</td>
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<td>Period and altitude</td>
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<td>Orbital geometry</td>
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<td>Sun- and earth-synchronous orbits</td>
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<td>Orbital Perspectives</td>
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<td>HW#1</td>
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<td>August 30:</td>
<td>Instrumentation:</td>
<td>Kidder: 120</td>
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<tr>
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<td>Current Platforms</td>
<td>151</td>
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<td>Imagers</td>
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<td>Sounders</td>
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<td>September 4:</td>
<td>Radiative Transfer:</td>
<td>Kidder: 52-78</td>
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<td>Emission, Absorption and Scattering</td>
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<td>Due: HW# 1</td>
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<td>September 6:</td>
<td>Planck function</td>
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<td>Radiance and grey bodies</td>
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<td>Lab#2: COMET Module</td>
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<td>September 11:</td>
<td>Applications for Feature Recognition</td>
<td>Kidder: 145 - 180</td>
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<td>Visible and infrared imagery basics</td>
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<td>Clouds, Cyclones, anticyclones, and jets</td>
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<td>HW#2</td>
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<td>September 13:</td>
<td>Application for Feature Recognition (cont’d)</td>
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<td>Surface features</td>
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<td>Due: Lab#2</td>
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<td>September 18:</td>
<td>Temperature Soundings</td>
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<td>Lab#3</td>
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<td>September 20:</td>
<td>Remote sensing of precipitation</td>
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<td>Due: HW#2</td>
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<td>September 25:</td>
<td>Climate and Global Water Cycling Using Satellite Data</td>
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<td>September 27:</td>
<td>TRMM/GPM: precipitation retrieval</td>
<td>supplementary</td>
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<td>MODIS/Lidar/GPS Occultation</td>
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<td>Due: Lab#3</td>
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<td>Due: term paper outline</td>
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October 2: Radar history and types
Radar system components
supplementary
(Rinehart 1 – 52)

October 4: Antenna beam patterns
Properties of electromagnetic waves
HW#3

October 12: Refractive index. Wave refraction effects
Anomalous propagation
supplementary
Due: HW#3
(Rinehart 53-63)

October 16: Mid-Term Exam

October 18: Radar pulse length, resolution and volume
PRT and PRF. Unambiguous range and velocity
supplementary
Lab #4

October 23: The Doppler Dilemma
(R: 98-172)

October 25: The radar equation for point targets
Scattering cross section. Mie vs. Rayleigh scattering
Due: Lab#4

October 30: The radar equation for distributed targets
Radar reflectivity. Logarithmics: dBZ, dB, dBm
supplementary
HW#4
(R: 69-96 343-354)

November 1: Precipitation measurement considerations
Attenuation by hydrometeors and gases

November 6: Drop size distributions. Terminal velocity
Liquid water content and rainrate
supplementary
Due: HW#4
(R: 137-142 154-167)

November 8: Z-R relations. Bright band and hail recognition
supplementary

November 13: Radar calibration. Area-time integral technique
HW#5
(R: 142-154)

November 15: Rainfall estimation techniques
Differential phase, attenuation, and dual wavelength
Lab#5

November 20: Polarization diversity radar measurements
Nyquist co-interval, Aliasing
supplementary
Due: HW#5
(R: 199-223)

November 22: Thanksgiving

November 27: Final presentation I
November 29: Final presentation II

December 06: Final exam review
Term paper due December 12

Important Dates:

August 20 First class
August 24 Last day to register or add a class
August 31 Last day to drop a class without receiving a grade of W
October 12 mid-term
October 13 Last day to withdraw from a course with a final grade of W
December 12 Final exam
December 14 term project due

Policies and Procedures

1. This course is offered to both senior undergraduate and graduate students. There are two tests (a mid-term and a final exam) that each count 20% and 20% toward your grade, respectively. The mid-term exam will be 50-minute and the final exam will be comprehensive. Both tests are closed-book.

2. Another 20% of your grade is derived from the score that you attain on a computer-interactive laboratory exercises (4 ~ 5) that will enhance you on your ability to identify important features in actual satellite imagery. These labs will be given periodically. Written reports are required for each lab you conducted.

3. Another 20% of your grade is derived from homework problems. Several problem sets (4~5) will be handed out every 2~3 weeks to help you maintain understanding of the lecture and reading materials. This homework involves primarily simple applications of the materials, but also some time consuming quantitative analysis of satellite or radar imagery. Programming assignments will be included.

4. The final 20% of grade comes from your term project. Everyone will give an AMS (American Meteorological Society) oral presentation. Describe in a 15-minute talk. Either a summary of reviewing articles or case studies (i.e., remote sensing data application).

5. Grading scale:
   A 90-100%
   B 80-89%
   C 70-79%
D 60-69%
F 59% and below

6. Homework turned in late will be penalized by 10% off if turned in one class late, but will not be accepted beyond that time.

7. Exams may only be made up with prior approval of a valid excuse. If you miss a test without prior approval or a certified medical excuse, you will receive a zero.

8. To receive audit credit for this course, the student will be expected to attend and participate in each class. Problem sets, the term paper, oral presentation and examinations will not be required, however.

9. I am familiar with and will adhere to the requirements of the Code of Student Conduct dealing with all matters of academic integrity, including revocation of credit on any exam, assignment, or work for which a violation of academic honesty occurred.