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| **1. Course title/number, number of credit hours** |
| **SUR 4384, Thermal Infrared Remote Sensing and Applications** | **3 credit hours**  |
| **2. Course prerequisites, corequisites, and where the course fits in the program of study** |
| **Prerequisite: GIS 4035C with minimum grade of "C" or Special permission from instructor** |
| **3. Course logistics** |
| **Term: Fall 2015****This is a live, on-line course with 2 lab demonstrations****Class location and time****Class time: Tuesday, 7:00 –10:00 PM****Office Hour: Tuesday 9am-12pm in Room 223, also for laboratory demonstration** |
| **4. Instructor contact information** |
| *Instructor’s name**Office address**Office Hours* *Contact telephone number**Email address* | **Dr. Hongbo Su.** **Building: 36, Room: 223** **Boca Raton, FL** **Phone: (561) 297 3936** **E-mail: suh@fau.edu** |
| **5. TA contact information** |
| *TA’s name**Office address**Office Hours* *Contact telephone number**Email address* |  N/A |
| **6. Course description** |
| **Methods and applications of thermal infrared remote sensing, temperature information with an appropriate spatial and temporal coverage at local and regional scales, use of thermal infrared thermometer and thermal camera technologies.** |
| **7. Course objectives/student learning outcomes/program outcomes** |
| *Course objectives* | To provide a basic understanding of the theoretical background of thermal infrared remote sensing and the geometrical calibration of thermographic cameras; To learn and design the thermal infrared remote sensing systems and their applications in environmental monitoring such as detection of energy leaks in building, urban heat island effects, industrial related thermal water pollution. |
| *Student learning outcomes**& relationship to ABET a-k objectives* | **1. Comprehend physical principles in thermal infrared remote sensing (a, b, k)** **2. Understand the thermal infrared remote sensing measurement** **techniques (a, b, e, k)** **3. Learn geometrical and radiometric calibrations of remote sensing measurement (a, b, e, k)** **4. Understand the applications of thermal remote sensing in environmental monitoring (a, b, c, d, h, j, k)** **5. Understand the data processing procedures in thermal infrared remote sensing (a, b, e, k)****Relationship to program outcomes** **Outcome 1: An understanding of professional and ethical responsibility (High)** **Outcome 2: A working knowledge of fundamentals, engineering tools, and experimental methodologies (High)** **Outcome 3: An understanding of the social, economic, and political contexts in which engineers must function (Medium)** **Outcome 4: An ability to plan and execute an engineering design to meet an identified need (Low)** **Outcome 5: An ability to function on multi-disciplinary teams (Low)** **Outcome 6: An ability to communicate effectively (Medium)** **Outcome 7: Graduates will have proficiency in the following areas of civil engineering: (i) structural engineering, (ii) transportation engineering, (iii) geotechnical engineering, (iv) water resources, and (v) environmental engineering (High)** **Outcome 8: Graduates will have an adequate appreciation for the role of civil engineering in infrastructure planning and sustainability including safety, risk assessment, and hazard mitigation (Medium)** **Outcome 9: Graduates will be successful in finding professional employment and/or pursuing further academic studies (High)** |
| **8. Course evaluation method** |
| **Course attendance: 5%** **Assignments: 35%****Midterm - 20%****Final Examination - 40%** | *Note*: The minimum grade required to pass the course is C. |
| **9. Course grading scale** |
| Grading Scale: 90 and above: “A”, 87-89: “A-“, 83-86: “B+”, 80-82: “B”, 77-79 : “B-“, 73-76: “C+”, 70-72: “C”, 67-69: “C-“, 63-66: “D+”, 60-62: “D”, 51-59: “D-“, 50 and below: “F.” |
| **10. Policy on makeup tests, late work, and incompletes** |
| **Makeup tests are given only if there is solid evidence of a medical or otherwise serious emergency that prevented the student of participating in the exam. Makeup exam should be administered and proctored by department personnel unless there are other pre-approved arrangements.** **Incomplete grades are against the policy of the department. Unless there is solid evidence of medical or otherwise serious emergency situation incomplete grades will not be given.** |
| **11. Special course requirements** |
| **All assigned homework must be submitted on or before the posted time. Per day 10% penalty will be enforced for late submissions.** **To succeed in this course all exams must be taken. The reasons for missing an exam must be documented, i.e. doctor’s note etc. An unsatisfactory excuse will result in an F entered for that exam. Make-up exams will be administered for ONLY valid reasons.**  **All exams will be taken on the honor system and must be done by the student ONLY with NO** **ASSISTANCE FROM ANYONE. A student MAY NOT provide assistance to another student.**  **You are encouraged to work in groups to complete the homework assignments and/or to study together. However, the completed homework assignments must be your own work.** |
| **12. Classroom etiquette policy** |
| **University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones and laptops, are to be disabled in class sessions.** |
| **13. Disability policy statement** |
| **In compliance with the Americans with Disabilities Act (ADA), students who require special accommodations due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) located in Boca Raton campus, SU 133 (561) 297-3880 and follow all OSD procedures.** |
| **14. Honor code policy** |
| **Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and place high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. See University Regulation 4.001 at** [**www.fau.edu/regulations/chapter4/4.001\_Code\_of\_Academic\_Integrity.pdf**](http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf) |
| **15. Required texts/reading** |
| **Thermal Infrared Remote Sensing****Sensors, Method, Applications****Claudia Kuenzer and StefanDech****Springer; 2013** **Language: English****ISBN 978-94-007-6639-6** |
| **16. Supplementary/recommended readings** |
| **Journal papers distributed in the class**   |
| **17. Course topical outline, including dates for exams/quizzes, papers, completion of reading** |
| **Week 1: Theoretical background of Thermal Infrared Remote Sensing****Week 2: Geometric Calibration of Thermographic Cameras****Week 3: Thermal Infrared Spectroscopy in the Laboratory and Field****Week 4: Challenges and Opportunities for UAV-Borne Thermal Imaging****Week 5: Spaceborne Thermal Infrared Observation****Week 6: NASA’s Hyperspectral Infrared Imager (HyspIRI)****Week 7: Thermal Remote Sensing of Sea Surface Temperature****Week 8: Application of the Apparent Thermal Inertia Concept for Soil Moisture Estimation****Week 9: Thermal Infrared Remote Sensing of Surface and Underground Coal Fires****Week 10: Thermal Infrared Remote Sensing of Geothermal Systems****Week 11: Analysis of Surface Thermal Patterns in Relation to Urban Structure Types****Week 12: Thermal Remote Sensing of Active Vegetation Fires and Biomass Burning Events****Week 13: Validation of Thermal Infrared Emissivity Spectra Using Pseudo-Invariant Sand Dune Sites****Week 14: Detection of Energy Leaks in the buildings** **Week 15: Course review** |