Department of Computer & Electrical Engineering and Computer Science
Florida Atlantic University
Course Syllabus

1. Course title/number, number of credit hours	
Thermal Infrared Remote Sensing and Applications (SUR 4384)	3 credit hours
2. Course prerequisites, corequisites, and where the course fits in the program of study	
None	
3. Course logistics	
Term: Fall 2019 **This is a live, on-line course with 2 lab demonstrations** **Class location and time** **Class time: Monday, 7:10 –10:00 PM, in CM128** **Office Hour: Monday and 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 an understanding of the advanced theoretical background of thermal infrared remote sensing and the geometrical calibration of thermographic cameras; To operate the thermal camera and do image processing of the thermal infrared images; 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.**
ABET 1-7 outcomes	1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

	2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors 3. an ability to communicate effectively with a range of audiences 4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts 5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives 6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
Student learning outcomes & relationship to ABET outcomes	1. The ability to understanding theoretical background of thermal infrared remote sensing (1,3) 2. The ability to operate the thermal camera and do image processing of the thermal infrared images (1, 2, 7) 3. The ability to design a thermal infrared remote sensing system for a geomatics engineering application (1,2,3,4, 5,6)
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 (Medium) **Outcome 5**: An ability to function on multi-disciplinary teams (Medium) **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 (High) **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. Attendance Policy Statement

Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance.

Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

14. Disability policy statement

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses –

Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

15. Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau.edu/counseling/

16. Code of Academic Integrity policy statement

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 an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001. If your college has particular policies relating to cheating and plagiarism, state so here or provide a link to the full policy—but be sure the college policy does not conflict with the University Regulation.

17. Required texts/reading

Thermal Infrared Remote Sensing
Sensors, Method, Applications
Claudia Kuenzer and StefanDech

Springer; 2013
Language: English
ISBN 978-94-007-6639-6

18. Supplementary/recommended readings

Journal papers distributed in the class

19. 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 with lab demonstration

Week 3: Thermal Infrared Spectroscopy in the Laboratory and Field

Week 4: Challenges and Opportunities for UAV-Borne Thermal Imaging with lab demonstration

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: class project on applications of thermal infrared remote sensing

Week 15: Course review

Final Exam (Dec. 09)