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Remote Sensing Center

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## Course Descriptions

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# REMOTE SENSING CENTER

# RSC

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## Course Descriptions

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### Remote Sensing Intelligence Course Descriptions

NAME & NUMBER IN RSI COURSE MATRIX

#### SS3011 Space Technology and Applications (3-0) As Required

An introduction to space mission analysis with an emphasis on those space missions supporting military operations. Topics include space history, doctrine and organizations, orbital mechanics, communication link analysis, space environment, spacecraft technology, and military, civil and commercial space systems. Prerequisites: None.

#### PH3052 Physics of Space and Airborne Sensor Systems (4-0) As Required

This interdisciplinary course explores the physical principles underlying the sensor systems needed for satellites and tactical aircraft, as well as limitations imposed by the atmosphere and operating environment on these systems and their communication links. Topics include: satellite orbits, the satellite environment, ionospheric interactions and atmospheric propagation, phased array and pulsed compressed radars, imaging synthetic aperture and inverse synthetic aperture radars, noise resources, thermal radiation, principles of semiconductor devices, optical and infrared imaging detector systems, and their resolution limitations and bandwidth requirements. Prerequisites: Basic physics class. Must be familiar with the concepts of energy and wave motion.

#### IS4056 Geographic Information Systems (GIS) (3-2)

Theory and application of geographic information systems to military-relevant problems. Topics include spatial data models, map projections, data fusion, satellite surveying, spatial query and analysis, and cartographic principles. Application of GIS to decision-making processes and the solution of current real-world problems.

#### OS3105 Probability and Statistics for HSI and MOVES (4-0)

Noncalculus-based introduction in the context. Descriptive statistics and graphical techniques. Probability rules including Bayes Rule and independence. Discrete and continuous probability distributions, expected values, quantiles, variance, covariance, correlation, expected values, and variance of linear combinations of random variables, notably the sample mean. Fundamentals of statistics in one-sample setting including the ideas of estimation, confidence intervals, and hypothesis testing. Use and comparison of parametric and nonparametric approaches. Prerequisite: None.

#### CS4330 Introduction to Computer Vision (3-2)

This course introduces students to the main concepts that allow computers to "see" and understand visual information. It teaches methods and skills in image processing, pattern recognition, statistical analysis, classification, and learning. These are exemplified on applications such as military intelligence, surveillance, object tracking, robotic navigation, human-computer interfaces, and visual effects. Students complete a small class project that demonstrates the use of computer vision for an application of their interest. In laboratory activities, students get hands-on experience with the most important tools for building practical vision systems. Experiments and projects are tightly coupled with the material covered in class. Students must be familiar with a programming language such as C, C++, or Java (CS2020, CS2171, CS2173, etc.). Prerequisites: Helpful, but not necessary, is knowledge of basic linear algebra, probability or game theory, and Matlab (EC1010), or consent of the instructor.

#### IS4053 Spectral and Polarimetric Tools and Analysis Techniques (3-2)

Analysis of multi-dimensional data sets, primarily multispectral and polarimetric imagery. Fundamentals of imagery data structures, statistical analysis techniques. Use of analysis methods with application to military and civil problems, including terrain classification and target detection. Prerequisite: PH3052

#### IS4052 Imaging Spectrometry Theory, Analysis, and Applications (3-2)

Analysis of high-dimension spectral imagery, with applications to terrain analysis and target detection. Development of analysis methods with application to military and civil problems. Prerequisite: PH3052

#### IS0810 Thesis Research (0-8) As Required

Thesis research time for IST Students. Prerequisite: None

#### SS3001 Military Applications of Space (3-2) (NTM) (TS/SCI)

Space Systems and technologies of interest to the military. Strategic and tactical imagery and SIGINT requirements. Tasking and use of national space systems and ground support elements. Vulnerability considerations and impact of current R&D programs. Prerequisites: SS3500, SS3525 (or PH3052) and understanding of Fourier Analysis. Classification: TOP SECRET clearance with access to SCI.

#### IS4055 Synthetic Aperture Radar Systems Analysis Techniques and Applications (3-2)

Active imaging systems (RADAR), tools for analysis, application to civil and military problems. Theory of non-literal analysis techniques for RADAR (interferometric synthetic aperture RADAR). Application of RADAR to development of digital elevation models (DEMs) and terrain classification. Prerequisites: PH 3052

#### IS4060 Laser imaging – Light Detection and Ranging (LiDAR) Analysis Techniques and Applications (3-2)

Active imaging laser system basics are developed. Techniques and tools for analysis are developed for application to civil and military problems. Application of LiDAR to development of digital elevation models (DEMs) and terrain classification. Laboratories include field tests with terrestrial laser scanners, and exploitation of point clouds. Prerequisites: PH 3052

#### NS3159 Principles of Joint Operational Intelligence (4-0) As Required

This course examines the intelligence process, organizational structure and related C4I architecture within the context of intelligence support to the planning and conduct of joint and combined operations at the operational level of war. This course addresses the conduct of intelligence to include the development of requirements, collection management, threat analysis, assessments, and dissemination of intelligence to the decision maker. The course includes an overview of intelligence data systems and associated connectivity. Students are required to prepare and present intelligence briefings and staff intelligence studies, incorporating the knowledge gained in the course. Classification: U.S. citizen holding a TOP SECRET clearance with eligibility for access to SCI.

#### IS4054 Analysis Techniques for Thermal Imaging Systems (3-2) (TS/SCI)

Analysis techniques for thermal imagery from ground, airborne, and satellite systems. Applications in imaging systems, and to Overhead Persistent Infrared Systems (OPIR). Tools and applications for systems, applications to military and intelligence problems. TS/SCI Prerequisites: PH3052

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