ENGINEERING, MECHATRONIC SYST (ENMT)

ENMT 3220 Mechatronics II - Real-Time Systems (4 Credits)
Real-time systems require timely response by a computer to external stimuli. This course examines the issues associated with deterministic performance including basic computer architecture, scheduling algorithms, and software design techniques including data flow diagrams, real-time data flow diagrams, stat transition diagrams, and petri nets. In the lab portion of this class, students program a microcontroller to interact with mechatronic devices. Prerequisite: ENCE 3210.

ENMT 4000 Space Systems Design I (4 Credits)
The application of advanced theory and concepts as they relate to the development of spacecraft and missile subsystems, and how those subsystems are related under the umbrella of systems engineering. The course emphasizes practical aspects of space systems design and integration, and is team-taught by faculty and functional experts in the various fields. Lecture topics include aerospace materials, mechanics, thermal control, embedded systems, distributed sensor networks and aerospace probability and statistics.

ENMT 4010 Space Systems Design II (4 Credits)
The continuation of Space Systems Design I. Lecture topics include payload communications, guidance and control, spacecraft electric power, propulsion systems, radiation and avionics and sensor subsystems. Prerequisite: Space Systems Design I.

ENMT 4100 Systems Engineering (4 Credits)
Systems engineering is an interdisciplinary field of engineering and engineering management that focuses on how to design and manage complex systems over their life cycles. At its core, systems engineering utilizes systems thinking principles to organize this body of knowledge. Systems follow systems theory by having the design interface with its environment. System design typically follow the “V-diagram”, a serial process with structured verification occurring at each level of abstraction (system-subsystem-component hierarchy levels). The V-diagram traces the basic design process, starting with a problem, developing requirements, definitized with a concept of operations, and accomplishing a functional analysis and decomposition. Systems engineering takes a holistic approach to design, taking an idea to a concept and detail design. This includes a functional architecture and physical architecture, with particular attention paid to interfaces. Having built or procured components and developing software, the system is assembled and integrated. Verification and Validation is accomplished at each level of decomposition, starting at the lowest level and moving up to a system level that can be validated with the customer or shareholders. There are a series of milestones that are used to monitor the progress of the design. Instructor permission required.

ENMT 4220 Mechatronics II (4 Credits)
This course combines systems design and integration with a real world project involving the design and fabrication of an integrated system. Prerequisite: Mechatronics I or equivalent.

ENMT 4225 System Models, Simulation & Tools (4 Credits)
A physical model is a smaller or larger physical copy of an object. Physical models allow visualization, from examining the model, of information about the thing the model represents. A model can be a physical object such as a spacecraft or spacecraft subsystem. Modeling and simulation are a key enabler for systems engineering activities as the system representation in a computer readable (and possibly executable) model enables engineers to reproduce the system (or Systems of System) behavior. Modeling is a tool for diagramming and understanding complex processes; Model-Based Systems Engineering (MBSE) is a powerful engine for design growth. It’s endlessly adaptable to human needs and technological trends, unlocking incredible potential for analysis, and helping solve tomorrow’s grand engineering challenges such as in aerospace. Physics-based models can be combine for use with equations of mathematical physics, coupled with real-time sensor measurements, and their numerical solution in an effort to understand complex design and operations.

ENMT 4270 Fundamentals of System Electrical, Mechanical and Software Design (4 Credits)
Design of individual electrical and mechanical components comprising a system. Comprehensive integrated approach making the transition from design of individual electrical/mechanical components into a complete electrical-mechanical system design. Topics include systems engineering of complex electronics (FPGAs, ASICs, Hybrids), electromagnetic compatibility, electromagnetic interference, electrical compatibility analysis, system power modeling and energy efficiency, electrical systems integration and test methodologies, mechanical system modeling, system thermal/stress analysis methods and tools, mass management, mechanical systems integration and test methodologies. Prerequisites: ENMT 4000, ENMT 4010, or permission by the Instructor. Course Requirements: Assignments and projects.

ENMT 4275 Applied System Electrical, Mechanical, and Software Design (4 Credits)
This is a practice-centered course. Assess case studies of design, implementation and testing, validation and verification of complete complex (e.g. spacecraft) systems to meet mission requirements with performance guarantees. Prerequisites: It is recommended that the elective course ENMT 4270 is taken first, or permission by the Instructor.

ENMT 4280 Design for Feasibility and Resilience (4 Credits)
A feasible design is an activity based on selected testing and engineering analysis, which presents enough information to determine whether or not the project should be advanced to the final design and production fabrication stage. In the fields of engineering, resilience is the ability to absorb or avoid damage without suffering complete failure and is an objective of the design. Resilience is described as the ability to return to the steady-state condition following a perturbation of the control behavior. When thinking about resilience, system engineering typically refer to this as an alternative (or as a complement) to the conventional view of safety. But resilience (or more accurately, the ability to perform in a resilient manner) is not about avoiding failures and breakdowns, i.e., it is not just the opposite of a lack of safety. This has led to early discussions about resilience versus robustness, resilience versus brittleness, etc. The focus of resilience engineering is thus resilient performance, rather resilience as a property (or quality) or resilience in a 'X versus Y' dichotomy. Students enrolling in this course should have knowledge of probability and statistics, familiarity with MATLAB/Simulink, or permission of the instructor.

ENMT 4285 Complex System Architectures, Models, and Tools (4 Credits)
The course focuses on mission requirements and how an overall mission should function by examining different architecture configurations and tools for modeling purposes. Example architecture models include: executable, networked, distributed, real-time, information assurance, framework, and reference. Students learn about development and allocation of functional and non-functional requirements and how to analyze architecture issues. Emphasis is on development of Service Oriented Architecture (SOA) solutions and ability to modeling and analysis using Systems Modeling Language (SysML). Prerequisites: ENMT 4100, or permission by the instructor. Course Requirements: Assignments and projects.

ENMT 4730 Advanced Ground Robotics (4 Credits)
Introduction to path planning and sensing and estimation for robotic manipulations and mobile robots. Review of the mathematical preliminaries required to support robot theory. Topics include advanced sensors, mobile robot mechanisms, advanced manipulator mechanisms, path planning in 2-D and 3-D, and simultaneous localization and mapping. Applications include task and motion planning for idealized and real robots.

ENMT 4800 Adv Topics (Mechatronics) (1-5 Credits)
Various topics in Mechatronics System Engineering as announced. May be taken more than once. Prerequisite: varies with offering.

ENMT 4801 Adv Topics (Mechatronics) (1-5 Credits)
Various topics in Mechatronics System Engineering as announced. May be taken more than once. Prerequisite: varies with offering.

ENMT 4991 Independent Study (1-5 Credits)

ENMT 4995 Independent Research (1-18 Credits)