Descriptions of Courses

SPE510 Space Mission and Orbit Analysis **3:0:3(6)**

This course covers space mission design and orbit analysis. Target spacecraft include earth observation satellites, geostationary and solar system exploration satellites. For such a goal, basic analysis on mission requirements and procedures to meet the requirements will be discussed with fundamental orbit analysis.

SPE520 Introduction to Spacecraft Engineering **3:0:3(6)**

This course covers basics on spacecraft engineering. Basic mission analysis, and introduction to sub-systems are discussed. In addition, launch trajectory analysis, docking systems and reentry dynamics are introduced. Different sensors onboard the spacecraft will be studied also.

MAE463 Global Positioning System **3:0:3(6)**

This course will provide an in-depth understanding of GPS architecture, signals, measurements and performance. It is by nature an interdisplinary course, covering subject material in orbit prediction, satellite systems, signal processing, error modeling, and computer programming. It will include detailed consideration of differential GPS since this innovation greatly increases the power and utility of the system.

MAE466 Satellite Systems **3:0:3(6)**

The primary objective of this course is to introduce fundamentals of spacecraft systems. With this goal in mind, topics such as basics of orbital mechanics, orbit transfer, rendezvous, station keeping and geostationary spacecraft mission are covered. In addition, attitude dynamics of rigid spacecraft are introduced in conjunction with basic principles of spacecraft attitude control. An introduction to spacecraft sub-systems for small-scale satellites is provided on a frequent basis.

MAE518 Rocket System Engineering **3:0:3(6)**

Elementary principles of the rocket propulsion system are taught in this lecture. This course is offered for senior level undergraduate and 1st year master program students majoring aerospace engineering and mechanical engineering. Students will practice design calculation to apply basic principles of fluid mechanics and heat transfer to this calculation. The lecture will cover issues of maximum velocity, acceleration, total impulse and derivation of performance parameters from thrust chamber data.

MAE540 Structural Dynamics **3:0:3(6)**

This course covers the following topics: Vibrations of simple and complex structures, bars, strings, rods, beams, and plates; analysis of continuous and multimass systems; finite elements, Galerkin, integral equation; numerical collection; Hamilton's principle and Lagrange's equations; response of structures by modal superposition; vibration of composite materials.

MAE542 Mechanics of Composite Materials **3:0:3(6)**

This course covers the following topics: Classification and characteristics of composite materials; strain-stress relations of anisotropic materials; classical laminate theory; analysis of symmetric and unsymmetric laminate; interlaminar stress; failure criteria of composite; mechanical testing methods and applications.

MAE595 Introduction to Optimal Control **3:0:3(6)**

In this course, classical optimal control theory is introduced. Then, various practical optimization algorithms are introduced and applied to trajectory optimization and flight control design. Students are supposed to develop the code by themselves. Emphasis will be given to formulation of optimization problems and numerical efficiency of algorithms such as convergence characteristics.

MAE597 Spacecraft Dynamics **3:0:3(6)**

Advanced spacecraft attitude dynamics and control subjects are covered in this course. Classical dynamics approach are introduced to establish a variety of spacecraft attitude dynamics problems. Different attitude kinematics are also discussed to provide thorough understanding on the description of attitude dynamics and kinematics modelling. Attitude control problems using on-off thrusters are explained with simulation results. Recent developments in thruster modulation techniques are addressed. Flexible spacecraft modelling and control law design are presented to provide basic knowledge on recent advances in large spacecraft modeling and control technologies.

MAE664 Navigation and Guidance **3:0:3(6)**

In this class, fundamentals of inertial navigation and GPS are introduced, and detail algorithms of strapdown inertial navigation are also discussed. For integrated navigation, Kalman filtering is studied in depth. Guidance laws for aircraft en-route flight and missile systems are also reviewed. Students are expected to conduct extensive computer simulations of GPS / INS navigation systems.

MAE728 Reentry Aerothermodynamics **3:0:3(6)**

This course deals with the heat transfer phenomena, ablation phenomena of the thermal protection systems, and methods of testing thermal protection systems. Beginning with the theory of boundary layers in hypersonic flight, one learns the phenomena occurring at the surface of the thermal protection system, the phenomena occurring inside the thermal protection system, shock tubes, arc-heated wind tunnels, and ballistic ranges.

MAE430 Introduction to Reliability in Mechanical Engineering Design **3:0:3(6)**

This course treats statistical distributions and methods for evaluation of reliability in mechanical engineering design. The students also learn the general fundamental statistics as a prerequisite knowledge briefly and efficiently. Projects to evaluate reliability are given to the students.

MAE500 Mathematical Methods in Mechanical Engineering **3:0:3(6)**

This course covers the following topics: Fundamental mathematical techniques applicable to study of mechanical engineering, Matrices and linear equations, Vector space, Eigenvalue problem, Quadratic form, Calculus of variations, Introduction to tensor analysis, Introduction to theory of functions of a complex variable. Conformal mapping, Integral transforms, and Asymptotic expansions.

MAE502 Introduction to Finite Element Method **3:0:3(6)**

Finite element method to solve a differential equation.

MAE505 Sensor and Instrumentation Engineering **3:0:3(6)**

The goal of this subject is to help the students understand the fundamentals of chemical and physical sensors (pressure, temperature, force, velocity, electromagnetic, chemical/bio) from macroscale to nanoscale dimensions and their applications in modern engineering systems. Also, technologies of micro/nano sensors and sensor networks are investigated. In addition, topics on the measurement and instrumentation of physical signals through sensors are discussed.

MAE550 Advanced Dynamics **3:0:3(6)**

Kinematics of two and three dimensional motions of rigid bodies are started with as well as particle motions. An efficient and systematic method for derivation of equations of motion of such a system is studied based on Kane's approach. The most fundamental law, i.e.,Newton's 2nd law and other advanced dynamic(Hamilton and Lagrange) equations are covered as well for comparison purpose.

MAE551 Vibration in Linear Systems **3:0:3(6)**

Beginning with linear system theory, principles in advanced dynamics are introduced. Then, single and multiple degree-of-freedom(DOF) systems are covered. Relevance of eigenvalue problems to multiple DOF system analysis is introduced together with some numerical techniques. How to deal with distributed systems such as string, rod, beam, membrane and plate is covered for simple geometries. Numerical approximation techniques for the distributed systems are studied finally.

MAE561 Linear System Control **3:0:3(6)**

Designed to enable graduate students to make analysis of a given linear system in terms of stability, controllability and observability, and to design a linear controller by using eigenstructure assignment

MAE563 Microprocessor Application **2:3:3(6)**

Designed to give graduate students the ability to understand basic principles of microprocessors and their applications in modern product designs. Prerequisites by topics: basic electrical circuits, computer languages.

EE421 Wireless Communication Systems **3:0:3(6)**

This course emphasizes practical implementation aspects of digital communication systems. A physical-layer software implementation project will be assigned for a selected commercially-deployed communication system.

Topics covered in this digital communication course include : (1) Digital modulation and demodulation, Optimum receivers, (2) Adaptive equalization and Synchronization, (3) Channel capacity, Error control codes.
(Prerequisite: EE321)

EE432 Digital Signal Processing
3:0:3(6)
This course studies the representation, analysis, and design of discrete-time signals and systems. Topics include a review of the z-transform and the discrete Fourier transform, the fast Fourier transform, digital filter structures, digital filter design techniques, analog-to-digital and digital-to-analog data conversion, rate conversion, sampling and aliasing issues.
(Prerequisite: EE202)

EE535 Digital Image Processing
3:0:3(6)
This course deals with the fundamental concept of digital image processing, analysis, and understanding. Topics include sampling, linear and nonlinear operations of images, image compression, enhancement and restoration, reconstruction from projections, feature extraction, and image understanding.

EE542 Microwave Engineering **3:1:3(6)**
This course is designed to provide in-depth understanding and knowledge on the theory and applications of microwave circuits, components, and systems used in Microwave and RF wireless communication systems.
(Prerequisite: EE204)

EE567 Photovoltaic Power Generation **3:0:3(6)**
In this course, various photovoltaic devices and systems are introduced. This course deals with basic theory of solar cells, the structures and characteristics of various solar cells, and the recent R&D trend and future prospects of photovoltaic technologies.
(Prerequisites: EE302)

EE571 Advanced Electronic Circuits **3:0:3(6)**
This course introduces new analysis methods for analog-circuits implemented by using bipolar and MOS transistors. Since the design of analog circuit requires both approximation and creativity, this course explains how to approximate and design complicated circuits.
(Prerequisites: EE304, EE403)

EE581 Linear Systems **3:0:3(6)**
Topics include system representation (input-output description, state variable description), solutions of linear dynamical equations, controllability and observability, irreducible realization, stability (BIBO stability, Lyapunov stability) for rigorous treatment of linear systems. In addition, feedback linearization is to be covered.

EE594 Power Electronics Systems **3:0:3(6)**
This course covers the design and analysis of the topology about the DC / DC converter, PFC (Power Factor Correction) circuit and control methode in that topology. Also the topology such as inverter, resonant converter, and active power filter is introduced, and the control algorithm of that topology is studied in this course. Finally the state of the art in power conversion system is discussed, and every student carries out a term project about design and modeling of power supply. On completion of this course students will have built confidence on their ability to design and analyse the power conversion system.
(Prerequisite: EE391)

EE681 Nonlinear Control **3:0:3(6)**
This course is intended to present the fundamental result of analysis and design of nonlinear control systems. Especially, this course is concerned with the analysis tools for nonlinear dynamical systems and the design techniques for nonlinear control systems.
(Prerequisite: EE581)

PH441 Introduction to Plasma Physics **3:0:3(4.5)**
This course is designed to help students build their ability to understand basic plasma concepts. Topics include

discharge processes and application of plasmas, motion of charged particles in electric and magnetic fields, plasmas as fluids (magnetohydrodynamics), diffusion in weakly and fully ionized plasmas, waves in fluid plasmas, and kinetic theory and nonlinear effects.
Topical Prerequisite: Electromagnetism

PH481 Astrophysics **3:0:3(4.5)**
This course is designed to help students understand the astronomical phenomena in terms of basic physical principles. Topics include the physical properties of interstellar medium, stellar structure and evolution, structure and dynamical evolution of galaxies, and theories of cosmological evolution.

PH622 Geometrical Optics **3:0:3(4.5)**
This course is designed to teach general concepts on Gaussian optics, Seidel first order aberration theory, and optical design method. Methods of optical testing are also reviewed.
Recommended Topical Prerequisites: Introductory of optics, Introductory on wave optics.

IE425 Project Management **3:1:3(4)**
This course describes the use of projects to support business objectives in modern organizations and discusses factors necessary for the successful project management. Topics include project management concepts, needs identification, the project manager, teams, project organizations, project communications, project planning, scheduling, control and associated costs. The roles of the project manager and project team members will be covered as well.

IE632S tochastic Modeling **3:1:3(5)**
The course deals with stochastic modeling and performance analysis methods for system design and operation of complex engineering systems such as production / manufacturing systems, computer / communication systems, and service systems. The course covers more advanced mathematical modeling and analysis than OR-II. Topics include basic concepts, modeling and analysis, and applications for fundamental stochastic models, including Poisson processes, renewal processes, Markov chains, stationary processes, Brownian and diffusion processes, stochastic Petri nets, basic queueing models and queueing networks, and Markov decision processes. Advanced topics like Markov renewal processes, Martingales, large deviation theories, and advanced traffic models can be introduced depending on the class.

CS453 Formal software verification techniques **3:0:3(6)**
This class covers software verification techniques based on formal methods including model checking. These automated and mathematical verification techniques can provide high reliability for complex embedded software compared to traditional testing methods. In addition, this class utilizes various model checking tools for pragmatic knowledge acquisition.

CS530 Operating System **3:0:3(6)**
The main focus of this course is to understand the concurrency features of modern operating systems. Concurrent programming is dealt with in detail to simulate various parts of an OS. Other topics that are required to understand the process-oriented OS structure are also discussed.

CS552 Models of Software Systems **3:0:3(10)**
For long time, computer scientists have investigated the problem of automating software development from a specification to its program. So far the efforts were not fully successful but much of the results can be fruitfully applied to development of small programs and critical small portions of large programs. In this course, we study the important results of such efforts and, for that, we learn how to model software systems with formal description techniques, how to model software systems such that the various properties expected of the software systems are verifiable and how to verify various properties of software systems though the models.

CS554 Designs for Software and Systems **2:3:3(4)**
Development of software and systems requires to understand engineering design paradigms and methods for bridging the gap between a problem to be solved and a working system. This course teaches how to understand problems and to design, architect, and evaluate software solutions.

CS632 Embedded Operating Systems 3:0:3(6)

The goal of this course is to provide in-depth design concepts and implementation skills required for designing and developing embedded operating systems. Topics covered include boot loader, process management, memory management, I/O device management, and file systems in embedded operating systems.