**Artificial Intelligence**

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| **SYDE 422 - Machine Intelligence** | | **Winter** |
| The objective of this course is to introduce the students to current intelligent system concepts. An overview of different learning schemes will be provided, including: Decision Tree, Bayesian, Inductive, Analytical and Rule-based Learning. The main focus of the course will be on Neural Nets, Genetic Algorithms and Reinforcement Learning. | | |
| **ECE 457 Applied Artificial Intelligence** | **Summer** | |
| Artificial intelligence concepts and techniques, including search, inference, knowledge representation and planning. Knowledge-based systems. Applications in electrical and computer engineering, with emphasis on design and maintenance.[*Note: Includes Lab*] | | |

**Robotics Control**

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| **ME 547 - Robot Manipulators: Kinematics, Dynamics, Control** | **Winter** |
| Homogeneous transformations, D-H convention, forward and inverse kinematics. Differential transformations and Jacobians. Robot dynamics. Programming, trajectory generation and joint control. End-of-arm sensing and outer loop control. Industrial applications. | |
| **ECE 486 - Robot Dynamics and Control** | **Winter** |
| Homogeneous transformations. Kinematics and inverse kinematics. Denavit-Hartenberg convention. Jacobians and velocity transformations. Dynamics. Path planning, nonlinear control. Compliance and force control. | |

**Advanced Dynamics**

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| **SYDE 553 - Advanced Dynamics** | **Fall** |
| Newtonian and Eulerian formulation of particle and rigid body kinematics and dynamics. Energy (Lagrangian and Hamiltonian) formulations of particle and rigid body dynamics; generalized coordinates, generalized forces, holonomic constraints, Lagrange multipliers. | |
| **ME 524 - Advanced Dynamics** | **Winter** |
| This course is a continuation of ME 212 and ME 321. Basic kinematic and dynamic concepts are extended. The emphasis is on vector methods, general kinematic relationships, planar and three-dimensional motion, gyroscopic effects, variational mechanics, Lagrange's equation and Hamilton's equations. Computer simulation of non-linear systems is discussed and a project involving computer simulation is usually assigned. | |

**Biomechanics List B**

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| **SYDE 543 - Cognitive Ergonomics** | | **Fall** |
| This course focuses on the role engineering psychology research plays in design of the information displays and devices associated with simple and complex cognitive tasks. Main topics include: signal detection and target location tasks, navigation tasks, training tasks, communication tasks, human error, stress and mental workload, supervisory control, and situational awareness. | | |
| **KIN 420 - Occupational Biomechanics** | **Winter** | |
| A course designed to provide the student with knowledge to reduce the risk of injury and increase worker productivity. Issues include identification of injury risk factors, understanding injury mechanism, quantitative assessment of injury risk and intervention strategies to reduce the risk of injury. Specific examples include the use of computerized models and EMG methods to analyze low back loading, optimizing tool design and workspace layout and the examination of related issues such as office seating and vibration. | | |

**Biomechanics List D**

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| **KIN 221 - Advanced Biomechanics of Human Movement** | | **Winter, Summer** | | |
| The course is structured to introduce measurement, analytical and computation techniques involving multisegmental, dynamic analysis of human activity. Examples of human activity in occupational, clinical and leisure settings from the perspectives of anthropometry, kinematics, kinetics, energetics, muscle mechanics and electromyography are given. The utility of biomechanical variables in the solution of questions involving human activity is emphasized using lectures and laboratories. | | | | |
| **KIN 255 - Introduction to Psychomotor Behaviour** | | **Fall** | | |
| An information processing approach is used to introduce the principles of learning and performing fine and gross motor skills. In addition, social psychological variables are studied as they relate to the facilitation or decrement in learning and performance. | | | | |
| **KIN 356 - Information Processing in Human Perceptual Motor Performance** | | | **Winter** | |
| An information processing model of perceptual-motor behaviour is presented. Human performance theory is used to study processes mediating input and output information. Specifically, the subprocesses of storage of information in memory, perception, retrieval of information from memory and execution of movement are examined. | | | | |
| **KIN 422 - Human Gait, Posture, and Balance: Pathological and Aging Considerations** | | | | **Fall** |
| This course will provide a detailed understanding of the kinematics, kinetics, and neural control of standing posture, stepping, walking, and running under normal and perturbed conditions. Measurement techniques, processing data, and the interpretation of total body and limb synergies will be emphasied from a biomechanical and neural control perspective. The problems of the elderly and the assessment of those with pathologies will be emphasized. | | | | |
| **KIN 425 - Biomechanical Modelling of Human Movement** | **Fall** | | | |
| The quantitative measurement and analysis of the movement of the human musculo skeletal system. Multisegment dynamic movements will be studied using computer programs, with emphasis on kinematics, kinetics and energetics, as well as the use of EMG in the assessment of the control of the movement. Examples are presented from pathological, normal and athletic movement. | | | | |

**Very Interesting Courses**

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| **SYDE 556 - Simulating Neurobiological Systems** | | **Winter** |
| This course develops and applies a general framework for understanding neural computation in the context of recent advances in theoretical and experimental neuroscience. Particular emphasis is placed on understanding representation, nonlinear computation, and dynamics in real neurobiological systems. Students will apply signal processing, control theory, linear algebra, probability theory, and similar quantitative tools for the purpose of modelling sensory, motor, and cognitive systems. Topics covered include single neuron function, neural coding, neural dynamics, attractor networks, learning, statistical inference, locomotion, working memory, etc. Familiarity with neural systems is helpful but not essential. | | |
| **SYDE 558 - Fuzzy Logic and Neural Networks** | **Winter** | |
| Fuzzy systems and neural networks have recently become widely applied to various areas including consumer products, mechatronics systems, industrial process control, information systems, pattern and speech recognition, and prediction of future stock prices to name a few. Fuzzy logic and neural networks share the common ability to improve the decision making process for systems characterized by ill-defined dynamics and working in an imprecise environment. For fuzzy systems this is done through linguistic description of the system by combining fuzzy sets with fuzzy rules following a well-structured numerical estimation procedure. For neural networks, this is done through detecting patterns and relationships from a set of training input-output data gathered from the system, while learning from relationships and adapting to change. The course is mainly intended as introductory material for fuzzy logic and neural networks and outlines the most recent developments in these areas and their applications for intelligent systems design. | | |

**Moderately Interesting Courses**

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| **ME 559 - Finite Element Methods** | | **Fall, Summer** | | |
| A course presenting the fundamental ideas involved in conventional finite element analysis in Mechanical Engineering. Domain discretization, interpolation and shape functions, element derivation and types, element stiffness or property equations, assembly procedure, boundary conditions, solution methods for the algebraic equation system, applications in heat transfer, fluid flow, and stress analysis. Students will, throughout the course, write and test their own finite element code through individual subroutine construction as the course progresses. | | | | |
| **SYDE 524 - Embedded Real-time Systems Design** | | **Winter** | | |
| Introduction to Embedded Systems and Real-time Systems. Hard versus soft Real-time Systems. Real-time issues in computer architecture. Clocks and timing issues. Correctness and predictability. Structuring and describing Real-time software. Clock Synchronization. Real-time objects and atomicity. Validation of timing constraints. Formal Real-time systems design and analysis techniques: process-based, event-based, and Petri Nets. Resource management and control, Real-time scheduling and task allocation (Uni-processor and Multi-processor). Hardware/Software Co-design. Design for dependability, reliability and fault tolerance. Real-time programming. | | | | |
| **SYDE 554 - Systems Models 2** | | | | **Winter** |
| This course focuses on methods for parameter and tolerance design that ensure system responses meet specifications with low variability and low cost. Topics include: system models from mechanistic (linear graph-based) and empirical methods; quality metrics in terms of sensitivities, second moments and probability of conformance; production and loss of quality costs; gradient-based methods and constrained optimization to provide designs for minimum total cost, minimum cost for set quality, and best quality for set cost. Examples come from industrial processes, as well as hydraulic, electrical, and mechatronic systems. | | | | |
| **SYDE 551 - Advanced Graph Theoretic Methods** | | | | **Fall** |
| The theory of linear graphs as applied to linear systems analysis; definitions, properties and theorems are developed on a rigorous basis. Introduction and review of graph theoretic modelling in the Laplace domain; the branch, chord, nodal and mixed or hybrid methods. Modelling large systems in terms of subsystems; tree transformations, multi terminal representations, interconnection of multi port subsystems. Development of the state model using graph theory and its solution. There will also be an introduction to additional topics such as sensitivity analysis, probabilistic systems, and tolerance optimization. Students apply the material in an individual course project. | | | | |
| **ME 564 – Aerodynamics** | | | **Winter** | |
| An introductory course in aerodynamics for engineers. Kinematics and dynamics of inviscid flow; airfoil dynamics including thin airfoil theory, finite wings, panel methods and airfoil parameters. Boundary layer theory and boundary layer control as applied in aerodynamics. Introduction to high speed aerodynamics. Introduction to dynamics of flight including stability and control. | | | | |
| **KIN 264 - Developmental Aspects of Movement** | Course ID: 006561 | | | |
| A study integrating the theoretical and applied aspects of motor and perceptual motor development in children and adolescents. Tutorials will examine children in an applied setting. | | | | |