Spring 2021 Topic Course Offerings/Descriptions:

BMED 4961 **BIOMEDICAL INSTRUMENTATION** - This course introduces students to concepts related to design, operation, evaluation, and optimization of biomedical instrumentation. Students learns the basic principles of how physical devices interface with biological systems for measuring, characterizing, and manipulating cells, tissues, organs, or an entire organism. These measurements are central to the biomedical field; whether enabling physician and health care professional to monitor, diagnose, and treat patients, or, by supporting discovery in translational and fundamental biomedical engineering fields.

CHEM 4961/6961 **ASPECTS AND TOOLS OF CHEMICAL PRACTICE** - This course will cover tools and practical aspects of chemical science in an industrial setting, with modules on Grantsmanship, Project Management, Design of Experiments, and Intellectual Property. The goal of the course is to introduce students to an industrial scientist's (chemist's) perspective and endeavor to: (i) garner federal funding for corporate R&D projects (proposal writing and general PI training), (ii) effectively manage project work in a matrix-organization (administrative and programmatic aspects, including teaming), (iii) execute on project deliverables leveraging experiment optimization tools, and (iv) protect project work-products through intellectual property (IP). This class is geared towards undergraduate and graduate Students who foresee entering an industrial R&D environment. Key concepts will include grantsmanship 'do's and don'ts', "patent-ese" and strategies to identify opportunities and gaps in existing IP, and tools for experimentation and optimization of processes and/or chemical reactions. Course concepts will be crystallized through writing assignments and speaking/presentation report-outs.

CHEM 4962/6962 **PROTEOMICS AND FUNCTIONAL GENOMICS** - This course is a survey of modern techniques of protein biochemistry, bioinformatics, proteomics, and functional genomics. It will include a discussion of basic concepts of protein structure and function, protein characterization and purification, enzyme kinetics, nmr, cryoEM, x-ray crystallography, mass spectrometry, and various techniques of functional and structural genomics, together with readings from current literature.

CIVL 4962 **WATER RESOURCES ENGINEERING** - Incorporating theory, analysis and design, this course provides a foundational treatment of water resources engineering within the Civil and Environmental Engineering curriculum at Rensselaer Polytechnic Institute. The main topics covered include: water resources sustainability, water distribution systems and water resources planning; the hydrological cycle. The course has a strong emphasis on hydraulic processes such as pipe flow, pipe networks, and open-channel flow. Hydraulic control structures such as culverts, gates, weirs, spillways and stilling basins and reservoir routing are considered in depth with experimental laboratory sessions reinforce lectures and provide hands-on learning opportunities. Contemporary and social issues are introduced at various points throughout the term: green infrastructure, storm surge and climate change. Students who take water resources cannot take ENVE 4310 Applied Hydrology and Hydrology.

ECSE 4961/6961 **ADVANCED COMPUTER SYSTEMS** - Developing a solid understanding of advanced computer systems is essential not only for designers who design and implement computing infrastructure (e.g., cloud, data center, enterprise appliance, and mobile computing devices), but also for programmers who develop software packages/systems on the computing infrastructure. This course will cover the major hardware and software aspects of advanced computer systems. On the hardware aspect, this course will cover the key techniques and design principles of CPU, cache and memory, and solid-state data storage. On the software aspect, this course will span over important software system design concepts including consistency, concurrency, transaction, and indexing. This course will also cover the design and implementation of advanced in-memory database, filesystem, and distributed computing systems. This course will further discuss the future trends in the semiconductor and computing industry in the post-Moore era.

ECSE 4962/6962 **FUNDAMENTALS OF RF/MICROWAVE ENGINEERING** - Fundamentals of RF/microwave engineering. Study of noise, linearity, transmission lines, impedance matching. Working with S-parameters and experiment with the use of Smith chart. Introduction to microwave CAD tools for 2D and 3D electromagnetic simulations and microwave testing. The course will cover passive and active microwave circuits such as low noise amplifiers, filters, mixers, and power amplifiers. Emphasis on intuitive design methods, physical understanding, quantitative performance evaluation using both hand calculations and EM simulations. A module on RF measurements will include multiple labs to characterize basic building blocks.

 Two projects, one on a passive microwave device (ideal simulations and extracted electromagnetic simulations using Keysight ADS), and the second on a building an RF receiver or transmitter and characterize it using a network and a spectrum analyzer.

ECSE 4963/6963 **NETWORKS AND NETWORKED SYSTEMS** - Networks and networked systems are ubiquitous in our everyday lives, emerging from social and economic connections as well as networked engineering systems. This course focuses on modeling and analyzing the behavior of complex networks and networked systems, and controlling and optimizing such networks to attain desired system properties and performance goals. This course will cover the mathematical tools and techniques commonly used in analysis of such networks, which include graph models and algorithms, network flows and optimization, distributed control, queueing theory, and network game theory. These analysis methods will be discussed in the context of common networked structures and systems that exist today, such as the Internet and wireless networks, social networks, power distribution networks, transportation networks, online search networks.

ECSE 6965 **RENEWABLE ENERGY CONVERSION AND GRID INTEGRATION** - This graduate-level course teaches the conversion and control of solar and wind energy and its integration into the power grid. Topics include fundamentals of photovoltaics and wind energy conversion; power electronics for renewable energy; solar inverters and solar energy system architectures; wind turbines based on full power conversion and doubly fed induction generators; grid interconnect requirements and grid support functions; high-voltage dc technology for renewable energy transmission; and renewable energy system modeling, stability and control.

ENVE 4961 **ENVIRONMENTAL IMPACT ANALYSIS** - Studies related to the evaluation of the impacts of major actions by state and federal agencies on the quality of human environment. Consideration is given to the preparation of impact statements. The impacts of various types of action are discussed; the adverse effects produced and alternatives to proposed action considered, and the tradeoffs between short-term uses and long-term productivity are evaluated. Case studies are presented and analyzed.

ITWS 4960/6960 **DATA AND SOCIETY** - Data and Society provides a board overview of how society is leveraging and responding to the social, organizational, policy, and technical opportunities and challenges of a data-driven world. Course themes focus on various aspects of the data ecosystem, data and innovation, and data and the broader community. Assignments build writing, presentation, and critical thinking, and assessment skills, all of which are important for professional success. This is a communication-intensive course.

MATH 6960 **APPLIED STOCHASTIC DIFFERENTIAL EQUATIONS** - The course focuses on the development of mathematical frameworks for analyzing complex dynamical systems where some interactions are modeled statistically.

Techniques from stochastic differential equations and other stochastic process theory are developed and illustrated in applications drawn from finance, the natural sciences, and optimization.