

## Courses Description

**College:** Engineering

**Department:** Electrical Engineering

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**Course ID:** 2204091701      **Description:** Stochastic Processes

**Full Course Description:** Review of probability and random variables. Moments and characteristic function. Random vectors. Random processes: definition of a random process, specifying a random process, examples of random processes, stationary and wide-sense stationary processes, cyclo-stationary processes, mean and autocorrelation functions, power spectral density, time averages and ergodicity, response of linear systems to random signals. Optimum linear systems. Markov chains. Introduction to queueing theory. Poisson processes. Brownian motion process. Introduction to stochastic geometry.

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**Course ID:** 2204091702      **Description:** Advanced Linear System Theory and Applications

**Full Course Description:** Matrix theory and mathematical fundamentals for analysis of linear systems, Effect of round-off error. Maps and operators in finite and infinite dimensional linear vector spaces, metric spaces, and inner-product spaces. Introduction to representation theory. Eigen systems, Spectral theorems and singular value decomposition. Continuity, convergence and separability. Sturm-Louisville theory, Cayley-Hamilton Theory, Least square solution of unsolvable systems.

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**Course ID:** 2204091703      **Description:** Introduction to Optimization Methods in Engineering

**Full Course Description:** The course introduces the fundamentals of optimization problem techniques, including the formulations of the optimization problems and their applications in engineering, and the potential methods to solve the optimization problems. Specifically, this course will cover the following topics: convex and nonconvex optimization problems (including both linear and nonlinear formulations), Stochastic optimization, Numerical algorithms for both unconstrained and constrained optimization problems, forecasting and optimization (Receding horizon optimization methods), Selected applications of the optimization techniques in electrical engineering filed, such as resource allocation techniques. This course will include simulation projects.

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**Course ID:** 2204091704      **Description:** Smart and Micro grid technologies

**Full Course Description:** Introduction to smart and micro-grid, distributed generation systems, the impact of renewable energy and Energy storage systems on the power grid and fault calculations, SCADA systems, Smart meters and data Communications in smart grid, Communication technologies for the smart grid, Information security for the smart grid, load forecasting for smart grid.

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**Course ID:** 2204091705      **Description:** Programming Simulation and modelling

**Full Course Description:** Hands on elementary skills of programming (MATLAB, Python, R, etc.). The hands-on construction of simulation models using Generating Uniform random numbers using Linear Congruential methods. Tests of randomness including Frequency and Serial tests and Lattice behavior. Generating Random Variates from distributions: Inversion of the cumulative distribution function and Rejection methods. Generating variates from standard distributions including normal, gamma, beta, Poisson, binomial. Theory and simulation of Poisson and other birth-death processes. Discrete event simulation: Entity, Event, Activity, Attribute, and Set. Event and Three-Phase approaches to model construction. Design and analysis of experiments: Use of random number seeds. Variance Reduction including Antithetic and Control Variates. Analysis of autocorrelated output data.

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**Course ID:** 2204091706      **Description:** Research Methods

**Full Course Description:** This course will cover the ethics of graduate research as well as the necessary skills and background required to conduct basic and advanced research in Electrical Engineering. Students will learn how to write and present various types of research documents including proposals and technical reports.

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**Course ID:** 2204091715      **Description:** Advanced Analysis of Electrical Machines and Drive Systems

**Full Course Description:** This course provides an in-depth analysis of electric machines, the drive systems and the dynamic behavior of electric machines. Topics include the dynamic model of DC and AC machines, simulation models and control for stability analysis. Power electronic drives for speed and torque control of machines, transients and dynamics of DC and AC machines along with an electromagnetic transient simulation program.

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**Course ID:** 2204091716      **Description:** Simulation of Communication Systems

**Full Course Description:** Fundamental and advanced concepts of simulation and its key elements of modeling, analysis and design, modeling of the elements of a communication systems such as filters, signals and transmission media including multipath channels, satellite channels and optical fiber, statistical estimation of performance measures such as spectral estimation, average power, error probabilities.

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**Course ID:** 2204091717      **Description:** Advanced Analysis and Control of Power Systems

**Full Course Description:** The course aims to provide advanced knowledge about stability problems and dynamic mechanisms in electric power and controller design for power systems based on state-of-the-art computer-based methods and tools for dynamic analysis of power system transients including simulation of various aspects of power system stability phenomena like subsynchronous resonance and voltage collapse. The effect of various FACT devices on dynamics, control and stability of power system is included.

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**Course ID:** 2204091718      **Description:** Error Control Coding

**Full Course Description:** Introduction to linear algebra: groups, rings, finite fields, vector spaces, linear block codes: Hamming codes, cyclic codes and linear shift register circuits, burst error correcting and error trapping, BCH and Reedsolomon codes, introduction to trellis codes, convolutional codes, turbo codes with applications.

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**Course ID:** 2204091719      **Description:** Power System Economics Markets & Asset Management

**Full Course Description:** This class will present and give an understanding of the economics, trading and pricing of electricity supply and how it is shaped by technical, commercial and regulatory considerations. It will give you an understanding of power system economics under an environment of multiple suppliers and users, and present the challenges, technologies and value of asset management within an electricity supply industry context. The course will provide a perspective on power policy models and train the participant to look at technical issues of power system operation simultaneously with the economic aspects.

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**Course ID:** 2204091720      **Description:** Advanced Topics in Wireless Communications

**Full Course Description:** This course will cover recent developments in wireless communication systems. Diversity, equalization, smart antennas, Interference suppression and signal separation in multiuser systems. OFDM using DFT/IDFT, Coded-OFDM. MIMO Channel model and detection, parallel decomposition of MIMO channel, optimal beamformer, orthogonal block space-time codes. The basics of 5G, spectrum for 5G, LTE overview, NR overview, overall transmission structure, Bandwidth parts and frame structure.

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**Course ID:** 2204091721      **Description:** Advanced Power Protection system

**Full Course Description:** To provide students with an advanced and systematic understanding of the protection requirements for transmission and distribution networks; components of a protection system; types of protection relay; principles of protection, unit protection schemes, non-unit protection schemes. Advanced Protection topics; selected material from a range of topics including, but not limited to; coordinated power system protection schemes, advanced measurement devices, the impact of Renewable energy sources on fault calculations and protection model design, optimization methods for power system protection schemes coordination.

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**Course ID:** 2204091722      **Description:** Applications of Machine Learning in

**Full Course Description:** This course motivates to deliver a general introduction and fundamentals of machine learning followed by the application of machine learning in the design of physical layer techniques in wireless communications and in the optimization of mobile networks. The fundamentals of machine learning techniques will be discussed, namely deep neural network (DNN) and reinforcement learning. In addition, this course covers the ideas of supervised and unsupervised learning. Furthermore, the applications of machine learning in wireless communication systems will be also discussed. These applications include channel detection, solving resource allocation problem, recognition problems, and the applications of machine learning in Internet of thing (IoT) systems.

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**Course ID:** 2204091723      **Description:** Energy Resources and Environment

**Full Course Description:** Classification of various energy sources, Renewable and non-renewable energy sources, Pattern of energy consumption. Effects of air pollutions, Atmospheric dispersion, Environmental effects of fossil fuels . Principles of sustainable energy and environment management. Methods for evaluation of large and complex sustainable energy systems. Building studies and comparisons on energy systems and the sustainable energy mixes.

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**Course ID:** 2204091724      **Description:** Communications and networking for Internet of Things

**Full Course Description:** Introduction to communication networks and the OSI model. IoT components and architecture. Technologies in each layer of the architecture. Sensors and Sensing technology. Data transmission and connectivity. Building IoT platforms. IoT specific data processing and analytics. IoT and open data. IoT user interface issues including data models and semantics. Applications of IoT including smart cities, smart homes; Ongoing and future IoT challenges. Green wireless communications and networks, Green wireline communications. Energy harvesting and storage. RF wireless power transfer. Security and energy efficiency.

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**Course ID:** 2204091725      **Description:** Solar Cells and Photovoltaic Energy Systems

**Full Course Description:** This course will provide students with Introduction to semiconductor physics and solar cells operation, describe the technologies and manufacturing processes of different types of Solar cells and electrical characteristics, understand the fundamentals and the importance of Photovoltaic system, educate the Analyze/Design Off-grid and On-grid PV systems and the pay-back period calculations using many software tools, knowledge on laws, codes and standards associated with PV energy systems, Case Study project.

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**Course ID:** 2204091726      **Description:** Satellite Communications Networks and Applications

**Full Course Description:** Satellite communications networks and applications from system and service perspectives. Learn the fundamentals, architecture, and development of modern satellite networks, with emphasis on cutting-edge broadcast, broadband interactive, and mobile applications. satellite and ground station principles, basic satellite link budgets, digital image and full-motion video for broadcast distribution using the MPEG 4 and DVB-S2 and DVB-S2x standards and extensions, Internet Protocol (IP)-based data performance optimization over satellite; Ku- and Ka-band Very Small Aperture Terminals (VSATs); and advanced broadband capabilities of high throughput satellite systems currently in use and under development.

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**Course ID:** 2204091727      **Description:** Electric Power Quality

**Full Course Description:** The theory and analysis of electric power quality for commercial, industrial and residential power systems. Specific topics include harmonics, voltage sags, wiring and grounding, instrumentation, distributed generation and power electronic systems. Case studies complement the theoretical concepts. Overview of the related industry and government regulations for power system protection and reliability.

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**Course ID:** 2204091728      **Description:** Fourier Optics

**Full Course Description:** This course will focus on how Fourier transformation and linear system theory are used to understand optical systems. Transfer functions and convolution will be applied to signals and electro-optical systems. Furthermore, different kinds of diffraction which affects the way light is collected and focused will be studied, such as Fresnel, Fraunhofer, Rayleigh Summerfeld and Kirchoff diffractions. Coherent optical systems, optical imaging systems and holography will be studied too.

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**Course ID:** 2204091729      **Description:** Design of Advanced Power Distribution Systems

**Full Course Description:** Design considerations of electric power distribution systems, including distribution transformer usage, distribution system protection implementation, primary and secondary networks design, applications of advanced equipment based on power electronics, and use of capacitors and voltage regulation.

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**Course ID:** 2204091730      **Description:** Advanced Mixed-Mode Integrated Circuit Design

**Full Course Description:** This course covers electrical system building blocks that link analog and digital worlds in integrated circuits. Such structures include CMOS analog and digital Integrated Circuits, Models for analog and digital designs, Channel length modulation, Designing combinational CMOS logic gates, RC-delay model, Capacitance of CMOS, Inverter delay estimate for complex logic gates, Digital phase-Locked loop, Phase detector, Voltage-controlled oscillator, Loop filter, Delay-locked loops, Digital-to-analog converters (DAC), Differential and Integral Nonlinearity, Signal-to-Noise Ratio, Dynamic Range, Analog-to-digital converters (ADC), Quantization error, Sample-and-hold S/H, Integrating ADC, Successive Approximation, Wide-swing current mode, Topologies without Op-Amp, methodologies to carry out mixed-mode design utilizing computer- aided design (CAD) software tools to improve the quality of mixed-signal IC designs.

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**Course ID:** 2204091731      **Description:** Advanced Grid Connected Power Electronics

**Full Course Description:**

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**Course ID:** 2204091732      **Description:** CMOS Integrated Circuit Design

**Full Course Description:** CMOS Principles, Operation and fabrication, Wafer manufacture, Doping processes, Photolithography, Metallization, Modeling of MOSFETs in CAD tools, Temperature and Voltage coefficients, Interdigitated and common-centroid layouts, Oxide encroachment, Short- and long-channel MOSFETs, Square-law equations, Body effect, Small signal models, Noise Modeling, Effective switching resistance, Delay and transition times, Pass gates, Switching characteristics, Static Logic Gates, complex logic gates (characteristics and layout), Current Mirror, Matching currents in the mirror, Biasing the current mirror, Cascoding the current mirror, Voltage Reference, and Parasitic Diode-based references.

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**Course ID:** 2204091733      **Description:** Power Semiconductor devices

**Full Course Description:** Physics of operation of power semiconductor devices and wide bandgap materials that are commonly used in power electronic circuits. Various models for some power semiconductor devices are discussed.

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**Course ID:** 2204091734      **Description:** Quantum Computing

**Full Course Description:** This course is an introduction to quantum computing. It will include quantum state spaces, quantum gates, quantum state transformations, quantum versions of classical computations, quantum subroutines, quantum algorithms, quantum error correction. Students will run quantum computing simulations on the IBM Quantum Experience, IBM cloud-based quantum prototype processors. No previous exposure to quantum physics is required.

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**Couse ID:** 2204091735      **Description:** Energy Management and Audit

**Full Course Description:** This module focuses on techniques for auditing and managing the amount of energy used in a range of industrial processes. The module will provide an understanding of the strategies and procedures of energy audit and energy asset management. The module will cover the following areas: Energy consumption, prices, costing and tariffs. Overview of renewable energy sources, energy storage, transmission and distribution and the impact upon energy use in systems. Equipment used for monitoring energy use within installations and their effectiveness. The principles of energy audit, the audit process and reporting. Economics of energy audit, including energy accounting and analysis carried out to measure effectiveness of changes. The role of energy audit in developing energy conservation and sustainability strategies.

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**Couse ID:** 2204091736      **Description:** Modern Wireless Networking

**Full Course Description:**

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**Couse ID:** 2204091799      **Description:** thesis

**Full Course Description:**

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**Couse ID:** 2204093799      **Description:** thesis

**Full Course Description:**

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**Couse ID:** 2204096799      **Description:** thesis

**Full Course Description:**

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**Couse ID:** 2204099799      **Description:** Thesis

**Full Course Description:**