FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

Bachelor of Science (BS) Degree – 109 Credits

Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
1	CSIS 206	Principles of Programming	3		
1	ELCP 211	Engineering Drawing	1		
1	ELEN 201	Instrumentation Lab	1		
1	ENGL 203	English Communication Skills III	3		
1	MATH 200	Calculus I	3		
1	MATH 211	Linear Algebra I	3		
1	ELCP 290	Introduction to the Engineering Design Fundamentals	1		
1		Engineering Breadth Elective	3		
Sem	**Course Code**	**Course Title**	**Credit**	**Pre-Req**	**Co-Req**
2	GENG 221	Engineering Ethics	3	ELCP 290 ENGL 203	
2	ENGL 2XX	English Elective	3	ENGL 203	
2	CPEN 211	Introduction to Digital Logic Design	3	CSIS 206	
2	ELEN 202	Electrical Simulation and Design	1	CSIS 206	ELEN 221
2	ELEN 221	Circuits Analysis I	3	MATH 200 MATH 211 ELEN 201	ELEN 202
2	MATH 202	Calculus II	3	MATH 200	
2	MATH 270	Differential Equations	3	MATH 200	
Sem	**Course Code**	**Course Title**	**Credit**	**Pre-Req**	**Co-Req**
3	CPEN 202	Logic Lab	1		CPEN 212
3	CPEN 212	Logic Circuits	3	CPEN 211	CPEN 202
3	CPEN 220	Programming for Engineering Solutions	3	CSIS 206	MATH 230
3	ELEN 222	Signals and Systems Theory	3	ELEN 221 MATH 270	
3	ELEN 223	Electricity and Electromagnetism	3	ELEN 221 MATH 202 MATH 270	
3	ELEN 231	Electronics I	3	ELEN 221	

3	MATH 230	Numerical Analysis I	3	MATH 200 CSIS 206	
Sem	**Course Code**	**Course Title**	**Credit**	**Pre-Req**	**Co-Req**
4	LISP 200	Information Skills and Search Techniques	1		ENGL 102
4	GENG 222	Sustainable Development for Engineers	3	ENGL 203 ELCP 290	
4	ELEN 303	Circuits Analysis Lab	1	ELEN 221	
4	ELEN 304	Electronics Lab	1	ELEN 231	
4	CPEN 213	Microprocessors	3	CPEN 212	
4	ELEN 324	Circuits Analysis II	3	ELEN 221	
4	ELEN 332	Electronics II	3	ELEN 231	
4	MATH 246	Probability for Engineers	3	MATH 200	
Sem	**Course Code**	**Course Title**	**Credit**	**Pre-Req**	**Co-Req**
5		Elective	3		
5		Elective Lab	1		
5	CSPR XXX	Cultural Studies	3		
5	CPEN 305	Microcontrollers Lab	1	CPEN 213	
5	ELEN 341	Telecommunications	3	ELEN 222 MATH 246	
5	ELEN 350	Control Systems	3	ELEN 222	
5	ELEN 361	Electric Machines	3	ELEN 223	
5	ELCP 391	Senior Design 1	2	ELCP290 LISP200 GENG 221 GENG 222	
Sem	**Course Code**	**Course Title**	**Credit**	**Pre-Req**	**Co-Req**
6		Elective	3		
6	ELEN 306	Telecommunications Lab	1	ELEN 341	
6	ELEN 308	Electric Machines Lab	1	ELEN 361	
6	ELEN 325	Electrical Installations	3	ELEN 303	
6	ELEN 326	Digital Signal Processing	3	ELEN 222	
6	ELEN 362	Power Electronics	3	ELEN 231 ELEN 361	
6	ELCP 392	Senior Design 2	2	ELCP 391	
		TOTAL	**109**		

Engineering Breadth Elective (3 credits from the following list):					
	CIVE 201	Statics	3		
	MECH 221	Engineering Dynamics	3	CIVE 201	
	MECH 232	Thermodynamics	3		
Elective Lab (1 credit from the following list):					
	CPEN 307	PLC Lab	1		CPEN 324
	CPEN 309	Embedded Controllers Lab	1		CPEN 313
	CPEN 310	Cybersecurity Lab	1		
	ELEN 307	Control Lab	1		
Electives (6 credits from the following list):					
	BMEN 301	Introduction to Biomedical Engineering	3		
	CPEN 241	Information Networking I	3		
	CPEN 313	Computer Embedded Systems	3	CPEN 212	CPEN 309
	CPEN 314	Computer Architecture	3	CPEN 313	
	CPEN 324	Programmable Logic Controllers	3		CPEN 307
	CPEN 341	Cybersecurity	3		
	CPEN 349	Artificial Intelligence for Engineers	3	CSIS 206	
	ELEN 340	Signal Transmission	3	ELEN 223	
	ELEN 351	Digital Control Systems	3	ELEN 350	
	GENG 311	Engineering Management and Economics	3		

COURSE DESCRIPTIONS

BMEN 301 INTRODUCTION TO BIOMEDICAL ENGINEERING 3.0: 3 cr. E

This course provides an overview of applications of engineering in medicine. Topics covered include basic biology and engineering problems associated with living systems and health care delivery; introduction to biomedical problems using fundamental concepts and tools from electrical, mechanical, and chemical engineering. Examples will be used to illustrate how basic concepts and tools of science and engineering can be brought to bear in understanding and simulation of biological processes.

BMEN 467 MUSCULOSKELETAL BIOMECHANICS 3.0: 3 cr. E

This course presents an integrated approach to the study of human movement. Fundamental mechanical principles will be reviewed, with subsequent application to the major joints and structures of various regions of the human body, resulting in an understanding of and appreciation for total body movement and the integration of biomechanics with other exercise and sport science disciplines.

ELCP 211 ENGINEERING DRAWING 0.3: 1 cr. E

This course prepares students to use AutoCAD to create complete, concise, and accurate engineering drawings. Students will also use the AutoCAD Electrical Toolset that offers automated drafting tools for designing wiring, circuiting, PLC modules, panels and more. They will also learn the interface and the workflow of developing accurate electrical schematics and drawings.

ELCP 290 INTRODUCTION TO THE ENGINEERING DESIGN FUNDAMENTALS 3.0: 1cr. E

This course serves as a general introduction to the engineering profession, its main objectives, and concerns. It introduces the engineering design process, its phases, challenges and constraints, the qualities, and attributes of a modern-day engineer as expected by professional engineering societies, including integrity, professionalism, ethical commitment, and environmental requirements, as well as the role of the engineer in society. In addition, students will be introduced to project management skills, technical writing, and effective multidisciplinary teamwork. The course aims to set students on the way to future design and professional work in Electrical and Computer Engineering.

ELCP 391 SENIOR DESIGN 1 0.3: 2 cr. E

This course constitutes the first semester of a year-long culminating senior design project. In the course, small groups of two to four students are requested to form multidisciplinary teams and solve a relatively open-ended engineering design problem. Each team follows an iterative design process to propose a system/solution that meets the desired requirements, specifications, and constraints. The design should abide to the appropriate realistic constraints i.e., ethical, environmental, financial, safety health and technical, as well as the set standards, codes, and protocols. Students employ engineering design tools, documentation and previously acquired Engineering, Science and Mathematics knowledge for the complete conceptual phase of the design process. Namely, (1) understanding and formulating the problem (objectives, scope, elements, purpose), (2) define the design constraints and specifications (3) Performing a literature review and gathering the appropriate technical documentations, (4) analyzing the various components of the system, (5) selecting the appropriate hardware/software needed and (6) proposing a solution. At the end of the semester, teams will present a detailed design and convey to the public their findings through a comprehensive report that synthesizes all steps of the design process and exhibits individual team members' contributions.

Pre-requisites: ELCP 290, LISP 200, GENG 221, GENG 222

ELCP 392 SENIOR DESIGN 2 **0.3: 2 cr. E**

This course constitutes the second semester of a year-long culminating senior project. In this sequel course to ELCP391, the teams of students must complete the chosen capstone projects to complete the second phase of the design process namely, (1) carry on the culminating design by synthesis and analysis, and (2) build, test, and evaluate the physical/virtual model. At the end of the semester, teams will present/demonstrate their final design prototype/product and convey to the public their findings through a comprehensive report and presentation that synthesizes all steps of the design process and exhibits individual team members' contributions.

Pre-requisite: ELCP 391

ELEN 201 INSTRUMENTATION LAB **0.3: 1 cr. E**

This laboratory provides an introduction on the use of multi-meters, oscilloscopes, function generators, power supplies and other instrumentation. Applications include solenoids, resistors, capacitors, periodic signals analysis, RC, RL, and RLC circuits; balanced bridge circuit.

ELEN 202 ELECTRICAL SIMULATION AND DESIGN **0.3: 1 cr. E**

This course introduces electrical engineering students to static electric and magnetic fields basic laws such as Coulomb, Faraday, Gauss, Ampere, Biot-Savart, and boundary conditions which leads to the ability of deriving Maxwell's equations. In addition, deep theoretical insights will be given to electromagnetic related issues such as energy, potential, current, magnetic force/torque, magnetic vector potential, and magnetic circuits.

Co-requisite: ELEN 221
Pre-requisites: CSIS 200 or CSIS 206

ELEN 221 CIRCUITS ANALYSIS I **3.0: 3 cr. E**

This course provides students with a basic understanding of electrical circuit theory. Topics covered include fundamental definitions and laws; resistive circuit analysis; mesh and nodal analysis; RL, RC, and RLC circuit analysis; DC/AC analysis; Thevenin and Norton theorems.

Co-requisite: ELEN 202
Pre-requisites: ELEN 201, MATH 200, MATH 211

ELEN 222 SIGNALS AND SYSTEMS THEORY **3.0: 3 cr. E**

This course covers continuous-time and discrete-time signal transformations and system classifications; Linear Time Invariant system analysis (convolution and ordinary differential/difference equation); Fourier series; Fourier transform; Laplace transform; and z-transform.

Pre-requisites: ELEN 221, MATH 270

ELEN 223 ELECTRICITY AND ELECTROMAGNETISM **3.0: 3 cr. E**

This course introduces electrical engineering students to static electric and magnetic fields basic laws such as Coulomb, Faraday, Gauss, Ampere, Biot-Savart, and boundary conditions which leads to the ability of deriving Maxwell's equations. In addition, deep theoretical insights will be given to electromagnetic related issues such as energy, potential, current, magnetic force/torque, magnetic vector potential, and magnetic circuits.

Pre-requisites: ELEN 221, MATH 202, MATH 270

ELEN 231 ELECTRONICS I **3.0: 3 cr. E**

This course covers the physics and operation of semiconductor devices such as diodes and transistors. It also covers two-port networks, small-signal models, operational amplifiers, and circuit analysis at intermediate frequencies.

Pre-requisites: ELEN 221

ELEN 303 CIRCUITS ANALYSIS LAB **.3: 1 cr. E**

This laboratory prepares students to verify the basic laws of circuit analysis by designing, analyzing, and implementing DC/AC networks.

Pre-requisites: ELEN 221

ELEN 304 ELECTRONICS LAB **0.3: 1 cr. E**

This laboratory provides practical experience in telecom through a series of experiments in analog communications and illustrates various methods of modulation/demodulation of an information signal, namely, AM, DSB, SSB, FM, and stereophonic FM.

Pre-requisite: ELEN 231

ELEN 306 TELECOMMUNICATIONS LAB **0.3: 1 cr. E**

This laboratory work includes oscillators, AM, FM modulation and demodulation, detectors, phase locked loops, AM receivers, ASK, PSK modulators and receivers; effects of white noise on binary signals; signal degradation and filtering; fiber optics.

Pre-requisite: ELEN 341

ELEN 307 CONTROL LAB **0.3: 1 cr. E**

This laboratory analyses, simulates, and designs LTI systems and then verifies experimentally. It primarily determines the time constant of a 1st order, the dampness of a 2nd order, and the stability of a 3rd order systems. The students design and build analog computers to emulate real physical systems. The lab also covers the design and implementation of classical and modern controllers (PID, phase compensation, SFC). The students use MATLAB/Simulink and NI Multisim for simulation. They also use Quanser's Rotary Servo and Ball-and-Beam modules to model, design, simulate, and implement control systems.

Pre-requisite: ELEN 350

ELEN 308 ELECTRIC MACHINES LAB **0.3: 1 cr. E**

This laboratory covers electric machines where the students tend to do electrical and mechanical measurements and basic operation characteristics of transformers (single and three phase), DC machines used as motor and as generators and AC machines (induction and synchronous).

Pre-requisite: ELEN 361

ELEN 324 CIRCUITS ANALYSIS II **3.0: 3 cr. E**

This course covers characteristics of sinusoids; phasor relationships; instantaneous and average power; RMS values, complex power, and power measurements; Three-phase Circuit Analysis, magnetically coupled networks; ideal transformers; frequency response; MultiSim applications of all topics.

Pre-requisites: ELEN 221

ELEN 325 ELECTRICAL INSTALLATIONS **3.0: 3 cr. E**
This course exposes students to residential and industrial wiring systems and techniques in conformance with the National Electrical Code (NEC) and local codes.

Pre-requisite: ELEN 303

ELEN 326 DIGITAL SIGNAL PROCESSING **3.0: 3 cr. E**
This course covers sampling, quantization, and reconstruction of signals; Discrete Fourier Transform (DFT); z-transform analysis. It also introduces the design of IIR, FIR, and recursive digital filters by transforming a suitable continuous filter (Butterworth, Chebyshev type I and II) to satisfy the given digital specifications (Impulse Invariant method, Bilinear Transformation).

Pre-requisite: ELEN 222

ELEN 332 ELECTRONICS II **3.0: 3 cr. E**
This course covers the behavior and operating limitations and efficiency of operational amplifiers, multistage amplifiers, current mirrors, feedback amplifiers, power amplifiers, low and high-frequency amplifications, active filters, and large-signal and small-signal behavior and limitations of differential amplifiers.

Pre-requisite: ELEN 231

ELEN 340 SIGNAL TRANSMISSION **3.0: 3 cr. E**
This course covers the principles of field theory. Topics include solution of boundary value problems in electromagnetic using both analytic and numerical techniques; transmission line concepts; Smith charts and design tools for distributed circuits; conducting and dielectric guiding structures for waves; radiation from antennas; low frequency applications.

Pre-requisite: ELEN 223

ELEN 341 TELECOMMUNICATIONS **3.0: 3 cr. E**
This course covers the principles of bandpass analog communication; linear demodulation AM, DSB, SSB, VSB; envelope detection, coherent/non-coherent demodulation, super-heterodyne receiver; angular (nonlinear) modulation, Phase Modulation (PM), Frequency Modulation (FM), angular demodulation, different types of discriminators pre-emphasis and de-emphasis, and performance analysis using Signal to Noise Ratio (SNR), and Frequency Division Multiplexing (FDM). It also involves the study of some baseband digital signaling such as the pulse modulation, PAM, PWM, PPM, PCM, Line coding, and Time Division Multiplexing (TDM).

Pre-requisites: ELEN 222, MATH 246

ELEN 349 INTRODUCTION TO CONTROL SYSTEMS **3.0: 3 cr. E**
This course covers continuous-time signal types and transformations; system classifications and analysis in both time and frequency domains; Laplace transform pairs, properties, and applications; Linear Time Invariant real physical dynamical continuous-time systems analysis such as convolution and ODE; block diagram algebra and signal flow graph; stability analysis techniques (Routh-Hurwitz stability test); state space analysis; classical control systems design (PID and phase compensation).

Pre-requisites:

- For Electrical Engineering Students: MATH 270, ELEN 202, ELEN 221
- For Mechanical Engineering Students: MATH 270, MECH 241, MECH 231

ELEN 350 CONTROL SYSTEMS 3.0: 3 cr. E

This course covers control systems analysis and design; block diagram algebra and signal flow graph; stability analysis and the Routh-Hurwitz stability test, root locus, time and frequency domains design criterion; Bode, Nyquist, and Nicholas plots; Gain and Phase Margins; classical control design (PID and phase compensation); state space analysis and design.

Pre-requisites: ELEN 222

ELEN 351 DIGITAL CONTROL SYSTEMS 3.0: 3 cr. E

This course covers discrete-time Linear Shift-Invariant (LSI) real physical dynamical system analysis and discrete control systems design; discrete-time signal conversion and processing; sampling theorem; stability analysis techniques (Jury stability criterion); root locus; z-transform; discrete equivalents; classical (PID, phase compensation) and modern (state feedback) discrete-time control systems design.

Pre-requisite: ELEN 350

ELEN 360 ELECTRIC MOTORS AND DRIVES 3.0: 3 cr. E

This course covers the fundamentals of electromagnetic circuits; AC three-Phase Circuits; Construction and operation: fundamentals of AC machines, operation of Synchronous generators; induction motors: construction and principle of operation, power, torque, and efficiency; AC drives: starting and speed regulation, plugging and regenerative breaking; DC motor types and control strategies, stepper motors: types, operational characteristics, drivers configurations.

Pre-requisites:

- For Electrical Engineering Students: MATH 211, ELEN 221
- For Mechanical Engineering Students: MATH 211, MECH 231

ELEN 361 ELECTRIC MACHINES 3.0: 3 cr. E

This course covers Faraday's law applied to magnetic circuits and transformers; per unit system; energy balance and electromechanical conversion processes; analysis of reluctance machines; three-phase and single-phase induction motors; synchronous motors and generators; DC motors and generators; fractional horsepower motors.

Pre-requisites: ELEN 223

ELEN 362 POWER ELECTRONICS 3.0: 3 cr. E

This course covers the applications of power semiconductor devices; circuit analysis; signal analysis and energy of AC/DC, DC/DC, DC/AC, AC/AC conversions. These generic converters are applied as controlled rectifiers, switching power supplies, motor drives, HVDC transmission, induction heating, and others.

Pre-requisite: ELEN 231

FACULTY OF ENGINEERING GENERAL COURSES

GENG 221 ENGINEERING ETHICS **3.0: 3 cr. E**

This course introduces and reinforces the concepts, theories, and practice of engineering ethics and aims at providing basic knowledge of ethics for engineers in different types of work roles. It prepares the engineering students for identifying, taking responsibility for, and finding solutions to potential ethical problems/cases. It provides students with an interactive study of ethical theory and the development of professionalism and helps them think more clearly and deeply about ethical issues of the natures that engineers often face in professional practice, and explore resources, strategies, and options for dealing with such complications. Students review case studies of ethical conflicts in engineering practice. The course also covers engineering codes of ethics and requires students to resolve theoretical situations through the application of ethical codes.

(A core BS course as of 2023/24 to replace a CSPR XXX course for students who started from year 2022/2023. Previous students can take it as an equivalent of a CSPR XXX course if they have not already taken the required 3 CSPR XXX courses)

Pre-requisite: CHEN/CIVE/ELCP/MECH/290 (according to discipline), ENGL 203

GENG 222 SUSTAINABLE DEVELOPMENT FOR ENGINEERS **3.0: 3 cr. E**

This course introduces the fundamental and advanced concepts of sustainable development. It transitions students' understanding of the UN Sustainable Development Goals (SDGs) to focus specifically on the critical role of engineers in achieving these SDGs. Students should then be able to resolve problems by adopting sustainability principles, which should in turn reflect on the students' multidisciplinary design ability to ensure a proper sustainable design process to improve and preserve the quality of life for future generations.

(A core BS course as of 2023/24 to replace a CSPR XXX course for students who started from year 2022/2023. Previous students can take it as an equivalent of a CSPR XXX course if they have not already taken the required 3 CSPR XXX courses)

Pre-requisite: CHEN/CIVE/ELCP/MECH/290 (according to discipline), ENGL 203

GENG 311 ENGINEERING MANAGEMENT AND ECONOMICS **3.0: 3 cr. E**

Engineers with excellent managerial skills and superior economic acumen are needed as leader of the new century engineering world. This course prepares engineers to fulfill their managerial responsibilities and acquire useful economic perspectives. This course is organized to contain two major parts: (I) Functions of engineering management, and (II) Economic fundamentals for engineering managers. Part (I) introduces the basic functions on engineering management such as planning, organizing, leading and controlling, while part (II) covers the fundamentals of engineering economics.

Refer to General Listing of Course Descriptions for:

CPEN XXX
Refer to the Department of Computer Engineering

CSIS XXX
Refer to the Faculty of Arts and Sciences

CSPR XXX
Refer to the Faculty of Arts and Sciences

ENGL XXX
Refer to the Faculty of Arts and Sciences

ENMG XXX
Refer to the Faculty of Engineering

GENG XXX
Refer to the Faculty of Engineering

LISP XXX
Refer to the Faculty of Arts and Sciences

MATH XXX
Refer to the Faculty of Arts and Sciences

MECH XXX
Refer to the Department of Mechanical Engineering