



FACULTY OF ENGINEERING



DEPARTMENT OF COMPUTER ENGINEERING

Master of Science (MS) Degree – 46 Credits

The Master of Science (MS) in Computer Engineering degree is 46 credits after the BS of which 37 are the transition credits from the BS program to the BE program and an additional minimum of 9 credits.

Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
7	ELEN 401	Optimization Theory	3		
7	GENG 450	Advanced Engineering Analysis and Research Methods	3		
7		Directed Elective	3		
7		Directed Elective	3		
7		Specialized Area Course	3		
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
8	ELEN 402	Stochastic Theory	3		
8	GENG 599	Master's Thesis	6	GENG 450	
8		Specialized Area Course	3		
8		Specialized Area Course	3		
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
9	CPEN 480	Field Training	3		
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
10	ELEN 400	Linear Systems	3		
10	GENG 400	Engineering Seminars	1		
10	GENG 599	Master's Thesis (Reactivation)	0		
10		Specialized Area Course	3		
10		Specialized Area Course	3		
10		General Elective	3		
Sem	Course Code	Course Title	Credit	Pre-Req	Co-Req
11	GENG 599	Master's Thesis (Reactivation)	0		
		TOTAL	46		

Directed Electives (6 credits from the following list):					
	CPEN 441	Information Networking II	3	CPEN241	
	CSIS 375	Software Engineering	3		
	ELEN 417	Measurement Systems	3		
	ELEN 443	Digital Communication	3		

COURSE DESCRIPTIONS

CPEN 425 NEURAL NETWORKS DESIGN

3.0: 3 cr. E

This course focuses on Neural dynamics: architecture and signals, activation model, unsupervised learning, supervised learning, architectures and equilibrium. It also covers the Hopfield model and recurrent networks; the self-organizing map and Adaptive resonance theory.

CPEN 426 DEEP LEARNING

3.0: 3 cr. E

This course introduces students to the theory and practice of deep learning, a subfield of machine learning that involves training artificial neural networks with multiple layers. Topics include Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Generative Adversarial Networks (GAN), autoencoders and Reinforcement learning. In this course, students will gain hands-on experience with deep learning algorithms and frameworks, and learn how to apply them to real-world problems in image recognition, natural language processing, and more.

Pre-requisite: CSIS200 or CSIS206.

CPEN 441 INFORMATION NETWORKING II

3.0: 3 cr. E

This course presents the different aspects of computer networks. In this course, we follow the bottom up model starting from the physical layer and going towards the application layer. However, when presenting the application layer, a top down presentation will be followed in order to close the loop. Upon successful completion of the course the students shall be able to: - Describe the TCP/IP stack in details - Discuss the technological choices in a networking protocol - Suggest a network design and configuration - Discuss advanced networking protocols - Select Network Protocol for Applications: HTTP, POP3, SMTP, DNS - Develop Basic Networking Programs - Identify the needs and propose new networking protocols - Setup a VLAN

Pre-requisite: CPEN241

CPEN 442 NETWORKING PROGRAMMING

3.0: 3 cr. E

This course gives the students a fundamental knowledge and hands-on exercise of the networking software design and client/server applications development. Topics include the Common Gateway Interface (CGI), PHP, Servlets, JSP, RPC, CORBA, XML (parsing), SOAP, Web Service Development Language (WSDL), RESTful, RMI, EJB. They are grouped in three parts of the course: i/ web development, ii/ remote procedure calling and, iii/ distributed programming. Drupal is also introduced as a content management system (CMS). Notions of client-side programming are also introduced (JavaScript, AJAX).

Pre-requisite: CPEN241

CPEN 445 BIOMETRICS

3.0: 3 cr. E

Biometrics has emerged from the specialized use in the forensics domain to a more mainstream use for computer authentication, identification document security, and surveillance for public safety. This course introduces the emerging area of biometrics and its challenges, with applications using MATLAB/OCTAVE and/or Python. Topics include: Identity recognition (verification, identification), biometric modalities (Face, fingerprint, voice, iris, handgeometry, etc.), performance measurement evaluation and reliability, multimodal biometric recognition (fusion, score normalization), biometric security, biometric privacy, imposture.

CPEN 446 NETWORK MANAGEMENT AND SECURITY

3.0: 3 cr. E

This course details different aspects of network management and network security. This is a lecture oriented class really composed of two parts the network management and the network security. :

At the end of the course the students will be able to:

- Design a Firewall and a Network Security Policy
- Build and setup a Firewall
- Design a security solution
- Discuss and share cryptographic information
- Use open source network management and security solutions
- Integrate advanced network security protocols with applications
- Design a network management solution based on SNMP protocol
- Connect to a network management console component
- Add management capabilities to some components.

Pre-requisite: CPEN310

CPEN 447 ADVANCED TELETRAFFIC

3.0: 3 cr. E

This course exposes students to source characterization of bursty sources (video, audio) through stochastic modeling of bursty traffic. The theory is illustrated through simulated results from the research literature. Students are also given computer projects to simulate bursty traffic sources. A major portion of the course is devoted to performance evaluation of networks using advanced queueing theory. The course will also treat traffic management and control in ATM networks, statistical multiplexing, dimensioning of cellular networks, and frame relay dimensioning.

Pre-requisite: ELEN 443

CPEN 448 CLOUD COMPUTING AND BIG DATA

3.0: 3 cr. E

This course is divided into two parts tightly connected: Cloud Computing and Big Data. In the first part the course introduces the concepts of cloud computing and covers the different models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Different existing open source clouds are introduced with a focus on OpenStack. The different types of clouds are covered: private, public and hybrid clouds with examples of the most popular clouds today. MapReduce algorithm and Hadoop framework will be presented as well as several Big Data tools in particular Hive. Finally, this part shall introduce Data Warehousing. The second part of the course is dedicated to machine learning algorithms. Data analytics and data mining will be detailed as well. The course also stresses on the importance of data preparation and preprocessing.

CPEN 452 ADVANCED MICROCONTROLLER APPLICATIONS

3.0:3 cr. E

This course covers advanced topics in microcontroller applications. It covers the following topics: UART, SPI, I2C, 1-wire protocol, Capture/Compare/PWM modules, A/D conversion, D/A conversion, interface to sensors, human machine interface, software state machines, home automation concepts and advanced software techniques. Essentially, the course teaches students to design microcontroller-based automation modules and how to network them together to form a complete home automation system.

Pre-requisite: CPEN 213 and CPEN 220

CPEN 528 MACHINE VISION

3.0: 3 cr. E

This course introduces the students to fundamental techniques for low level and high level computer vision. Topics include image formation, early processing, boundary detection, image segmentation, texture analysis, shape from shading, photometric stereo, motion analysis via optic flow, object modeling,

shape description, and object recognition. Models of human vision, subjective contours, visual illusions, apparent motion, mental rotations, cyclopean vision.

CPEN 545 CRYPTOGRAPHY

3.0: 3 cr. E

This course aims to introduce the students to cryptography in its algorithmic sides. The course starts with a definition of cryptosystems using simple examples (shift cipher, affine cipher, hill cipher, Vigenere cipher.). A small review of Shannon theory is then performed. Bulk encryption is detailed with a focus on Data Encryption Standard (DES) and its variants. Afterwards, public-key cryptosystems are studied (Diffie-Hellman, RSA, .). Attacks on both classes of cryptosystems are presented. The final part of the course is relative to hashing algorithms (MD4, MDs, .). At the end of the course, students will become aware of cryptography and of the strength and weakness of every cryptosystem.

Pre-requisite: ELEN 402

CPEN 546 WIRELESS NETWORKS

3.0: 3 cr. E

This graduate course introduces existing and currently developed Networking technologies used in Wireless systems. This covers both mobile and wireless networks. This is a lecture oriented class. The students will acquire knowledge and competences on how to design and build wireless networks and using which generation. The course has parts. In a first part we briefly review the wireless communication systems. In part2 cellular systems from 2G till 4G are covered. Part3 is dedicated to Wireless LAN. Part4 covers satellite communication and localization. Ad hoc networks and sensor networks are provided in Part5. Part 6 is dedicated to Internet of Things and Artificial Intelligence.

CPEN 549 INTELLIGENT NETWORKS

3.0: 3 cr. E

This course presents intelligent networks in details. The underlying communication protocols (INAP) will be described. Those presentations will cover intelligent networks for both fixed and wireless telephone networks. Students must have a good knowledge of networking principles and general telecommunication concepts in order to attend this course.

Pre-requisites: ELEN 443, CSIS 321

ELCP 211 ENGINEERING DRAWING

0.3: 1 cr. E

The 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: 1 cr. E

The 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

The 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, GENG 221, GENG 222, LISP 200

ELCP 392 SENIOR DESIGN 2

0.3: 2 cr. E

The 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

ELCP 480 FIELD TRAINING

0.0: 3 cr. E

Prior to graduation, students are expected to undergo training program at an institution whereby they get exposed and engaged in activities related to their field of studies, thereby gaining experience and demonstrating their skills.

FACULTY OF ENGINEERING GENERAL COURSES

GENG 400 ENGINEERING SEMINARS

2.0: 1 cr. E

This module consists of lectures and seminars covering recent research and advances in various fields and applications of engineering disciplines.

GENG 402 PROJECT MANAGEMENT

3.0: 3 cr. E

To make available the fundamentals of project management with the most workable types of organizations and the necessary capabilities that must be included to reasonably ensure success and minimize the possibility of failure. The course consists of construction contracting for contractors, owners, and engineers: bidding, industry structure, types of contracts, and delivery systems of construction, planning, estimating, quantity take-off and pricing, labor and equipment estimate, proposal preparation, contract documents to prepare detailed estimates, permits, risk management, and taxes. Basic critical path planning and scheduling with activity on nodes and activity on arrows, monitoring, updating, controlling, crashing, resource leveling, resource allocation, and least cost scheduling including time-cost trade-off analysis. Computer applications using the Primavera software.

GENG 450 ADVANCED ENGINEERING ANALYSIS AND RESEARCH METHODS 3.0: 3cr. E

The aim of this course is to train MS students in the methodologies used for research. Starting from existing literature, students will learn the formulation and development of original research problems in engineering management and civil engineering. The focus of the course is how to plan, prepare and present research manuscripts, such theses, and papers. Overview of the most popular modeling techniques, and statistical sampling methods used for engineering research.

GENG 599 MASTER'S THESIS

6.X: 6 cr. E

An approved final thesis project.

Refer to General Listing of Course Descriptions for:

CSIS XXX

Refer to the Faculty of Arts and Sciences

CSPR XXX

Refer to the Faculty of Arts and Sciences

ELEN XXX

Refer to the Department of Electrical Engineering

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