MASTER OF SCIENCE IN COMPUTER ENGINEERING (MCEN)

Overview

In 1440 H, the department introduced a Master of Science in Computer Engineering program, which was prepared according to the highest standards to match similar programs taught in world-class international universities, this is to prepare graduates for employment in, governmental organizations, educational institutions and other computer engineering enterprises.

The Master program designed to foster principles such as critical thinking, innovation and lifelong learning in various areas of computer engineering and to raise the awareness of their leading role in the development of their community. As the graduate program objectives integrate to achieve the FBSU mission, consequently, the university, over the past few years, has hired qualified faculty members of different ranks who have graduated from top universities all over the world and have rich experience in research and teaching as well.

The Master of Science in Computer Engineering curriculum is a two-year program designed to grant students the Master of Science in Computer engineering degree upon the successful completion of the requirements.

Mission

The Department of Computer Engineering is dedicated to providing students with a quality education in Computer Engineering, mathematics, physical sciences, and technology. We aim to expose students to significant research experiences, fostering leadership awareness in regional development. Committed to community engagement, we encourage students to apply their skills for positive societal impact.

Objectives

Graduates of the Master of Sciences in CEN program:

1. Possess skills and knowledge that qualify them for professional practice in computer engineering and for admission to reputable graduate programs.

Are capable of applying fundamental knowledge, appropriate mathematical principles and computing tools, critical thinking, and best practices in computer engineering analysis and design.

Are provided with an educational foundation that fosters creativity, teamwork, leadership, and communication skills, and prepares them for life-long learning along diverse career paths.

Have an appreciation of technical, social, economic, environmental, ethical, and global aspects of engineering practice.

Learning Outcomes

By the time of graduation, students with a Master's degree in CEN will be expected to demonstrate:

Knowledge and Understanding:

K1 Recognize and apply knowledge of Computer engineering

K2 Outline and reproduce designs and conduct experiments, as well as to analyze and interpret data

K3 Describe the design of a system, component, or process to meet desired needs within realistic constraints such as technical, economic, environmental, social, ethical, health and safety, manufacturability, and sustainability.

K4 Recall and memorize concepts, principles, theories, and procedures in CE.

Skills:

S1 Analyze, and judge complex CE problems to provide solutions by applying principles of CE science, and research through critical thinking.

S2 Design and implementation of a computer-based system, process, or program to meet desired needs within realistic constraints.

S3 Analyze a problem, and identify the computing requirements appropriate to its solution.

S4 Demonstrate a good level and the ability to work effectively in a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

S5 Demonstrate communication skills such as writing, reading, presenting, negotiating and debating.

S6 Assess and Demonstrate skills in the usage of computer, network, and software packages relevant to CE.

Values:

V1 Show values of professional and ethical responsibilities as an individual or as part of a team.

V2 Demonstrate the ability for collaborative learning and working to finish team assignments and projects on time, while selecting and judging resources and recognizing economic, environmental impact, and ethical responsibilities in CE solutions.

V3 Operate and Communicate effectively with other members of the team and a range of audiences

Program Tracks

Currently, the Department of Computer Engineering offers one graduate program:

Master of Sciences in Computer Engineering (MCEN)

Career Opportunities

The Department of Computer Engineering is committed to providing its students with meaningful, up-to-date skills and knowledge that will allow them to explore the education and skills of computer engineering. Furthermore, allows them to pursue successful careers and make deep impacts at leading commercial hardware and software companies. With these objectives in mind, the CEN graduate program is designed around fostering contemporary best practices and skills in line with the job opportunities for computing professionals.

Examples of career opportunities include:

Computer Network Engineering
Computer System and Application Development
Software Design
Digital Signal and Image Processing
Integrated Circuit Design
Internet Applications Development
Robotics and Automated Manufacturing
Engineering consulting

Manufacturing
Global communication systems
Instrumentation

Degree Requirement:

The MCEN curriculum is a two-year program designed to grant students the Master of Science in Computer Engineering upon the successful completion of the requirements. In the first year; the student studies the required core courses, then in the second year, students are allowed to determine which electives they prefer along with writing a project or thesis distributed in the last two terms of the program.

A) Project Track (42 credit hours)

Successful completion of a minimum of 39 credit hours of graduate courses.
Completion and successful defense of a research project of 3 credit hours.

B) Thesis Track (42 credit hours)

Successful completion of a minimum of 30 credit hours of graduate courses.
Completion and successful defense of a research project of 12 credit hours.

Program Structure

The Master of Computer Engineering curriculum is a two-year program designed to grant students the Master of Science in Computer Engineering upon the successful completion of the requirements. In the first year; the student study the required core courses, then in the second year students are allowed to determine which electives they prefer along with writing project or thesis distributed in the last two terms of the program.

A) Project Track :

5 Required Courses	15 credit hours
8 Elective Courses	24 credit hours
Project (CEN 598)	3 credit hours
Total	**42 credit hours**

Curriculum Study Plan Table

Semester	Course Code	Course Title	Credit Hours
Semester 1	CEN 571	Advanced Computer Networks	3
	CEN 574	Advanced Computer Architecture	3
	CEN 576	Advanced Embedded Systems	3
	CEN 580	Programmable System-on-Chip	3
	Total		**12**
Semester 2	CEN 514	Research Methodology	3
		Elective course 1	3
		Elective course 2	3
		Elective course 3	3
	Total		**12**
Semester 3		Elective course 4	3
		Elective course 5	3
		Elective course 6	3
		Elective course 7	3
	Total		**12**

Semester 4		Elective course 8	3
	CEN 598	Project	3
	Total		**6**
Total			**42**

B) Thesis track:

5 Required Courses	15 credit
5 Elective Courses	15 credit
Research Thesis (CEN 600: A, B, C and D)	12 credit
Total	**42 credit hours**

Curriculum Study Plan Table (Thesis Track)

Semester	Course Code	Course Title	Credit Hours
Semester 1	CEN 571	Advanced Computer Networks	3
	CEN 574	Advanced Computer Architecture	3
	CEN 576	Advanced Embedded Systems	3
	CEN 580	Programmable System-on-Chip	3
	Total		**12**
Semester 2		Elective course 1	3
		Elective course 2	3
		Elective course 3	3
	CEN 592	Research methodology	3
	Total		**12**
Semester 3		Elective course 4	3
		Elective course 5	3
	CEN 600	Research Thesis (A, B)	6
	Total		**12**
Semester 4	CEN 600	Research Thesis (C, D)	6
	Total		**6**
Total			**42**

Required and Elective Courses

A) Required Courses:

Course Code	Course Title	Credit Hours
CEN 571	Advanced Computer Networks	3
CEN 574	Advanced Computer Architecture	3
CEN 576	Advanced Embedded Systems	3
CEN 580	Programmable System-on-Chip	3
CEN 592	Research Methodology	3
Total		**15 Credits**

B) Elective Courses:

Course Code	Course Title	Credit Hours
MSC 541	Selected Topics in Cybersecurity	3
MSC 502	Software Engineering	3
CEN 528	Advanced Computer Graphics	3
CEN 540	Advanced Topics in Computer Engineering	3
CEN 515	Advanced Wireless Sensor Networks	3
MSC 520	Artificial Intelligence	3
MSC 521	Computer Security	3
MSC 526	Data Warehouse and Mining Systems	3
MSC 540	Database System Implementation	3
CEN 538	Designing Software Systems	3
CEN 519	Digital Image Processing	3
CEN 511	Distributed Systems	3
CEN 525	Electronic Devices	3
CEN 524	High Performance Computation	3
CEN 523	Information Theory	3
CEN 520	Intelligent Systems	3
CEN 532	Interconnection Networks	3
CEN 512	Mobile Computing and Wireless Networks	3
CEN 513	Network Security	3
CEN 521	Performance Analysis of Computer Networks	3
CEN 516	Robotics	3
CEN 570	Simulation and Modelling	3
MSC 522	Web Database and Information Retrieval	3
CEN 514	Wireless Ad-hoc Networks	3

~~1. Networks Courses Group~~

Course Code	Course Title	Credit Hours
~~CEN 511~~	~~Distributed Systems~~	~~3~~
~~CEN 512~~	~~Mobile Computing and Wireless Networks~~	~~3~~
~~CEN 513~~	~~Network Security~~	~~3~~
~~CEN 514~~	~~Wireless Ad-hoc Networks~~	~~3~~
~~CEN 515~~	~~Advanced Wireless Sensor Networks~~	~~3~~
~~CEN 516~~	~~Robotics~~	~~3~~

~~CEN 517~~	~~Fault Tolerance and Reliability in Computer Networks~~	~~3~~
~~CEN 518~~	~~Queuing Theory and Network Applications~~	~~3~~

~~2. Embedded Systems Courses Group~~

Course Code	Course Title	Credit Hours
~~CEN 516~~	~~Robotics~~	~~3~~
~~CEN 519~~	~~Digital Image Processing~~	~~3~~
~~CEN 520~~	~~Intelligent Systems~~	~~3~~
~~CEN 523~~	~~Information Theory~~	~~3~~
~~CEN 524~~	~~High Performance Computation~~	~~3~~
~~CEN 525~~	~~Electronic Devices~~	~~3~~

~~3. General Elective Courses~~

Course Code	Course Title	Credit Hours
~~CEN 526~~	~~Artificial Intelligence~~	~~3~~
~~CEN 527~~	~~Web Database & information Retrieval~~	~~3~~
~~CEN 528~~	~~Advanced Computer Graphics~~	~~3~~
~~CEN 529~~	~~Graphical User Interface~~	~~3~~
~~CEN530~~	~~Software Project Management~~	~~3~~
~~CEN531~~	~~Data Warehouse and Mining Systems~~	~~3~~
~~CEN532~~	~~Interconnection Networks~~	~~3~~
~~CEN533~~	~~Advanced Topics in Databases~~	~~3~~
~~CEN534~~	~~Expert Systems & Knowledge Engineering Applications~~	~~3~~
~~CEN535~~	~~Software Quality Management~~	~~3~~
~~CEN536~~	~~Advanced Topic in Artificial Intelligence~~	~~3~~
~~CEN537~~	~~Advanced Topics in Software Engineering~~	~~3~~
~~CEN538~~	~~Designing Software Systems~~	~~3~~
~~CEN539~~	~~Neural Networks & Machine learning applications~~	~~3~~
~~CEN540~~	~~Selected Topics in Computer Engineering~~	~~3~~

MCS Course Descriptions

A) Required Core Courses:

CEN 571 Advanced Computer Networks (3 Credits)
This course covers first-year graduate-level material in the area of advanced computer networks with an emphasis on OSI layered Architecture, Application layer, TCP/IP Protocols, and Data link layer, HDLC, Network layer, Datagram and virtual circuit, Error-detection and recovery, Presentation layer, Security, Privacy, and Text compression.

CEN 574 Advanced Computer Architecture (3 Credits)
This course covers material in the area of advanced computer architecture with a focus on pipelining, superscalar, parallel processors, hard-wired scheduling branch prediction, cache and virtual memory-hierarchy design, shared-memory and message-passing scalable multiprocessors.

CEN 576 Advanced Embedded Systems (3 Credits)
This course covers material in the area of advanced embedded systems which aims to provide comprehensive knowledge about embedded systems architecture, design and operation, programming and development, interfacing, applications, custom single-purpose processors design embedded systems peripherals design, keypad controller, UART, Timers, LCD controller, and embedded systems interfacing.

CEN 514 Research Methodology (3 Credits)
This course covers material in the area of research methodology and covers literature survey, design and implementation, findings and results, conclusion and research methodology. The course will enable the Researchers to develop the most appropriate methodology for their research studies. Prerequisite: Senior stand

CEN 580 Programmable System-on-Chip (3 Credits)
This course covers material in the area of programmable system-on-chip and focuses on the basics of system-on-chip (SoC) design, hardware-software co-specification, co-synthesis, Network-on-Chip (NoC) systems and system-on-programmable-chip technologies.

CEN 599 Project (3 Credits)
This course covers dissertation project that is accomplished via the formal, academic, and scientific approach under the supervision of an academic advisor.
Prerequisite: CEN 514

CEN 600 Research Thesis (A, B, C, D) (12 Credits)
This course covers dissertation thesis that is accomplished via the formal, academic, and scientific approach under the supervision of an academic advisor. ***Prerequisite: CEN 514***

B) Elective Courses

CEN 511 Distributed System (3 Credits)
This course covers material in the area of distributed systems and emphasizes architectural models varying from client/server to peer-to-peer, grid-computing, communication models varying from client-pull to server-push models, synchronization techniques, logical clock communications, timestamps, token ring, and communication standards such as RPC, RMI, CORBA and SOAP.
Prerequisite: CEN 571

CEN 512 Mobile Computing and Wireless Networks (3 Credits)
This course covers material in the area of mobile computing and wireless networks and emphasizes digital modulation techniques, multiple access techniques for wireless systems, frequency reuse,

cellular, microcellular, Pico cell, femtocell concepts, wireless networking standards, PAN (IEEE 802.15.1 (Bluetooth) and IEEE 802.15.4 (Zigbee)), wireless LAN (IEEE 802.11 a/b/g/n), 4G mobile wireless (LTE, LTE-advanced, and mobile WIMAX IEEE802.16e/m), radio and network resource management, systems issues such as performance evaluation, quality of service guarantees and reliability, cognitive radio networks, and mobile IP.

Prerequisite: CEN 571

CEN 513 Network Security (3 Credits)

This course covers material in the area of computer security and focuses on topics such as introduction to network security, symmetric encryption and message confidentiality, public key cryptography and message authentication, key distribution and user authentication, transport-level security, wireless networks security, intruders, and IP security.

Prerequisite: CEN 571

CEN 514 Wireless Ad-hoc Networks (3 Credits)

This course covers topics in the area of wireless Ad-hoc networks that covers basics of wireless communication, multipath, loss, noise, and interference, multiplexing techniques, wireless media access control protocols, Ad-hoc networks design, routing techniques, QoS in wireless networks, wireless networks standards such as Bluetooth, IEEE 802.11 a/b/g/n, IEEE 802.15 standards, and IEEE802.11e for differentiated services.

Prerequisite: CEN 571

CEN 515 Advanced Wireless Sensor Networks (3 Credits)

This course covers material in the area of advanced wireless sensor networks with emphasis on wireless sensor network protocols, deployment and coverage issues, applications, sensor hardware platforms (MOTES), Tiny OS, physical and link layers, MAC issues, localization, self-organization, time synchronization, power management, network layer protocols (energy-aware or attribute-based routing), node discovery protocols, data dissemination, data aggregation, cluster-based protocols (LEACH), query models, reliable transport protocols, and security issues in sensor networks.

Prerequisite: CEN 571

CEN 516 Robotics (3 Credits)

This course provides material in the area of robotics with the focus on topics such as robotics systems overview, mobile robotics analysis, challenges for autonomous intelligent systems, present the state of the art solutions, kinematics, sensors, vehicle localization, Map building, SLAM, path planning, and the exploration of unknown terrain.

Prerequisite: Senior standing

CEN 519 Digital Image Processing (3 Credits)

This course provides material in the area of digital image processing and explains topics such as fundamentals of digital image processing, image enhancement in spatial and frequency domains, image restoration, color image processing, image compression and multi-resolution image processing.

Prerequisite: Senior standing

CEN 520 Intelligent Systems (3 Credits)

This course provides material in the area of intelligent systems with an emphasis on knowledge-based intelligent systems overview, rule-based expert systems, uncertainties management in rule-based expert systems, fuzzy expert systems, frame-based expert systems, artificial neural networks, evolutionary algorithms, hybrid intelligent systems, knowledge engineering and data mining.

Prerequisite: MSC 520

CEN 521 Performance Analysis of Computer Networks (3 Credits)

This course covers material in the area of performance analysis of computer networks and explains

fundamental performance analysis techniques, performance measurement methods, performance metrics, monitoring, experimental design, system modeling, queuing theory, Markov chains, performance bottleneck identification, characterizing the load on the system, determining the number and size of components, and mean value analysis.

Prerequisite: CEN 571

CEN 523 Information Theory (3 Credits)

This course provides material in the area of information theory and its applications to communications theory, computer science, statistics, and probability theory, quantities of entropy, relative entropy, and mutual information, and shows how they arise as natural answers to questions of data compression, channel capacity, rate distortion, and hypothesis testing.

Prerequisite: MSC 521

CEN 525 Electronic Devices (3 Credits)

This course provides material in the area of electronic devices and covers diodes, P-N junctions, Schottky barrier junctions, heterojunctions and ohmic contacts, bipolar junction transistors, field effect transistors, amplifiers, electronic devices for embedded systems, semiconductors and diodes in optoelectronics.

Prerequisite: CEN 576

CEN 528 Advanced Computer Graphics (3 Credits)

This course provides material in the area of advanced computer graphics with an emphasis on mathematics for three-dimensional computer graphics, hierarchical representation and basic shapes, surfaces and curves in three dimensions, three-dimensional modelling, solid bodies modelling, three-dimensional viewing, visible surface, illumination and shades, texture mapping, computer graphics systems such as open GL, and finally animation techniques.

Prerequisite: CEN 519

CEN 532 Interconnection Networks (3 Credits)

This course provides material in the area of interconnection networks and covers a review of general concepts, LAN and WAN, management of token ring networks, ISO model of seven layers, network standard specifications, urban networks, large bandwidth networks, network design and performance, network programming, error detection, security and privacy, interconnection networks evaluation criteria, interconnection networks design, classification and evaluation.

Prerequisite: CEN 571

CEN 540 Advanced Topics in Computer Engineering (3 Credits)

This course provides material in a company of topics of interest to the students.

Prerequisite: Senior standing

CEN 570 Simulation and Modeling (3 Credits)

This course covers material in the area of simulation and modeling with an emphasis on discrete-event simulation approaches, simulation cycle, probability, statistics in simulation, mathematical and statistical models, validation and verification of simulation models, random number generation, building valid and credible simulation models, modeling of simulation data, output data analysis, simulation software, distributed and parallel simulation, simulation techniques of some well-known systems such as queues, and applications to computer systems.

Prerequisite: Senior standing