

MASTER OF SCIENCE IN COMPUTER ENGINEERING

Introduction and Program Objectives:

Computer Engineering Department was established in 1424 H. The department has graduated hundreds of students from its BS programs. The primary mission of the Computer Engineering department is to provide quality education in different advanced Computer Engineering fields by exposing students to both theoretical and practical experiences. Preparing them to contribute significantly to the research and advancement of new and emerging technology in computing, and fostering perception and awareness of their leading role in the development of their community.

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 a world class international universities, this is to prepare graduates for employment in, governmental organizations, educational institutions and other computer engineering enterprises. Moreover through its curriculum the program allows students to contribute significantly to the scientific society, and qualifies them to pursue further studies in respected universities worldwide.

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 programs objectives integrates together to achieve the FBSU mission, consequently, the university, over the past few years, have hired qualified faculty members of different ranks who have graduated from top universities all over the world and have rich experience in the research and teaching as well.

Degree Requirement:

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.

Admission Requirements

FBSU invites students with a sound academic record, good personal character, strong interest to serve their communities and eagerness to serve as professionals in allied fields.

Applicants must satisfy the following eligibility requirements:

1. Hold a Bachelor degree in computer engineering or related computer streams or scientific stream from an academic institution accredited/recognized by the KSA's Ministry of Education (MOE). The field including, but not limited to software engineering, information systems, business information systems, electrical engineering, and electronics.
2. Hold a Bachelor's degree with a minimum ranking/rating of "Very Good": 3.75/5 or 2.75/4. However, applicants with a rating of "Good": equals to or greater than 3.25/5 and less than 3.75/5 or equals to or greater than 2.25/4 and less than 2.75/4 can be accepted if approved by the Council of Graduate Studies. Furthermore, applicants with a rating of "Good": equals to or greater than 2.75/5 and less than 3.25/5 or equals to or greater than 1.75/4 and less than 2.25/4 can be accepted if their GPA in their major of study is at least "Very good": Equal or above of 3.75/5 or 2.75/4.
3. Achieve a minimum score of 5.5 on the IELTS exam (about 500 in paper-based TOEFL or 61 in internet-based tests) or a minimum score of 75% on the University English placement exam. In case this condition is not met, a student may requested to take some additional English courses based on his scores in IELTS, TOEFL or FBSUniversity Placement Test.
4. General Graduate Record Examination (GRE) score will be the advantageous at the time of admission.
5. At least three letters of recommendation from the faculty who taught the applicant undergraduate courses. [Sealed and signed]
6. Satisfactorily meeting any additional departmental or university admission requirements. Present a "No-Objection" letter from the employer, if applicable.

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
CEN 599	Project	3 credit hours
	Total	42 credit hours

Curriculum Study Plan Table

Semester	Course Code	Course Title	Required or Elective	Credit Hours
Semester 1	CEN 571	Advanced Computer Networks	R	3
	CEN 574	Advanced Computer Architecture	R	3
	CEN 576	Advanced Embedded Systems	R	3
	CEN 580	Programmable System-on-Chip	R	3
	Total			12
Semester 2	CEN 592	Research Methodology	R	3
		Elective course 1	E	3
		Elective course 2	E	3
		Elective course 3	E	3
	Total			12
Semester 3		Elective course 4	E	3
		Elective course 5	E	3
		Elective course 6	E	3
		Elective course 7	E	3
	Total			12
Semester 4		Elective course 8	E	3
	CEN 599	Project	R	3
	Total			6
Total				42

B) Thesis track:

----	5 Required Courses	15 credit
----	5 Elective Courses	15 credit
CEN 599	Thesis (A, B, C, D)	12 credit
Total		42 credits

Curriculum Study Plan Table (Thesis Track)

Semester	Course Code	Course Title	Required or Elective	Credit Hours
Semester 1	CEN 571	Advanced Computer Networks	CEN 571	3
	CEN 574	Advanced Computer Architecture	CEN 574	3
	CEN 576	Advanced Embedded Systems	CEN 576	3
	CEN 580	Programmable System-on-Chip	CEN 580	3
	Total			12
Semester 2		Elective course 1	E	3
		Elective course 2	E	3
		Elective course 3	E	3
	CEN 592	Research methodology	R	3
	Total			12

Semester	Course Code	Course Title	Required or Elective	Credit Hours
Semester 3		Elective course 4	E	3
		Elective course 5	E	3
	CEN 599	Thesis (A, B)	R	6
	Total			12
Semester 4	CEN 599	Thesis (C, D)	R	6
	Total			6
Total				42

Required and Elective Courses

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

Elective Courses:

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

B) Elective Courses

CEN 570 Simulation and Modeling (3 Credits)

This course covers second year graduate level 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.

CEN 511 Distributed System (3 Credits)

This course covers graduate level material in the area of distributed systems and emphasizes on 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.

CEN 512 Mobile Computing & Wireless networks (3 Credits)

This course covers graduate level material in the area of mobile computing and wireless networks and emphasizes on 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.

CEN 513 Network Security (3 Credits)

This course covers graduate level material in the area of computer security and focuses on topics such as introduction to networks 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.

CEN 533 Performance Analysis of Computer Networks (3 Credits)

This course covers graduate level 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.

CEN 514 Wireless Ad-hoc Networks (3 Credits)

This course covers graduate level 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

CEN 515 Advanced Wireless Sensor Networks (3 Credits)

This course covers graduate level material in the area of advanced wireless sensor networks with emphasis on wireless sensor networks protocols, deployment & 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.

CEN 516 Robotics (3 Credits)

This course provides graduate level material in the area of robotics with the focus on topics such as robotics systems overview, mobile robotics analyzes, 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.

CEN 517 Fault Tolerance and Reliability in Computer Networks (3 Credits)

This course provides graduate level material in the area of fault tolerance and reliability in computer networks where the student will study introduction to concepts of faults, errors, and failures, basic concepts of dependable computing including dependability attributes, means, and validation, stochastic modeling techniques in the context of network reliability analysis. Error detection and correction techniques, fault tolerant, topology design, and the practices of reliable and fault-tolerant computer networks design.

CEN 518 Queuing Theory and Network Applications (3 Credits)

This course provides graduate level material in the area of queuing theory and network applications and covers introduction to network applications, discrete random variables, continuous random variables, characteristic functions, stochastic processes, discrete-time Markov chains, continuous time Markov chains, introduction to queuing theory, M/M/1 and derivative queues, and M/G/1 queues, Burke's theorem, Jackson's theorem, finally open and closed network of queues.

CEN 519 Digital Image Processing (3 Credits)

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

CEN 520 Intelligent systems (3 Credits)

This course provides graduate level 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 algorithm, hybrid intelligent systems, knowledge engineering and data mining.

CEN 523 Information Theory (3 Credits)

This course provides graduate level 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 show how they arise as natural answers to questions of data compression, channel capacity, rate distortion, and hypothesis testing.

CEN 524 High Performance Computation (3 Credits)

This course provides graduate level material in the area of high performance computation and focuses on reviewing major causes of performance degradation in scientific computing, scheduling problem, classification and solutions, task scheduling, load balancing algorithms, and deadline scheduling for real-time systems.

CEN 525 Electronic Devices (3 Credits)

This course provides graduate level 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.

CEN 526 Artificial Intelligence (3 Credits)

This course provides graduate level material in the area of artificial intelligence with an emphasis on advanced techniques implemented to AI, problem solving, knowledge representation, evolutionary algorithms, supervised learning, learning by analogy, learning by discovery, self-reference and self-production, reasoning, causal reasoning, common sense reasoning, Bayesian network, logical agents and approaches, reasoning with uncertainty, confirmation theory, Belief theory, necessity and possibility theory, theory of endorsements, and finally spatial and temporal reasoning.

CEN 527 Web Database & Information Retrieval (3 Credits)

This course provides graduate level material in the area of web database & information retrieval with an emphasis on modeling, query operations, Markup languages, XML technologies and its applications, Searching the Web, IR models and languages, Indexing, searching, and finally digital libraries.

CEN 528 Advanced Computer Graphics (3 Credits)

This course provides graduate level 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.

CEN 529 Graphical User Interface (3 Credits)

This course provides graduate level material in the area of graphical user interface with an emphasis on foundations of human computer interaction, structural approaches of design, interactive SW systems, techniques, interaction styles, interactive software systems design, usability, finally systems attribute and evaluation.

CEN 530 Software Project Management (3 Credits)

This course provides graduate level material in the area of software project management and aims to introduce project management, basic activities of software project management, charts used in project management, evaluation and acceptance of project phases, advanced techniques of project management as for maintenance, project scheduling, project insurance, and project management tools.

CEN 531 Data Warehouse and Mining Systems (3 Credits)

This course provides graduate level material in the area of data warehouse and mining systems and explains topics such as introduction to decision support systems (DSS), development of DSS, data modelling techniques and development of data warehouse in an architecture environment, different data warehouse architectures and development techniques, user-interface for data warehouses, data mining, application domains for data warehouse and mining, and project.

CEN 532 Interconnection Networks (3 Credits)

This course provides graduate level material in the area of interconnection networks and covers 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.

CEN 533 Advanced Topics in Databases (3 Credits)

This course provides graduate level material in the area of advanced topics in databases and focuses on new trends in the area of software engineering, methodology of application, current research topics.

CEN 534 Expert Systems & Knowledge Engineering Applications (3 Credits)

This course provides graduate level material in the area of expert systems & knowledge engineering applications and covers introduction to expert systems, a brief presentation of knowledge representation paradigms, inference rules, resolution, and basic aspects of reasoning under uncertainty.

CEN 535 Software Quality Management (3 Credits)

This course provides graduate level material in the area of software quality management and focuses on introduction to quality management systems and total quality, ISO quality system and its application to software industry, capability maturity model (CMM) and its five levels, tick IT system, quality assurance, application of quality systems, and software tools for quality.

CEN 536 Advanced Topic in Artificial Intelligence (3 Credits)

This course provides graduate level material in the area of advanced topic in artificial intelligence and focuses on the following topics contemporary topics and research in artificial intelligence, methodology of application, and current research topics.

CEN 538 Designing Software Systems (3 Credits)

This course provides graduate level material in the area of designing software systems and provides a review of known methodologies and principles of object engineering, unified modelling language (UML), comparative study of available methodologies, conversion methodology to object design, evaluation of object design and use of object metrics, and use of object methodology.

CEN 539 Neural Networks & Machine learning applications (3 Credits)

This course provides graduate level material in the area of neural networks & machine learning applications with an emphasis on explanation based learning, learning by observation and discovery, analogical and case-based learning, learning models, evaluation of learning algorithms, experimental methodology, empirical learning, reinforced learning and genetic algorithms, neural computations, examples and applications, history of artificial neural system development, fundamental concepts and models of artificial neural system, finally applications like neural network simulation and implementations.

CEN 540 Selected Topics in Computer Engineering (3 Credits)

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