



Bachelor of Science in Computer Engineering: Student Guide

Academic Year 1443 AH - 2021 AD

BSc. in Computer Engineering – Student Guide

Program Information:

The College of Computer and Information Sciences in King Saud University was founded in 1984. The college was founded with two departments: computer engineering and computer science. Since then the college has expanded, and it currently has five departments: information systems, information technology, and software engineering, in addition to the two original departments. The college was borne of the need to have highly qualified computer engineers available.

The Department of Computer Engineering aims to graduate engineers specialized in various areas of computer engineering, who are capable of enhancing the Kingdom's fast-paced development. The B.Sc. Program in Computer Engineering is Accredited by The Engineering Accreditation Commission (EAC) Of ABET. The graduate performs setting up standards for computer systems, providing technical consultation, as well as supervising installation, configuration, and operation of equipment. In addition, the graduate should be capable to design, develop, manage, and monitor the performance of computer networks. With the Kingdom's entry to the manufacturing era, the graduates will take an essential role in designing computer systems and computer networks. The graduate will design control systems for automated tasks in laboratories and factories.

Program Mission:

The Department of Computer Engineering is committed to implementing the highest standards of excellence in higher education. It promotes team work activities in a student-centered learning environment. It inspires meaningful research, and high professional services to the Kingdom of Saudi Arabia.

Program Goals:

To provide students with a high quality education that will transform them into professional computer engineers who are prepared to meet the needs of industry and society and adapt to rapidly changing technology.

Degree Name: Bachelor of Science in Computer Engineering

Program General Structure:

Type of Courses	Number of Courses	Number of Required Credits
Compulsory Courses	42	132
Elective Courses	8	21
Graduation Project	2	6
Practical Training	1	1
Total	53	(160) Credit Hours

Program Optimal Study Plan:

1 st Semester	2 nd Semester	3 rd Semester	4 th Semester
MATH 101 ENG 100 CHEM 101 ARAB 100	STAT 101 ENG 110 CT 101 CUR 101 EPH 101 ENT 101	CSC 111 MATH 106 MATH 151 PHYS 103 IC Elective I	CENX 211 CSC 113 MATH 205 PHYS 104 ENGL 109
15 Credit Hours	17 Credit Hours	16 Credit Hours	17 Credit Hours

5 th Semester	6 th Semester	7 th Semester	8 th Semester
CENX 212 CSC 212 EE 207 MATH 204 ENGL 110 IC Elective II	CENX 316 CENX 351 CSC 227 EE 310 EE 312 MATH 244	CENX 352 CENX 341 CENX 318 CENX 390 SWE 211	CENX 453 CENX 441 CENX 415 CENX 490 CSC 311 CENX 479
17 Credit Hours	17 Credit Hours	15 Credit Hours	18 Credit Hours

9 th Semester	10 th Semester
CENX 492 CENX 442 CEN Elective I CEN Elective II IC 107	CENX 493 CEN Elective III CEN Elective IV Technical Elective IC Elective III
14 Credit Hours	14 Credit Hours

Compulsory Courses: A student should pass all the courses from the following list:

Course Code	Course Title	Effective Hours	Previous Requirements
Compulsory Courses			
ENG 100	English Language	6	-
ARAB 100	Writing Skills	2	-
MATH 101	Differential Calculus	3	-
CHEM 101	General Chemistry I	4	-
STAT 101	An Introduction to Probability & Statistics	3	-
CT 101	IT Skills	3	-
ENT 101	Entrepreneurship	1	-
EPH 101	Fitness and Health Education	1	-
CUR 101	University Skills	3	-
ENG 110	English For Academic Purposes	6	ENG 100

Course Code	Course Title	Effective Hours	Previous Requirements
Compulsory Courses			
CSC 111	Computer Programming I	4	CT 101
MATH 106	Integral Calculus	3	MATH 101
MATH 151	Discrete Math	3	MATH 101
PHYS 103	General Physics I	4	-
CENX 211	Digital Logic Design I	4	MATH 151
CSC 113	Computer Programming II	4	CSC 111
MATH 205	Differential & Integral Calculus	3	MATH 106
PHYS 104	General Physics II	4	PHYS 103
ENGL 109	Language & Communication	2	ENG 110
CENX 212	Digital Logic Design II	4	CENX 211
CSC 212	Data Structures	3	CSC 113
EE 207	Electric Circuits	3	MATH 205
MATH 204	Differential Equations	3	MATH 205
ENGL 110	Technical Writing	2	ENGL 109
CENX 316	Computer Architecture	3	CENX 212
CENX 351	Signals and Systems Analysis	4	MATH 204, EE 207
CSC 227	Operating Systems	3	CSC 212
EE 310	Microelectronic Devices and Circuits	3	EE 207
EE 312	Basic Electronics Lab	1	EE 207
MATH 244	Linear Algebra	3	MATH 106
CENX 352	Digital Signal Processing	3	CENX 351
CENX 341	Data Communication	4	CENX 351
CENX 318	Embedded Systems	4	CENX 316
CENX 390	Computer Engineering Seminar	1	ENGL 110
SWE 211	Introduction to Software Engineering	3	CSC 113
CENX 453	Digital Control & Robotics	4	CENX 352, MATH 244
CENX 441	Computer Networks	4	CENX 341
CENX 415	Introduction To VLSI Design	3	CENX 212, EE 310
CENX 490	Engineering Design & Project Management	3	CENX 316, ENGL 110
CSC 311	Design and Analysis of Algorithms	3	MATH 151, CSC 212
CENX 442	Computer and Network Security	3	CENX 441
IC 107	Ethics of the Profession	2	-

Course Code	Course Title	Effective Hours	Previous Requirements
Graduation Project			
CENX 492	Graduation Project I	3	CENX 490, Level 7 is the zero level, Completing 120 Credit Hours
CENX 493	Graduation Project II	3	CENX 492
Practical Training			
CENX 479	Practical Training	1	Completing 120 Credit Hours
Total		139 Credit Hours	

CEN Elective Courses: A student should choose 4 courses from the following list:

Course Code	Course Title	Effective Hours	Previous Requirements
CENX 402	Introduction to Random Processes	3	MATH 244
CENX 413	Computer Architecture II	3	CENX 316
CENX 414	Programmable Logic Devices	3	CENX 212
CENX 416	Introduction to Computer Arithmetic	3	CENX 316
CENX 443	Wireless & Sensor Networks	3	CENX 441
CENX 445	Network Protocols & Algorithms	3	CENX 441
CENX 446	Network Design & Management	3	CENX 441
CENX 454	Intelligent Systems	3	CENX 453
CENX 459	Robotics	3	CENX 453
CENX 460	Digital Speech Processing	3	CENX 352
CENX 465	Digital Image Processing	3	CENX 352
CENX 491	Selected Topics in Computer Engineering	3	CENX 318, CENX 441, CENX 351
Total		12 Credit Hours	

Technical Elective Courses: A student should choose 1 course from the following:

Course Code	Course Title	Effective Hours	Previous Requirements
EE 203	Engineering Electromagnetics (1)	3	-
EE 204	Engineering Electromagnetics (2)	3	-
EE 407	Electronic Communication Circuits	3	-
EE 422	Digital Communications	3	-
EE 423	Wave Propagation and Antennas	3	-

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Course Code	Course Title	Effective Hours	Previous Requirements
EE 425	Satellite Communications	3	-
EE 454	Advanced Control Systems	3	-
EE 456	Automatic Control Applications	3	-
EE 458	Advanced Logic Design	3	-
EE 463	Wireless Communications	3	-
EE 464	Optical Communications	3	-
CSC 361	Artificial Intelligence	3	-
CSC 380	Fundamentals of Database Systems	3	-
CSC 412	Simulation and Modeling	3	-
CSC 429	Computer security	3	-
CSC 453	Parallel Processing	3	-
CSC 456	Distributed Systems	3	-
CSC 457	Internet Technologies	3	-
CSC 462	Machine Learning	3	-
SWE 312	Software Requirements Engineering	3	-
SWE 321	Software Design and Architecture	3	-
SWE 486	Cloud Computing and Big Data	3	-
IS 230	Introduction to Database Systems	3	-
IS 335	Database Management Systems	3	-
IS 385	Enterprise Resource Planning Systems	3	-
Total		3 Credit Hours	

Important Contact Information:

Title	E-mail
CEN Chairman	CEN@ksu.edu.sa
CCIS Dean	CCISDean@ksu.edu.sa
CCIS Vice Dean for Academic Affairs	CCISAA@ksu.edu.sa

Important Handouts:

Title	Webpage
Know Your Library	https://cutt.ly/Cn3qoRE
Graduation Project Phase I: Report Template	https://cutt.ly/2n3qWHJ
Graduation Project Phase II: Report Template	https://cutt.ly/on3qYNW
Graduation Project - Self Assessment	https://cutt.ly/un3qjDY

Expected Schedule for CEN Elective Courses:

1 st Semester	2 nd Semester
CENX 413 or CENX 416	CENX 402 or CENX 414
CENX 445	CENX 443 or CENX 445
CENX 446 or CENX 491	CENX 454 or CENX 459
CENX 460	CENX 465

Important Webpages:

Title	Webpage
CEN Department	https://ccis.ksu.edu.sa/en/ce/new-ce-bsc-program
CEN Faculty and Staff	https://ccis.ksu.edu.sa/en/node/683
Practical Training – General Information	https://ccis.ksu.edu.sa/en/practical-training/m-students
Online Academic Portal	https://edugate.ksu.edu.sa/
KSU Learning Management System (Blackboard)	https://lms.ksu.edu.sa/
KSU Libraries	http://library.ksu.edu.sa/en
Deanship of Admissions and Registration	https://dar.ksu.edu.sa/en
Deanship of Student Affairs	https://sa.ksu.edu.sa/en
Student Guidance and Counseling Center	https://sa.ksu.edu.sa/ar/ccg

Academic Advising:

The department has established an academic advising unit (AAU), which is primarily responsible for advising students prior to the start of each academic year. AAU allocates groups of students among the academic staff. Then, this allocation is posted on EduGate, KSU's electronic registration system, for students' access.

Advisors engage students in their educational planning, illuminate them how to navigate college and university resources, and encourage them to take responsibility for decisions about their academic progress.

Registration Process:

- 1- Students can register their courses online using www.edugate.ksu.edu.sa.
- 2- Then, if they could not make the desired changes or are **not fulfilled** by EduGate system, the student must consult the academic advisor. The academic advisor will check **the validity of the request**. In the affirmative case (the request is valid), the student must follow the following 3 steps:
 - a. Fill the form correctly, send it to his academic advisor via email.
 - b. The student has to put the correct section number of the requested course in order to avoid any conflict with the registered courses (lecture, tutorial, Lab, or final exam).
 - c. The form will be submitted by the academic advisor to the CEN registrar.

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- 3- CEN registrar **will not process** requests that violate department policies:
- Overload registration (adding beyond student's GPA-based limit) even for graduating students (see the table below).
 - Dropping a course from the zeroth level of the student plan. The 0th level is defined as the lowest level with unfinished courses. This will delay the student in the plan and will deprive him of registering CEN492, which now required Level 7 as a prerequisite.
 - Adding CEN492 before passing 120 credits+ CEN490.
 - Adding any course with CEN479 (Practical Training).
 - Bypassing the Prerequisite courses.
 - Dropping below 12 credit hours.
 - Over-registration beyond section limit (especially on CEN Lab sections).

Maximum Credits:

Maximum credits allowed to the student is related to his overall GPA is as follows:

GPA	1-2	2.01-2.5	2.51- 3	3.01-3.5	3.51-4	4.01-4.5	4.51-5
Max (Hours)	12-14	15	16	17	18	19	20

Program Course Description:

Note: credit hours are represented as follows: # of credit hours (lecture, tutorial, lab).

CENX 211	Digital Logic Design (I)	4 (3, 1, 2)
<p>Course Description: This course provides students with basic knowledge on combinational and sequential circuit design. The course includes a lab component to help students get hands-on experience with the theoretical concepts they take in the course. Topics include: number systems, application of Boolean algebra, modular design of combinational logic and basic design of sequential circuits using state diagrams. Prerequisites: MATH 151</p>		
CENX 212	Digital Logic Design (II)	4 (3, 1, 2)
<p>Course Description: This course provides students with advanced knowledge on synchronous sequential machines and basic knowledge in programmable logic devices including hardware description language. The course includes a lab component to help students get hands-on experience with the theoretical concepts they take in the course. Topics include: registers and counters, state machines, design of data path and control circuits, hardware description languages (HDL) and the synthesis of logic circuits on programmable logic devices such as FPGA and CPLDs. Prerequisites: CENX 211</p>		

CENX 316	Computer Architecture	3 (3, 1, 0)
<p>Course Description: History and factors affecting the advances in processor design. Basic computer organization. Performance evaluation and metrics. Assembly Language of MIPS processor. Instruction formats, instruction sets and their design. Integer and floating-point representations and arithmetic operations. Data path design. Control design, pipelining and their effect on performance. Memory Hierarchy Organization and its effect on performance. I/O Systems. Prerequisites: CENX 212</p>		
CENX 318	Embedded Systems Design	4 (3, 1, 2)
<p>Course Description: This course introduces embedded system design concepts. Students will investigate the architecture of a selected microcontroller family and learn how to configure and program its core and peripherals. The course includes a lab component to help students get hands-on experience with the theoretical concepts they take in the course. Prerequisites: CENX 316</p>		
CENX 341	Data Transmission	4 (3, 1, 2)
<p>Course Description: Introduction to communication systems; Protocol architecture and reference models; Transmission Impairments; Transmission media: guided and unguided media, wireless propagation; Digital signaling: NRZ, AMI, Biphase; Analog signaling: ASK, FSK, PSK, Multi-level signaling; Error detection: 2D Parity, Checksum, CRC; Forward Error Correction; Data Link Control: framing, flow-control, ARQ protocols; Multiplexing: FDM, TDM; Digital carrier systems: PCM, E1, SONET/SDH; xDSL systems; Duplexing techniques: FDD, TDD. Prerequisites: CENX 351</p>		
CENX 351	Signals and Systems	4 (3, 1, 2)
<p>Course Description: Mathematical description and classification of various signals and systems: introduction to mathematical software packages (e.g. MATLAB), continuous linear time-invariant systems, convolution, Fourier series and transform, and Laplace transform. Prerequisites: MATH 204 and EE 207.</p>		
CENX 352	Digital Signal Processing	3 (3, 1, 0)
<p>Course Description: History and overview; sampling theorem, aliasing; sampled signals, periodic signals, non-periodic signals; impulse response and convolution; digital spectra analysis; discrete Fourier transform, fast Fourier transform; z-transform; digital filters, FIR and IIR filter design; windowing; effect of finite word length in digital signal processors; application in audio and image processing. Prerequisites: CENX 351.</p>		

CENX 390	Computer Engineering Seminar	1 (1, 0, 0)
<p>Course Description: Professional ethics in the context of computer engineering: IEEE code of ethics, writing ethics, legal and ethical issues in software development; Research skills: research report organization and formatting, referencing and bibliography management; Guidelines for good research paper; Guidelines for effective oral presentation. The main goal of this course is to improve students' research and report writing skills in preparation for their graduation projects. It also exposes students to current research topics in computer engineering. Students conduct a small research project on a relevant subject and write a formal report along with an oral presentation.</p> <p>Prerequisites: ENGL 110.</p>		
CENX 402	Computer Engineering Seminar	3 (3, 1, 0)
<p>Course Description: Introduction to random variables, parameter estimation, stochastic processes, random signal processing and applications to systems.</p> <p>Prerequisites: MATH 244 and CENX 351.</p>		
CENX 413	Computer Architecture II	3 (3, 1, 0)
<p>Course Description: This course focuses on Fundamentals of computer architecture, power, cost, performance, instruction set principles, instruction and arithmetic pipelines, dynamic and speculative execution, precise exception, memory hierarchy, multilevel caches, virtual memory, multicores, multiprocessors, new trends in computer architecture.</p> <p>Prerequisites: CENX 316.</p>		
CENX 414	Programmable Logic Devices	3 (3, 1, 0)
<p>Course Description: This course provides detailed knowledge in the area of implementing digital circuits into PLD components such as FPGA and CPLD. Students get more detailed knowledge in the area of digital circuits design, especially with respect to their implementation into PLDs (FPGAs, CPLDs) and ASICs. Students get overview of current technology of these integrated circuits, their off-the-shelf architectures. Students will be able to design and implement a digital system into an FPGA using HDL language.</p> <p>Prerequisites: CENX 212.</p>		
CENX 415	Introduction to VLSI Design	3 (3, 1, 0)
<p>Course Description: Large-scale MOS design: MOS transistors, static and dynamic MOS gates, stick diagrams, MOS circuit fabrication, design rules, power and delay estimates, scaling, MOS combinational and sequential logic design, register and clocking schemes, memory, data-path, and control unit design. Elements of computer-aided circuit analysis and layout techniques.</p> <p>Prerequisites: CENX 212 and EE 310.</p>		

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CENX 416	Introduction to Computer Arithmetic	3 (3, 1, 0)
<p>Course Description: Students will be introduced to several computer arithmetic topics at an advanced level. Topics include: Standard and unconventional number representations, design of fast two-operand and multi-operand adders, high-speed multiplication and division algorithms, floating-point numbers, algorithms, and hardware algorithms. Also, implementations like pipelined, digit-serial and fault-tolerant arithmetic processors are introduced. Prerequisites: CENX 316.</p>		
CENX 441	Computer Networks	4 (3, 1, 2)
<p>Course Description: Introduction to computer networks; Network architecture with respect to OSI and TCP/IP reference models; Ethernet, 802.11 technologies, Bluetooth, and cellular systems; Frame Switching and VLANs; Bridges and spanning trees; Basic network protocols: IPv4, ARP, DHCP, ICMP. Interior routing protocols. Transport layer protocols: UDP, TCP, and RTP. Prerequisites: CENX 341.</p>		
CENX 442	Computer and Network Security	3 (3, 1, 0)
<p>Course Description: Symmetric and public key cryptography; digital signatures; cryptographic hash functions; authentication pitfalls; Network and Internet security: Network Access Control and Cloud Security; Transport-Level Security; Wireless network security; Electronic mail security, and IP security; System Security: Malicious software, Intruders, and firewalls. Prerequisites: CENX 441.</p>		
CENX 443	Wireless and Sensor Networks	3 (3, 1, 0)
<p>Course Description: Introduction to Wireless and Mobile Networks: Fundamental concepts in mobile wireless networks, Characteristics of wireless links, RF propagation, path loss models; Fixed assignment Multiple access techniques: FDMA/TDMA/CDMA, Performance of Fixed assignment techniques, Erlang-B model; The cellular concept: frequency reuse, cell architecture and handoff protocols; Cellular Technologies: 2G/GSM, 3G/UMTS/HSPA, 4G/LTE/LTE-A; Wireless LANs: multiple access techniques for LANs, IEEE 802.11 (Wi-Fi); Mobility management: Mobile IP protocol. Prerequisites: CENX 441.</p>		
CENX 445	Network Protocols and Algorithms	3 (3, 1, 0)
<p>Course Description: A broad range of advanced internetworking topics; Inter-domain Routing (BGP); IPv6, and Multicast Routing; Multiprotocol Label Switching (MPLS). Quality of Service; Congestion Control; Application layer protocols (Web, DNS, E-mail, Real-time Streaming, Video-on-Demand, Voice over IP and BitTorrent). Prerequisites: CENX 441.</p>		

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CENX 446	Network Design & Management	3 (3, 1, 0)
<p>Course Description: Internetworking: Internetworking hardware, Bridging and switching technologies, Virtual LANs; Network Design: the network development life cycle, Network analysis and design methodology, Enterprise network design model, backbone design concepts; Network Management: foundations of network management, management architectures, information model, organizational model, communication model, functional model; Network Management Standards, Network Management Protocols, Abstract Syntax Notation One (ASN.1), Simple Network Management Protocol (SNMP), SNMPv2 and SNMPv3, Structure of Management Information (SMI), Management Information Base (MIB), Remote Monitoring RMON 1 and 2. Prerequisites: CENX 441.</p>		
CENX 453	Digital Control and Robotics	4 (3, 1, 2)
<p>Course Description: Review of mathematical representation of systems modeling (in frequency domain and in time domain) and parameter identification; system analysis in time domain, system stability, and steady state error; root locus, and compensator design using pole placement and root locus; digital control and stability; introduction to robotics; control of robotic systems. Prerequisites: MATH 244 and CENX 352.</p>		
CENX 454	Intelligent Systems	3 (3, 1, 0)
<p>Course Description: Applications of intelligent systems in computer engineering field: artificial intelligence (AI) definitions, knowledge representation, rule-based and fuzzy-based expert systems, evolutionary computation, and deep neural networks. Use AI methods for solving computer engineering problems such as image/video analysis, speech processing and analysis, robotics, and computer networks. Prerequisites: CENX 453.</p>		
CENX 459	Robotics	3 (3, 1, 0)
<p>Course Description: Historical development of robotics, robot arm kinematics, inverse kinematics, trajectory planning, resolved motion control, MATLAB simulation of control algorithms. Introduction to autonomous mobile robots. Kinematic model of a wheeled mobile robot, sensors for localization and perception. Mapping, and navigation. Control of a mobile robot. Algorithms implementation on Q-bot mobile robot. Internet and Web Robotics. Prerequisites: CENX 453.</p>		
CENX 460	Digital Speech Processing	3 (3, 1, 0)
<p>Course Description: Review of sampling theorem, filtering, and noise management; speech and language fundamentals; speech perception and production; tools for digitally processing speech signal: windowing, pre-emphasis, and framing; linear predictive coding; applications of digital speech processing such as speech recognition and synthesis. Prerequisites: CENX 352.</p>		

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CENX 465	Digital Image Processing	3 (3, 1, 0)
<p>Course Description: It covers quantitative models of imaging systems, spatial domain and frequency domain methods, digital filter design for image enhancement and restoration, edge detection, image denoising, image enhancement, image restoration, image compression, and image representation and description. Prerequisites: CENX 352.</p>		
CENX 479	Practical Training	1 Credit Hour
<p>Course Description: Students are requested to achieve different activities outside the campus doing work related to their field of study while enrolled as students. Typically, in these activities, the student is supervised by someone on site who is usually not among the KSU/college/department faculty. The practical training course is a great experience that provides students with hands-on, real world experience in a work setting. This is mandatory internship program for all students in the computer engineering department. The course is designed to provide students opportunity to apply their academic education with work experience. A continuous period of 300 hours spent in company with purpose of acquiring practical experience. Prerequisites: Completing 120 Credit Hours.</p>		
CENX 490	Engineering Design & Project Management	3 (3, 0, 0)
<p>Course Description: Computer engineering discipline: the potential role of computer engineers in modern society, the role of engineering societies and organizations, liabilities and opportunities for computer engineers; Overview of the engineering design process; Project selection and needs identification; Requirements specification; Concept generation and evaluation; System design: bottom-up and top-down design, functional decomposition; Behavior models: state diagrams, flowcharts, data flow diagrams, UML; Testing and system reliability; Ethical and legal Issues; Project management: Project plan, Gantt charts, Cost models, Break-even analysis, Cost estimation; Professional skills: effective teamwork, effective written and oral communication. Prerequisites: ENGL 110 and CENX 316.</p>		
CENX 491	Special Topics in Computer Engineering	3 (3, 0, 0)
<p>Course Description: This is an elective course offering special topics in computer engineering that may differ from one semester to the other depending on students' need. Prerequisites: CENX 318, CENX 441, CENX 351.</p>		

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CENX 492	Graduation Project I	3 Credit Hours
<p>Course Description: The student should take a B.Sc. project in related area to his specialization and with technical merit. This project is for two semesters; it is counted as three credits for the first semester. At the end of the semester the student submits a report describing his projects and the parts he completed in the first semester and proposed parts in the 2nd semester. The projects are oriented toward providing experience in the establishment of objectives, criteria, synthesis, analysis, construction, testing, and evaluation; solution of open-ended problems; design methodology.</p> <p>Prerequisites: CENX 490, Level 7 is the zero level, and completing 120 Credit Hours.</p>		
CENX 493	Graduation Project II	3 Credit Hours
<p>Course Description: After completing the requirements of CENX 492, the student should finalize the implementation of the hardware and/or software aspects of his project. At the end of the semester, the student has to submit a report and deliver an oral presentation to support the claim that he has made.</p> <p>Prerequisites: CENX 492.</p>		