# Howard R. Hughes College of Engineering

## *Introduction*

The College of Engineering offers majors in several engineering disciplines, computer science, and construction management as well as minors in engineering disciplines, technology commercialization, computer science and Reserve Officers' Training Corps (ROTC) related fields.

Engineering is a discipline that has had a direct and vital impact on people's lives throughout history. In ancient times, mankind practiced the art of engineering by creating fundamental inventions such as stone tools, the lever, and the wheel. In modern times, engineers apply innovative methods using scientific and mathematical principles to the design, manufacture, and control of structures, machines, processes, and systems. Today engineers are responsible for creations such as skyscrapers, dams, water treatment plants, automobiles, airplanes, electric power, computers, electronic communication systems, the internet and medical diagnostic tools. An engineering education provides opportunities for solving problems of great social significance and for increasing humankind's quality of life.

Since the development of the electronic computer in the 1940s, the computer science field has seen spectacular growth. Electronic computers now range from single-chip microcomputers in any number of electrical appliances, such as refrigerators and thermostats, to supercomputers which can perform thousands of trillions of operations per second. Computer Science is the study of the design of computer software and hardware as it relates to the theory of computation, algorithms and data structures, programming methodology and languages, operating systems, and computer elements and architecture. Its applications include computer system architecture, computer networks, distributed computer systems, programming languages and software systems, information and data management, artificial intelligence, computer science theory, evolutionary algorithms, and computer vision and graphics.

Construction Management is a discipline and management system specifically created to promote the successful execution of construction projects for clients. A construction manager or management team coordinates the different processes, budgets and timetables necessary to complete a major construction project. In particular, a construction manager or management team is responsible for the overall planning, coordination and control of a construction project from inception to completion while meeting a client's requirements. This includes ensuring the construction of functionally and financially viable project that will be completed on time within authorized cost and to the required quality standards.

The mission of the Howard R. Hughes College of Engineering is to serve society and the region as a center of higher learning and research by providing technology, computer science, and engineering education to technologists and engineers, some of whom will become future leaders, entrepreneurs and innovators. The College's goals are:

- To provide quality undergraduate education through nationally-accredited programs in computer science, civil engineering, computer engineering, electrical engineering, entertainment engineering and design, mechanical engineering, and construction management. Graduates of our undergraduate programs will have the
  1. Appropriate technical knowledge and skills to be technically competent in their disciplines
  2. Appropriate interpersonal skills to function professionally in their disciplines
  3. Knowledge and skills to be a responsible citizen
- To provide competitive graduate and professional education in computer science, civil and environmental engineering, electrical engineering, mechanical engineering, and construction management.
- To create knowledge through research and to disseminate the results of research through publication.
- To engage in private and public service through outreach, creation, and dissemination of knowledge, or to function as a repository of knowledge.

## *Accreditation*

Northwest Commission on Colleges and Universities, www.nwccu.org

Bachelor of Science in Engineering degree programs in Civil Engineering, Computer Engineering, Electrical Engineering, and Mechanical Engineering accredited by the Engineering Accreditation Commission of ABET, http://www,abet.org.

Bachelor of Science in Computer Science accredited by the Computing Accreditation Commission of ABET, http://www.abet.org.

Bachelor of Science in Construction Management accredited by the American Council for Construction Education (ACCE), http://www.acce-hq.org/

## *Departments, Majors, Minors and Undergraduate Degrees*

**College of Engineering**

Technology Commercialization — Minor

Entertainment Engineering and Design — Bachelor of Science
- Engineering Option
- Design Technology Option

Entertainment Engineering and Design — Minor

**Department of Aerospace Studies (Air Force Reserve Officers' Training Corps)**

Aerospace Studies — Minor

**Department of Civil and Environmental Engineering and Construction**

Civil Engineering — Bachelor of Science in Engineering

Construction Management — Bachelor of Science
- Engineering Science Option
- Management Option

**Department of Computer Science**
Computer Science — Bachelor of Arts
Computer Science — Bachelor of Science
Computer Science — Minor
**Department of Electrical and Computer Engineering**
Computer Engineering — Bachelor of Science in Engineering
Electrical Engineering — Bachelor of Science in Engineering
**Department of Mechanical Engineering**
Mechanical Engineering — Bachelor of Science in Engineering
**Department of Military Science (Army Reserve Officers' Training Corps)**
Military Science — Minor

## *Graduate Degree Programs*

Aerospace Engineering — Master of Science
Biomedical Engineering — Master of Science
Civil Engineering — Master of Science in Engineering
Doctor of Philosophy in Engineering
Computer Science — Master of Science
Doctor of Philosophy
Construction Management — Master of Science
Electrical Engineering — Master of Science in Engineering
Doctor of Philosophy in Engineering
Materials and Nuclear Engineering — Master of Science
Mechanical Engineering — Master of Science in Engineering
Doctor of Philosophy in Engineering
Transportation — Master of Science

## *Multicultural Engineering Program*

The mission of UNLV's Multicultural Program (MP) is to recruit minority and underrepresented undergraduate and graduate students into the Science, Technology, Engineering, Math (STEM) and healthcare related disciplines; foster a positive and caring learning atmosphere that supports classroom instruction and professional development; increase retention and graduation rates; and improve overall student success. The MP office provides a wide range of student support services and assistance in finding scholarships, internships, summer and part-time jobs, as well as, post graduate full-time employment within the STEM and Health Science industries.

The original MP began in 1989, as the Minority Engineering Program in response to the under-representation of American-Indians, African Americans, Latino and Hispanic Americans, and women in engineering, computer science, informatics, and construction management professions. As of 2013 we have expanded from the College of Engineering and now include the entire STEM and health science related disciplines.

## *Admission to the College*

**Admission Policies:** All programs in the College of Engineering require elevated levels of mathematics preparedness. A student admitted to UNLV must meet one of the following requirements for admission to the College of Engineering:

- SAT Mathematics Score of 520 or higher, or
- ACT Mathematics Score of 22 or higher, or
- Grade of C or better in MATH 096, or
- Placement into MATH 126 (Precalculus) or above by the UNLV Department of Mathematical Sciences.

High school graduates are strongly advised to complete four years of English, four years of high school mathematics including AP Calculus, three years of high school science including chemistry, physics and one AP science course while in high school.

**Transfer Policies:** Transfer students from other universities or from other UNLV colleges must have a minimum GPA of 2.5 for admission to the College of Engineering. Transfer students with a GPA of less than 2.5 can be admitted on probationary status and must schedule an interview with the Engineering Academic Advising Center prior to entering the college. The student may be required to agree to an academic performance contract.

## *College Policies*

**Pre-major Placement:** Except for students entering the Entertainment Engineering and Design major, all freshman and transfer students admitted to the college are placed in one of the following pre-major programs in the college.
CEGPRE — Civil and Environmental Engineering
CEMPRE — Construction Management
COEPRE — Computer Engineering
CSCPRE — Computer Science
EEGPRE — Electrical Engineering
MEGPRE — Mechanical Engineering
ECSPRE — Undecided
EGGPRB — Probation

Students in these pre-programs will be assigned an advisor by the College of Engineering Academic Advising Center. Students in these pre-programs are expected to complete courses in their majors. After a student has completed pre-engineering courses prescribed by their chosen major, the student is eligible to submit an application to the Academic Advising Center for advanced standing in their major. Advanced standing status allows a student to take upper-division courses in the student's major.

**Credit for Transfer Courses**: Transfer students from other Nevada institutions should obtain a copy of the Nevada System of Higher Education (NSHE) Course Transfer Guide to determine course equivalencies between those institutions and UNLV. Students may also visit the transfer student information page found linked from the Admissions webpage. Students can access the transfer course equivalency tables, learn about admission requirements and FAQ's about transferring to UNLV. Transfer students must be aware that even though the Office of the Registrar & Admissions accepts courses for transfer credit, each department evaluates courses for content and level prior to acceptance toward a degree in any major. Students may be required to furnish documentation on some courses before they can be considered for acceptance as an equivalent course.

**International Students:** International students are required to take placement exams in English as a second language (ESL) and to enroll in the appropriate ENG or ESL courses recommended by the Director of the English Language Center.

**Probation:** A student may be placed on college probation if:

1. The cumulative GPA falls below 2.00.
2. The student is not taking courses toward a college degree program.
3. The student does not have credit for ENG 101 and MATH 181 or is not progressing toward these course requirements.

**Suspension:** A student will be placed on college suspension for one semester if on probation for two consecutive semesters.

A suspended student, whether on college or university suspension, may be readmitted to the college based on approval of the Associate Dean for Undergraduate Programs. The re-admitted student will remain on college probation and may be suspended again unless specific goals that are articulated in a contract entered into by the student and the Associate Dean for Undergraduate Programs have been achieved. All re-admitted students must make an appointment with the College of Engineering Academic Advising Center to develop contract requirements. A student on college suspension, while not eligible to take any courses in the college, may take other courses to improve academic standing and demonstrate readiness to continue a degree program within the college. Please see the University policy regarding suspension rules..

### *Academic Advising Center*

It is the goal of the College of Engineering Academic Advising Center to assist each student in navigating the requirements of their degree while at UNLV. The advising center staff is committed to providing academic assistance to students as they fulfill their educational goals and achieve academic success, thereby enabling our graduates to enter into their chosen field within the engineering, construction management and computer science professions.

The Academic Advising Center administers the academic advising services for all college disciplines and facilitates transfer course evaluations, student applications for advanced standing status and graduation initiation. All undergraduate students are encouraged to visit the College of Engineering Academic Advising Center located in TBE A-207 and take advantage of the services and assistance provided to ensure accuracy of semester schedules, to obtain referrals to campus resources and student support services to help with academic and personal goals, and ensure a timely graduation. Additionally, students should also review the Academic Advising Center's website for additional information (http://engineering.unlv.edu/advising/).

The Academic Advising Center schedules general advising and registration specific advising appointments each semester on a first-come, first-serve basis, however weekly open advising is also available for short questions. Students should come to the Academic Advising Center or call 702-895-2522, to make an appointment for advising with the Advisor assigned to their major. During the first week of classes, students should be prepared to submit proof that they have taken and passed all necessary prerequisite courses; and are currently registered in all corequisite courses, otherwise, they face being administratively dropped from courses in which they do not meet the necessary prerequisites and corequisites. The college may refuse to accept any course taken more than eight years prior to graduation. Students to whom this requirement might apply should consult with their academic advisor for further direction.

## Entertainment Engineering and Design Major - Bachelor of Science (BS)

Engineering is the creative application of scientific and mathematical principles to the design, manufacture, and control of structures, machines, processes, and systems. Entertainment engineering is an engineering discipline that creates the highly technical designs that the entertainment industry has come to demand. Entertainment engineering involves the application of traditional engineering disciplines including computer, electrical, mechanical and civil engineering to the art of entertainment. The Bachelor of Science in Entertainment Engineering and Design provides two academic paths for students who are interested in pursuing the interdisciplinary fusion of engineering and the fine arts that will allow them to succeed in the entertainment industry.

Please see the UNLV Entertainment Engineering and Design department web page at www.eed.egr.unlv.edu/ for more information about department programs, faculty, and facilities.

Please see advising information at the UNLV College of Engineering Advising Center at http://engineering.unlv.edu/advising/

### *Accreditation*

Institution - Northwest Commission on Colleges and Universities www.nwccu.org

## Design Technology Option

### *Learning Outcomes*

To achieve these objectives and goals, each graduate of the Entertainment Engineering Technology and Design program will attain the following outcomes before graduation:

1. Appropriate technical knowledge and skills
   a. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies
   b. an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities
   c. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives
   d. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes
   e. an ability to identify, analyze, and solve broadly-defined engineering technology problems
2. Appropriate fine art knowledge and skills
   a. knowledge and comprehension of entertainment design principles and concepts
   b. an ability to use technology to communicate through art
   c. an ability to express visual concepts and ideas in a creative manner at a professional level
   d. an ability to demonstrate appropriate technical knowledge and skills of various artistic mediums
3. Appropriate interpersonal skills
   a. an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature
   b. an ability to function effectively as a member or leader on a technical team
4. The knowledge and skills to be a responsible citizen
   a. an understanding of the need for and an ability to engage in self-directed continuing professional development
   b. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
   c. a knowledge of the impact of engineering technology solutions in a societal and global context
   d. a commitment to quality, timeliness, and continuous improvement

## Program Objectives

The educational objectives of the Bachelor of Science in Entertainment Engineering Technology and Design is to educate students so that they can work in the design, production, installation, and operation of entertainment devices, systems, and venues.

## Program Goals

To achieve these objectives, the Entertainment Engineering and Design: Technology Option program's goals are for the graduate to possess:

1. Appropriate technical knowledge and skills
2. Appropriate fine art knowledge and skills
3. Appropriate interpersonal skills
4. The knowledge and skills to be a responsible citizen

## Engineering Option

### *Learning Outcomes*

To achieve these objectives and goals, each graduate of the Entertainment Engineering and Design program will attain the following outcomes before graduation:

1. The appropriate technical knowledge and skills
   a. An ability to apply knowledge of mathematics, science, and engineering
   b. An ability to design and conduct experiments, as well as to analyze and interpret data
   c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
   d. An ability to identify, formulate, and solve engineering problems
   e. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
2. Appropriate fine art knowledge and skills
   a. knowledge and comprehension of entertainment design principles and concepts
   b. an ability to use technology to communicate through art
   c. an ability to express visual concepts and ideas in a creative manner at a professional level
   d. an ability to demonstrate appropriate technical knowledge and skills of various artistic mediums
3. The appropriate interpersonal skills
   a. An ability to communicate effectively
   b. An ability to function on multidisciplinary teams
4. The knowledge and skills to be responsible citizens
   a. An understanding of professional and ethical responsibility
   b. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
   c. A recognition of the need for, and an ability to engage in life-long learning
   d. A knowledge of contemporary issues

## Program Objectives

The educational objectives of the Bachelor of Science in Entertainment Engineering and Design: Engineering Option is to educate students so that they can work in the entertainment engineering field as it applies to the design, manufacture, and control of structures, machines, processes, and systems used in the entertainment industry.

## Program Goals

To achieve these objectives, the Entertainment Engineering and Design program's goals are for the graduate to possess:

1. Appropriate technical knowledge and skills
2. Appropriate fine art knowledge and skills
3. Appropriate interpersonal skills
4. The knowledge and skills to be a responsible citizen

**University Graduation Requirements**

- Please see Graduation Policies for complete information

Entertainment Engineering and Design
Degree Requirements.....Total: 135-141 Credits
(see notes 1-3 below)
General Education Requirement..... Subtotal: 33-36 Credits
First-Year Seminar ..... Credits: 2-3
English Composition ..... Credits: 6

- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar ..... Credits: 3
(see note 5)
Constitutions ..... Credits: 4-6

- HIST 100 - Historical Issues and Contemporary Society

or

- PSC 101 - Introduction to American Politics

Or a combination of one course from each of the following two lists
US Constitution

- HIST 101 - United States: Colonial Period to 1877
- HIST 106 - European Civilization Since 1648

Nevada Constitution

- HIST 102 - United States Since 1877
- HIST 217 - Nevada History
- PSC 100 - Nevada Constitution

Mathematics
Fulfilled within the major.
Distribution Requirement ..... Credits: 18
Please see Distribution Requirements for more information.

- Humanities and Fine Arts: 9 credits
  - PHIL 242 - Ethics For Engineers and Scientists (see note 5)
  - COM 216 - Survey of Communication Studies
  - ART 101 - Drawing I
- Social Science: 9 credits
  - ECON 190 - Global Economics (see note 4)
  - EGG 307 - Engineering Economics
  - One social science elective course chosen to satisfy the Multicultural Requirement
- Life and Physical Sciences and Analytical Thinking:
  - Automatically satisfied by Major requirement

Multicultural and International
Multicultural, one 3 credit course required
International, one 3 credit course required
These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students
(see note 4)
Major Requirements - BS in Entertainment Engineering and Design
Major - Design Technology Option - Subtotal: 102-103 Credits
Required Mathematics, and Natural Science Courses.... Credits: 19

- MATH 181 - Calculus I Fulfills the Mathematics General Education Requirement

- MATH 182 - Calculus II
- STAT 152 - Introduction to Statistics
- PHYS 151 - General Physics I
- PHYS 151L - General Physics I
- PHYS 152 - General Physics II
- PHYS 152L - General Physics II

Required Entertainment Design Courses ..... Credits: 24
- EED 110 - Material Science and Fabrication Techniques
- EED 111 - Basic Kinetic Structures
- EED 210 - Multi-Media Design
- EED 220 - Design for Live Entertainment
- EED 250 - History of Entertainment and Technology
- AAL 270 - Design Communication
- THTR 200 - Introduction to Design/Technology

Required Seminars..... Credits: 8
- EED 100 - Entertainment Engineering and Design Seminar I
- EED 200 - Entertainment Engineering and Design Seminar II
- EED 300 - Entertainment Engineering and Design Seminar III
- EED 400 - Entertainment Engineering and Design Seminar IV

Required Entertainment and Engineering
Technology Science Courses..... Credits:19
- CEM 250 - Construction Materials and Methods
- CEM 250L - Construction Materials and Methods
- ABS 341 - Structures for Architects I
- CEM 457 - Project Management

or
- CEE 409 - Engineering Project Management
- CS 135 - Computer Science I
- CpE 100 - Computer Logic Design I
- CpE 200 - Computer Logic Design II

Entertainment Engineering Technology Tracks ..... Credits: 17-18
Complete two of the three tracks listed below:

Automation..... Credits: 8
- EE 292 - Fundamentals of Electrical & Computer Engineering
- CS 202 - Computer Science II
- CpE 200L - Computer Logic Design II Laboratory
- CpE 310L - Microcontroller Systems Design Laboratory for EE

Structural Design and Rigging..... Credits: 9
- CEM 270 - Construction Engineering Mechanics
- CEM 370 - Steel and Wood Design in Construction
- EED 320 - Rigging and Structural Design Principles

Entertainment Venue Design..... Credits: 9
- CEM 350 - Facility Systems Design and Construction I
- CEM 351 - Facility Systems Design and Construction II
- EED 451 - Entertainment Venue Design

Fine Arts Electives..... Credits: 9
Complete nine credits from the courses listed below:
- AAD 180 - Fundamentals of Design I
- ART 107 - Design Fundamentals I
- ART 156 - Design Fundamentals III
- ART 216 - Sculpture I
- ART 243 - Digital Imaging I
- GRC 250 - Design & Media Studio I
- ART 419 - Foundry Sculpture
- MUS 213 - Fundamentals of Music Composition II
- THTR 204 - Theatre Technology I
- THTR 404 - Theatre Technology II

Required Internship and Capstone ..... Credits: 6
- EED 493 - Internship in EED
- EED 497 - Senior Design I
- EED 498 - Senior Design II

Major Requirements - BS in Entertainment Engineering and Design - Engineering Option - Subtotal: 107 Credits

Required Mathematics, and Natural Science Courses.... Credits: 33
- MATH 181 - Calculus I Fulfills the Mathematics General Education Requirement
- MATH 182 - Calculus II
- MATH 283 - Calculus III
- MATH 431 - Mathematics for Engineers and Scientists I
- MATH 432 - Mathematics for Engineers and Scientists II
- STAT 463 - Applied Statistics for Engineers
- PHYS 180 - Physics for Scientists and Engineers I
- PHYS 180L - Physics for Scientists and Engineers Lab I
- PHYS 181 - Physics for Scientists and Engineers II
- PHYS 181L - Physics for Scientists and Engineers Lab II
- PHYS 182 - Physics for Scientists and Engineers III
- PHYS 182L - Physics for Scientists and Engineers Lab III

Required Entertainment Design Courses ..... Credits: 6
- EED 110 - Material Science and Fabrication Techniques
- EED 111 - Basic Kinetic Structures

Required Seminars..... Credits: 4
- EED 100 - Entertainment Engineering and Design Seminar I
- EED 200 - Entertainment Engineering and Design Seminar II
- EED 300 - Entertainment Engineering and Design Seminar III
- EED 400 - Entertainment Engineering and Design Seminar IV

Required Entertainment Engineering Science Courses .. Credits: 43
- CEE 241 - Statics
- CEE 370 - Engineering Mechanics of Deformable Bodies
- CEE 370L - Engineering Mechanics of Deformable Bodies Laboratory
- CEE 381 - Structural Analysis I
- CS 135 - Computer Science I
- CS 202 - Computer Science II
- CpE 100 - Computer Logic Design I
- CpE 200 - Computer Logic Design II
- CpE 200L - Computer Logic Design II Laboratory
- CpE 310L - Microcontroller Systems Design Laboratory for EE
- EE 292 - Fundamentals of Electrical & Computer Engineering
- EE 360 - Signals and Systems I
- EE 370 - Classical Feedback and Control Systems

or
- ME 421 - Automatic Controls
- ME 242 - Dynamics
- ME 380 - Fluid Dynamics for Mechanical Engineers

Entertainment Engineering Tracks..... Credits: 18
Complete any two of the tracks listed below:

Structural Engineerin ..... Credits: 9
- CEE 346 - Civil Engineering Materials
- CEE 432 - Geological Engineering

or
- CEE 444 - Steel Structural Design

Complete any 3 credits from the courses listed below:
- AAD 180 - Fundamentals of Design I
- AAI 322 - Interior Construction and Detailing
- THTR 200 - Introduction to Design/Technology
- THTR 204 - Theatre Technology I

Computer Science Internet ..... Credits: 9
- CS 218 - Introduction to Systems Programming
- CS 341 - Internet Programming
- CS 341L - Internet Programming Lab
- ART 107 - Design Fundamentals I

Computer Science Graphics..... Credits: 9
- MATH 365 - Computational Linear Algebra
- CS 480 - Computer Graphics

Complete any 3 credits from the courses listed below:
- ART 108 - Design Fundamentals II-3D
- ART 216 - Sculpture I
- ART 243 - Digital Imaging I

Robotics..... Credits: 9
- ME 425 - Robotics
- EE 472 - Digital Control Systems

or
- ME 429 - Computer Control of Machines and Processes

Complete any 3 credits from the courses listed below:
- ART 216 - Sculpture I
- ART 419 - Foundry Sculpture

THTR 200 - Introduction to Design/Technology

Acoustics..... Credits: 9
- ME 434 - Noise Control
- MUS 231 - Recording Technology I
- THTR 407 - Sound Design for the Theatre

With consent of faculty advisor, THTR 404 - Theatre Technology II can be substituted for any Fine Arts course in Structural Engineering, Robotics and Acoustics tracks.

Required Capstone..... Credits: 3
- EED 497 - Senior Design I
- EED 498 - Senior Design II

**Notes:**
1. Regardless of catalog of graduation, students must satisfy prerequisite and corequisite course requirements as specified in the current Undergraduate Catalog.
2. All prerequisite courses must be completed with a grade of C or better before the subsequent course can be taken.
3. All courses counted towards the degree must be completed with a grade of C or better.
4. ECON 190 satisfies the International requirement. The one free 3-credit social science elective should be selected to satisfy the Multicultural requirement.
5. PHIL 242 will simultaneously satisfy both a humanities requirement and the Second Year Seminar requirement for students obtaining a degree from the College of Engineering that requires more than 120 credits.

## Technology Commercialization Minor

This minor is intended for all undergraduate students of the College of Engineering. The minor consists of curriculum covering prototyping, commercialization, and business-related concepts. The minor exposes engineering majors to elements of technology commercialization with the relevant aspects of both entrepreneurship and commercialization within established enterprises. The minor is coupled with senior design experience. The minor will culminate in a business plan competition.

Required Courses.....Total Credits: 20-21
- EGG 101 - Introduction to Engineering Experience
- ECON 102 - Principles of Microeconomics

or
- ECON 190 - Global Economics
- COM 101 - Oral Communication

or
- COM 216 - Survey of Communication Studies
- EGG 307 - Engineering Economics
- EGG 460 - Technology Commercialization
- MGT 493 - Seminar in Entrepreneurship

or
- MGT 497 - Business Plan Creation
- Engineering or Computer Science Capstone (Senior Design) can be met with any of the following options:
- (option a) CEE 498 - Civil Engineering Capstone Design

or
- (option b) CS 472 - Software Product Design and Development I

or
- (option c) CS 495 - Senior Project Development I

and
- CS 496 - Senior Project Development II

or
- (option d) EE 497 - Senior Design Project I

and
- EE 498 - Senior Design Project II

or
- (option e) EED 497 - Senior Design I

and
- EED 498 - Senior Design II
- (option f) ME 497 - Senior Design Project I

All courses included in the minor must be passed with grades of C or better.

**EGG 100 - People and Technology**
Problems and issues caused by and solved by applications of technology. Such issues as natural disasters, populations, food supply, distribution of energy, and other topics considered. Note(s): Satisfies the General Education Core Science requirement. 3 credit(s)

**EGG 101 - Introduction to Engineering Experience**
Seminar: Introduction to UNLV learning outcomes and the programs that reside within the College of Engineering. Topics include professional ethics, technical communication, the design process, and technology's impact on a global society. 2 credit(s)

**EGG 102 - Introduction to Engineering Design**
Engineering problems for math. Introduces the design process to include team design, problem formulation, statement of criteria, brainstorming, decision matrix, preparation of specifications and presentation of results. Corequisite(s): ENG 101. Prerequisite(s): MATH 127. 2 credit(s)

**EGG 102L - Introduction to Design Laboratory**
Introduction to techniques used in the design process: sketching, dimensioning, brainstorming, decision trees, decision matrices, P.C. software packages. Corequisite(s): EGG 102. 1 credit(s)

**EGG 130 - Control of Environmental Pollution**
(Same as ENV 130.) Introduction to pollution control methods, beginning with water-borne diseases and sanitation. Progression to mass balance concepts and development of pollution control measures designed to improve air and water quality and minimize risk of exposure to hazardous wastes. Not for credit towards engineering degree. Prerequisite(s): CHEM 105, BIOL 100, MATH 128. 3 credit(s)

**EGG 300 - Quality Control and Quality Improvement Engineering**
Quality assurance as a system problem. Components and theory of the system presented including quality fundamentals, process definition, basic statistics, sampling distributions, control charts, assignable causes, diagnosing a process, and process improvement. Current quality philosophies discussed. Prerequisite(s): MATH 182 and junior standing. 3 credit(s)

**EGG 307 - Engineering Economics**
Engineering economic analysis for the evaluation of technical alternatives and necessary economic trade-offs made in planning, designing, and operating engineering systems. Prerequisite(s): Admission to construction management, civil, mechanical or electrical engineering major. 3 credit(s)

**EGG 412 - Engineering Law**
Survey course in legal principles and theory for contracts, methods of doing business, patents, and copyrights. Topics include: product liability, nuisance, defamation, and other torts. Prerequisite(s): Senior standing in engineering. 3 credit(s)

**EGG 417 - Mold Making and Casting**
Advanced mold making and casting techniques culminating in 3-D objects made in clay, porcelain, aluminum, bronze, and plaster. Prerequisite(s): ME 220. 3 credit(s)

**EGG 450 - Solar and Renewable Energy Utilization**
Introduction to renewable energy applications. Includes environmental motivations, historical perspectives, solar photovoltaic and thermal applications, implications in building designs, wind energy, biomass, alternative fuels, geothermal power utilization, utility considerations, and political and economic factors. Prerequisite(s): Admission to the Solar and Renewable Energy Minor and upper division standing. 3 credit(s)

**EGG 451 - Ergonomics**
Design of the work environment to facilitate the safety of the worker and the improvement of work performance, with emphasis on the biomechanical requirements and musculoskeletal consequences of work activity. Prerequisite(s): ME 242 and ME 302, or PHYS 151 and 152. 3 credit(s)

**EGG 460 - Technology Commercialization**
Combines the perspectives of engineering design, design for manufacturing, industrial design, and technology market identification into a unified product design method. Instruction and hands-on examples of customer needs to quality measures, concept generation, prototype optimization, and market introduction. Prerequisite(s): ME 242 or EE 221 or CEE 241 or CS 370 or instructor permission. 3 credit(s)

# Entertainment Engineering and Design

Engineering is the creative application of scientific and mathematical principles to the design, manufacture, and control of structures, machines, processes, and systems. Entertainment engineering is an engineering discipline that creates the highly technical designs that the entertainment industry has come to demand. Entertainment engineering involves the application of traditional engineering disciplines including computer, electrical, mechanical and civil engineering to the art of entertainment. The Bachelor of Science in Entertainment Engineering and Design provides two academic paths for students who are interested in pursuing the interdisciplinary fusion of engineering and the fine arts that will allow them to succeed in the entertainment industry.

## Entertainment Engineering and Design Minor

Entertainment engineering is an engineering discipline that creates the highly technical designs that the entertainment industry has come to demand. Entertainment engineering involves the application of traditional engineering disciplines including computer, electrical, mechanical and civil engineering to the art of entertainment.

Non-EED students may declare a minor through the advising centers of either the College of Engineering or the College of Fine Arts. A total of 30 credits are required for a minor in Entertainment Engineering and Design. 12 credits must come from the provided list of required classes and 18 credits from one of the two tracks. Work in the minor must be completed with a 2.75 or higher GPA by the date of graduation in the student's major field of study. All work must be completed in residence at UNLV.

Required Minor/Concentration Courses
Must take the following 12 credits
- EED 110 - Material Science and Fabrication Techniques
- EED 111 - Basic Kinetic Structures
- EGG 307 - Engineering Economics
- THTR 404 - Theatre Technology II

Engineering Track
Required Minor Engineering Track Courses 12 credits
Complete the following:
- CS 135 - Computer Science I
- CpE 100 - Computer Logic Design I
- ME 242 - Dynamics
- EE 292 - Fundamentals of Electrical & Computer Engineering

or
- EE 320 - Engineering Electronics I

Required Minor/Concentration Electives:
Electives
Complete 6 credits from any of the following courses:
- CEE 346 - Civil Engineering Materials
- CEE 432 - Geological Engineering
- CEE 444 - Steel Structural Design
- CS 341 - Internet Programming
- CS 341L - Internet Programming Lab
- CS 480 - Computer Graphics
- ME 425 - Robotics
- ME 434 - Noise Control
- EE 360 - Signals and Systems I

- EE 472 - Digital Control Systems
- THTR 407 - Sound Design for the Theatre

Design/Technology Track

Required Minor Design/Technology Track Courses 7 Credits

Complete the following for 4 credits

- MATH 182 - Calculus II

Complete 3 credits from any of the following courses:

- CS 135 - Computer Science I
- CpE 100 - Computer Logic Design I
- CEE 241 - Statics
- EE 292 - Fundamentals of Electrical & Computer Engineering

Required Minor/Concentration Electives:

Complete 11 credits from any of the following courses:

- ART 419 - Foundry Sculpture
- ABS 341 - Structures for Architects I
- CEE 409 - Engineering Project Management
- CEM 350 - Facility Systems Design and Construction I
- CEM 351 - Facility Systems Design and Construction II
- CEM 370 - Steel and Wood Design in Construction
- EED 100 - Entertainment Engineering and Design Seminar I
- EED 200 - Entertainment Engineering and Design Seminar II
- EED 300 - Entertainment Engineering and Design Seminar III
- EED 320 - Rigging and Structural Design Principles
- EED 400 - Entertainment Engineering and Design Seminar IV
- EED 451 - Entertainment Venue Design
- THTR 407 - Sound Design for the Theatre

## *Entertainment Engineering and Design*

**EED 100 - Entertainment Engineering and Design Seminar I**
Acquaints students with current trends and practices in the entertainment industry. Weekly discussions, guest speakers or presentations on current entertainment topics. May be repeated for a maximum of two credits. 1 credit(s)

**EED 110 - Material Science and Fabrication Techniques**
Provides an overview of the many types of materials currently used in the entertainment industry; the science of these materials; fabrication methods using these materials; and hands-on experience with these materials and techniques. Corequisite(s): EED 100. Prerequisite(s): Prior or concurrent enrollment in EED 100, MATH 181 or higher. 3 credit(s)

**EED 111 - Basic Kinetic Structures**
Provides an overview of the many types of kinetic structures currently used in the entertainment industry; the science of these structures; fabrication methods using these structures; and hands-on experience working with these structures. Corequisite(s): MATH 181 Prerequisite(s): EED 110. 3 credit(s)

**EED 120 - Intro to Entertainment Technologies for the Non-Major**
Provides an overview of the many types of technology currently employed in the entertainment industry. Emphasis will be given to examples developed in the past 10 years. 3 credit(s)

**EED 130 - Entertainment Visualization**
Fundamental concepts of computer visualization applicable to the entertainment industry. Corequisite(s): EED 111. Prerequisite(s): EED 100, 110, 111. 3 credit(s)

**EED 210 - Multi-Media Design**
Focuses on the conceptual, technical and visual design skills required to create multimedia environments for the entertainment industry. Corequisite(s): EED 200. Prerequisite(s): EED 111 and MATH 181. 3 credit(s)

**EED 220 - Design for Live Entertainment**
Introduction to the aesthetic principles of entertainment design. Study and practice of design for live entertainment through controlled use of color, line, mass, space, and light. Prerequisite(s): EED 200 and EED 210. 3 credit(s)

**EED 250 - History of Entertainment and Technology**
Study of the evolution of entertainment in the 19th century to the present as an art form and as a science. 3 credit(s)

**EED 300 - Entertainment Engineering and Design Seminar III**
Acquaints students with current trends and practices in the entertainment industry. Weekly discussions, guest speakers or presentations on current entertainment topics. Prerequisite(s): EED 200. May be repeated for a maximum of two credits. Note(s): Required of all majors. To be taken in junior year. 1 credit(s)

**EED 310 - Product Design I**
Students will learn to synthesize technology and aesthetics in the service of the entertainment industry. Emphasis is placed on conceptual thinking, creativity, risk-taking, non-fad-driven aesthetic appropriateness, personal motivation, networking, and interdisciplinary flexibility and co-operation. Prerequisite(s): EED 220. 3 credit(s)

**EED 320 - Rigging and Structural Design Principles**
Investigation of rigging systems in the entertainment industry and their demands on the structural design of a venue. Focuses on current trends in the entertainment industry. Prerequisite(s): EED 220. 3 credit(s)

**EED 330 - Programmable Systems for the Entertainment Industry**
Investigation of programmable logic systems in the entertainment industry with emphasis on current industry practices. Prerequisite(s): EED 220 3 credit(s)

**EED 400 - Entertainment Engineering and Design Seminar IV**
Acquaints students with current trends and practices in the entertainment industry. Weekly discussions, guest speakers or presentations on current entertainment topics. Prerequisite(s): Prerequisite(s):º EED 300. May be repeated for a maximum of two credits. Note(s): Required of all majors. To be taken in senior year. 1 credit(s)

**EED 410 - Design Aesthetics in Entertainment Design**
Examination of the aesthetic principles of entertainment design. Study and practice of design for the stage through controlled use of color, line, mass, space, and light. Prerequisite(s): EED 220. 3 credit(s)

**EED 420 - Entertainment Product Design II**
Students will learn to synthesize technology and aesthetics in the service of the entertainment industry. Emphasis is placed on conceptual thinking, creativity, risk-taking, non-fad-driven aesthetic appropriateness, personal motivation, networking, and interdisciplinary flexibility and co-operation. Prerequisite(s): EED 310. 3 credit(s)

**EED 431 - Control Systems for the Entertainment Industry**
Investigation of hydraulic, electrical and show control systems in the entertainment industry with emphasis on current industry practices. Prerequisite(s): EED 330. 3 credit(s)

**EED 432 - Rigging Systems for the Entertainment Industry**
Investigation of rigging systems in the entertainment industry with emphasis on current industry practices. Prerequisite(s): EED 320. 3 credit(s)

**EED 441 - Motion Capture**
Students will learn the technology used to create a 3D representation of a live performance or action through the use of modern technologies. Prerequisite(s): EED 220. 3 credit(s)

**EED 442 - Animatronics Techniques**
Automata and Robots support humans, and can and interact with them. Introduces the technologies that enable computer-driven stagecraft, concepts of feedback control, robot control, and the computer technologies (hardware and software) to coordinate and automate sequences of events. Prerequisite(s): EED 220. 3 credit(s)

**EED 451 - Entertainment Venue Design**
Students will learn the principles and requirements used in designing entertainment venues with emphasis on current practices. Prerequisite(s): EED 220. 3 credit(s)

**EED 491 - Special Topics in EED**
Topics announced in the class schedule each year. May be used for EED degree requirement with permission from program coordinator. Prerequisite(s): EED 111. May be repeated to a maximum of nine credits. 1-4 credit(s)

**EED 493 - Internship in EED**
Internship at regional/national centers of entertainment activity. Prerequisite(s): EED 220. May be repeated to a maximum of nine credits. 1-4 credit(s))

**EED 495 - Supervised Individual Study**
Tutorial study of special problems in entertainment engineering and design. Student submits a detailed project description agreed upon first by student and instructor and then by two other members of the EED faculty. May not be used in meeting the core requirement credits. Prerequisite(s): Junior or senior standing; permission in advance of registration from the program coordinator/advisor. May be repeated to a maximum of nine credits. 1-4 credit(s)

**EED 497 - Senior Design I**
The first of two capstone design courses for Entertainment Engineering students. Students will begin a major design experience that uses knowledge and skills from prior courses and incorporates appropriate engineering standards and multiple realistic constraints. Students will begin the design process including research, conceptualization, feasibility assessment, and establishing design requirements. Corequisite(s): EED 400. Prerequisite(s): EED 300 and consent of faculty advisor. 1 credit(s)

**EED 498 - Senior Design II**
The second of two capstone design courses for Entertainment Engineering students. Students complete the major design experience that began in EED 497. Students will complete the design process including completing a preliminary design and establishing design requirements, and analyzing, producing, testing and presenting the design. 2 credit(s)

# Aerospace Studies Department

## *Introduction*
Air Force Reserve Officer Training (AFROTC) is an educational program designed to give men and women the opportunity to become Air Force officers while completing their college degrees. The Air Force ROTC program is focused on preparing cadets to become leaders in today's high-tech Air Force. Upon completion of the AFROTC program and the attainment of a baccalaureate degree, the graduate receives a commission as an officer in the U.S. Air Force. A monthly subsistence is provided during the junior and senior years. Scholarships are awarded on a competitive basis in increments of four, three, and two years.

## *Program Eligibility*
The program is open to qualified men and women representing of all academic majors of the university. To qualify for membership in the AFROTC program, a student must be a citizen of the United States and by their junior year be at least 17 years of age, physically qualified, and enrolled as a full-time student. All UNLV students are eligible to register for AFROTC academic courses even if they are not members of AFROTC. UNLV students who desire a varied aerospace education without seeking a commission are encouraged to enroll in classes on a space-available basis for the purpose of academic credit only. These students are not required to attend traditional AFROTC activities.

## *AFROTC Scholarships*
Competitive scholarships are made directly to students by the Air Force in accordance with Department of Defense policies. All AFROTC scholarships and stipends involve transactions between the programs and the student without university intervention. Although the university will not supplement AFROTC scholarships directly, students enrolled in the AFROTC program are eligible to apply for merit-based university and college scholarships as well as need-based and merit-based state and federal assistance programs.

## Aerospace Studies Minor
## *Program Objectives*
The objective of the Air Force ROTC program is to educate and train cadets to become outstanding leaders in the United States Air Force and to guide and motivate cadets to embrace the Air Force core values of "integrity first, service before self, and excellence in all we do."

## *Program Overview*
AFROTC is typically a four-year program, but it is possible to complete the core requirements in as little as three years. A student with prior active-duty military experience can complete the program in just over two years.

The program is divided into two distinct sections, the General Military Course (GMC) and the Professional Officer Course (POC).

## *General Military Course*
The first two years of the Air Force ROTC program, the General Military Course, consist of one hour of classroom work and two hours of leadership laboratory each week. The General Military Course is an opportunity for students not on an Air Force ROTC scholarship to try out the program with no obligation. After completing General Military Course requirements, if you wish to compete for entry into

the last two years of the program, the Professional Officer Course, you must do so under the requirements of the Professional Officer Course selection system. This system uses qualitative factors, such as grade point average, physical fitness scores, unit commander evaluation and aptitude test scores to determine if you have officer potential. After selection, you must successfully complete a four-week field training encampment (during the summer break prior to your junior year in the program) before entering the Professional Officer Course. Once you are enrolled in the Professional Officer Course, you must attend a three-hour class each week and continue to participate in the weekly leadership laboratory.

### *Professional Officer Course*

In the Professional Officer Course, you apply what you have learned in the General Military Course and at field training. In the Professional Officer Course, you actually conduct the leadership laboratories and manage the unit's cadet corps. Each unit has a cadet corps based on the Air Force organizational pattern of flight, squadron, group and wing. Professional Officer Course classes are small. Emphasis is placed on group discussions and cadet presentations. Classroom topics include management, communication skills and national defense policy. Once you have enrolled in the Professional Officer Course, you enter into a contract with the Air Force stating that you agree to complete the remainder of the program and commission into the Air Force. As part of the contract, you are enlisted into the Air Force Reserve and assigned to the Obligated Reserve Section. This entitles you to a monthly $300-$500 non-taxable stipend during the academic year.

Partnership with College of Southern Nevada (CSN) or Nevada State College (NSC).

Students enrolled full-time at either the College of Southern Nevada (CSN) or Nevada State College (NSC) may enroll in the AFROTC program at their respective colleges, while attending AES classes at UNLV.

### *Program Objectives*

**Department Policies:** Students pursuing a commission in the USAF must enroll in the class and leadership lab. Students not pursuing a commission can enroll only in the class.

**Textbooks, Uniforms and Equipment:** The U.S. Air Force provides students with required textbooks at no additional expense. Uniforms, uniform items, and equipment will also be issued to qualified cadets at no additional expense.

Uniforms are for use during AES class, Leadership Lab, and other training conducted by the program. Uniforms will be turned in at the end of each semester.

## Aerospace Studies Minor

(16 credits)

AES 110/120, 111/121, 230/240, 231/241, 351/361, 352/362, 471/481, 472/482. Sixteen credits of AES classes: 100 and 200 level classes are not prerequisites and can be taken concurrently with any other AES classes for students not pursuing commission and therefore not eligible to enroll in the labs.

## Aerospace Studies Department Minor

Air Force Reserve Officer Training Corps (ROTC)

The Air Force Reserve Officer Training Corps (Air Force ROTC) is an educational program designed to give men and women the opportunity to become Air Force officers while completing their college degrees. The Air Force ROTC program is focused on preparing cadets to become leaders in today's high-tech Air Force. Upon completion of the AFROTC program and the attainment of a baccalaureate degree the graduate receives a commission as an officer in the US Air Force. A monthly subsistence is provided during the junior and senior years. Scholarships are awarded on a competitive basis in increments of four, three, and two years. Air Force ROTC enrollment is not restricted to individuals who wish to become commissioned officers in the USAF. Students may elect to take Air Force ROTC without seeking a commission in courses for academic credit only, earning elective credits for university degrees. These students are not required to attend the traditional AFROTC activities.

#### FOUR/THREE YEAR PROGRAM

The first half of the four-year program is called the General Military Course, which is offered during a student's freshman and sophomore years. NSC and CSN students may take these courses which are offered at UNLV. This program allows students to try out Air Force ROTC for up to two years without incurring any obligation (unless they are on an Air Force ROTC scholarship). As students attend class, they learn more about the Air Force and the historical development of airpower. The last two years are called the Professional Officer Course. These junior and senior level classes, offered at UNLV, cover leadership skills and national defense policy. Students must be enrolled full time at NSC and CSN in order to take these courses and commission as second lieutenants upon successful completion of the program.

#### FINANCES

Textbooks for all Air Force ROTC courses are provided by the Air Force free of charge. Students who have contracted with Air Force ROTC receive a tax-free subsistence allowance during the academic year of $300-$500 per month, depending on their academic year.

#### AIR FORCE ROTC SCHOLARSHIPS

Air Force ROTC offers scholarships covering a student's college education for two, three, or four years. Each scholarship pays up to full tuition, laboratory fees, incidental fees, an annual book allowance up to $600, and a tax-free subsistence allowance of at least $300 per month. In-college scholarship opportunities are also available for students already enrolled in the Air Force ROTC program. Freshmen can earn three-year scholarships, while sophomores can earn two-year scholarships. College transferees may also apply for these scholarships. All scholarship applicants must meet the following minimum requirements:

- Be a U.S. citizen
- Be less than 31 years old as of December 31 of the year you will commission
- Meet military and physical standards
- Pass the Air Force Officer Qualifying Test
- Have a minimum cumulative GPA of 2.50

Aerospace Studies Minor - Required Courses.....Total Credits: 16
AES 110/120, 111/121, 230/240, 231/241, 351/361, 352/362, 471/481, 472/482. Sixteen credits of AES classes; 100 & 200 level classes are not prerequisites and can be taken concurrently with any other AES classes for students not pursuing commission and therefore not eligible to enroll in the labs

**AS100 (AES 110/120) – The Foundations of the United States Air Force**
*Description:* AS100 is a survey course designed to introduce students to the United States Air Force and encourage participation in Air Force Reserve Officer Training Corps. Featured topics include: overview of ROTC, special programs offered through ROTC, mission and organization of the Air Force, brief history of the Air Force, introduction to leadership and leadership related issues, Air Force Core Values, Air Force officer opportunities, and an introduction to communication studies. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.
*Course Objectives:* The AS100 student should know what AFROTC and the Air Force have to offer potential entrants, as well as the expectations the Air Force will set concerning core values and leadership. The student should also have a basic knowledge of what role the Air Force plays and how it is organized to support national objectives. The individual should demonstrate basic communicative skills.

**AS200 (AES 230/240) – The Evolution of USAF Air and Space Power**
*Description:* A course designed to examine general aspects of air and space power from a historical perspective. The course covers the period from the first balloons and dirigibles to the space-age systems of the Global War on Terror. Historical examples are provided to show the development of Air Force distinctive capabilities (previously referred to as core competencies), and missions (functions) to demonstrate the evolution of what has become today's USAF air and space power. Furthermore, the course examines several fundamental truths associated with war in the third dimension, e.g., principles of war and tenets of air and space power. As a whole, this course provides the students with a knowledge-level understanding for the general employment of air and space power, from an institutional, doctrinal, and historical perspective. In addition, what the students learned about the Air Force Core Values in AS100 will be reinforced through the use of operational examples, and they will complete several writing and briefing assignments to meet Air Force communication skills requirements.
*Course Objectives:* The AS200 student should know the key terms and definitions used to describe air and space power. The individual should know the events, leaders, and technical developments that led to the evolution and employment of USAF air and space power. The individual should demonstrate basic verbal and written communication skills. The individual should know the Air Force Core Values and examples of their use throughout the evolution of USAF air and space power.

**AS 300 (AES 351/361) – Air Force Leadership Studies**
*Description:* AS 300 is a study of leadership, management fundamentals, professional knowledge, Air Force personnel and evaluation systems, leadership ethics, and communication skills required of an Air Force junior officer. Case studies are used to examine Air Force leadership and management situations as a means of demonstrating and exercising practical application of the concepts being studied. A mandatory Leadership Laboratory complements this course by providing advanced leadership experiences in officer-type activities, giving students the opportunity to apply leadership and management principles of this course.
*Course Objectives:* The AS 300 cadet should comprehend selected individual leadership skills and personal strengths and weaknesses as applied in an Air Force environment. The individual should comprehend the responsibility and authority of an Air Force officer, the Air Force officer's responsibilities in the counseling and feedback process, and the selected duties and responsibilities as a subordinate leader. The individual should comprehend and apply concepts of ethical behavior as well as comprehend the selected concepts, principles, and theories of quality in Air Force leadership and management. The individual should apply listening, speaking, and writing skills in Air Force-peculiar formats and situations with accuracy, clarity, and appropriate style.

**AS 400 (AES 471/481) – National Security Affairs/ Preparation for Active Duty**
*Description:* AS 400 examines the national security process, regional studies, advanced leadership ethics, and Air Force doctrine. Special topics of interest focus on the military as a profession, officer ship, military justice, civilian control of the military, preparation for active duty, and current issues affecting military professionalism. Within this structure, continued emphasis is given to refining communication skills.
*Course Objectives:* The AS 400 cadet should comprehend the basic elements of national security policy and process. The individual should comprehend the air and space power functions and competencies. Also, the individual should comprehend selected roles of the military in society and current issues affecting the military profession as well as selected provisions of the military justice system. The individual should comprehend the responsibility, authority, and functions of an Air Force commander. The individual should apply listening, speaking, and writing skills in Air Force-peculiar formats and situations with accuracy, clarity, and appropriate style. The individual should comprehend the factors, which facilitate a smooth transition from civilian to military life.

**Leadership Laboratory (AES 111/121, 231/241, 362/362, 472/482)**
*Description:* Leadership Laboratory (LLAB) is a dynamic and integrated grouping of leadership developmental activities designed to meet the needs and expectations of prospective Air Force second lieutenants and complement the AFROTC academic program. It is a student planned, organized, and executed practicum conducted under the supervision of the detachment commander and commandant of cadets. LLAB cadets are classified into one of four groups with respect to field training attendance and/or commissioning. Initial Military Training (IMT) cadets are part of the General Military Course (GMC) but are not scheduled to attend field training (normally AS100 cadets). The focus of IMT objectives/activities are to promote the Air Force way of life and help effectively recruit and retain qualified cadets. This time is spent acquainting the cadets with basic Air Force knowledge and skills to help them determine whether they wish to continue with the AFROTC program. Field Training Prep (FTP) cadets are scheduled to attend field training in the upcoming year (normally AS200 cadets). The FTP objectives provide training to ensure every cadet is mentally and physically prepared for the rigorous field training environment. Intermediate Cadet Leaders (ICL) are cadets returning from field training (normally AS300 cadets). ICL objectives/ activities give cadets the opportunity to further develop the leadership and followership skills learned at field training. Every cadet position should provide the ICL the opportunity to sharpen their planning, organizational, and communication skills, as well as their ability to effectively use resources to accomplish a mission in a constructive learning environment. Senior Cadet Leaders (SCL) are cadets scheduled to be commissioned in the upcoming year (normally AS400 cadets). This time is spent on additional opportunities to develop leadership and supervisory capabilities, and prepares cadets for their first active duty assignment. Extended Cadet Leaders (ECL) are cadets whose ROTC academic requirements are complete but still have one or more terms of college left to complete. These cadets may hold special duty or regular positions within the cadet corps upon discretion of the Detachment Commander (Det CC) or Commandant of Cadets (COC).
*Course Objectives:* The IMT cadet in the LLAB program should know the principles of the Holm Center Training Manual (HCTM), Air Force customs and courtesies, dress and grooming standards, and grade structure and insignia as well as the chain of command. The individual should know the AFROTC Honor Code. The individual should know effective time management skills, the benefits of exercise and nutrition, as well as the AFROTC weight and fitness standards. The individuals will know the courtesies and procedures associated with the United States flag and know and demonstrate individual and flight drill positions and movements. Finally, they will begin to know the environment of the Air Force officer by participating in a unit formal dinner, retreat, parade, and awards ceremony.

For more information, contact:
AFROTC Detachment 004
Department of Aerospace Studies
Box 454005 • 4505 Maryland Parkway
Las Vegas, Nevada 89154-4005
(702) 895-5313 • http://afrotc.unlv.edu/

## *Aerospace Engineering Studies*

**AES 110 - Foundations of the United States Air Force I**
Survey course designed to introduce AFROTC cadets and prospective Air Force officers to the Air Force culture. Describes heritage and structure of the United States Air Force and opportunities available to the Air Force corps. 1 credit(s)

**AES 111 - AFROTC Leadership Lab 1-A**
Progression of experiences designed to develop leadership ability and awareness of the Air Force lifestyle with emphasis on: Air Force customs and courtesies; drill and ceremonies, physical fitness, the Air Force officer's environment and culture and opportunities available to commissioned officers. Corequisite(s): AES 110 or equivalent. Note(s): S/F grading only. 2 credit(s)

**AES 120 - Foundations of the United States Air Force II**
Survey course designed to introduce AFROTC cadets to the leadership aspects of being an Air Force officer and the environment in which the Air Force officer functions. Course emphasizes the Air Force's core values and other unique characteristics of serving in the United States Air Force. Prerequisite(s): AES 110 or equivalent. 1 credit(s)

**AES 121 - AFROTC Leadership Lab I-B**
Progression of experiences designed to develop leadership ability and awareness of the Air Force lifestyle with emphasis on: Air Force customs and courtesies; drill and ceremonies, physical fitness, the Air Force officer's environment and culture and opportunities available to commissioned officers. Corequisite(s): AES 120 or equivalent. Note(s): S/F grading only. 2 credit(s)

**AES 230 - Evolution of USAF Air and Space Power I**
Survey course designed to trace the development of the U.S. Air Force air and space power through a historical prism. Begins with the study of early flight and concludes with the Korean conflict. Special emphasis is placed on the evolving nature of Air Force capabilities, functions and doctrine. 1 credit(s)

**AES 231 - AFROTC Leadership Lab II-A**
In-depth progression of experiences developing leadership ability and awareness of the Air Force lifestyle. Focuses on continued military training related to uniform wear, military customs and courtesies, and military ceremonies. AES 231 is required for all cadets applying to attend Field Training. Corequisite(s): AES 230 or equivalent. Note(s): S/F grading only. 2 credit(s)

**AES 240 - Evolution of USAF Air and Space Power II**
Survey course to trace the development of U.S. Air Force air and space power through a historical prism. Begins with study of the Vietnam War and concludes with the second war against Iraq. Emphasis placed on evolving nature of Air Force capabilities, functions and doctrine. Prerequisite(s): AES 230 or equivalent. 1 credit(s)

**AES 241 - AFROTC Leadership Lab II-B**
In-depth progression of experiences developing leadership ability and awareness of the Air Force lifestyle. Focuses on continued military training related to uniform wear, military customs and courtesies, and military ceremonies. AES 241 is required for all cadets applying to attend Field Training.
Corequisite(s): AES 240 or equivalent. Note(s): S/F grading only. 2 credit(s)

**AES 351 - Air Force Leadership Studies I**
Designed to provide AFROTC cadets the opportunity to study and master the leadership, management and communication skills required of successful Air Force officers. Participate and interactive learning methodologies are used throughout to ensure students have internalized and can apply concepts being studied. Prerequisite(s): AES 240 or equivalent or junior standing. 3 credit(s)

**AES 352 - AFROTC Leadership Lab III-A**
Study of advanced leadership topics such as: planning and controlling the military activities of the AFROTC cadet corps, preparing and presenting military briefings and written communications, and providing guidance, direction, and information to increase the understanding, motivation, and performance of other cadets. Corequisite(s): AES 351 or equivalent. Note(s): S/F grading only. 2 credit(s)

**AES 361 - Air Force Leadership Studies II**
Designed to provide AFROTC cadets the opportunity to study and master the leadership, management and communication skills required of successful Air Force officers. Emphasis placed on the study of military ethics, leadership accountability and professional relations. Participative and interactive learning methodologies used throughout. Prerequisite(s): AES 351 or equivalent or junior standing. 3 credit(s)

**AES 362 - AFROTC Leadership Lab III-B**
Study of advanced leadership skills such as: planning and controlling the military activities of the AFROTC cadet corps, preparing and presenting military briefings and written communications, and providing guidance, direction and information to increase the understanding, motivation, and performance of other cadets. Corequisite(s): AES 361 or equivalent. Note(s): S/F grading only. 2 credit(s)

**AES 471 - National Security Affairs/Preparation for Active Duty I**
Provides advanced AFROTC cadets the opportunity to study the national security policy process, the make-up and joint nature of the U.S. military and pertinent regional issues. Participative and interactive learning methodologies used throughout. Continued emphasis placed on developing effective leadership and communication skills. Prerequisite(s): AES 361 or equivalent or junior standing. 3 credit(s)

**AES 472 - AFROTC Leadership Lab IV-A**
Provides senior AFROTC cadets advanced leadership experiences involving: planning and controlling military activities of the AFROTC cadet corps, preparing and presenting military briefings and written communications, and providing guidance, direction and information to increase the understanding, motivation, and performance of other cadets. Corequisite(s): AES 471 or equivalent. Note(s): S/F grading only. 2 credit(s)

**AES 481 - National Security Affairs/Preparation for Active Duty II**
Provides advanced AFROTC cadets the opportunity to study regional issues impacting the U.S. Air Force, the unique aspects of the profession of arms and prepare them to enter active duty as an Air Force officer. Continued emphasis placed on developing effective leadership and communication skills. Prerequisite(s): AES 471 or equivalent or junior standing. 3 credit(s)

**AES 482 - AFROTC Leadership Lab IV-B**
Provides senior AFROTC cadets advanced leadership experiences involving: planning and controlling military activities of the AFROTC cadet corps, preparing and presenting military briefings and written communications, and providing guidance, direction and information to increase the understanding, motivation, and performance of other cadets. Corequisite(s): AES 481 or equivalent. Note(s): S/F grading only. 2 credit(s)

# Military Science Department

The Army ROTC program in the Department of Military Science offers an academically challenging and practical curriculum which can be completed in eight semesters or a compressed program of either four or six semesters. The military science curriculum supplements the university's baccalaureate or postgraduate studies. The Army is prepared to award a commission to any deserving student based on both Army ROTC and academic achievement upon graduation.

The scope of the military science curriculum is oriented toward developing the best all-around student who demonstrates leadership and managerial skill, reacts well under pressure, and understands general military subjects. Student cadets attend classroom conferences and a leadership laboratory program.

## *Program Objectives*

The overall objective of the Army ROTC program is to develop in the student cadet (through both classroom theory and practical application) the necessary traits, knowledge, proficiency, and experience needed to be commissioned as an officer in the United States Army. The candidate's course of study includes a broad educational base, including academic subjects of particular value in both civilian and military pursuits. Student cadets develop expertise in the following subject areas:

1. General knowledge of the historical development of the United States Army and its role in support of national objectives.
2. Working knowledge of general organizational structure and how the various components of an organization operate as a team in the fulfillment of overall objectives.
3. Strong understanding of personal integrity, honor, and individual responsibility.
4. Knowledge of the human relationships involved in an organization and an understanding of the responsibilities of military service assignments.
5. The ability to communicate effectively, both orally and in writing.
6. Sufficient knowledge of military life to ensure a smooth transition from the civilian environment.

The curriculum prepares the student for military service.

## *Admission to the Program*

The first two years of the Army ROTC program are called the Basic Program and are offered at the CSN and UNLV Campuses. Only the final two years, constitute the Advanced Program. The Advanced Program is open to undergraduate and graduate students who have successfully completed the Basic Program, the six-week Army ROTC basic summer camp, or those who have completed Basic Training and who have completed a minimum of 60 college credits.

The basic summer camp (Leader's Training Camp) is normally scheduled after the student's sophomore year. The basic summer camp substitutes for the basic program and is geared for students who join the ROTC program late and wish to finish the curriculum in four semesters (two years).

To be admitted into the Advanced Program, a student must:

1. Be a citizen of the United States and be regularly enrolled as a full-time student at the university.
2. Be able to complete the course, graduate and be commissioned prior to the 30th birthday (waivers are possible).
3. Have successfully completed such survey and screening tests as may be prescribed.
4. Have successfully passed a prescribed physical examination.
5. Be selected by the Chair of the Department of Military Science.
6. Executed a written contract with the United States government.

As part of the advanced program, the student enters into a contract with the Army, whereby the individual agrees, contingent upon continued university enrollment, to complete the Army ROTC program (including advanced summer camp) and to accept a commission, if offered, upon completion of the degree program. To be eligible for commissioning, a student must earn at least a bachelor's degree.

### *Advanced Program Requirements*

12 credits

MIL 301 MIL 302, MIL 401, MIL 402 (MIL 100 is required with each MIL course)

### *Volunteer Extracurricular Activities*

**Ranger Challenge Team:** A highly competitive organization that provides additional military training for students who are preparing to become Combat Arms Officers. The Ranger Challenge Team competes annually as a varsity sport against teams from other colleges and universities in the western United States.

## *Financial Assistance*

In the basic program, students with Army ROTC scholarships, or those contracted cadets receive up to $500/month. Students awarded two-, three- and four-year Army ROTC scholarships by the Department of the Army receive a per month subsistence stipend while enrolled in school (10 months per year maximum), as well as payment for tuition, fees, and books.

All other students formally enrolled in the advanced course are paid a per month stipend while enrolled in school, not to exceed a total of 20 months. Students are paid one-half of the base pay of a second lieutenant while attending the six-week summer camp training, plus travel pay to and from summer camp. The Department of Military Science has a limited number of in-state and out-of-state fee waivers available each semester for students requiring financial assistance.

Additionally, the National Guard and Army Reserve pay up to 100 percent of the credit costs plus book reimbursement for students who elect to serve simultaneously in the National Guard or Army Reserve and ROTC.

### *Textbooks, Uniforms and Equipment*

The U.S. government provides students with required textbooks, and provides uniforms and equipment to qualified cadets.

Uniforms are for use during MIL 100 and other training conducted by the program. Uniforms are turned in at the end of each semester.

## Military Science Minor

The Army ROTC program in the Department of Military Science offers an academically challenging and practical curriculum which can be completed in eight semesters or a compressed program of either four or six semesters. The military science curriculum supplements the university's baccalaureate or postgraduate studies. The Army is prepared to award a commission to any deserving student based on both Army ROTC and academic achievement upon graduation.

The scope of the military science curriculum is oriented toward developing the best all-around student who demonstrates leadership

and managerial skill, reacts well under pressure, and understands general military subjects. Student cadets attend classroom conferences and a leadership laboratory program.

Courses include ..... Total Credits: 25

- MIL 101 - Basic Military Skills I
- MIL 102 - Basic Military Skills II
- MIL 201 - Leadership and Management I
- MIL 202 - Leadership and Management II
- MIL 301 - Leadership in Small Unit Operations
- MIL 302 - Advanced Leadership Development
- MIL 350 - Leadership Development and Assessment Course
- MIL 401 - Adaptive Leadership
- MIL 402 - Leadership in a Complex World
- HIST 386A - Military History of the United States to 1900
- HIST 386B - Military History of the United States Since 1900

Can substitute MIL 101, 102, 201, 202 with MIL 250

## *Military Science*

**MIL 100 - Leadership Lab**
Practicum in those skills taught in the classroom during the other military science classes. Hands-on lab led by mentored cadets focusing on leadership, planning and execution of squad tactics, movement formations, drill and ceremonies, equipment inspections, rapelling, land navigation, orienteering, rifle marksmanship, and air-mobile operations. Lab required every semester in conjunction with the appropriate military science class. 1 credit(s)

**MIL 101 - Basic Military Skills I**
Mission of the armed services, introduction to the United States Army, its customs and traditions, the role of the Army Officer, the role of the Non-Commissioned Officers Corps, Organizations of the TOTAL Army (Including the National Guard and Army Reserves). Introductory orienteering, marksmanship, physical fitness and briefing skills. 2 credit(s)

**MIL 102 - Basic Military Skills II**
Continuation of the mission of the armed services, introduction to the United States Army, its customs and traditions, the role of the Non-Commissioned Officers Corps, Organizations of the TOTAL Army (Including the National Guard and Army Reserves). Introductory orienteering, marksmanship, physical fitness and briefing skills. 2 credit(s)

**MIL 201 - Leadership and Management I**
Introduction to leadership and management, which develops the basic skills that must be learned in order to perform as an effective leader. Introduction to the Army Leadership Development Program (LDP), the decision-making process, the code of conduct, the Army Operations Order format and its use. Advanced land navigation, physical fitness and briefing skills. 2 credit(s)

**MIL 202 - Leadership and Management II**
Leadership and management, which develops the basic skills that must be learned in order to perform as an effective leader. Introduction to the Army Leadership Development Program (LDP), the decision-making process, the code of conduct, the Army Operations Order format and its use. Advanced land navigation, physical fitness, and briefing skills. 2 credit(s)

**MIL 250 - Leader's Training Course**
A five week course at Fort Knox, KY intended for those who are interested in ROTC but have missed one or more semesters of military science. This course has four phases intended to develop and hone individual and collective skills. The first phases deals with military customs and courtesies, wear of uniforms and drill and ceremony. The second phase deals with adventure training, obstacle course, hand grenades/weapons, water survival etc. The third phase deals with tactics and military leadership, and the final phase combines all elements into a practical exercise. Travel will be paid by the government. Prerequisite(s): Students must have prior consent from the Professor of Military Science to attend the course. 2 credit(s)

**MIL 301 - Leadership in Small Unit Operations**
Includes current tactical doctrine as applied to small unit leadership with special emphasis on those leadership skills required for an ROTC cadet to be successful at the Army ROTC Leadership Development and Assessment course. Prerequisite(s): Completion of Basic Training, Leadership Training Camp or the first two years of ROTC and consent of instructor. 3 credit(s)

**MIL 302 - Advanced Leadership Development**
Continuation of MIL 301. Includes current tactical doctrine as applied to small unit leadership with special emphasis on those leadership skills required for an ROTC cadet to be successful at the Army ROTC Advanced Camp. Prerequisite(s): MIL 301 and consent of instructor. 3 credit(s)

**MIL 304 - Advanced Topics in Leadership**
Directed reading and research in contemporary military issues oriented towards a student's transition from cadet to commissioned officer. Prerequisite(s): Consent of instructor. May be repeated twice for credit. 2 credit(s)

**MIL 350 - Leadership Development and Assessment Course**
A five-week course offered during the summer at Fort Lewis, WA that emphasizes a variety of leadership positions, simulate stressful combat situations, formal evaluations on different scenarios, must meet physical fitness standards, and demonstrate proficiency in other military skills. Prerequisite(s): MIL 301 and MIL 302. 2 credit(s)

**MIL 401 - Adaptive Leadership**
Contemporary military policy and related subjects of topical military interest, military law, the military justice system, courts-martial, personal ethics and the role of the junior officer. Prerequisite(s): Consent of instructor. 3 credit(s)

**MIL 402 - Leadership in a Complex World**
Continuation of contemporary military policy and related subjects of topical military interest, including military law, the military justice system, courts-martial, personal ethics and the role of the junior officer. Prerequisite(s): MIL 401 and consent of instructor. 3 credit(s)

# Civil and Environmental Engineering and Construction Department

The Department of Civil and Environmental Engineering and Construction offers rigorous academic programs leading to degrees in Civil Engineering and Construction Management. Civil Engineering involves the planning, analysis and design, construction, operation, and stewardship of the world's structures and infrastructure. Civil Engineers design and construct buildings, bridges, highways, dams, water and wastewater treatment facilities, and other public and private works essential to civilized life in a modern society. Civil Engineers apply modern and sophisticated tools to plan and design large-scale systems for the public good, as well as select components and materials employed in these systems. Civil Engineers work primarily in teams, in a broad range of business models and as public servants. The Civil Engineering curriculum provides graduates with the skills needed to become successful, innovative and socially responsible Civil Engineers. The Construction Management curriculum offers courses in construction science and management that provide students with the necessary education to enter a wide range of professional positions in the construction industry or advanced degree programs. The program stresses a sound educational background in construction science to support the management decision-making capability required in the field.

## *Accredited by the:*

Northwest Commission on Colleges and Universities, www.nwccu.org
Engineering Accreditation Commission of ABET, http://www.abet.org
American Council for Construction Education, http://www.acce-hq.org

## *Undergraduate Majors*

Bachelor of Science in Engineering-Civil Engineering
Bachelor of Science in Construction Management

## *Mission*

It is the mission of the department to produce competent, ethical, and socially responsible graduates develop and advance relevant knowledge, and serve the community and the professions of Civil Engineering and Construction Management.

## *Goals*

The goals of the department's accredited baccalaureate programs are to:

- Prepare graduates for the lifelong practice of civil engineering and construction management.
- Meet educational requirements for professional licensure in civil engineering and professional certification in construction management.
- Provide graduates with solid academic preparation for graduate study.

**Civil Engineering Program—Educational Objectives**

The objectives of the Civil Engineering undergraduate degree program are to prepare graduates who can perform at the entry level in civil engineering practice so that, some years after graduation, they can become licensed professionals having responsibility for the planning, design, implementation, operation, continuous improvement and stewardship of civil engineering structures and infrastructure. Graduates will have the skills and tools for life-long learning, continuing professional development, and pursuit of advanced degrees.

**Measurable Program Outcomes**

Civil engineering graduates will have attained the following outcomes:

1. an ability to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of science, and engineering;
2. an ability to design and conduct civil engineering experiments, as well as to analyze and interpret the resulting data;
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
4. an ability to function on multidisciplinary teams;
5. an ability to identify, formulate, and solve engineering problems;
6. an understanding of professional and ethical responsibility;
7. an ability to communicate effectively;
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
9. a recognition of the need for, and an ability to engage in life-long learning;
10. a knowledge of contemporary issues;
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
12. an ability to apply knowledge of four technical areas appropriate to civil engineering;
13. an ability to design a system, component, or process in more than one civil engineering context;
14. an ability to explain basic concepts in management, business, public policy, and leadership;
15. an ability to explain the importance of professional licensure.

**Technical Areas:** The CEE Department has four required technical areas. The areas and the required course work in each respective area are:

1. Environmental/Water Resources Engineering — ME 242, CEE 367, CEE 413, CEE 450.
2. Geotechnical Engineering — CEE 334, CEE 346.
3. Structural Engineering — CEE 241, CEE 346, CEE 370, CEE 381, CEE 480.
4. Transportation Engineering — CEE 121, CEE 346, CEE 362.

Additionally, four technical elective courses are required in at least two technical areas, with a minimum of two courses in one area. The technical electives available in each technical area are:

1. Environmental/Water Resources Engineering — CEE 404, CEE 406, CEE 407, CEE 451, CEE 452, CEE 454, CEE 455.
2. Geotechnical Engineering — CEE 410, CEE 432, CEE 434, CEE 435, CEE 436.
3. Structural Engineering — CEE 410, CEE 444, CEE 476, CEE 477, CEE 478, CEE 482.
4. Transportation Engineering — CEE 410, CEE 461, CEE 462, CEE 463, CEE 464, CEE 466, CEE 467, CEE 470, CEE 471.
5. Construction Engineering — CEE 409 and one of CEM 451/451L, CEM 453/453L, CEM 454.

In addition to the courses identified above, students may take other elective courses such as computer applications, project management, construction engineering, and others. CEE 468 may be counted as an elective in Transportation Engineering, Environmental Engineering, or Geotechnical Engineering if a project is undertaken in that area. CEE 491 Independent Study courses and CEE 495 Special Topics courses will be categorized based on their content.

**Construction Management Program—Educational Objectives**

The Construction Management Program emphasizes course work in construction science, construction management, engineering, business and management, and mathematics and science.

**Measurable Program Outcomes**

Construction management graduates will have attained the following outcomes:

1. an ability to apply contemporary knowledge in project estimating, planning, scheduling and control;
2. an ability to contemporary knowledge of construction sciences;
3. an ability to state-of-the-art skills in construction computer applications;
4. an ability to define and solve problems
5. an ability to communicate effectively
6. an ability to function on multidisciplinary teams;
7. an ability to employ sound interpersonal and leadership skills
8. an understanding of professional and ethical responsibility;
9. an ability to apply contemporary knowledge of risk management, safety, litigation and documentation;
10. understanding of professional customer service and quality a recognition of the need for, and an ability to engage in life-long learning;
11. a knowledge of contemporary issues.

**Technical Areas:** The program offers the Bachelor of Science in Construction Management with either a management option or engineering science option.

**Engineering Sciences Option**

Prepares the student for professional practice as a construction manager or other professional construction-related positions. Emphasizes mathematics and engineering science for individuals desiring greater technical depth and for positions that are engineering related. Prepares the student for graduate studies in engineering course work and construction management.

**Management Option**

Prepares the student for professional practice as a construction manager or other professional construction-related positions. Prepares the student for graduate course work in construction management.

## *Admission to the Major*

General admission follows college requirements. Students transferring from other universities or from other colleges within UNLV who have GPAs of between 2.00 and 2.50 will be admitted on probation and considered to be pre-major students. Admission and transfer policies are described in the College of Engineering section.

## *Department Policies*

1. Regardless of catalog of graduation, students must satisfy prerequisite and corequisite course requirements as specified in the most recent Undergraduate Catalog.
2. All required and elective courses in engineering, mathematics, science, business, computer science, and English must be completed with a grade of C or better. Prerequisite courses must be completed with a grade of C or better before taking the next course. Students must complete all pre-major courses before promotion to advanced standing. Promotion to advanced standing requires a minimum GPA of 2.00 and a grade of C or better in all courses specified in No. 2 above.
3. All Civil Engineering majors must take the Discipline-Specific Fundamentals of Engineering Examination in Civil Engineering within one year prior to anticipated date of graduation. Students must register for CEE 499, one-credit, during the semester in which they plan to take the examination.
4. Civil Engineering students should register for CEE 498, Civil Engineering Capstone Design, in their last semester prior to anticipated date of graduation. To verify eligibility and permit registration for Civil Engineering Capstone Design, students must submit a completed graduation application prior to the start of instruction in their penultimate semester.
5. All Construction Management majors must take the American Institute of Constructors Qualification Examination (COE) Level I-Construction Fundamentals as part of CEM 455 within one year prior to anticipated date of graduation. A good-faith effort on the exam is required.

## Construction Management Major- Bachelor of Science (BS)

Please see the UNLV Howard R. Hughes College of Engineering web page at www.unlv.edu/engineering for information about department programs, faculty and facilities.

Please see advising information at the UNLV Howard R. Hughes College of Engineering Advising Center at www.engineering.unlv.edu/advising.

## *Accreditation*

Institution - Northwest Commission on Colleges and Universities www.nwccu.org

Program - Accreditation Board for Engineering and Technology www.abet.org

## *Learning Outcomes*

1. Graduates have a fundamental grounding in mathematics, physics, and statistics.
2. Graduates have a strong grounding in business (business, law, economics, engineering economics, and management).
3. Graduates have the ability to communicate effectively in written format and to provide professional presentation appropriate to the situation and audience.
4. Graduates have the ability to use modern construction management tools in construction management practice.
5. Graduates are aware of basic principles of ethical and professional conduct in providing for safety and health to construction practice.
6. Graduates fulfill a broad construction management curriculum to include required courses in construction management and construction science.

**University Graduation Requirements**

- Please see Graduation Policies for complete information

Construction Management Requirements.....Total: 130-139
General Education Requirements..... Subtotal 40-42 Credits
General Education Requirements required to complete in the Pre Major;
First-Year Seminar, English, Second-Year Seminar, Humanities (distribution requirement) Mathematics, Social Sciences (distribution requirement).
General Education Requirements required to complete in the Pre Major or in Advanced Standing;
Multicultural and International, Constitution, Fine Arts (distribution requirement).
First-Year Seminar.....Credits: 2-3
(See note 4 below)
English Composition ..... Credits: 6

- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar..... Credits: 3
(see note 5 below)
Constitutions ..... Credits: 4
Recommended courses:

- HIST 100 - Historical Issues and Contemporary Society

or

- PSC 101 - Introduction to American Politics

Mathematics..... Credits:
Engineering Science Option ..... Credits: 8
MATH 181 - Calculus I
MATH 182 - Calculus II
Management Option- Credits: 7
MATH 181 - Calculus I
STAT 152 - Introduction to Statistics
Distribution Requirements ..... Credits: 18
Please see Distribution Requirement for more information.

- Humanities and Fine Arts: 9 Credits
  - Two courses 3 credits each from two different humanities areas - 6 credits
  - COM 101 - Oral Communication or
  - PHIL 242 - Ethics For Engineers and Scientists (see note 5 below)
  - The following humanities course selections are for the Management Option only
  - PHIL 249 - Environmental Ethics

One course in Fine Arts

- Social Science: 9 Credits
  - ECON 190 - Global Economics (see notes 1 & 3 below)
  - EGG 307 - Engineering Economics (see notes 2 & 3 below)
  - PSY 101 - General Psychology or SOC 101 - Principles of Sociology
- Life and Physical Sciences and Analytical Thinking:
  - Automatically satisfied by Major requirement

Multicultural and International
International - ECON 190 - Global Economics - (see note 3 below )
Multicultural - Fine Arts course to satisfy Multicultural Requirement
These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students

Major Requirements - BS in Construction Management - Engineering Sciences Option.....Subtotal: 97
Pre-Major Courses..... Credits: 30
Business..... Credits: 3

- ECON 102 - Principles of Microeconomics

Sciences ..... Credits: 12

- CHEM 121 - General Chemistry I
- PHYS 180 - Physics for Scientists and Engineers I
- PHYS 180L - Physics for Scientists and Engineers Lab I
- PHYS 182 - Physics for Scientists and Engineers III
- PHYS 182L - Physics for Scientists and Engineers Lab III

Construction Management ..... Credits: 7

- CEM 100 - Fundamentals of Construction Management
- CEM 250 - Construction Materials and Methods
- CEM 250L - Construction Materials and Methods

Engineering ..... Credits: 8

- CEE 110 - Introduction to Civil Engineering Design
- CEE 241 - Statics

Other Required Courses (can be taken as Pre-Major or Advanced Standing)..... Credits: 27
Mathematics..... Credits: 10

- MATH 283 - Calculus III
- MATH 431 - Mathematics for Engineers and Scientists I
- STAT 463 - Applied Statistics for Engineers

Business..... Credits: 12

- ACC 201 - Financial Accounting
- ECON 102 - Principles of Microeconomics
- MGT 301 - Principles of Management and Organizational Behavior
- MGT 303 - Business Law and Society

Construction Management Courses..... Credits: 5

- CEM 253 - Quantity Surveying and Document Analysis
- CEM 253L - Quantity Surveying and Document Analysis

Advanced Standing Courses..... Credits: 40
Engineering ..... Credits: 18

- CEE 301 - CAD Tools for Civil Engineering Design
- CEE 346 - Civil Engineering Materials
- CEE 370 - Engineering Mechanics of Deformable Bodies
- CEE 370L - Engineering Mechanics of Deformable Bodies Laboratory
- CEE 381 - Structural Analysis I
- CEE 444 - Steel Structural Design
- CEE 480 - Concrete Structure Design

Construction Management Courses..... Credits: 22

- CEM 330 - Soils and Foundations for Construction
- CEM 350 - Facility Systems Design and Construction I
- CEM 451/451L - Construction Estimating
- CEM 452/452L - Construction Cost Control
- CEM 453/453L - Construction Scheduling
- CEM 455 - Construction Management Practice
- CEM 485 - Construction Law and Contracts

Total Credits: .....138-139
Major Requirements - Construction Management Major - Management Option - Subtotal: ..... 89 Credits
Pre-Major Courses..... Credits: 26
Business..... Credits: 3

- ECON 102 - Principles of Microeconomics

Sciences ..... Credits: 8

- PHYS 151 - General Physics I
- PHYS 151L - General Physics I
- PHYS 152 - General Physics II

- PHYS 152L - General Physics II

Construction ..... Credits: 13
- AAD 267 - Computer Applications in Architecture I
- CEM 100 - Fundamentals of Construction Management
- CEM 150 - Fundamentals of Construction Science
- CEM 250 - Construction Materials and Methods
- CEM 250L - Construction Materials and Methods

Engineering ..... Credits: 2
- CEE 121 - Elementary Surveying

Other Required Courses (can be taken as Pre-Major or Advanced Standing)..... Credits: 20

Business ..... Credits: 6
- ACC 201 - Financial Accounting
- MGT 301 - Principles of Management and Organizational Behavior
- MGT 303 - Business Law and Society

Construction Management Courses..... Credits: 14
- CEM 253 - Quantity Surveying and Document Analysis
- CEM 253L - Quantity Surveying and Document Analysis
- CEM 270 - Construction Engineering Mechanics
- CEM 301 - Construction Safety

Advanced Standing Courses..... Credits: 43
- CEM 330 - Soils and Foundations for Construction
- CEM 350 - Facility Systems Design and Construction I
- CEM 351 - Facility Systems Design and Construction II
- CEM 370 - Steel and Wood Design in Construction
- CEM 372 - Concrete Design in Construction
- CEM 432 - Temporary Construction Structures
- CEM 450 - Construction Field Inspection
- CEM 451/451L - Construction Estimating
- CEM 452/452L - Construction Cost Control
- CEM 453/453L - Construction Scheduling
- CEM 454 - Heavy Construction Methods and Equipment
- CEM 455 - Construction Management Practice
- CEM 480 - Sustainable Construction
- CEM 485 - Construction Law and Contracts

Total Credits: ..... 130

**Notes**

1. ECON 190 satisfies three credits of the social science requirement and the University International Requirement.
2. EGG 307, Engineering Economics, is approved by the University General Education Committee to meet three credits of the social science requirement.
3. UNLV requires six credits of humanities and nine credits of social science. Six of these 15 credits must be taken before the student can achieve advanced standing status. ECON 190 and the Multicultural/Humanities elective may be taken either pre-program or advanced standing. EGG 307 must be taken after achieving advanced standing status.
4. EGG 101 preferred for First-Year Seminar.
5. PHIL 242 will simultaneously satisfy both a humanities requirement and the Second Year Seminar requirement for students obtaining a degree from the College of Engineering that requires more than 120 credits.

## Civil Engineering Major- Bachelor of Science in Engineering (BSE)

Please see the UNLV Howard R. Hughes College of Engineering web page at www.unlv.edu/engineering for information about department programs, faculty and facilities.

Please see advising information at the UNLV Howard R. Hughes College of Engineering Advising Center at www.engineering.unlv.edu/advising.

### *Accreditation*

Institution - Northwest Commission on Colleges and Universities www.nwccu.org

Program - Accreditation Board for Engineering and Technology www.abet.org

### *Learning Outcomes*

1. Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of science, and engineering;
2. Design and conduct civil engineering experiments, as well as to analyze and interpret the resulting data;
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
4. Function on multidisciplinary teams;
5. Identify, formulate, and solve engineering problems;
6. An understanding of professional and ethical responsibility;
7. Ability to communicate effectively;
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
9. Recognition of the need for, and an ability to engage in life-long learning;
10. Knowledge of contemporary issues;
11. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
12. Ability to apply knowledge of four technical areas appropriate to civil engineering;
13. Ability to design a system, component, or process in more than one civil engineering context;
14. Explain basic concepts in management, business, public policy, and leadership; and an ability to explain the importance of professional licensure

**University Graduation Requirements**

- Please see Graduation Policies for complete information

Civil Engineering Degree Requirements.....Total: 135-136 Credits

General Education Requirements..... Subtotal: 37-40 Credits

First-Year Seminar ..... Credits: 2-3

English Composition ..... Credits: 6 (see note 1 below)
- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar ..... Credits: 3 (see note 2 and note 8 below)

Constitutions ..... Credits: 4-6
(see note 2 below)
Recommended courses:
- HIST 100 - Historical Issues and Contemporary Society

or
- PSC 101 - Introduction to American Politics

Mathematics ..... Credits: 4
(see note 2 below)
- MATH 181 - Calculus I

Distribution Requirements ..... Credits:18
Please see Distribution Requirement for more information.
(see note 3 below)
- Humanities and Fine Arts:9 credits
  - PHIL 242 - Ethics For Engineers and Scientists (see note 8 below)
  - COM 101 - Oral Communication
  - One course in Fine Arts - 3 credits
- Social Science: 9 credits
  - EGG 307 - Engineering Economics
  - Two additional Social Science courses
- Life and Physical Sciences and Analytical Thinking:
  - Automatically satisfied by Major requirements

Multicultural and International
(see note 2 below)
Multicultural, one 3 credit course required
International, one 3 credit course required
These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students

Civil Engineering Curriculum Pre-Major Courses ..... Credits: 33
Mathematics ..... Credits: 4
- MATH 182 - Calculus II

Sciences ..... Credits: 16
- CHEM 121 - General Chemistry I
- PHYS 180 - Physics for Scientists and Engineers I

and
- PHYS 180L - Physics for Scientists and Engineers Lab I
- PHYS 181 - Physics for Scientists and Engineers II

and
- PHYS 181L - Physics for Scientists and Engineers Lab II
- GEOL 101 - Exploring Planet Earth

Engineering ..... Credits: 13
- CEE 110 - Introduction to Civil Engineering Design
- CEE 241 - Statics
- CEE 250 - Sustainability in Civil and Environmental Engineering
- CEE 370 - Engineering Mechanics of Deformable Bodies

Major Requirements - BS in Civil Engineering ..Subtotal: 65 Credits
Other Required Courses (can be taken as Pre-Major or Advanced Standing)..... Credits: 16
Engineering ..... Credits: 9
- CEE 121 - Elementary Surveying
- CEE 198 - Ethics and Professional Practice of Engineering
- CEE 298 - Project Management and Professional Practice
- CEE 301 - CAD Tools for Civil Engineering Design
- ME 242 - Dynamics

Mathematics ..... Credits: 4
- MATH 283 - Calculus III

Engineering Science ..... Credits: 3
- ME 311 - Engineering Thermodynamics I

Advanced Standing ..... Credits: 49
Mathematics, Statistics ..... Credits: 6
- MATH 431 - Mathematics for Engineers and Scientists I
- STAT 463 - Applied Statistics for Engineers

Civil Engineering Requirements ..... Credits: 31
- CEE 334 - Soil Mechanics
- CEE 346 - Civil Engineering Materials
- CEE 362 - Transportation Engineering
- CEE 367 - Fluid Mechanics
- CEE 381 - Structural Analysis I
- CEE 413 - Water Resources Engineering I
- CEE 450 - Unit Operations and Processes in Environmental Engineering
- CEE 480 - Concrete Structure Design
- CEE 498 - Civil Engineering Capstone Design
- CEE 496 - Civil Engineering Professional Practicum
- CEE 499 - Fundamentals of Engineering Examination Registration

Civil Engineering Electives Credits: 12
CEE 400-level elective courses. (see notes 4, 5 and 6 below)
Total Credits: ..... 135-136

**Notes**

1. Must take as a Civil Engineering Pre-Major.
2. Can be taken as a Civil Engineering Pre-Major or in Advanced Standing.
3. UNLV requires six credits of humanities, three credits of fine arts and nine credits of social science. Six of these 18 credits must be taken before the student can achieve Advanced Standing status. Of the remaining 12 credits, EGG 307 must be taken after achieving Advanced Standing. The remaining nine credits may be taken either as pre-program or advanced standing.
4. CEE 491 may not replace a required course in the curriculum, may not count for more than three elective credits toward the degree, and may not be used for work experience.
5. Civil engineering elective courses are required in at least two technical areas with a minimum of two courses in one area. CEE 444 should be taken as one of the technical electives if a student elects the structural technical area.
6. Three credits of Cooperative Training (CEE 225 , CEE 325 , and CEE 425 may be used in place of one three-credit civil engineering elective. No more than one of these credits may be CEE 225.
7. To earn required credits for graduation, transfer students lacking laboratory credit for any CEE laboratory course (CEE 334 , 346, 367 or 450), must, for each lab course in which they lack credit, register simultaneously for both the corresponding zero-credit laboratory course and for a one-credit CEE 491 independent study course.
8. PHIL 242 will simultaneously satisfy both a humanities requirement and the Second Year Seminar requirement for students obtaining a degree from the College of Engineering that requires more than 120 credits.

**CEE 110 - Introduction to Civil Engineering Design**
Introduction to design of civil engineering systems, components, and processes including steps in problem solving, sustainability, relevant federal acts and laws, computer-based computational methods, and CAD design tools. Team projects with emphasis on technical communications Corequisite(s): ENG 101, CEE 198. Prerequisite(s): MATH 127 or MATH 128. Lab/Lecture/Studio Hours Two hours lecture and three hours laboratory. 3 credit(s)

**CEE 121 - Elementary Surveying**
Vertical and horizontal control methods: topographic and construction surveys, use of land survey equipment, note taking and graphical communication. Applications to earthwork and highway alignment. Prerequisite(s): CEE 110. Lab/Lecture/Studio Hours Two hours lecture plus three hours laboratory. 2credit(s)

**CEE 198 - Ethics and Professional Practice of Engineering**
Oral communication, engineers' code of ethics and other requirements for the professional practice of engineering studied through textbook material, oral communication workshops, professional society meetings, and journals. Corequisite(s): ENG 101. 1credit(s)

**CEE 225 - Cooperative Training I**
Introductory individual off-campus learning experiences in civil engineering. Students apply engineering concepts and theories in work-related settings. Minimum 200 supervised hours required. Progress reports required at least monthly. Final report and/or final poster required. Prerequisite(s): Sophomore standing in engineering. Prior approval of employer and department. May be repeated once Note(s): No more than one credit of CEE 225 may count towards the degree. 1 credit(s)

**CEE 241 - Statics**
Engineering analysis of concentrated and distributed force systems at equilibrium; analysis of structures, beams and cables, friction, virtual work, fluid statics, shear and moment diagrams. Prerequisite(s): PHYS 180, PHYS 180L, MATH 182, CEE 110 or EED 110, or ME 100 and ME 100L. 3 credit(s)

**CEE 250 - Sustainability in Civil and Environmental Engineering**
Sustainability concepts applied to transportation, structural materials, construction, and water and wastewater systems. Air pollution, waste minimization, sustainable water resources, and green construction. Alternative energy sources, and contemporary issues that impact sustainability as it relates to safety, durability, economics, environmental, societal and health impacts. Prerequisite(s): CEE 110, CEE 198, CHEM 121. 3 credit(s)

**CEE 298 - Project Management and Professional Practice**
Introduction to the activities of professional engineers. Through lectures, seminars by invited guests, and participation in organized activities outside the classroom, address civil engineering project management and other professional matters that affect engineering practice such as licensure, business, public policy, public administration, and contemporary issues. Prerequisite(s): CEE 198. 1 credit(s)

**CEE 301 - CAD Tools for Civil Engineering Design**
Introduction to CAD-based civil engineering design tools, including COGO, surveying, roadway and site layout, digital terrain modeling, and earthworks design software. Prerequisite(s): CEE 110, CEE 121, and advanced standing. 2 credit(s)

**CEE 325 - Cooperative Training II**
Individual off-campus learning experiences in civil engineering. Students apply engineering concepts and theories in work-related settings. Minimum 200 supervised hours required. Progress reports required at least monthly. Final report and/or final poster required. A combined maximum of three credits in CEE 225 and CEE 325 may count towards the degree. Prerequisite(s): Junior or senior standing in engineering. Prior approval of employer and department. May be repeated twice. 1 credit(s)

**CEE 334 - Soil Mechanics**
Elementary soil mechanics theory. Physical and mechanical properties of soils. Shear strength, consolidation, earth pressure. Laboratory testing - Atterberg Limits, compaction, shear, unconfined compression, permeability, sampling, and in-situ testing. Prerequisite(s): CEE 370, or ME 302 and ME 302L, GEOL 101. Lab/Lecture/Studio Hours Three hours lecture and three hours laboratory. 4 credit(s)

**CEE 334L - Soil Mechanics Laboratory**
Laboratory testing of soils, including Atterberg limits, compaction, consolidation, shear, unconfined compression and permeability tests. Field examination, sampling and in-situ testing. Corequisite(s): CEE 334.
Prerequisite(s): Admission to civil engineering or construction management major. Lab/Lecture/Studio Hours Three hours laboratory. 0 credit(s)

**CEE 341 - Building Structures I**
Theory and basic elements of simple structural systems for architects, designers, and construction managers. Does not satisfy program requirements for civil/mechanical degrees. Prerequisite(s): Upper-division standing in engineering. 3 credit(s)

**CEE 346 - Civil Engineering Materials**
Properties and uses of aggregates, Portland cement concrete, bituminous materials, ferrous and non-ferrous metals, and wood for buildings, highways and other civil engineering works. Corequisite(s): STAT 463 or equivalent. Prerequisite(s): CEE 370 or ME 302, admission to civil engineering major. Lab/Lecture/Studio Hours Two hours lecture and three hours laboratory. 3 credit(s)

**CEE 346L - Civil Engineering Materials Laboratory**
Laboratory to familiarize students with properties, and testing of aggregates, Portland cement concrete, bituminous materials, ferrous and non-ferrous metals, and wood. Corequisites CEE 346. Prerequisite(s): Admission to civil engineering major. Lab/Lecture/Studio Hours Three hours laboratory. 0 credit(s)

**CEE 362 - Transportation Engineering**
Design, operation, objectives, characteristics, and social, environmental and economic relations of transportation systems including water, air, and land facilities. Prerequisite(s): Admission to civil engineering major. PHYS 180 & PHYS 180L, or PHYS 151 & PHYS 152; CEE 110 or IS 101; CEE 121. 3 credit(s)

**CEE 367 - Fluid Mechanics**
Introduction to fluid properties, statics, and fluid dynamics, development and application of fundamental equations for the study of external and internal flows, compressible flows, dimensional analysis, and turbomachinery. Laboratory exercises on the dynamics and statics of fluids. Prerequisite(s): Admission to construction management, civil, electrical or mechanical engineering major; ME 242; MATH 283. Lab/Lecture/Studio Hours: Three hours lecture and three hours laboratory. 4 credit(s)

**CEE 367L - Fluid Mechanics Laboratory**
Laboratory designed to familiarize the student with the basic properties and behavior of incompressible and compressible fluids. Corequisite(s): Equivalent to CEE 367 lecture or CEM 460. Prerequisite(s): Admission to civil, electrical or mechanical engineering major. Lab/Lecture/Studio Hours: Three hours laboratory. 0 credit(s)

**CEE 370 - Engineering Mechanics of Deformable Bodies**
Concepts of stress and strain, transformation of stress and strain, Mohr's circle, engineering properties of materials, axially loaded members, torsion of circular members, bending of beams, buckling of columns, combined loading, thin-walled pressure vessels. Prerequisite(s): CEE 241. Lab/Lecture/Studio Hours: Three hours lecture and three hours laboratory. 4 credit(s)

**CEE 370L - Engineering Mechanics of Deformable Bodies Laboratory**
Strain gage attachment and calibration, tensile testing of metals and non-metals, elastic constants, beam deflection and failure, torsion testing, column stability, and bolted connection testing. Corequisite(s): CEE 370. Lab/Lecture/Studio Hours: Three hours laboratory. 0 credit(s)

**CEE 381 - Structural Analysis I**
Principles and techniques of structural mechanics and application to analysis of engineering structures. Prerequisite(s): Admission to civil, electrical or mechanical engineering major; CEE 370, or ME 302 & ME 302L; and MATH 283. 3 credit(s)

**CEE 404 - Open Channel Flow**
Detailed examination and design of open channel flow systems. Includes energy and momentum principles, non-uniform flow, transition design, design of channel controls, design of hydraulic structures, wave motions, unsteady flow, and flood routing. Prerequisite(s): CEE 367. 3 credit(s)

**CEE 406 - Hydrologic Analysis and Design**
Modeling and analysis of hydrologic systems with application to engineering design. Includes rainfall-runoff analysis, dynamic flood routing, statistical theories, and stochastic processes. Prerequisite(s): CEE 413. 3 credit(s)

**CEE 407 - Computer Applications in Environmental and Water Resources Engineering**
Application of computer models for analysis and design of environmental and water resource systems. Includes surface and groundwater hydrology, pipe networks, and water quality computer programs. Prerequisite(s): CEE 413 and CEE 450. 3 credit(s)

**CEE 409 - Engineering Project Management**
Engineering aspects of contracts, labor law, specification development, and cost estimating. Project scheduling and cost using critical path methods. Prerequisite(s): EGG 307. STAT 463 or equivalent. 3 credit(s)

**CEE 410 - Highway Construction Materials**
Composition, properties, and production of Portland cement, concrete, bituminous materials, and bituminous mixtures. Prerequisite(s): CEE 346. 3 credit(s)

**CEE 413 - Water Resources Engineering I**
Hydraulic and hydrologic design of water distribution, stormwater, and wastewater collection systems. Introduction to groundwater hydrology. Pumps, pipe flow, and pipe networks. Hydraulic design of open channels, culverts, and sanitary sewers. Prerequisite(s): CEE 367. 3 credit(s)

**CEE 423 - Engineering Surveys**
Solar observations, public land system, public land surveys, mineral surveys, vertical and horizontal curves, electronic distance measurements. Utilization of computers in survey calculations. Prerequisite(s): CEE 121, CEE 301. Lab/Lecture/Studio Hours: Three hours laboratory. 3 credit(s)

**CEE 425 - Cooperative Training III**
Continuation of off-campus individual learning experiences in Civil Engineering. Students continue to apply engineering concepts and theories in work-related settings. Students in the Co-op Program(s) are required to make a written engineering report on the work they do. Prerequisite(s): Junior or senior standing in engineering. 1 credit(s)

**CEE 432 - Geological Engineering**
Incorporation of geologic factors in civil engineering works. Engineering properties of rocks and soils; engineering implications of geologic structure and processes; geologic hazards; geologic/geotechnical site investigations, including engineering geophysics. Prerequisite(s): Admission to civil engineering major. GEOL 101, CEE 370 or ME 302/ME 302L. Lab/Lecture/Studio Hours: Two credits lecture, one credit laboratory. 3 credit(s)

**CEE 434 - Rock Mechanics**
Mechanical behavior of rock with engineering and geologic application; basic solid mechanics and rheology of rocks; rock testing; theories of failure; Griffith theory, McClintock-Walsh theory; scale effects and creep. Engineering applications in tunneling and dam foundations. Geologic applications in faulting, folding, isostasy, igneous intrusion, and petroleum formation. Prerequisite(s): CEE 334. 3 credit(s)

**CEE 435 - Foundations Engineering**
Site investigations, footings, slope stability, rock and soil foundations, piles. Prerequisite(s): CEE 334. 3 credit(s)

**CEE 436 - Engineering Geophysics**
Introduction to geophysical methods used in shallow earth explorations for engineering purposes, such as site characterization and waste site investigations. Emphasis on seismic and electrical/electromagnetic methods. Laboratory experience includes hands-on use of state-of-the-art equipment. Appropriate for students in Civil Engineering, Geoscience, and Physics. Prerequisite(s): PHYS 180 and PHYS 181, or PHYS 151 and PHYS 152; advanced standing. Lab/Lecture/Studio Hours: Two credits lecture, one laboratory. 3 credit(s)

**CEE 444 - Steel Structural Design**
Introduction to design of structural systems in steel; LRFD method. Design of tension members, beams, columns and beam-columns. Design of connections, welded and bolted. Introduction to torsion. Prerequisite(s): CEE 346, CEE 381, MATH 431. 3 credit(s)

**CEE 450 - Unit Operations and Processes in Environmental Engineering**
Water, wastewater system design overview. Water demand, wastewater generation. Water quality criteria. Mass balances, kinetics, reactor design. Coagulation, sedimentation, filtration, disinfection. Suspended, attached processes. Sludge and residual management. Measurements of solids, pH, alkalinity, hardness, DO, BOD, COD, SVI, turbidity, MPN, chlorine residual, nitrogen, phosphorus. Prerequisite(s): CHEM 121, CEE 367, MATH 431. Lab/Lecture/Studio Hours: Three hours lecture and three hours laboratory. 4 credit(s)

**CEE 450L - Unit Operations and Processes Laboratory**
Instrumental and wet chemical laboratory methods commonly used for characterization of water and wastewater. Measurements of solids, pH, alkalinity, hardness, dissolved oxygen, BOD, COD, SVI, turbidity, chlorine residual, MPN, nitrogen and phosphorus. Corequisite(s): CEE 450. Prerequisite(s): Admission to major in civil, mechanical or electrical engineering. Lab/Lecture/Studio Hours: Three hours laboratory. 0 credit(s)

**CEE 451 - Water and Wastewater Quality Analysis**
Theory and analysis of the standard methods used by environmental engineers to analyze drinking, industrial, and domestic wastewaters to control water quality and monitor efficiency of treatment. Topics may include biological oxygen demand (BOD), chemical oxygen demand (COD), coagulation, carbon absorption, ion-exchange resins, solids analysis, analysis by atomic absorption spectrometry, alkalimetry anions and determination. Laboratory intensive course. Prerequisite(s): CHEM 121. 3 credit(s)

**CEE 452 - Air Pollution Control Fundamentals**
Components of polluted air and air quality regulations. Control equipment material balances and process design for particulate removal. Combustion fundamentals and VOC removal. Meteorology and dispersion modeling. Automotive emissions controls. Prerequisite(s): CHEM 121, CEE 367, and MATH 431. ME 311 or ME 314 recommended. 3 credit(s)

**CEE 454 - Solid and Hazardous Wastes Engineering**
Solid waste collection, separation and disposal. Recycling and containment technologies. Adsorption and microbial degradation. Thermal, radiation, and solidification methods for destruction of hazardous wastes. Site remediation. Prerequisite(s): CHEM 121 and CEE 367. ME 311 recommended. 3 credit(s)

**CEE 455 - Water Treatment and Reuse**
Design principles and preliminary design of water treatment processes used for drinking water and water reuse. Topics include flocculation, sedimentation, filtration, disinfection, adsorption, ion-exchange, softening, chemical sludge dewatering, and water reuse. Corequisite(s): CEE 450. Prerequisite(s): CHEM 121, CEE 367. Note(s): Three hours lecture. 3 credit(s)

**CEE 463 - Traffic Engineering**
Studies in highway and traffic planning and principles of traffic operations. Prerequisite(s): CEE 362. 3 credit(s)

**CEE 464 - Airport Design**
Fundamental engineering principles in planning, location, design, and operation of airport facilities (terminals, apron areas, taxiways, and runways); ground access, drainage, aircraft characteristics and performance as they relate to airport design, aircraft noise and environmental considerations; elements of air traffic control. Prerequisite(s): CEE 362. 3 credit(s)

**CEE 466 - Geometric Design of Highways**
Design of visible elements of highways such as horizontal and vertical alignment and cross-section in accordance with design controls derived from characteristics of vehicles, drivers, traffic, and pedestrians interacting with geometry, terrain, and environment to yield a safe roadway at design capacity. Prerequisite(s): CEE 362. 3 credit(s)

**CEE 467 - Computer Applications in Transportation Engineering**
Application of computer software models and programs for solving planning, design, and operations problems in transportation engineering. Includes traffic network analysis models, transportation planning, and impact models. Prerequisite(s): CEE 362. 3 credit(s)

**CEE 468 - GIS Applications in Civil Engineering**
Introduction to the basics of Geographic Information Systems software and hardware and their use in civil engineering. Emphasis on the application of GIS for the planning, design, operations, and maintenance of civil engineering systems. Laboratory sessions provide hands-on experience with GIS software and hardware using specific examples/case studies of GIS applications in various areas of civil engineering. Prerequisite(s): CEE 301, and any one of: CEE 334, CEE 362, CEE 413, CEE 450. 3 credit(s)

**CEE 476 - Earthquake Engineering for Structures**
Introduction to vibration theory; seismic hazards; spectra of vibrations. Application of UBC Simplified Static Method and Static Method. Introduction to design of earthquake resistant structures. Discussion of diaphragms, chords and struts. Prerequisite(s): CEE 334 or CEE 432, CEE 444 or CEE 480. 3 credit(s)

**CEE 477 - Design of Underground Structures**
Design of tunnels, shafts, and underground chambers in soil and hard rocks. Prerequisite(s): CEE 432. 3 credit(s)

**CEE 478 - Applied Finite Element Analysis**
Introduction to the finite element method with computer applications to engineering problems in structural analysis, two- and three-dimensional solid mechanics and continuum. Prerequisite(s): MATH 431; CEE 370 or ME 302. 3 credit(s)

**CEE 480 - Concrete Structure Design**
Introduction to design of structural systems in concrete. Design of beams, one-way slabs, columns and beam-columns. Design of T-beams and doubly-reinforced beams. Anchorage and bar cutoffs. Prerequisite(s): CEE 346, CEE 381. 3 credit(s)

**CEE 482 - Design of Timber Structures**
Determination of simple wind and seismic forces on one and two story structures. Discussion of engineering properties of wood. Introduction to the design of sawn beams for flexure, shear, bearing and deflection. Introduction to the design of axially loaded columns. Brief introduction to the design of trusses, diaphragms and shear walls. Prerequisite(s): CEE 346, CEE 381. 3 credit(s)

**CEE 491 - Independent Study**
Independent design project or study of a selected engineering topic. Prerequisite(s): Senior standing in engineering, or consent of instructor with departmental approval. May be repeated up to a maximum of three credits. Note(s): May not be used to replace a required course. 1-3 credit(s)

**CEE 495 - Special Topics**
Outlet for experimental and other topics which may be of current interest. Prerequisite(s): Upper-division standing in engineering. May be repeated once under different topic. Note(s): Topics and credits to be announced. May have a laboratory. 1-4 credit(s)

**CEE 496 - Civil Engineering Professional Practicum**
Engineering practicum to perform work, preferably related to civil engineering design, supervised by experienced professional, in an agency, company or institution doing civil engineering work. Practicum proposal must be approved by chair prior to starting of work. Student report approved by supervisor. Prerequisite(s): The course should be taken in a year prior to graduation and should be completed within that time period; approval of host firm and Department Chair. Note(s): S/F grading only. 0 credit(s)

**CEE 498 - Civil Engineering Capstone Design**
Capstone course to involve students in the design process from project planning through analysis, synthesis, evaluation, and recommendations. Team efforts and oral, written, and graphical communications. Prerequisite(s): All required CEE courses except CEE 496 and CEE 499 and any one of CEE 413, CEE 450, or CEE 480. 3 credit(s)

**CEE 499 - Fundamentals of Engineering Examination Registration**
Preparation for and completion of the Fundamentals of Engineering Civil Discipline-Specific Examination administered by the National Council of Examiners for Engineering and Surveying. Prerequisite(s): All required CEE courses except CEE 496 and CEE 498 and any one of CEE 413, CEE 450, or CEE 480. Note(s): S/F grading only. 1 credit(s)

## *Construction Management*

**CEM 100 - Fundamentals of Construction Management**
Overview of construction industry roles, responsibilities, and risks from perspectives of owners, constructors, designers, financial institutions, and governmental agencies. Study of construction process techniques and applications. 3 credit(s)

**CEM 150 - Fundamentals of Construction Science**
Formerly Listed as (Formerly CEM 101)
Introduction to engineering problem solving applied to construction science. Fundamental topics include units, engineering analysis, early preliminaries of statics, and the built environment from a mechanics perspective emphasizing construction science. Corequisite(s): PHYS 151/PHYS 151L. Prerequisite(s): MATH 181. 3 credit(s)

**CEM 250 - Construction Materials and Methods**
Construction materials and components; materials specifications, descriptions, and usage; construction techniques,and optimal economic selection. Sustainable construction aspects considered. Corequisite(s): PHYS 151 PHYS 151L or PHYS 181 PHYS 181L. Lab/Lecture/Studio Hours: Two hours lecture and three hours laboratory. Field trips. 4 credit(s)

**CEM 250L - Construction Materials and Methods**
Construction materials and components; materials specifications, descriptions, and usage; construction techniques and optimal economic selection. Prerequisite(s): CEM 150 or CEE 110 and PHYS 181/PHYS 181L. Lab/Lecture/Studio Hours: Two hours lecture and three hours laboratory. Field trips. 0 credit(s)

**CEM 253 - Quantity Surveying and Document Analysis**
Quantity take off and comprehension, understanding, and critical analysis of documents from engineers, architects, other design professionals, governmental agencies, vendors, suppliers, and other contractors. Prerequisite(s): CEM 100 and CEM 250. Lab/Lecture/Studio Hours: Two hours lecture and three hours laboratory. 3 credit(s)

**CEM 253L - Quantity Surveying and Document Analysis**
Quantity take off and comprehension, understanding, and critical analysis of documents from engineers, architects, other design professionals, governmental agencies, vendors, suppliers, and other contractors. Prerequisite(s): CEM 100 and CEM 250. Lab/Lecture/Studio Hours: Two hours lecture and three hours laboratory. 3 credit(s)

**CEM 270 - Construction Engineering Mechanics**
Basic principles of engineering mechanics for constructors. Vectors, static analysis, stress, strain, Mohr's circle, beams, columns and trusses are covered. Computer applications. Prerequisite(s): CEM 250. 3 credit(s)

**CEM 300 - Construction Practicum I**
Supervised internship with one of a variety of industry organizations, including owners, contractors, designers. suppliers/manufacturers, government entitites, etc.. Minimum 10,000 word practicum report required with oral presentation before supervising faculty member(s). Corequisite(s): CEM 301. Prerequisite(s): CEE 121, CEM 253, CEM 253L, CEM 270, ACC 201. Note(s): S/F grading only 1 credit(s)

**CEM 301 - Construction Safety**
Field of construction safety covering OSHA safety, health and environmental challenges for owners, contractors, subcontractors, and construction workers. Covers zero-injury techniques. Prerequisite(s): CEM 100, CEM 250, CEM 270. 2 credit(s)

**CEM 330 - Soils and Foundations for Construction**
Introduction to basic concepts of soils and foundations including compaction, compressibility, settlement, shear strength, and site investigations. Problem soils and solutions. Types and systems of foundations, bearing capacity, sheeting, and braced excavations. Prerequisite(s): CEM 270 or CEE 370 or ME 302, CEM 250/CEM 250L. 3 credit(s)

**CEM 350 - Facility Systems Design and Construction I**
Introduction to mechanical systems for facilities including HVAC systems, boilers, chillers, air-handling units, fire protection, piping, and plumbing systems. Sustainable/green construction concepts. Energy conservation. Detailed knowledge to analyze needs, scope, design and construction of these systems as well as address design-construction integration issues. Prerequisite(s): CEM 250/CEM 250L, PHYS 152/PHYS 152L or PHYS 182/PHYS 182L. 3 credit(s)

**CEM 351 - Facility Systems Design and Construction II**
Introduction to electrical equipment and electrical systems for facilities including power, wiring, lighting, controls, automation, security, and life safety systems. Sustainable/green construction concepts. Energy conservation. Detailed knowledge to analyze needs, scope, design and construction of these systems as well as address design-construction integration issues. Prerequisite(s): CEM 250 CEM 250L, PHYS 152 PHYS 152L or PHYS 182 PHYS 182L. 3 credit(s)

**CEM 370 - Steel and Wood Design in Construction**
Analysis and design of simple steel, timber, and wood structures using AISC, AF&PA, ICC, APA, AITC and ASCE 7. Computer applications. Prerequisite(s): CEM 270. 3 credit(s)

**CEM 372 - Concrete Design in Construction**
Analysis and design of simple concrete structures using ACI 318 and ASCE 7. Computer applications. Prerequisite(s): CEM 270. 3 credit(s)

**CEM 400 - Construction Practicum II**
Supervised internship with one of a variety of industry organizations, including owners, contractors, designers. suppliers/manufacturers, government entitites, etc. Minimum 10,000 word practicum report required with oral presentation before supervising faculty member(s). Corequisite(s): EGG 307. Prerequisite(s): CEM 300, CEM 330, CEM 351, CEM 370, CEM 372, MGT 301, BLW 302. Note(s): S/F grading only 1 credit(s)

**CEM 432 - Temporary Construction Structures**
Analysis, design, and construction of temporary structures including formwork, falsework, shoring, rigging, and access units. Cost analysis. Computer analysis applications. Safety consideration. Prerequisite(s): CEM 330 or CEE 334, CEM 370 or CEE 381, CEM 372 or CEE 480. 3 credit(s)

**CEM 450 - Construction Field Inspection**
Construction field inspection at project sites and vendor surveillance. Construction codes including IBC/IRC, IPC, IMC, and NEC. Standards including ACI, AISC, ANSI, ASTM, and AWS. Quality assurance/ quality control concepts/development, techniques, analysis, enforcement and documentation. Corequisite(s): CEE 480 for engineering science option. Prerequisite(s): CEM 330 or CEE 334, CEM 370 or CEE 381, CEM 372 for management option. 3 credit(s)

**CEM 451/451L - Construction Estimating**
Principles and procedures used in estimating construction costs. Application of quantity determination, estimate pricing, specifications, subcontractor and supplier solicitation, risk assessment and risk analysis, and final bidding preparation. Computer-based estimating used for semester project. Corequisite(s): CEM 454. Prerequisite(s): CEM 253, EGG 307. Lab/Lecture/Studio Hours: Three hours lecture and three hours laboratory. 4 credit(s)

**CEM 452/452L - Construction Cost Control**
Construction cost management including productivity and cost reporting/analysis concepts. Financial/cost issues/cash flow for the construction firm including reporting methods with percentage of completion techniques. Performance/profitability enhancement. Earned value management. Construction bonding and insurance issues. Firm and jobsite analysis. Case studies. Prerequisite(s): EGG 307, ACC 201. Lab/Lecture/Studio Hours: Two hours lecture and three hours laboratory. 3 credit(s)

**CEM 453/453L - Construction Scheduling**
Scheduling and resource optimization. Includes short-interval scheduling, Gantt charts, linear, and matrix scheduling formats. Network techniques including CPM and PERT concepts and calculations. Computer applications. Corequisite(s): CEM 451/451L. Lab/Lecture/Studio Hours: Two hours lecture and three hours laboratory. 3 credit(s)

**CEM 454 - Heavy Construction Methods and Equipment**
Characteristics, capabilities, limitations, uses, and selection techniques for heavy construction methods and equipment Process planning, simulation, fleet operations, and maintenance programs. Field trip(s) where appropriate. Prerequisite(s): CEM 330 or CEE 334, EGG 307. 3 credit(s)

**CEM 455 - Construction Management Practice**
Direction and operation of construction organizations with examination of general contracting, design-build, and construction management methods. Synthesis of project management concepts, applications, and limitations through case studies and semester project. Prerequisite(s): CEM 451/451L, CEM 452/452L, CEM 453/453L. 3 credit(s)

**CEM 457 - Project Management**
Principles and application for effective project planning including finance, economic decisions making, risk management, team alignment, and pre-project planning processes and tools. Prerequisite(s): MATH 132 or STAT 152 or equivalent, senior standing. 3 credit(s)

**CEM 458 - Design-Build for Construction Management**
Design-build techniques and concepts for a variety of project types understanding the technical aspects associated with design/construction of these projects as well as the financial and management aspects required for a successful completion. Design-construct team building. Liability issues. Prerequisite(s): CEM 100 or CEM 457. 3 credit(s)

**CEM 459 - Quantitative Methods in Project Management**
Quantitative analysis techniques in project management. Introduction to quantitative decisions making, decision tree, simulation, linear programming, hypothesis testing, regression analysis, etc.
Prerequisite(s): CEM 457 or senior standing in major. 3 credit(s)

**CEM 470 - Construction Automation**
Automation applications, robotics, and analysis for construction, including, alignment, materials handling, and installation units. Location analysis from project site to fabrication shop. Repeatability and training considerations. Environmental influences. Prerequisite(s): CEM 454. 3 credit(s)

**CEM 480 - Sustainable Construction**
Overview of sustainable design and construction. Introduction to green buildings, LEED assessment process, high-performance building, and green building material. Economic analysis of green buildings. Prerequisite(s): Laboratory science course, consent of instructor. 3 credit(s)

**CEM 482 - Hazardous Waste Construction Operations**
Construction operations for hazardous waste sites and site remediation. On-site control techniques. Off-site disposal. Equipment and methods issues. Personnel protection and training. Prerequisite(s): CEM 454. 3 credit(s)

**CEM 484 - Construction Site Water Management**
Management of water at construction sites. Prerequisite(s): CEM 330. 3 credit(s)

**CEM 485 - Construction Law and Contracts**
Legal problems in the construction process. Stipulated sum, unit price, and cost-plus contracts. Construction lien rights and bond rights. Scope of work issues. Builders risk issues. Risk-shifting. Case studies. Prerequisite(s): CEM 453/453L. 3 credit(s)

**CEM 493 - Independent Study**
Independent study of a selected construction topic. Prerequisite(s): Consent of instructor. May be repeated to a maximum of six credits. 1-3 credit(s)

**CEM 495 - Special Topics in Construction Management**
Experimental and other topics which may be of current interest in construction management. Prerequisite(s): Consent of instructor. May be repeated to a maximum of eight credits. Note(s): Topics and credits to be announced. 1-4 credit(s)

# Computer Science Department

The Department of Computer Science offers courses and programs that provide students with a solid theoretical foundation as well as familiarity with several areas within experimental computer science. This solid foundation, combined with extensive hands-on application work, provides a balanced educational environment that prepares students for both the current employment market and advanced degree programs.

## *Accreditation*
Northwest Commission on Colleges and Universities www.nwccu.org. Computing Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) http://www.abet.org — B.S. in Computer Science.

## *Undergraduate Majors*
Bachelor of Science in Computer Science
Bachelor of Arts in Computer Science

## *Mission*
The mission of the Department of Computer Science is to educate future computer scientists in academic programs that are competitive with those of the best schools in the country.

## *Program Objectives*
The objectives of our undergraduate degree programs are to:
1. Provide students with the broad background skills necessary to learn, practice, and grow in computer science.
2. Provide students with the fundamental core and advanced knowledge of computer science.
3. Provide students with adequate skills for effective communication of computer science technicalities, both in written and oral forms.
4. Produce students who can use and practice computer science in various application areas.

## *Program Outcomes*
Each computer science graduate will be able to:
1. Analyze problems, and to identify the computing and/or mathematical techniques appropriate to their solutions.
2. Apply design and development principles in the construction of software systems.
3. Apply computer science theory and mathematical models to comprehend the tradeoffs involved in various design choices.
4. Use current tools or techniques to implement and evaluate programs or computer- based systems.
5. Function effectively on a team to accomplish a common goal.
6. Communicate effectively with a range of audiences.
7. Understand the professional, ethical, legal, and security impacts of computing on individuals, organizations, and society.
8. Appreciate an application area of computing and recognize the need to engage in continuing professional development.

Additional information on the mission, goals and objectives of the School of Computer Science is available online at www.cs.unlv.edu.

### *Admission to the Major*

Minimum GPA: 2.75

Admission and transfer policies as described in the College of Engineering section.

### *Department Policies*

1. Grades of C (2.00) or higher are required in all immediate prerequisites of all engineering and computer science courses and in ENG 101 and 102.
2. Students must satisfy prerequisite and corequisite course requirements as specified in the current Undergraduate Catalog.

## Computer Science Major - Bachelor of Arts (BA)

Please see the UNLV Howard R. Hughes College of Engineering, Department of Computer Science web page at www.cs.unlv.edu for information about department programs, faculty and facilities.

Please see advising information at the UNLV Howard R. Hughes College of Engineering Advising Center at www.engineering.unlv.edu/advising.

### *Accreditation*

Institution - Northwest Commission on Colleges and Universities www.nwccu.org

### *Learning Outcomes*

1. Analyze problems and identify the computing and/or mathematical techniques appropriate to their solutions
2. Apply design and development principles in the construction of software systems
3. Use current tools or techniques to implement and evaluate programs or computer-based systems
4. Apply computer science techniques and tools to solve problems in a chosen application area

**University Graduation Requirements**

- Please see Graduation Policies for complete information

Computer Science Degree Requirements - Total 120 Credits

General Education Requirements ..... Subtotal 36-40 Credits

First-Year Seminar ..... Credits: 2-3

English Composition ..... Credits: 6

- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar ..... Credits: 3

Constitutions ..... Credits: 3-6

Mathematics ..... Credits: 4

- MATH 181 - Calculus I

Distribution Requirement ..... Credits: 18

Please see Distribution Requirements for more information.

- Humanities and Fine Arts: 9 credits
  - COM 101 - Oral Communication - 3 credits
  - PHIL 422 - Advanced Logic - 3 credits
  - One course in Fine Arts - 3 credits
- Social Science: 9 credits
  - One course each from three different fields
- Life and Physical Sciences and Analytical Thinking:
  - Automatically satisfied by Major requirements

Multicultural and International

Multicultural, one 3 credit course required

International, one 3 credit course required

These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students

Major Requirements -

BA in Computer Science ..... Subtotal: 61 Credits

Mathematics ..... Credits: 10

- MATH 182 - Calculus II
- MATH 251 - Discrete Mathematics I

or

- MATH 365 - Computational Linear Algebra
- STAT 411 - Statistical Methods I

Philosophy ..... Credits: 3

- PHIL 114 - Introduction to Symbolic Logic

Computer Science ..... Credits: 24

- CS 135 - Computer Science I
- CS 202 - Computer Science II
- CS 218 - Introduction to Systems Programming
- CS 219 - Computer Organization
- CS 302 - Data Structures
- CS 326 - Programming Languages, Concepts and Implementation
- CS 370 - Operating Systems
- CpE 100 - Computer Logic Design I

Choose from CS courses numbered 300 or higher ..... Credits: 9

- Three 300+ level CS courses (students may also choose from MATH 466 and/or MATH 467.

Application Area ..... Credits: 15

Choose courses numbered 300 or higher from an area other than CS (must be approved by advisor).

Electives ..... Credits: 23

Free electives to ensure that minimum total credits are 120.

Total Credits: ..... 120

## Computer Science Major - Bachelor of Science (BS)

Please see the UNLV Howard R. Hughes College of Engineering, Department of Computer Science web page at www.cs.unlv.edu for information about department programs, faculty and facilities.

Please see advising information at the UNLV Howard R. Hughes College of Engineering Advising Center at www.engineering.unlv.edu/advising.

### *Accreditation*

Institution - Northwest Commission on Colleges and Universities www.nwccu.org

Program - Accreditation Board for Engineering and Technology www.abet.org

### *Learning Outcomes*

1. Analyze problems and identify the computing and/or mathematical techniques appropriate to their solutions
2. Apply design and development principles in the construction of software systems
3. Apply design and development principles in the construction of software systems
4. Use current tools or techniques to implement and evaluate programs or computer-based systems
5. Function effectively on a team to accomplish a common goal

6. Communicate effectively with a range of audiences
7. Understand the professional, ethical, legal, and security impacts of computing on individuals, organizations, and society
8. Appreciate an application area of computing and recognize the need to engage in continuing professional development

**University Graduation Requirements**

- Please see Graduation Policies for complete information

Computer Science Degree Requirements.....Total 120 Credits
General Education Requirements.....Subtotal 36-40 Credits
First-Year Seminar.....Credits: 2-3
English Composition.....Credits: 6

- ENG 101 - Composition I

and

- ENG 102 - Composition II

Second-Year Seminar.....Credits: 3
Constitutions.....Credits: 3-6
Mathematics.....Credits: 4

- MATH 181 - Calculus I

Distribution Requirements.....Credits: 18
Please see Distribution Requirements for more information.

- Humanities and Fine Arts:9 credits
  - COM 101 - Oral Communication 3 credits
  - PHIL 422 - Advanced Logic 3 credits
  - One course in Fine Arts - 3 credits
- Social Science: 9 credits
  - One course each from three different fields
- Life and Physical Sciences and Analytical Thinking:
  - Automatically satisfied by Major requirements

Multicultural and International
Multicultural, one 3 credit course required
International, one 3 credit course required
These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students
Major Requirements -
BS in Computer Science.....Subtotal: 80 Credits
Mathematics.....Credits: 16

- MATH 182 - Calculus II
- MATH 251 - Discrete Mathematics I
- MATH 351 - Discrete Mathematics II
- MATH 365 - Computational Linear Algebra
- STAT 411 - Statistical Methods I

Philosophy.....Credits: 3

- PHIL 114 - Introduction to Symbolic Logic

Technical Writing.....Credits: 3

- ENG 407B - Fundamentals of Technical Writing

Computer Science.....Credits: 38

- CS 135 - Computer Science I
- CS 202 - Computer Science II
- CS 218 - Introduction to Systems Programming
- CS 219 - Computer Organization
- CS 301 - Social Implications of Computer Technology
- CS 302 - Data Structures
- CS 326 - Programming Languages, Concepts and Implementation
- CS 370 - Operating Systems
- CS 456 - Automata and Formal Languages
- CS 460 - Compiler Construction
- CS 472 - Software Product Design and Development I
- CS 477 - Analysis of Algorithms
- CpE 100 - Computer Logic Design I
- CpE 100L - Computer Logic Design I Laboratory

Sciences.....Credits: 8

- BIOL 189 - Fundamentals of Life Science
- BIOL 197 - Principles of Modern Biology II

or

- CHEM 121 - General Chemistry I
- CHEM 122 - General Chemistry II

or

- GEOL 101 - Exploring Planet Earth
- GEOL 102 - Earth and Life Through Time

or

- PHYS 180 - Physics for Scientists and Engineers I
- PHYS 180L - Physics for Scientists and Engineers Lab I
- PHYS 181 - Physics for Scientists and Engineers II
- PHYS 181L - Physics for Scientists and Engineers Lab II

Choose from CS courses numbered 400 or higher Credits: 12

- 400+ level CS courses

Electives.....Credits: 4
Free electives to ensure that minimum total credits are 120.
Total Credits:.....120

**Optional Concentration Areas**

Students who complete either the BS or the BA program in Computer Science may also pursue one of the following concentration areas by completing the listed courses with grades of B- or better:
Software Engineering.....Credits: 12

- CS 457 - Database Management Systems
- CS 472 - Software Product Design and Development I
- CS 473 - Software Product Design and Development II

and

- CS 474 - Decision Environments for Software Product Development

Computer Networks.....Credits: 12

- CS 370 - Operating Systems
- CS 445 - Internet Security
- CS 465 - Computer Networks I

and either

- CS 466 - Computer Networks II

or

- CS 470 - Networks and Distributed Systems

**Information Assurance Concentration**

Information Assurance.....Total Credits: 12

- CS 443 - Information Assurance
- CS 445 - Internet Security
- CS 448 - Computer Security

and one of the following:

- CS 441 - Advanced Internet Programming
- CS 449 - Computer and Network Forensics
- CS 457 - Database Management Systems
- CS 465 - Computer Networks I

Completion of one of these concentration area will result in the awarding of a certificate to the student by the Department of Computer Science.

## Computer Science Minor

Required Courses..... Total Credits: 27

- CpE 100 - Computer Logic Design I
- CS 135 - Computer Science I
- CS 202 - Computer Science II
- CS 218 - Introduction to Systems Programming
- CS 219 - Computer Organization
- CS 302 - Data Structures

and nine additional credits of electives selected from CS courses numbered 300 or higher

or

- MATH 466 - Numerical Methods I

or

- MATH 467 - Numerical Methods II

## Information Technology Minor

Information Technology (ITE) is comprised of a set of topics encompassing technologies in Human Computer Interaction (HCI), information management, programming, information assurance, and web systems.

*Subject to prior approval from Computer Science Department – Please see your College of Engineering Academic Advisor to discuss.

Note 1: Student to choose one course in their respective field of study.

Note 2: Students can elect either to register for CS 490 to study topics that prepare them for certification exams or to register for one of the pre-approved courses offered by College of Southern Nevada (CSN). The following is a list of pre-approved courses at CSN:

- CIT 211 Microsoft Networking I
- CIT 217 Security+
- CIT 263 Introduction to IT Project Management
- CIT 283 Oracle Database Administration II
- CIT Oracle PL/SQL Programming II
- CIT 216 Server+
- Topics available in CS 490:
- Oracle PL/SQL developer
- Oracle MYSQL developer
- Oracle Database SQL
- Oracle Java Standard Edition Programmer
- Microsoft Certified Solution Associate (MSCA) SQL Server
- Cisco Certified Network Associate (CCNA)

## *Computer Science*

**CS 115 - Introduction to Computers**
Computer literacy. History of computing, description of basic hardware components, use of application software, introduction to Internet resources, uses of computers in society, and the impact of computerization on society. Prerequisite(s): MATH 96 or two years of high school mathematics. 3 credit(s)

**CS 117 - Programming for Scientists and Engineers**
Structured approach to programming and problem solving in FORTRAN. Emphasis placed on techniques of good programming style and on solving numerical problems encountered in science and engineering. Includes use of standard library routines. Prerequisite(s): MATH 181. 3 credit(s)

**CS 135 - Computer Science I**
Problem-solving methods and algorithm development in a high-level programming language. Program design, coding, debugging, and documentation using techniques of good programming style. Program development in a powerful operating environment. Prerequisite(s): MATH 127 or MATH 128. Lab/Lecture/Studio Hours: Three hours lecture and one hour lab. 3 credit(s)

**CS 140 - Computing Languages**
Use of a single programming language for problem formulation and solution. Language varies each semester. Typical languages include Java, LISP, Prolog, Scheme, etc. Prerequisite(s): Ability to program in a high-level language. May be repeated if language is different. 1-3 credit(s)

**CS 202 - Computer Science II**
Data structures and algorithms for manipulating linked lists. String and file processing. Recursion Software engineering, structured programming and testing, especially larger programs. Prerequisite(s): CS 135. 3 credit(s)

**CS 218 - Introduction to Systems Programming**
Algorithms from systems programming including conversion, buffering, device drivers, assemblers and loaders. Use of system services, macros, and linkage conventions. Laboratory exercises programmed in assembly language. Prerequisite(s): CpE 100 and (CS 117 or CS 135). 3 credit(s)

**CS 219 - Computer Organization**
Basic organization of digital computers, including I/O units, arithmetic logic units, control units, and memory organization. Number and character representations. Instruction sets and addressing. Microprogramming. Prerequisite(s): CS 218 and CS 202. 3 credit(s)

**CS 270 - Introduction to Internet & World Wide Web**
Introduction to Internet and World Wide Web tools and resources, including Web browsers, robots and search engines, agents, multimedia authorizing environments, electronic publishing, virtual reality, anonymizing and the use of relative identities, Internet security, digital watermarking, and Web censorship. Programming skills covered in corequisite lab. Intended for non-CS majors. Corequisite(s): CS 270L. Prerequisite(s): CS 115 or equivalent. 2 credit(s)

**CS 270L - Introduction to Internet & World Wide Web - Lab**
Acquaints students with the underlying theory behind, and practical experience in, the use of Interactive Internet and World Wide Web resources in such areas as education, scholarship and research, interpersonal and group communication, virtual communities, electronic publishing, and electronic commerce.Corequisite(s): CS 270. Prerequisite(s): CS 115 or equivalent. 1 credit(s)

**CS 301 - Social Implications of Computer Technology**
In-depth examination of moral and ethical issues created by advancing computer technology. Review of ethical theories and examination of issues in malfunction liability, privacy, power, ownership and intellectual property. Discussion of social trends and their possible effects. Extensive reading, classroom discussion, and class presentations required. Prerequisite(s): COM 101, CS 218. 1 credit(s)

**CS 302 - Data Structures**
Introduction to sequential and linked structures. File access including sequential, indexed sequential and other file organizations. Internal structures including stacks, queues, trees, and graphs. Algorithms for implementing and manipulating structured objects. Big-O-notation. Prerequisite(s): CS 202 and MATH 181. 3 credit(s)

**CS 326 - Programming Languages, Concepts and Implementation**
Design, evaluation and implementation of programming languages. Includes data types and data abstraction, sequence control and procedural abstraction, parameter passing techniques, scope rules, referencing environments and run-time storage management. Study and evaluation of a number of current programming languages. Prerequisite(s): CS 302 and either CS 219 or CpE 300. 3 credit(s)

**CS 341 - Internet Programming**
Fundamentals of Web page design, use of environment and SSI variables, GGI-Bin programming concepts with both scripting languages and interpreted and compiled languages, creation of advanced form applications, design of search/index utilities Web databases, design and implementation of interactive Web sites. Corequisite(s): CS 341L. Prerequisite(s): CS 219 or CpE 310L and CS 202. 2 credit(s)

**CS 341L - Internet Programming Lab**
Helps develop practical skills and applies industry-wide standards and practices for activities such as Web design and layout, electronic publishing, network communications, cybermedia authoring systems, animations, virtual reality, and the development of executable content. Corequisite(s): CS 341. Prerequisite(s): CS 202 or equivalent. 1 credit(s)

**CS 351 - Introduction to Multimedia**
Nature and development of digital multimedia, including content selection, scripting, editing, transforming, and producing multimedia material. Basic multimedia development environments including analog and digital image and video capturing, motion development tools, scripting environments, and meta-level directing software. Semester project involves creation of an entire multimedia cd. Corequisite(s): CS 351L. Prerequisite(s): CS 202 or equivalent. 2 credit(s)

**CS 351L - Introduction to Multimedia Lab**
Develops practical skills and applies industry-wide standards and practices for the creation of interactive multimedia, including, but not limited to, use of such development tools as screen capture utilities, analog and digital video capture environments, motion development programs, and scripting and directing programs. Corequisite(s): CS 351. Prerequisite(s): CS 202 or equivalent. 1 credit(s)

**CS 370 - Operating Systems**
Operating systems organization, sharing and allocation of system resources, protection mechanisms, and integration of system components. Prerequisite(s): CS 302 and either CS 219 or CpE 300. 3 credit(s)

**CS 417 - Introduction to Computer Simulation**
Simulation as a tool for the investigation of random phenomena. Emphasis on discrete simulation. Preparation of input for simulation and analysis of results. Use of SIMSCRIPT for discrete simulation. Comparison of discrete and continuous simulation. Simulation problems in several disciplines examined in detail. Prerequisite(s): CS 302 and MATH 351. 3 credit(s)

**CS 420 - Human-Computer Interaction**
Overview of human-computer interaction principles, guidelines, methods, and tools. User research, low-fidelity prototyping, participatory design, usability evaluation, visual design, usability principles, and affordances. Graphical user interface implementation, including design patterns, event handling, widget toolkits, languages, and development environments. Prerequisite(s): CS 302. 3 credit(s)

**CS 441 - Advanced Internet Programming**
Advanced Internet programming design and applications including client/server technologies and environment and software, client/server network operating systems, client/server database management systems, data warehousing environments, data mining, basic networking models and protocols, CASE tools, Groupware, Middleware, Internet security, privacy considerations. Corequisite(s): CS 441L. Prerequisite(s): CS 341 and CS 370. 2 credit(s)

**CS 441L - Advanced Internet Programming Lab**
Helps student develop practical skills and learn to apply industry-wide standards and practices for advanced Internet and Internet 2 applications. Corequisite(s): CS 441. Prerequisite(s): CS 341 and CS 370. 1 credit(s)

**CS 445 - Internet Security**
Internet security theory and practice, advanced IP concepts, the concepts of stimulus and response in the context of securing a network, network packet and traffic analysis, internet protocol (IP) vulnerabilities, packet filtering, intrusion detection, internet exploits, exploit signatures, internet forensics, network security investigation. Prerequisite(s): CS 370. 3 credit(s)

**CS 448 - Computer Security**
Overview of computer security, threats, vulnerabilities and controls. Physical security, computer security policies and implementation plans, and computer forensics including penetration testing and investigation. Management issues. Legal, privacy and ethical issues. Prerequisite(s): CS 370. 3 credit(s)

**CS 451 - Multimedia Systems Design**
Theory and practice of multimedia system design overview. High-level topics include multimedia content and formats, underlying technologies, digital cinematography, scripting, storyboarding, CD-ROM production and online publication, porting multimedia to the Web. Emphasis on the design process and the seamless integration of content in an interactive environment. Corequisite(s): CS 451L. Prerequisite(s): CS 351. 3 credit(s)

**CS 451L - Multimedia Systems Design Laboratory**
Helps student develop practical skills and learn to apply industry-wide standards and practices for the design of multimedia systems. Corequisite(s): CS 451. Prerequisite(s): CS 351. 1 credit(s)

**CS 456 - Automata and Formal Languages**
Regular expressions. Regular, context-free, and unrestricted grammars. Finite and pushdown autoamata. Turing machines and the halting problem; introduction to decidability. Prerequisite(s): CS 302 and MATH 351. 3 credit(s)

**CS 457 - Database Management Systems**
Concepts and structures necessary for design and implementation of a database management system. Survey of current database management systems and use of a DBMS. Prerequisite(s): CS 302 and MATH 351. 3 credit(s)

**CS 458 - Introduction to Data Mining**
Introduction to basic concepts in data mining. Topics include association-rule mining, information extraction, web mining, categorization, and clustering. Prerequisite(s): CS 302, MATH 251 3 credit(s)

**CS 460 - Compiler Construction**
Current methods in the design and implementation of compilers. Construction of the components of an actual compiler as a term project.
Prerequisite(s): CS 326 and CS 456. 3 credit(s)

**CS 463 - Computer Architecture**
Introduction to computer architecture. Topics include basic computer organization concepts; history and taxonomy of computer architectures; language and software influences on architecture; instruction set design; stack, array, data flow, and database machines; multiprocessor and network architectures; and fault tolerant designs. Prerequisite(s): CS 370. 3 credit(s)

**CS 465 - Computer Networks I**
An introduction to the design and implementation of computer communication networks, their protocols and applications. It covers the technologies and standards in data transmission, telecommunication networks, network architectures, networking hardware, wireless networks, and the basis of the Internet including UDP and TCP as well as a number of application protocols. Prerequisite(s): CS 370. 3 credit(s)

**CS 466 - Computer Networks II**
Explores advanced topics in computer networks, the protocols, algorithms, hardware, and performance issues, especially in TCP/IP networks. Details of IP routing algorithms, quality of service, protocol implementation issues, router architecture and types, various TCP versions and their performance, the related telecommunication networks, and wireless technologies are discussed. Prerequisite(s): CS 465. 3 credit(s)

**CS 469 - Introduction to Digital Image Processing**
Background and basics of digital image processing. Topics include: the human visual system, image representation, sampling, image mathematics, and geometry, image enhancement, smoothing and sharpening, the fast Fourier transform, and a survey of image restoration methods. Prerequisite(s): MATH 365, STAT 411, CS 117 or CS 135. 3 credit(s)

**CS 470 - Networks and Distributed Systems**
Explores protocols and experiments with creating and implementing new protocols. In addition, students will be introduced to concepts such as deadlocks in networks/distributed applications, communication in distributed systems (among other RPC/RMI and the client server model in more detail), synchronization, reliability, transparency, and atomicity/transaction semantics. Prerequisite(s): CS 465. 3 credit(s)

**CS 471 - Program Derivation**
Introduction to the formal derivation of computer programs from program specifications. Review of the logical and notational Prerequisite(s): needed for formal derivation. Guarded commands and the predicate transformer WP. Developing loops from invariants. Program development via sequence of refinements. Prerequisite(s): MATH 351 and CS 326. 3 credit(s)

**CS 472 - Software Product Design and Development I**
Current techniques in software design presented with emphasis on architecture first development. Introduction to the processes involved in development. Practice architectural design through a series of homework problems. Students work in teams to prepare the architecture for a software product. Prerequisite(s): CS 326 and CS 370. 3 credit(s)

**CS 473 - Software Product Design and Development II**
Synthesis (term project) course to involve students, working in teams, in all of the activities necessary to define, model, implement, test, document, and deliver a program product. Students practice Object-Oriented and Component Based development and utilize UML and CASE tools to model the product and document the process. Prerequisite(s): CS 472. 3 credit(s)

**CS 474 - Decision Environments for Software Product Development**
Term project course to involve students, working in teams, with all of the activities and tools necessary to measure progress and monitor the development of a software product. Students utilize CASE tools for planning, for requirements management, for configuration management, for change management, and for product and process measurement for a product development project. Prerequisite(s): CS 472. 3 credit(s)

**CS 477 - Analysis of Algorithms**
Analysis of the time and space complexity of algorithms. Techniques for efficient algorithm design and effect of structure choice on efficiency. Fast algorithms for problems such as set, graph and matrix manipulations, pattern matching, sorting, and storage organization. Exponential time problems and introduction to NP-completeness. Prerequisite(s): CS 302 and MATH 351. 3 credit(s)

**CS 480 - Computer Graphics**
Graphics hardware, software and applications. Data structures for graphics, graphics languages, computer-aided design, and three-dimensional graphics. Prerequisite(s): CS 202 and MATH 365. 3 credit(s)

**CS 482 - Artificial Intelligence**
Survey of current artificial intelligence technologies: game playing, theorem-proving, natural language processing, pattern recognition, and heuristic programming. Prerequisite(s): CS 302 and PHIL 422. 3 credit(s)

**CS 489 - Advanced Computer Science Topics**
Undergraduate-level course in advanced topics of computer science, depending upon the interest of faculty and studentPrerequisite(s): Consent of instructor. May be repeated to a maximum of six credits. 3 credit(s)

**CS 490 - Independent Study**
Library research and reports on topics of computer science interest. Prerequisite(s): Consent of instructor. May be repeated to a maximum of six credits. 1-3 credit(s)

**CS 494 - Internship in Computer Science**
A summer internship in an approved, computer science related position. This course will be offered only in the summer and not during the fall or spring semesters. Students will apply computer science concepts in a work-related setting. A final report is required. Prerequisite(s): CS 302 and prior approval by the school and employer. Note(s): A final report is required. 1-3 credit(s)

**CS 495 - Senior Project Development I**
This course will give students the opportunity to develop a prototype piece of software from design through implementation, including documentation and presentation. May be done in cooperation with an external entity and may be entered into the College of Engineering's Senior Design Competition. This course focuses on selecting the project, initial requirements, problem analysis and problem specification. Prerequisite(s): CS 302. 1 credit(s)

**CS 496 - Senior Project Development II**
This course will give students the opportunity to develop a prototype piece of software from design through implementation, including documentation and presentation. May be done in cooperation with an external entity and may be entered into the College of Engineering's Senior Design Competition. This course focuses on implementing, testing, documenting and presenting the prototype solution to the problem selected in CS 495. Prerequisite(s): CS 495. 2 credit(s)

# Electrical and Computer Engineering Department

The Department of Electrical and Computer Engineering offers undergraduate degrees in electrical engineering and computer engineering. Both curricula are designed to provide students with the foundation necessary to enter either professional engineering employment or an engineering graduate program immediately after graduation. Students are prepared for lifelong practice by emphasizing the application of fundamental scientific and mathematical principles to engineering methodologies. The innovative art of engineering design is integrated throughout the curriculum from the freshman design course to the culminating capstone senior design course in the senior year.

## *Department Mission*

The mission of the Department of Electrical and Computer Engineering is to serve society as a center of higher learning by providing an electrical and computer engineering education to society's future leaders, innovators and engineers.

## *Department Goals*

- Provide undergraduate, graduate and professional education.
- Create knowledge through research.
- Disseminate knowledge through publication.
- Provide private and public service, in as much as said service educates, creates and disseminates knowledge, or functions as a repository of knowledge.

## *Undergraduate Majors*

Bachelor of Science in Computer Engineering
Bachelor of Science in Electrical Engineering

## Computer Engineering Major- Bachelor of Science in Engineering (BSE)

Please see the UNLV Howard R. Hughes College of Engineering web page at www.unlv.edu/engineering for information about department programs, faculty and facilities.

Please see advising information at the UNLV Howard R. Hughes College of Engineering Advising Center at www.engineering.unlv.edu/advising.

## *Accreditation*

Institution - Northwest Commission on Colleges and Universities www.nwccu.org

Program - Accreditation Board for Engineering and Technology www.abet.org

## *Program Objectives*

The educational objectives of the Bachelor of Science in Engineering – Computer Engineering Major are to transmit, create, and apply knowledge so that:

1. The graduate can practice in the field of Computer Engineering.
2. The graduate can be admitted to and successfully complete a graduate program in Computer Engineering.

## *Program Goals*

To achieve the above program objectives, the Computer Engineering program's goals are for the graduate to possess:

1. Appropriate technical knowledge and skills
2. Appropriate interpersonal skills
3. The knowledge and skills to be a responsible citizen

## *Learning Outcomes*

To achieve the above objectives and goals, each graduate of the Computer Engineering Major will attain the following outcomes before graduation:

1. The appropriate technical knowledge and skills
   a. An ability to apply mathematics through differential and integral calculus,
   b. An ability to apply advanced mathematics such as differential equations and discrete mathematics,
   c. An ability to apply knowledge of basic sciences,
   d. An ability to apply knowledge of computer science
   e. An ability to apply knowledge of probability and statistics,
   f. An ability to apply knowledge of engineering
   g. An ability to design a system, component, or process to meet desired needs within realistic constraints
   h. An ability to identify, formulate, and solve engineering problems
   i. An ability to analyze and design software and systems containing hardware and software
   j. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
   k. An ability to design and conduct experiments, as well as to analyze and interpret data
2. The appropriate interpersonal skills
   a. An ability to communicate effectively
   b. An ability to function on multidisciplinary teams
3. The knowledge and skills to be responsible citizens
   a. An understanding of professional and ethical responsibility
   b. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
   c. A recognition of the need for, and an ability to engage in life-long learning
   d. A knowledge of contemporary issues
   e. A knowledge of the basic content and concepts of the U.S. and Nevada constitutions

## *Admission to the Major*

Minimum GPA: 2.0

To enter the Computer Engineering (CpE) Major, a student must be admitted to the College of Engineering. Admission and transfer policies are described in the College of Engineering section. Students who have been admitted to the College of Engineering and are interested in being admitted to the CpE Major will be placed in the Computer Engineering Pre-major (CpEPRE). A student in the CpEPRE is eligible to submit an application to the Academic Advising Center for advanced standing in the CpE Major after completing the 22 credit CpEPRE curriculum listed below. Students who have not completed the CpEPRE curriculum and do not have advanced standing in the CpE Major cannot enroll in upper division Computer Engineering courses except for those listed below in the CpEPRE Extended Curriculum.

## *University Graduation Requirements*

- Please see Graduation Policies for complete information

## *Department Policies*

Regardless of catalog of graduation students must satisfy prerequisite and corequisite course requirements as specified in the current Undergraduate Catalog. All mathematics, science, and computer science courses, and ENG 101 and ENG 102 must be completed with a grade of C or better. All engineering courses and their immediate prerequisite courses must be completed with a grade of C or better. Electrical and computer engineering students should register for EE 497 - Senior Design Project I in their next to last semester before their anticipated date of graduation.

Computer Engineering Degree Requirements .....Total: 127-133

Computer engineering is the application of scientific and mathematical principles to the design and analysis of all hardware, software, and operating systems for a computer system. Computer engineering integrates several fields of electrical engineering and computer science and includes the study of hardware, software, and their integration. As such, students learn the principles of electricity, signals and systems, and technologies used in making digital devices. They further study programming languages, data structures, operating systems, and databases. The knowledge acquired during the first three years of the undergraduate program will culminate in architecture and design-related courses in which students experience the cost-performance tradeoffs associated with mitigating hardware issues to software.

General Education Requirements ..... Subtotal: 37-40 Credits

First-Year Seminar ..... Credits: 2-3

English Composition ..... Credits: 6

- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar ..... Credits: 3

(see note 2 below)

Constitutions ..... Credits: 4-6

Recommended courses:

- HIST 100 - Historical Issues and Contemporary Society

or

- PSC 101 - Introduction to American Politics

Or a combination of one course from each of the following two lists

US Constitution

- HIST 101 - United States: Colonial Period to 1877
- HIST 106 - European Civilization Since 1648

Nevada Constitution

- HIST 102 - United States Since 1877
- HIST 217 - Nevada History
- PSC 100 - Nevada Constitution

Mathematics ..... Credits: 4

- MATH 181 - Calculus I

Distribution Requirement ..... Credits: 18

Please see Distribution Requirements for more information.

- Humanities and Fine Arts:9 credits (see note 1 below)
  - PHIL 242 - Ethics For Engineers and Scientists
  - COM 216 - Survey of Communication Studies
  - One elective course to fulfill the Fine Arts Distribution Requirement
- Social Science: 9 credits
  - ECON 190 - Global Economics (Satisfies international requirement)
  - EGG 307 - Engineering Economics (see note 1 below)
- Life and Physical Sciences and Analytical Thinking:
  - Automatically satisfied by Major requirements

Multicultural and International

Multicultural, one 3 credit course required

International, one 3 credit course required

These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students

Computer Engineering Pre-major (CpEPRE) Curriculum

Sciences ..... Credits: 8

- CHEM 121 - General Chemistry I *
- PHYS 180 - Physics for Scientists and Engineers I *
- PHYS 180L - Physics for Scientists and Engineers Lab I *

Mathematics ..... Credits: 8

- MATH 181 - Calculus I *
- MATH 182 - Calculus II *

Electrical and Computer Engineering ..... Credits: 3

- CpE 100 - Computer Logic Design I **

Computer Science ..... Credits: 3

- CS 135 - Computer Science I **

Computer Engineering Pre-Major (CpEpre) Extended Curriculum (can be taken as Pre-Major or Advanced Standing students)

Sciences ..... Credits: 4

- PHYS 181 - Physics for Scientists and Engineers II *
- PHYS 181L - Physics for Scientists and Engineers Lab II *

Mathematics ..... Credits: 9

- MATH 251 - Discrete Mathematics I *
- MATH 431 - Mathematics for Engineers and Scientists I *
- STAT 411 - Statistical Methods I *

Electrical and Computer Engineering ..... Credits: 14

- CpE 200 - Computer Logic Design II **
- CpE 200D - Computer Logic Design II Discussion
- CpE 200L - Computer Logic Design II Laboratory **
- CpE 300 - Digital System Architecture and Design **
- EE 220 - Circuits I **
- EE 220D - Circuits I Discussion **
- EE 221 - Circuits II **
- EE 221L - Circuits II Laboratory **

Major Requirements -

BS in Computer Engineering Major .....Subtotal: 75 Credits

Required Mathematics and Natural Science Courses..... Credits: 29

Courses that satisfy the required Mathematics and Natural Science courses have an (*) in the Pre-major (CpEpre) and advanced standing courses section.

Required Fundamental Computer Engineering Courses ..... Credits: 46

Each student must complete the following courses:

Courses that satisfy the required Fundamental Computer Engineering courses have an (**) in the Pre-major (CpEpre) and advanced standing courses section.

- CpE 301 - Embedded System Design
- CpE 301L - Microcontroller Systems Design Laboratory for CpE
- CpE 302 - Digital System Design
- CS 202 - Computer Science II
- CS 218 - Introduction to Systems Programming
- CS 302 - Data Structures
- CS 370 - Operating Systems
- EE 320 - Engineering Electronics I

- EE 320L - Engineering Electronics I Laboratory
- EE 497 - Senior Design Project I
- EE 498 - Senior Design Project II

Computer Engineering Core Requirements..... Credits: 12
Students must select and complete at least 6 credits in at least 2 concentration areas from the following four areas: (see note 5 below)
Digital Electronic Design:
- EE 421 - Digital Electronics
- CpE 408 - VLSI Physical Design, Verification and Testing

Computer Networks:
- CpE 400 - Computer Communications Networks
- CS 445 - Internet Security

Computer System Design:
- CpE 403 - Advanced Embedded System Design
- CpE 404 - Modern Processor Architecture

Security Systems:
- CpE 405 - Information Coding Systems
- CpE 407 - Biometrics
- CS 445 - Internet Security

Computer Engineering Labs..... Credit: 1
Students must select and complete at least 1 lab credit from the following list:
- EE 340L - Electric Power Engineering Laboratory
- EE 370L - Feedback and Control Systems Laboratory
- EE 420L - Engineering Electronics II Laboratory
- EE 421L - Digital Electronics Laboratory
- EE 450L - Solid State Characterization Laboratory
- EE 460L - Communication Systems Lab
- EE 480L - Digital Signal Processing Laboratory

Professional Electives..... Credits: 6 (see note 3 below)
Mathematics/Science Elective ..... Credits: 3 (see note 4 below)
Minimum Credits: ..... 127-133

**Notes**

1. Please see Department approved lists available in the Department office or Academic Advising Center, for courses in social science, humanities, and fine arts. In addition, ECON 190, EGG 307, PHIL 242, and COM 216 are required.
2. Every student must complete a three-credit Second-Year Seminar course. PHIL 242 may satisfy the three-credit Second-Year Seminar course requirement as well as three credits of the Humanities requirement for College of Engineering students only whose degree requires 120+ credits.
3. Professional Electives: Professional electives must be electrical or computer engineering courses. Students are encouraged to select sequences of at least two courses in a given field. All professional electives must be approved by the Department. A list of approved professional electives is available through the department office or Academic Advising Center. Students who want to apply a professional elective that is not on the approved list towards their computer engineering major must obtain the Department Chair's and the Undergraduate Curriculum Committee's Chair's approval.
4. Mathematics/Science Elective. The mathematics/science elective must be from mathematics courses (MATH, STAT) or natural science courses (BIOL, CHEM, PHYS). All mathematics/science electives must be approved by the Department. A list of approved mathematics/science electives is available through the department office or Academic Advising Center. Students who want to apply a mathematics/science elective that is not on the approved list towards their computer engineering major must obtain the Department Chair's and the Undergraduate Curriculum Committee's Chair's approval.
5. CS 445 - Internet Security course cannot be used to satisfy requirements for both the Computer Networks Core and Security System Core.

## Electrical Engineering Major - Bachelor of Science in Engineering (BSE)

Please see the UNLV Electrical and Computer Engineering department web page at http://ece.unlv.edu/ for more information about department programs, faculty, and facilities.

Please see advising information at the UNLV College of Engineering Advising Center at http://engineering.unlv.edu/advising/

### *Accreditation*

Institution - Northwest Commission on Colleges and Universities www.nwccu.org
Program - Engineering Accreditation Commission of ABET http://www.abet.org

### *Electrical Engineering Program Objectives*

The program educational objectives of the Bachelor of Science in Engineering – Electrical Engineering Major are to transmit, create, and apply knowledge so that:

1. The graduate can practice in the field of electrical engineering.
2. The graduate can be admitted to and successfully complete a graduate program in electrical engineering.

### *Electrical Engineering Program Goals*

To achieve the above program objectives, the Electrical Engineering program's goals are for the graduate to possess:

1. Appropriate technical knowledge and skills
2. Appropriate interpersonal skills
3. The knowledge and skills to be a responsible citizen

### *Electrical Engineering Program Outcomes*

1. To achieve the above objectives and goals, each graduate of the Electrical Engineering Major will attain the following outcomes before graduation:
   a. The appropriate technical knowledge and skills
   b. An ability to apply mathematics through differential and integral calculus,
   c. An ability to apply advanced mathematics such as differential equations, linear algebra, complex variables, and discrete mathematics,
   d. An ability to apply knowledge of basic sciences,
   e. An ability to apply knowledge of computer science
   f. An ability to apply knowledge of probability and statistics,
   g. An ability to apply knowledge of engineering
   h. An ability to design a system, component, or process to meet desired needs within realistic constraints
   i. An ability to identify, formulate, and solve engineering problems
   j. An ability to analyze and design complex electrical and electronic devices
   k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

l. An ability to design and conduct experiments, as well as to analyze and interpret data

2. The appropriate interpersonal skills
   a. An ability to communicate effectively
   b. An ability to function on multidisciplinary teams
3. The knowledge and skills to be responsible citizens
   a. An understanding of professional and ethical responsibility
   b. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
   c. A recognition of the need for, and an ability to engage in life-long learning
   d. A knowledge of contemporary issues
   e. A knowledge of the basic content and concepts of the U.S. and Nevada constitutions

## *Admission to the Major*

Minimum GPA: 2.0

To enter the Electrical Engineering (EE) Major, a student must be admitted to the College of Engineering. Admission and transfer policies are described in the College of Engineering section. Students who have been admitted to the College of Engineering and are interested in being admitted to the EE Major will be placed in the Electrical Engineering Pre-major (EEGPRE). A student in the EEGPRE is eligible to submit an application to the Advising Center for advanced standing in the EE Major after completing the 23 credit EEGPRE curriculum listed as an (*) in Major Requirements. Students who have not completed the EEGPRE curriculum and do not have advanced standing in the EE Major cannot enroll in upper division Electrical Engineering courses except for those in the EEGPRE Extended Curriculum listed as a (**) in the Major Requirements.

## *Department Policies*

Regardless of catalog of graduation students must satisfy prerequisite and corequisite course requirements as specified in the current Undergraduate Catalog. All mathematics, science, and computer science courses, and ENG 101 and 102 must be completed with a grade of C or better. All engineering courses and their immediate prerequisite courses must be completed with a grade of C or better. Electrical and computer engineering students should register for EE 497 - Senior Design Project I in their next to last semester before their anticipated date of graduation. Students should register for Senior Design I, in their next-to-last semester of expected graduation.

**University Graduation Requirements**

- Please see Graduation Policies for complete information

Electrical Engineering Major

Degree Requirements.....Total: 128-133 Credits

General Education Requirements..... Subtotal: 30-36 Credits

First-Year Seminar ..... Credits: 2-3

English Composition Credits: 6

- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar ..... Credits: 3
(see note 1 below)

Constitutions ..... Credits: 4-6

- HIST 100 - Historical Issues and Contemporary Society

or

- PSC 101 - Introduction to American Politics

Or a combination of one course from each of the following two lists

US Constitution

- HIST 101 - United States: Colonial Period to 1877
- HIST 106 - European Civilization Since 1648

Nevada Constitution

- HIST 102 - United States Since 1877
- HIST 217 - Nevada History
- PSC 100 - Nevada Constitution

Mathematics..... Credits: (Fulfilled by Major Requirements)

- MATH 181 - Calculus I

Distribution Requirements ..... Credits: 18

Please see Distribution Requirements for more information.

- Humanities and Fine Arts:9 credits
  - PHIL 242 - Ethics For Engineers and Scientists (see note 1 & 2 below)
  - COM 216 - Survey of Communication Studies (see note 2 below)
  - One elective course in Fine Arts - 3 credits
- Social Science: 9 credits
  - ECON 190 - Global Economics (satisfies International Requirement)
  - EGG 307 - Engineering Economics (see note 2 below)
- Life and Physical Sciences and Analytical Thinking:
  - Automatically satisfied by Major requirements

Multicultural and International

Multicultural, one 3 credit course required

International, one 3 credit course required

These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students

Major Requirements -

BS in Electrical Engineering .....Subtotal: 97 Credits

(*) signifies courses students are required to take in the Pre-major (EEGPRE) curriculum

(**) signifies courses students are required to take in the Pre-major (EEGPRE) Extended curriculum (can be taken as Pre-major or Advanced Standing students)

Required Mathematics, and Natural Science Courses.... Credits: 33

Each student must complete the following courses:

- CHEM 121 - General Chemistry I (*)
- CS 117 - Programming for Scientists and Engineers (*)

or

- CS 135 - Computer Science I (*)
- MATH 181 - Calculus I - fulfills the General Education Mathematics Requirement. (*)
- MATH 182 - Calculus II (*)
- MATH 283 - Calculus III (**)
- MATH 431 - Mathematics for Engineers and Scientists I (**)
- MATH 432 - Mathematics for Engineers and Scientists II (**)

or

- MATH 459 - Elementary Complex Analysis (**)
- PHYS 180 - Physics for Scientists and Engineers I (*)
- PHYS 180L - Physics for Scientists and Engineers Lab I (*)
- PHYS 181 - Physics for Scientists and Engineers II (**)
- PHYS 181L - Physics for Scientists and Engineers Lab II (**)

Required Fundamental Electrical Engineering Courses.. Credits: 33

Each student must complete the following courses:

- CpE 100 - Computer Logic Design I (*)
- CpE 200 - Computer Logic Design II (**)

- CpE 200L - Computer Logic Design II Laboratory (**)
- EE 220 - Circuits I (**)
- EE 220D - Circuits I Discussion (**)
- EE 221 - Circuits II (**) (**)
- EE 221L - Circuits II Laboratory
- EE 320 - Engineering Electronics I
- EE 320L - Engineering Electronics I Laboratory
- EE 330 - Engineering Electromagnetics I
- EE 360 - Signals and Systems I
- EE 360D - Signals and Systems I - Discussion
- EE 361 - Signals and Systems II
- EE 370 - Classical Feedback and Control Systems
- EE 497 - Senior Design Project I
- EE 498 - Senior Design Project II

Electrical Engineering Core Requirements ..... Credits: 18
Students must select and complete one course in six areas:
Computers:
- CpE 302 - Digital System Design

Electronics:
- EE 420 - Engineering Electronics II
- EE 421 - Digital Electronics

Electromagnetism:
- EE 430 - Transmission Lines
- EE 431 - Engineering Optics
- EE 432 - Antenna Engineering
- EE 436 - Active and Passive Microwave Engineering

Power:
- EE 340 - Introduction to Electrical Power Engineering

Solid State:
- EE 450 - Solid State Devices

Communications:
- EE 460 - Introduction to Communication Systems

Controls:
- EE 472 - Digital Control Systems

Digital Signal Processing:
- EE 480 - Digital Signal Processing

Laboratory Requirements Credits: 5
Students must select and complete four laboratory credits from:
- CpE 310L - Microcontroller Systems Design Laboratory for EE
- EE 340L - Electric Power Engineering Laboratory
- EE 370L - Feedback and Control Systems Laboratory
- EE 420L - Engineering Electronics II Laboratory
- EE 421L - Digital Electronics Laboratory
- EE 450L - Solid State Characterization Laboratory
- EE 480L - Digital Signal Processing Laboratory

Professional Electives ..... Credits: 6
(see note 3 below)
Mathematics/Science Elective ..... Credits: 3
(see note 4 below)
Total Credits: ..... 128-133

**Notes**

1. Every student must complete a three-credit Second-Year Seminar course. Course PHIL 242 satisfies the three-credit Second-Year Seminar course requirement as well as three credits of the Humanities requirement for College of Engineering students only whose degree requires 120+ credits.
2. Please see department approved lists available in the department office or Advising Center, for courses in social science, humanities, and fine arts. In addition, ECON 190, EGG 307 and PHIL 242 and COM 216 are required.
3. Professional Electives: Professional electives must be electrical or computer engineering courses. Students are encouraged to select sequences of at least two courses in a given field. All professional electives must be approved by the Department. A list of approved professional electives is available through the department office or Advising Center. Students who want to apply a professional elective that is not on the approved list towards their EE major must obtain the Department Chair's and the Undergraduate Curriculum Committee's Chair's approval.
4. Mathematics/Science Elective. The mathematics/science elective must be from mathematics courses (MATH, STAT) or natural science courses (BIOL, CHEM, PHYS). All mathematics/science electives must be approved by the Department. A list of approved mathematics/science electives is available through the department office or Academic Advising Center. Students who want to apply a mathematics/science elective that is not on the approved list towards their EE major must obtain the Department Chair's and the Undergraduate Curriculum Committee's Chair's approval.

## *Electrical and Computer Engineering*

**CpE 100 - Computer Logic Design I**
Digital design concepts and fundamentals. Combinational circuits. MSI and LSI circuits. Sequential machine fundamentals. Sequential circuit analysis and design. Modern developments. Prerequisite(s): MATH 126 and MATH 127 or MATH 128. 3 credit(s)

**CpE 100L - Computer Logic Design I Laboratory**
Logic gates, simplification of Boolean functions, design and testing of combinational and sequential circuits including code converters, multiplexers, adders, and synchronous counters. Corequisite(s): CpE 100. Note(s): For non-electrical and non-computer engineering majors only. 1 credit(s)

**CpE 200 - Computer Logic Design II**
Sequential logic, Synchronous and asynchronous circuits, Hazards, PAL/PLA based implementation, Introduction to computers, Introduction to instruction set architecture, Computer Arithmetic, Assembly Language. Prerequisite(s): CpE 100. 3 credit(s)

**CpE 200L - Computer Logic Design II Laboratory**
Design and testing of combinational and sequential logic circuits. Includes synchronous and asynchronous circuits, races, cycles, hazards, timing considerations and design programmable logic devices (PLD), Design and simulation of a simple arithmetic-logic unit, Assembly Language Simulation. Corequisite(s): CpE 200. Prerequisite(s): CpE 100. 1 credit(s)

**CpE 260 - Signals and Systems for Computer Engineers**
Real and complex signals and linear time invariant (LTI) systems. Signal analysis using linear combinations of signals from linear signal spaces. Analysis of LTI systems described by linear constant coefficient differential equation using zero imput and zero state responses, homogeneous and particular response, and the Laplace transform. Prerequisite(s): MATH 182. 3 credit(s)

**CpE 300 - Digital System Architecture and Design**
Digital systems, ALU and CPU implementations. Data & control path design using hardware description language. Memory organization: DRAM and SRAM, Interfacing. Prerequisite(s): CpE 200. 3 credit(s)

**CpE 300L - Digital Systems Design Laboratory**
Digital logic laboratory. Implementation of combinational and sequential logic design. Introduction to large systems. Prerequisite(s): CpE 200L and EE 320L. 1 credit(s)

**CpE 301 - Microcontroller Based Systems**
Study of the microcontrollers and its application to a broad range of engineering problems. Study of architecture, instruction set, interfaces, etc. Study of Assembly and C programming for microcontrollers. Use of simulation and emulation. Study of microcontroller interface with sensors, acctuators, motors, peripheral devices and communication. Prerequisite(s): CpE 300 and CS 218. 3 credit(s)

**CpE 301L - Microcontroller Systems Design Laboratory for CpE**
Hands-on study of microprocessor and microcontroller application to a broad range of engineering problems. Usage of simulation and emulation tools. Assembly and C microcontroller programming. Hardware interface design and programming. Advanced projects on sensors, acctuators, communication protocol, etc. Prerequisite(s): CpE 301 and CS 218. 1 credit(s)

**CpE 310L - Microcontroller Systems Design Laboratory for EE**
Hands-on study of microcontroller application to a broad range of engineering problems. Usage of simulation and emulation tools. Assembly and C microcontroller programming. Hardware interface design and programming. Prerequisite(s): EE 221L or EE 292 and CpE 200L. 1 credit(s)

**CpE 400 - Computer Communications Networks**
Computer network architecture; the OSI Model; network protocols; local area networks; fiber optics communication; ISDN; elements of Queueing Theory, with emphasis on hardware design issues. Prerequisite(s): CpE 300, CS 370 and MATH 431. 3 credit(s)

**CpE 400L - Computer Communications Lab**
Includes network modeling, simulation, and analysis. It allows the students to choose network devices, such as switches, routers, and workstations, connect them together with various types of links, and create network traffic patterns. Network behavior studied by collecting and interpreting statistics under various settings. Prerequisite(s): CpE 400. 1 credit(s)

**CpE 403 - Embedded Systems**
Design of hardware and software for embedded systems. Study of advanced 32-bit microcontrollers. Hands-on approach in learning assembly language, high-level language programming, debugging, simulators and emulators. Design of efficient embedded systems. RTOS for embedded systems and RTES Design. Project-based, requiring design/construction of an embedded system. Prerequisite(s): CpE 300. 3 credit(s)

**CpE 404 - Modern Processor Architecture**
Instruction level parallel processing. Processor performance evaluation and optimization. Scalar and superscalar pipelines. Instruction, register data and memory data flow techniques. Cache organization and performance analysis. Comparison of RISC, CISC and VLIW architecture. Survey of modern processors. Introduction to multithreading. Prerequisite(s): CpE 300. 3 credit(s)

**CpE 405 - Data Compression Systems**
Source modeling. Foundations of lossy and lossless compression, code properties, Huffman and arithmetic coding, predictive coding, dictionary techniques, compression techniques and standards for facsimile, audio, video and still image coding, Hardware design specifics, coding and watermarking. Prerequisite(s): MATH 431, EE 220. 3 credit(s)

**CpE 407 - Biometrics**
Taxonomies of devices and applications, probability and statistical testing methods, one and two dimensional transform techniques, finger printing, voice recognition, facial recognition, and iris scanning, large scale identification applications, multibiometrics, social, legal, and ethical concerns. Prerequisite(s): STAT 463 and MATH 431. 3 credit(s)

**CpE 408 - Digital Design Verification and Testing**
A study of complete digital design testing during all design flow stages - from writing code to testing chips after manufacturing, creating and implementing effective test scenarios and assertion techniques, designing self-testing devices. Students will get hands-on experience with various EDA tools for design testing, verification, logic and fault simulation. Prerequisite(s): CpE 300. 3 credit(s)

**CpE 410 - Digital System Design using Hardware Description Languages: HDL**
Modern methodologies in design and test of digital/computer systems. Primary focus on very high speed integrated circuit hardware description languages, in particular, VHDL. Verilog and other hardware programming languages explored. Behavior level simulation, debugging. Introduction to synthesis, placement and routing. Prerequisite(s): CpE 200 or CS 302. 3 credit(s)

**EE 190 - Electrical and Computer Engineering Freshman Design**
Introduces safety, ethics and various branches of electrical and computer engineering through one-hour weekly lectures by various professors and practitioners. Students introduced to design principles in electrical and computer engineering and design, build, and test an electrical and/or computer system. Prerequisite(s): Freshman status in Electrical and/or Computer Engineering. 1 credit(s)

**EE 220 - Circuits I**
Introduction to linear circuit analysis. Kirchhoff's laws, operational amplifiers, node and loop analysis. Thevenin, Norton, and other network theorems, first order RL and RC circuits, second order RLC circuits. Corequisite(s): EE 220D. Prerequisite(s): MATH 182. 3 credit(s)

**EE 220D - Circuits I Discussion**
Introduction to PSpice - simulation tool for electrical circuits, problem solving using SPICE. Corequisite(s): EE 220. 0 credit(s)

**EE 221 - Circuits II**
Sinusoidal steady state analysis using phasors, sinusoidal steady state power, the Laplace transform and its application to circuit analysis, network functions, frequency response, magnetically coupled circuits and transformers.. Prerequisite(s): EE 220 and CS 117, CS 135. 3 credit(s)

**EE 221L - Circuits II Laboratory**
Basic measurements and instrumentation. Principles of experimentation. Corequisite(s): EE 221. 1 credit(s)

**EE 292 - Fundamentals of Electrical & Computer Engineering**
Introduction to electrical circuit analysis, electronic devices and circuits, transducers, electric machines and power transmission. Prerequisite(s): PHYS 180 or PHYS 151 and MATH 182. Note(s): For non-electrical engineering majors only. 3 credit(s)

**EE 320 - Engineering Electronics I**
Introduction to electronic devices, electronic circuits and electronic signal processing. Design and analysis of diode circuits including rectifiers and power supplies. Design and analysis of single stage amplifiers and digital circuits. Prerequisite(s): CHEM 121, EE 221, MATH 431, PHYS 181, and PHYS 181L. 3 credit(s)

**EE 320L - Engineering Electronics I Laboratory**
Laboratory-based analysis and design of electrical and electronic systems. Corequisite(s): EE 320. Prerequisite(s): EE 221L. 1 credit(s)

**EE 330 - Engineering Electromagnetics I**
Static electric and magnetic fields. Dielectric and ferromagnetic materials. Laplace's equation. Time-varying electric and magnetic fields. Maxwell's equations. Engineering applications. Corequisite(s): MATH 432 and EE 330D. Prerequisite(s): PHYS 181, MATH 431 and EE 221. 3 credit(s)

**EE 340 - Introduction to Electrical Power Engineering**
Electric energy sources and energy conversion principles, modeling and analysis of synchronous generators, transmission lines, transformers, AC and DC machines. Brief introduction to power system analysis including power flow, fault calculation and economic dispatch. Corequisite(s): EE 330. Prerequisite(s): EE 320. 3 credit(s)

**EE 340L - Electric Power Engineering Laboratory**
Measurement of different electric powers, measurement of equivalent circuit parameters and characteristics of electric generators, transformers, transmission lines, AC and DC motors, use of software packages for fault calculation and load flow. Corequisite(s): EE 340. Prerequisite(s): EE 320L. 1 credit(s)

**EE 360 - Signals and Systems I**
Deterministic signals and linear systems. Time domain description and analysis of analog and discrete linear systems. Analysis of linear systems using the Laplace transform and the z-transform. Block diagram and flow graph representation of signals and linear systems. Introduction to state space representation and analysis. Corequisite(s): MATH 459 or MATH 432 and EE 360D. Prerequisite(s): EE 221 or EE 292 and MATH 431. 3 credit(s)

**EE 360D - Signals and Systems I - Discussion**
Introduction to MATLAB- simulation tool for signals and systems, solving problems using MATLAB. Corequisite(s): EE 360. 0 credit(s)

**EE 361 - Signals and Systems II**
Stochastic and deterministic signals and linear systems. Analog and discrete Fourier Series, analog and discrete Fourier transforms, basic probability theory, stochastic processes, stochastic signals and linear systems. Prerequisite(s): EE 360 and MATH 432. 3 credit(s)

**EE 370 - Classical Feedback and Control Systems**
Introduction to control systems. Feedback control characteristics, performance, stability. Analysis, synthesis and design of feedback control systems. Prerequisite(s): MATH 459 or MATH 432 and EE 360. 3 credit(s)

**EE 370L - Feedback and Control Systems Laboratory**
Laboratory projects and exercises in feedback control. Corequisite(s): EE 370. Prerequisite(s): EE 221L. 1 credit(s)

**EE 420 - Engineering Electronics II**
Analysis, synthesis, and design techniques of modern electronic analog and digital circuits Prerequisite(s): EE 320 and MATH 431 3 credit(s)

**EE 420L - Engineering Electronics II Laboratory**
Applications and study of modern electronic analog and digital circuits. Advanced instrumentation. Corequisite(s): EE 420 Prerequisite(s): EE 320L 1 credit(s)

**EE 421 - Digital Electronics**
Digital circuit analysis. Discrete and integrated circuit technology, logic families, A/D-D/A circuits, comparators, Schmitt triggers. Prerequisite(s): CpE 100 and EE 320 3 credit(s)

**EE 421L - Digital Electronics Laboratory**
Laboratory-based analysis and design of digital and computer electronic systems. Corequisite(s): EE 421 Prerequisite(s): EE 320L. 1 credit(s)

**EE 422 - Introduction to Analog Integrated Circuit Design**
Design of CMOS, BICMOS, and bipolar analog integrated circuits. Topics include device models, current mirror design, single stage amplifier design, differential amplifier design, frequency response analysis and noise analysis. Prerequisite(s): EE 320 3 credit(s)

**EE 427 - Introduction to VLSI System Design**
Introduction to the theory, design and implementation of digital VLSI systems including MOS transistor theory and integrated circuit fabrication technology, digital system design, layout and design rules and use of CAD tools. Prerequisite(s): EE 320 and CpE 200. 3 credit(s)

**EE 430 - Transmission Lines**
Telegraphist's equations; transient response—steady state response; reflection diagrams; Smith chart; matching techniques and designs; narrow and broadband impedance matching techniques; scattering matrix; introduction to stripline and microstrip devices. Prerequisite(s): EE 330 3 credit(s)

**EE 431 - Engineering Optics**
Engineering applications of optics. Includes aperture and grating antennas, holography, optical image processing, optical waveguides, and tomography. Prerequisite(s): EE 330 and MATH 432. 3 credit(s)

**EE 432 - Antenna Engineering**
Fundamentals of antennas and antenna design; linear wire, loop, and antenna arrays; antenna measurements. Prerequisite(s): EE 330 and MATH 432. 3 credit(s)

**EE 436 - Active and Passive Microwave Engineering**
Waveguides, dispersion diagrams, microwave network analysis, broadband impedance matching, open and closed resonators, power dividers, directional couplers, filters, circulators, phase shifters, solid state amplifier, and oscillator design. Prerequisite(s): EE 330 and MATH 432. 3 credit(s)

**EE 442 - Power Electronics**
Topics include: diode circuits and rectifiers, power semiconductor diodes and transistors, thyristors and static switches, controlled rectifiers, AC voltage controllers, DC choppers, inverters, AC and DC drives, power supplies and protection of devices and circuits. Prerequisite(s): EE 320 and EE 340 3 credit(s)

**EE 450 - Solid State Devices**
Semiconductor physics, pn diode, bipolar junction transistor, metal semiconductor FET devices, metal oxide semiconductor FET devices. Prerequisite(s): EE 320, MATH 431 3 credit(s)

**EE 450L - Solid State Characterization Laboratory**
Capacitance and voltage, Hall mobility and carrier concentration, oxidation and etching silicon dioxide processing of silicon. Prerequisite(s): EE 450 1 credit(s)

**EE 451 - Electronic and Magnetic Materials and Devices**
Semiconductors, dielectrics, ferroelectrics, antiferromagnetics, derromagnetics, ferrimagnetics, crystal structure, structure-property relations, device applications. Prerequisite(s): EE 330 3 credit(s)

**EE 452 - Introduction to Optical Electronics**
Topics include: modulation of light, display devices, lasers, photodetectors, fiber optics, engineering applications, and systems. Prerequisite(s): EE 330 3 credit(s)

**EE 453 - Introduction to Nanotechnology**
Overview of Nanotechnology, Physics of the Solid State, Properties of Individual Nanostructures, Bulk Nanostructured materials, magnetic nanoparticles, Quantum Wells, Wires and Dots, Self-Assembly and Catalysis, nanoscale Biological materials. Prerequisite(s): EE 320 3 credit(s)

**EE 460 - Analog and Digital Communications**
Review of Fourier theory, linear system theory, probability and random processes. Modulation and detection. Noise in modulation systems. Introduction to digital data transmission. Prerequisite(s): EE 361 3 credit(s)

**EE 462 - Advanced Digital Communications**
Information theory and fundamental limits on performance, digital coding of waveforms, pulse shaping for baseband transmission, digital bandpass modulations, channel coding. Prerequisite(s): EE 460. 3 credit(s)

**EE 466 - Wireless and Mobile Communication Systems**
The study of wireless systems including cellular telephone systems, wireless local area networks and other wireless data services. Topics include digital modulation techniques, frequency reuse, diversity techniques, multiple access schemes and channel modeling including path loss, shadowing, fading and multipath interference. Prerequisite(s): EE 460. 3 credit(s)

**EE 472 - Digital Control Systems**
Introduction to discrete time of control. State space representation of linear systems; stability; the concepts of controllability and observability. Sample data control system design techniques, including pole placement, observer design. Prerequisite(s): EE 370 or ME 421. 3 credit(s)

**EE 480 - Digital Signal Processing**
Review of discrete linear system theory including the z-transform, the Fourier transform, discrete and fast Fourier transform. Sampling, reconstruction and multirate systems, IIR and FIR digital filter design including digital filter structures and finite word length effects. Prerequisite(s): EE 361. 3 credit(s)

**EE 480L - Digital Signal Processing Laboratory**
Laboratory projects and exercises in digital signal processing including the design and implementation of FIR, IIR, and multirate systems. Corequisite(s): EE 480. 1 credit(s)

**EE 482 - Introduction to Biomedical Signals and Systems**
Introduction to biomedical signals, transduction devices, bioelectric potentials and sensors. Application of electrical signal and system principles to biosignals, such as cardiovascular electrical signals, neural electrical communication, and diagnostic ultrasound. Includes current biomedical engineering topics. Prerequisite(s): EE 361. 3 credit(s)

**EE 493 - Independent Study**
Independent study of a selected engineering topic. Prerequisite(s): Senior standing in Electrical Engineering. May be repeated once for credit. 1-3 credit(s)

**EE 494 - Fundamental Engineering Examination**
Course is used by undergraduate programs to prepare students for FE examination. Corequisite(s): EE 497. 0 credit(s)

**EE 495 - Special Topics**
Covers experimental and other topics which may be of current interest. Prerequisite(s): Upper-division standing in Engineering. May be repeated once under a different topic. May be repeated to a maximum of six credits. Note(s): Topics and credits to be announced. May have a laboratory. 1-4 credit(s)

**EE 497 - Senior Design Project I**
Capstone synthesis course to teach students the design process from problem definition, team building, to project planning, paper design, written and oral communications. Corequisite(s): EE 494. Prerequisite(s): EE 190 and consent of faculty advisor. 1 credit(s)

**EE 498 - Senior Design Project II**
Capstone synthesis course to teach students hardware and software implementation of their projects proposed and paper-designed in EE 497, testing and recommendations, project presentation. Prerequisite(s): EE 497 and final semester senior. 2 credit(s)

# Mechanical Engineering Department

Mechanical engineering is a diverse and flexible engineering discipline. Mechanical engineers work in number of fields including design of machinery, controls, vibrations and acoustics, power generation, renewable energy, energy conservation, fluid flow and heat transfer applications, and air-conditioning. The program synthesizes math, science, engineering science, and engineering design. The program provides electives in several general areas, including thermal-sciences, mechanical design and manufacturing, robotics and automation, mechanical and environmental systems, nuclear engineering, aerospace engineering, and bioengineering. Students begin the practice of design in their freshman year and integrate it throughout their programs which culminate in a team-oriented capstone design project in the senior year. The program is geared to prepare students for the lifelong practice of mechanical engineering and for immediate entry to positions in industry or further studies in graduate schools. The department also offers the Integrated B.S.-M.S. program for qualified undergraduate students.

## *Mission*
It is the mission of the Department of Mechanical Engineering to prepare students for the lifelong practice of mechanical engineering and related engineering disciplines. This includes preparation for immediate entry into positions in industry or for further study in graduate school.

In addition, the department sustains an outstanding academic program, motivating the faculty to attain excellence in research by acquiring external funding and by incorporating students into their research programs.

## *Accredited by the:*
Northwest Commission on Colleges and Universities, 8060, 165th Avenue NE, Suite 100, Redmond, WA 98052 - telephone: (425) 558-4224

Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - telephone: (410) 347-7700

## *Undergraduate Major*
Bachelor of Sciences in Engineering — Mechanical Engineering

## *Program Goals*
The goals of Bachelor of Sciences in the Engineering — Mechanical Engineering program are to:
- Prepare graduates for the lifelong learning of mechanical engineering.
- Provide graduates with solid academic preparation for professional positions and/or graduate study.

## *Program Objectives*
The Bachelor of Sciences in Engineering — Mechanical Engineering program has several objectives:
1. Our graduates will apply acquired technical capabilities when solving engineering problems or in their graduate studies in mechanical engineering or other fields.
2. Our graduates will use acquired professional skills to work effectively with colleagues and others in the work-place.
3. Our graduates will demonstrate a sense of responsibility as a professional member of society.

## *Program Outcomes*
1. Our graduates will apply acquired technical capabilities when solving engineering problems or in their graduate studies in mechanical engineering or other fields. The objective outcomes are:
   a. Fundamental knowledge of state-of-the-art and evolving areas associated with the mechanical engineering field.
   b. Ability to design and conduct experiments, analyze data, and utilize statistical methods.
   c. Ability to solve open-ended design problems.
   d. Ability to use modern computational techniques to solve engineering problems.
   e. Ability to mathematically model and analyze engineering systems.
2. Our graduates will use acquired professional skills to work effectively with colleagues and others in the work-place. The objective outcomes are:
   a. Oral and written presentation of technical information.
   b. Introductory knowledge of economics.
   c. Working on a multi-disciplinary team with peers.
   d. Motivation to pursue lifelong learning.
3. Our graduates will demonstrate a sense of responsibility as a professional member of society. The objective outcomes are:
   a. Commitment to professional and ethical behavior in the workplace.
   b. Awareness of world affairs and cultures.
   c. Recognition of the impact of engineering on local and global societies.
   d. Seeking professional licensure.

## *Admission to the Major*

Minimum: GPA 2.50

Admission and transfer policies are described in the College of Engineering section.

## *Department Policies*

1. Grade of C (2.00) or higher must be earned in each engineering course (ME, CEE, EE, EGG) for graduation.
2. Grades of C (2.00) or higher are required in all immediate prerequisites of all science, engineering, construction management, and computer science courses and in ENG 101 and 102.
3. An overall 2.3 GPA and 2.5 GPA in engineering courses is required for probation, transfer, and graduation.
4. Students must satisfy prerequisite and corequisite course requirements as specified in the current Undergraduate Catalog.
5. Students must be admitted to advanced standing prior to registering for upper-division courses in the College of Engineering.
6. All mechanical engineering students must take the Fundamentals of Engineering Discipline Specific Mechanical Engineering Examination as a graduation requirement. Students who fail to pass the exam are required to take the Fundamentals of Engineering Discipline Specific Mechanical Engineering Examination a second time.

## Mechanical Engineering Major - Bachelor of Science in Engineering (BSE)

Please see the UNLV Mechanical Engineering department web page at http://www.unlv.edu/mel for more information about department programs, faculty, and facilities.

Please see advising information at the UNLV College of Engineering Advising Center at http://engineering.unlv.edu/advising/

## *Accreditation*

Institution - Northwest Commission on Colleges and Universities www.nwccu.org

Program - Engineering Accreditation Commission of ABET http://www.abet.org

## *Learning Outcomes*

1. Our graduates will apply acquired technical capabilities when solving engineering problems or in their graduate studies in mechanical engineering or other fields. The objective outcomes are:
   - Fundamental knowledge of state-of-the-art and evolving areas associated with the mechanical engineering field.
   - Ability to design and conduct experiments, analyze data, and utilize statistical methods.
   - Ability to solve open-ended design problems.
   - Ability to use modern computational techniques to solve engineering problems.
   - Ability to mathematically model and analyze engineering systems.
2. Our graduates will use acquired professional skills to work effectively with colleagues and others in the work-place. The objective outcomes are:
   - Oral and written presentation of technical information.
   - Introductory knowledge of economics.
   - Working on a multi-disciplinary team with peers.
   - Motivation to pursue lifelong learning.
3. Our graduates will demonstrate a sense of responsibility as a professional member of society. The objective outcomes are:
   - Commitment to professional and ethical behavior in the workplace.
   - Awareness of world affairs and cultures.
   - Recognition of the impact of engineering on local and global societies.
   - Seeking professional licensure.

**University Graduation Requirements**

- Please see Graduation Policies for complete information

Mechanical Engineering

Degree Requirements.....Total: 122-128 Credits

General Education Requirements..... Subtotal: 30-36 Credits

First-Year Seminar.....Credits: 2-3

English Composition ..... Credits: 6

- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar..... Credits: 3
(see note 1 below)

Constitutions .....Credits: 4-6

- HIST 100 - Historical Issues and Contemporary Society

or

- PSC 101 - Introduction to American Politics

Mathematics..... Credits: (Fulfilled by Major Requirements)

Distribution Requirements ..... Credits: 18

Please see Distribution Requirements for more information.

- Humanities and Fine Arts: 9 credits
  - PHIL 242 - Ethics For Engineers and Scientists (can satisfy Second-Year Seminar for Engineering Students)
  - One elective courses from a different area (see Multicultural and International Requirements)
  - One course in Fine Arts - 3 credits
- Social Science: 9 credits
  - ECON 102 - Principles of Microeconomics
  - EGG 307 - Engineering Economics
  - One elective course to fulfill the Distribution Requirement (see Multicultural and International Requirements)
- Life and Physical Sciences and Analytical Thinking:
  - Automatically satisfied by Major requirement

Multicultural and International

Multicultural, one 3 credit course required

International, one 3 credit course required

These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students

Major Requirements -

BS in Mechanical Engineering Major.....Subtotal: 92 Credits

Mechanical Engineering Pre-Major Courses..... Credits: 27

Students in the Pre-major for Mechanical Engineering have to complete the First-Year Seminar and the English Composition Requirements as well as the classes below before being eligible for Advance Standing status.

Mathematics..... Credits: 8

- MATH 181 - Calculus I - fulfills the General Education Mathematics Requirement.
- MATH 182 - Calculus II

Sciences ..... Credits: 12

- CHEM 121 - General Chemistry I

- PHYS 180 - Physics for Scientists and Engineers I
- PHYS 180L - Physics for Scientists and Engineers Lab I
- PHYS 182 - Physics for Scientists and Engineers III
- PHYS 182L - Physics for Scientists and Engineers Lab III

Engineering ..... Credits: 6
- CEE 241 - Statics
- ME 242 - Dynamics

Drafting Requirement ..... Credit: 1

Choose one course from:
- ME 220 - 3D Modeling with Pro Engineer
- ME 240 - 3D Modeling with Solidworks

Pre-Major or Advanced Standing Courses..... Credits: 19

Students in the Pre-major or Advanced Standing status for Mechanical Engineering are advised to complete Second-Year Seminar, Constitution and Distribution Requirements along with the following courses:

Mathematics..... Credits: 7
- MATH 283 - Calculus III
- MATH 431 - Mathematics for Engineers and Scientists I

Engineering ..... Credits: 12
- EE 292 - Fundamentals of Electrical & Computer Engineering
- ME 301 - Structure and Properties of Solids
- ME 302 - Materials Mechanics
- ME 302L - Mechanical Testing Lab
- ME 319 - Introduction to Programming for Mechanical Engineers

Mechanical Engineering Advanced Standing Courses.... Credits: 46

Mathematics..... Credits: 6
- ME 402 - Computational Methods for Engineers

and one of
- MATH 432 - Mathematics for Engineers and Scientists II
- MATH 488 - Partial Differential Equations
- STAT 463 - Applied Statistics for Engineers

or any four-hundred level courses in math (except MATH 466 and MATH 467 ) after the approval of the student's academic advisor.

Engineering ..... Credits: 34
- ME 311 - Engineering Thermodynamics I
- ME 314 - Introduction to Heat Transfer
- ME 315 - Thermal Engineering Laboratory
- ME 320 - Dynamics of Machines
- ME 330 - Analysis of Dynamic Systems
- ME 337 - Engineering Measurements
- ME 337L - Engineering Measurements Laboratory
- ME 380 - Fluid Dynamics for Mechanical Engineers
- ME 380L - Fluid Dynamics Laboratory
- ME 421 - Automatic Controls
- ME 421L - Automatic Controls Laboratory
- ME 440 - Mechanical Engineering Design
- ME 453 - Mechanical Vibrations
- ME 492 - FE Exam Review Sessions for Mechanical Engineers
- ME 497 - Senior Design Project I
- ME 498 - Senior Design Project II

Technical Electives ..... Credits: 6

Students must select and complete six credits for upper level mechanical engineering courses. At least 1.5 design credits must also be completed.

Total Credits: ..... 122-128

**Notes**

1. Every student must complete a three-credit Second-Year Seminar course. PHIL 242 may satisfy the three-credit Second-Year Seminar course requirement as well as three credits of the Humanities requirement for College of Engineering students only whose degree requires 120+ credits.

## *Mechanical Engineering*

**ME 100 - Introduction to Mechanical and Aerospace Engineering**
Introduction to mechanical and aerospace engineering profession. Engineering problems and calculations and creativity in the design process. Ethics and professionalism in engineering design. Laboratory and machine shop demonstrations. Prerequisite(s): ME major. 2 credit(s)

**ME 100L - Introduction to Mechanical and Aerospace Engineering Laboratory**
Introduction to techniques and their practice used in the design process: sketching, dimensioning, brainstorming, decision trees, decision matrices, P.C. software packages, experimentation. Corequisite(s): ME 100. Prerequisite(s): Pre-Engineering major. 1 credit(s)

**ME 110 - Private Pilot Ground School**
Preparation for the FAA's Private Pilot Knowledge Exam. Airframes and powerplants; aircraft systems and instrumentation; aerodynamics; aircraft performance; weight and balance; flight physiology; the national airspace system; aeronautical charts; pilotage, dead reckoning and radio navigation; aviation weather; and Federal Aviation Regulations. 4 credit(s)

**ME 120 - Introduction to AUTOCAD**
Introduction to two-dimensional renderings with AUTOCAD. Basic customization features such as menu modification and the addition of command aliases. 1 credit(s)

**ME 130 - Machine Shop Practices**
Introduction to basic machining processes. Safety practices. Cutting theory. Use of lathe, milling machines, and other devices. 1 credit(s)

**ME 220 - 3D Modeling with Pro Engineer**
Parametric, feature-based solid modeling with ProEngineer software package. 1 credit(s)

**ME 230 - Principles of CNC**
Includes the programming, setup, and use of Computer Numerically Controlled (CNC) machines. Students will learn the "G-code" programming language in addition to descriptions of the tools, equipment, and procedures special to this type of machines. Prerequisite(s): ME 130. 1 credit(s)

**ME 240 - 3D Modeling with Solidworks**
Parametric, feature-based solid modeling with Solidworks software package. 1 credit(s)

**ME 242 - Dynamics**
Problem course in engineering dynamics, emphasizing the engineering applications of rigid body motion and mechanisms. Kinematics, energy, momentum, and impulse momentum methods utilized. Prerequisite(s): CEE 241, PHYS 180-180L, and MATH 182. 3 credit(s)

**ME 301 - Structure and Properties of Solids**
Electronic structure and bonding in solids, crystalline and noncrystalline solids, defects and their relation to properties, phase transformations, diffusion in solids, and corrosion. Prerequisite(s): CHEM 121; must be concurrently enrolled in PHYS 182. 3 credit(s)

**ME 302 - Materials Mechanics**
Study of the response of isotropic elastic solids to load, stress and strain of a point, elasticity, thin walled pressure vessels, torsion, bending, deflection of beams, column failure, and connections. Prerequisite(s): CEE 241, MATH 182, and PHYS 180-180L. 3 credit(s)

**ME 302L - Mechanical Testing Lab**
Strain gage attachment and calibration, tensile testing of metals and non-metals, elastic constants, beam deflection and failure, torsion testing, column stability, and bolted connection testing.Corequisite(s): ME 302. 1 credit(s)

**ME 311 - Engineering Thermodynamics I**
Engineering applications of thermodynamics including the first and second laws, behavior of condensable and non-condensable substances, analysis of open and closed systems, equations of state, power and refrigeration cycles. Prerequisite(s): PHYS 181, 181L or PHYS 182, 182L. 3 credit(s)

**ME 314 - Introduction to Heat Transfer**
Engineering applications of heat transfer. Conduction, convection, and radiation. Introduction to heat exchangers. Prerequisite(s): PHYS 181, 181L or PHYS 182, 182L, and MATH 431. 3 credit(s)

**ME 315 - Thermal Engineering Laboratory**
Laboratory studies related to heat transfer, thermodynamics, energy conversion, and HVAC applications. Prerequisite(s): ME 311, ME 314, ME 380. 1 credit(s)

**ME 319 - Introduction to Programming for Mechanical Engineers**
Introduction to computer languages and computer hardware, MATLAB programming environment, MATLAB data types, MATLAB graphics, Functions, Inputs / Outputs, text processing function library, Plotting functions, Reading and writing data files, and Case Studies using different MATLAB Toolboxes. Prerequisite(s): ME 100, ME 100L, MATH 182. 2 credit(s)

**ME 320 - Dynamics of Machines**
Algebraic and graphical methods for synthesis of cam, gear, and linkage mechanisms; methods of planar motion analysis; characteristics of plane motion, and kinematics. Prerequisite(s): MATH 283 and ME 242. 3 credit(s)

**ME 330 - Analysis of Dynamic Systems**
Mathematical modeling and analysis of dynamic systems with mechanical, electrical, and fluid elements. Topics include: time and frequency domain solution, state space modeling and solutions, linearization techniques, numerical solution using Matlab. Prerequisite(s): MATH 431, ME 242. 2 credit(s)

**ME 337 - Engineering Measurements**
Generalized measurements systems, characteristics of dynamic signals, basic transducer, signal conditioning and recording systems, applied mechanical measurements, and statistical analysis. Prerequisite(s): EE 292, PHYS 182, PHYS 182L. 3 credit(s)

**ME 337L - Engineering Measurements Laboratory**
Laboratory instruction includes basic hardware setup of computer based data acquisition and control system and software programming skill using LabVIEW. Measurement process planning including selection of correct transducers and signal conditioning units commonly encountered in mechancial engineering. Corequisite(s): ME 337. 1 credit(s)

**ME 345 - Safety Engineering I**
Engineering approach to safety and health problems and solutions in industries. Includes OSHA and MSHA regulations, safety problems, and equipment and design considerations for safe operations. Retrofit and original designs related to their cost-benefit and to human production factors. Prerequisite(s): CHEM 121 and junior standing for majors in the Colleges of Science and Engineering (senior standing for other majors). 3 credit(s)

**ME 380 - Fluid Dynamics for Mechanical Engineers**
Introduction to fluid properties, statics, and fluid dynamics. Development of the Navier-Stokes equations for the study of flow in closed conduits, external flows, boundary layers, compressible flows, potential flows, and turbomachinery. Prerequisite(s): ME 242, MATH 283, PHYS 182, PHYS 182L. 3 credit(s)

**ME 380L - Fluid Dynamics Laboratory**
Laboratory and computer-based experiments on the dynamics of fluids including pressure in pipes, fluid properties, compressible flows, inviscid flow simulations, boundary layer measurements, usage of wind tunnels, and applications of computational fluid dynamics. Corequisite(s): ME 380. 1 credit(s)

**ME 400 - Intermediate Fluid Mechanics**
Basic laws and equations of fluid flow; very viscous flow solutions; boundary layer flows; potential flows; wave phenomena; transport phenomena; turbulence. Prerequisite(s): ME 380. 3 credit(s)

**ME 402 - Computational Methods for Engineers**
Applied numerical analysis for linear and nonlinear engineering problems. Systems of linear equations, nonlinear equations, and eigen value problems. Approximate numerical integration and differentiation. Development of numerical methods for initial and boundary value problems of ordinary differential equations. Introduction to the numerical solution of partial differential equations. Prerequisite(s): MATH 431, ME 319. 3 credit(s)

**ME 412 - Sizing Solar Energy Systems**
Covers the sizing of solar thermal and photovoltaic systems using various types of software. Design criteria are also covered. Required course of the technical branch of the renewable energy minor. Prerequisite(s): Junior division standing in an Engineering or Science Discipline. 3 credit(s)

**ME 415 - Design of Thermal Systems**
Design of thermal systems and subsystems, especially as they relate to current and new means of energy utilization and power generation; computer simulation and optimization of thermal systems based on performance and economic constraints. Prerequisite(s): EGG 307, ME 311, ME 314, ME 380, or consent of instructor. 3 credit(s)

**ME 416 - Introduction to Biomechanical Engineering**
Fundamental engineering principles in several engineering areas to problems in the biological world. Discussion includes biomechanics of solids, biofluid and transport phenomena, biomaterials, cell and tissue engineering, medical imaging and electrophoresis. Prerequisite(s): BIOL 223, ME 314, ME 380. 3 credit(s)

**ME 417 - Fuel Cell Fundamentals**
Fuel Cell Principles, Fuel Cell Thermodynamics, Fuel Cell Reaction Kinetics, Fuel Cell Charge Transport, Fuel Cell Mass Transport, Fuel Cell Modeling, Fuel Cell Characterization, Fuel Cell Technology, Fuel Cell Types and Systems. Prerequisite(s): ME 311, ME 314, ME 380. 3 credit(s)

**ME 418 - Air Conditioning Engineering Systems**
Analysis and design of air conditioning systems, load calculations, system selection, duct sizing, and controls. Relationships between internal and external environments. Development of economic, functional and energy conserving concepts in air conditioning design. Prerequisite(s): ME 311, ME 314. 3 credit(s)

**ME 419 - Advanced HVAC and Energy Conservation Systems**
Room air distribution. Fan and building air distribution. Mass transfer and humidity measurement. Direct contact heat and mass transfer extended surface heat exchangers. Refrigeration. Current energy conservation technologies, computer simulations of dynamic building energy demand. Prerequisite(s): ME 311, ME 314. 3 credit(s)

**ME 421 - Automatic Controls**
Introduction to feedback system concepts; mathematical modeling of mechanical, hydraulic, electromechanical and servo systems; feedback system characteristics and performance; stability; design and compensation of control systems. Prerequisite(s): ME 330 or EE 360 and EE 292. 3 credit(s)

**ME 421L - Automatic Controls Laboratory**
Control system identification. Controller design, experimentation, computer simulation, and analysis of position and speed control systems. Control system performance optimization. Corequisite(s): ME 421. 1 credit(s)

**ME 425 - Robotics**
Instruction to basic concept and theory behind motions generated by robot manipulators; kinematics, dynamics, and trajectory generation. Design of basic feedback position controllers and computer simulation techniques of robot dynamics and control system. Corequisite(s): ME 421. Prerequisite(s): ME 242, MATH 431. Lab/Lecture/Studio Hours: Three hours lecture and three hours laboratory. 3 credit(s)

**ME 426 - Manufacturing Processes**
Survey of the principal processes used to cast, form, machine, and join material. Tolerances, statistical quality control, costs, operation sequencing, and design for productivity covered. Research paper on related topic required. Prerequisite(s): Senior standing in engineering or architecture. 3 credit(s)

**ME 427 - Manufacturing Systems**
Study of the ways of organizing people and equipment so that production can be performed more efficiently. Includes production lines design, CIM, GT, FMS, production planning, inventory control and MRP, lean production, JIT, and agile manufacturing. Prerequisite(s): ME 301. 3 credit(s)

**ME 429 - Computer Control of Machines and Processes**
Discrete control theory reduced to engineering practice through comprehensive study of discrete system modeling, system identification and digital controller design. Selected industrial processes and machines utilized as subjects on which computer control is to be implemented. Focuses on the time-domain analysis of the control theory and programming. Prerequisite(s): ME 421 or EE 370 or equivalent. 3 credit(s)

**ME 430 - Corrosion Engineering**
Examination of the fundamental processes of metallic corrosion from the thermodynamic and kinetic points of view. Specific types of corrosion and prevention strategies discussed. Materials selection, design features, and fabrication techniques of corrosion control covered. Prerequisite(s): CHEM 121, ME 301. 3 credit(s)

**ME 434 - Noise Control**
Development and solution of one-dimensional wave equation for propagation of sound in air; one-dimensional plane and spherical sound waves; sound transmission phenomena; sound in enclosed spaces; sound propagation outdoors; and human responses to noise. Prerequisite(s): MATH 431 and junior or senior standing in engineering. 3 credit(s)

**ME 440 - Mechanical Engineering Design**
Stress analysis; deflection of machine elements; design of machine elements for static and fatigue strength.
Prerequisite(s): ME 301 and ME 302. 3 credit(s)

**ME 441 - Advanced Mechanical Engineering Design**
Continuation of ME 440; use of advanced concepts in machine design. Prerequisite(s): ME 440. 3 credit(s)

**ME 442 - Advanced Mechanism Design**
Cam design, synthesis of mechanisms, spatial mechanisms. Prerequisite(s): ME 320. 3 credit(s)

**ME 443 - Design Techniques in Mechanical Engineering**
Computational techniques for use in mechanical engineering design. Emphasis on the use of existing commercial codes for the analysis and design of machine elements and for the study of heat transfer and fluid flow. Corequisite(s): ME 314. Prerequisite(s): ME 302 and ME 380. 3 credit(s)

**ME 446 - Composite Materials**
Overview of matrix and fiber systems, processing techniques, anisotropic elasticity, unidirectional lamina, multidirectional laminate theory, failure theories, and design of composite structures. Prerequisite(s): ME 302, MATH 431. 3 credit(s)

**ME 453 - Mechanical Vibrations**
Free and forced response of single-and-multi-degree-of-freedom, lumped parameter systems. Fourier series and Fourier and Laplace transforms. Introduction to vibration of continuous systems and applications. Prerequisite(s): ME 242, ME 330. 3 credit(s)

**ME 454 - Physical Metallurgy**
Physical metallurgy of the common engineering alloys, including carbon, low alloy and stainless steel, cast irons, copper-, nickel- and aluminum based alloys. Relationship between composition, structure, properties, and thermal-mechanical history emphasized. Prerequisite(s): ME 301. 3 credit(s)

**ME 455 - Fundamentals of Nuclear Engineering**
Fundamentals of nuclear reactor design and analysis of the fission process. Basic health physics, reactor shielding, and nuclear waste management. Calculation of reactor dimensions for criticality. Reactor kinetics and control. Prerequisite(s): MATH 431, PHYS 182. 3 credit(s)

**ME 460 - High School Mentoring for Engineering Design**
Students help high school teams design robots for the FIRST robotics competition. Weekly meetings discuss: mentoring, design, robotics, organizational skills, and teamwork. Must arrange transport to assigned local high school. Class begins with the international FIRST Kick-off meeting usually scheduled for the first Saturday after New Year's Day. Prerequisite(s): Junior standing and consent of instructor. May be repeated to a maximum of six credits. 3 credit(s)

**ME 462 - Vehicle Design Projects**
Students design and build a vehicle for entry into a national or regional collegiate competition such as Mini-Baja or Human Powered Vehicle. Design topics may include structural analysis, composite materials, aerodynamics, engine performance, occupant safety, drive train, suspension systems, project management, team building, technical report writing, and oral presentations. Prerequisite(s): Juniors standing and consent of instructor. May be repeated to a maximum of six credits. 3 credit(s)

**ME 470 - Experimental Mechanics of Materials**
Failure theories for isotropic and composite materials, stress concentration, fracture mechanics, combined loading, photoelasticity, composites fabrication, mold making, mechanical testing, and microstructural analysis. Prerequisite(s): ME 302 lecture and lab. Lab/Lecture/Studio Hours: Three hour lab and two hour lecture per week. 3 credit(s)

**ME 480 - Gas Dynamics**
Examines the basic concepts and theories associated with compressible fluid flow. Normal and oblique shocks, 1-D analysis, and method of characteristics discussed. Prerequisite(s): ME 311, ME 380. 3 credit(s)

**ME 482 - Aerodynamics**
Presents fluid flow concepts leading to the design of flow surfaces and passages to achieve optimum performance over the widest range of significant parameters. Topics include boundary layer theory, lift, airfoil analysis, and numerical methods for fluid mechanic analyses. Prerequisite(s): ME 380. 3 credit(s)

**ME 491 - Independent Study**
Independent study of a selected engineering topic. Prerequisite(s): Senior standing in engineering or consent of instructor with departmental approval. May be repeated for a maximum of six credits. 1-3 credit(s)

**ME 492 - Fundamentals of Engineering Examination Registration**
Registration for the Fundamentals of Engineering Discipline-Specific Mechanical Engineering examination. Review of exam materials. Required of all graduating seniors in mechanical engineering. Attendance at the FE examination is required. Corequisite(s): ME 497. Prerequisite(s): Senior standing. Note(s): S/F grading only. 1 credit(s)

**ME 495 - Special Topics in Engineering**
Outlet for experimental and other topics which may be of current interest. Prerequisite(s): Upper-division standing in engineering. May be repeated once under different topic. Note(s): Topics and credits to be announced. May have a laboratory. 1-4 credit(s)

**ME 497 - Senior Design Project I**
Synthesis course to involve students in the design process. Project proposal and design definition. Corequisite(s): Senior standing in engineering. 2 credit(s)

**ME 498 - Senior Design Project II**
Synthesis course to involve students in the design process. Analysis, design completion, and presentation. Prerequisite(s): ME 497. 2 credit(s)