The Raymond B. Jones College of Engineering

Fred T. Gilliam, *Dean*

Engineers solve problems. They apply science, mathematics, and creativity to invent, design, test, build, and operate engineering systems that will meet the needs of society. In the latter half of the 20th century, engineers developed the personal computer, the space shuttle, artificial hearts, cellular phones, and many other "high-tech" products. The opportunities to use technology for the benefit of 21st century society will be even greater.

The Raymond B. Jones College of Engineering provides students with the excellent opportunity to prepare for an exciting engineering career in an educational environment that also encourages Christian character and spiritual growth. In creating this opportunity for students, Mr. and Mrs. Raymond Jones have built upon the original goals of Lipscomb University that "such other branches of learning may be added ... as will promote usefulness and good citizenship among men." In keeping with that goal, graduates of the Raymond B. Jones College of Engineering will be challenged to use their engineering education for the betterment of society, their profession, and their church.

The Raymond B. Jones College of Engineering consists of the following academic departments: Department of Electrical and Computer Engineering, Department of Mechanical Engineering, and Department of Computing and Information Technology. The College offers seven majors that lead to a bachelor of science degree from Lipscomb University. The seven majors include two, Engineering Mechanics and Computer Engineering, that are accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET). The other majors offered in the Raymond B. Jones College of Engineering are: Computer Science, Information Technology Applications, Web Application Development, Mechanical Engineering, and Electrical and Computer Engineering. ABET evaluation of the programs in Mechanical Engineering and Electrical and Computer Engineering have been requested during the fall of 2009, and the results of that evaluation will be received during the late summer of 2010.

In addition to the academic majors offered within the Raymond B. Jones College of Engineering, students have the opportunity to participate in Dual Degree programs that lead to a Bachelor of Science from Lipscomb University and an ABET accredited engineering degree (in engineering disciplines not offered at Lipscomb) from another university. Specific dual degree programs are available with Tennessee Technological University and Vanderbilt University; individual programs can be developed for students who are interested in schools of engineering other than those specified above.

The educational programs offered by the Raymond B. Jones College of Engineering are designed to prepare students for a rewarding professional career and to support the mission of Lipscomb University and the mission of the Raymond B. Jones College of Engineering. Each program is monitored by the faculty in order to continually improve the curriculum and the overall preparation of each graduate.

Mission Statement for the Engineering Programs:

The mission of the engineering programs at Lipscomb University is to prepare its students for engineering careers guided by a Christian understanding of the mission, methods, and structure of their profession and of the world they will serve.

Engineering (ENGR) Courses

Courses bearing the ENGR prefix are courses designed for multiple engineering majors, although they may be required within certain majors. These courses may be taught by faculty members from any department in the Raymond B. Jones College of Engineering, and certain courses may be taught by faculty members in other colleges.

ENGINEERING (ENGR)

1114 Introduction to Engineering (4) F

An introduction to the profession of engineering: its history, role, disciplines, and functions. Engineering ethics, life-long learning, engineering teams and teamwork. Engineering design including a series of projects that are designed, built and tested against design requirements. Engineering graphics including sketching and CAD. Fundamental concepts of engineering mechanics are introduced including forces, equilibrium, dynamics, strength and stress. Corequisite: Mathematics 1123. Lecture, 2 hours; laboratory 2 two-hour labs.

1123 Fundamentals of Engineering Design (3) SP

Fundamentals of engineering mechanics and of computer engineering are presented, and designs involving both are carried out by student teams, starting with performance specification formulated by the instructor, and culminating in a set of fabrication drawings and specifications prepared by student teams. Prerequisite: Engineering 1114. Lecture, 2 hours; laboratory, 3 hours.

2513 Engineering Computer Applications (3) F

Introduction to the use of engineering computational tools, as well as a review of basic vector and matrix operations. A major component of this course is the design and implementation of MatLAB programs. Prerequisites: Engineering 1123 with a minimum of "C" (or equivalent) and satisfaction of Information Technology Proficiency requirement. Lecture, 3 hours.

3122 Appropriate Technology in Engineering Missions (2) SP

The purpose of this course is to prepare students biblically, culturally, and with engineering skills to effectively use appropri ate technologies to serve those in developing countries in a Christian mission situation, and to develop in each student the vision for living a missional lifestyle as Christian engineers. The student will need to go on at least one engineering mission trip during or at the end of the semester to receive credit for the course. Prerequisites: Physics 1013, 1224, or 2424 and Chemistry 1013, 1113, or 1144. Lecture, 3 hours. This course ***may satisfy*** the SALT Tier II requirement.

3303 Applied Mathematics (3) F

Partial differential equations, vector calculus, Fourier analysis, orthogonal functions, elementary matrices, applications of complex variables, Cauchy theorem, residues, and infinite series. Prerequisites: Mathematics 3133. Lecture, 3 hours.

3513 Introduction to Control Systems (3) SP

Classical feedback control systems for continuous time systems. Block diagrams and performance and stability criteria. Root locus, frequency methods, and state space approach. Prerequisites: Computer Science 1513, Electrical and Computer Engineering 2013, Mechanical Engineering 2123, Mathematics 3133. Lecture, 3 hours.

395V Topics in Engineering (1, 2, 3, 4, or 5)

Selected topics from an engineering discipline in either lecture- or laboratory-oriented format, depending on the specific topic selected. Course may be repeated for credit. Prerequisite: Consent of instructor. Offered on demand.

398V Engineering Practicum (1-3)

Work experience in an engineering environment pre-approved by the student's advisor. The student is required to make periodic reports during the semester to a member of the engineering faculty designated by the appropriate academic chair, culminating in a comprehensive practicum report. Credit will be determined by the student's academic chair based on the content of the proposed work experience. This course may be repeated for credit with departmental approval up to a maximum total of 3 credits. Prerequisites: Engineering 1123, and Electrical and Computer Engineering 2223 or Mechanical Engineering 2123. Credit 1 to 3.

4942 Design Process Management (2) F

This course is intended to equip the student with a basic understanding of project management techniques, including work breakdown structures, scheduling, and resource management. It will also incorporate topics related to environment, reliability, and safety. As part of this course, the students will develop the proposal and concept for the project to be completed during Interdisciplinary Design Project. Corequisite: Mechanical Engineering 3812 or Electrical and Computer Engineering 4823, lecture/lab/recitation; 3 hrs, Credit 2.

4953 Interdisciplinary Design Project (3) SP

A major, realistic design experience based on the knowledge and skills acquired in prior and concurrent course work, and requiring teamwork involving more than one discipline. The project begins with a performance specification formulated by the instructor. The student team must carry out the design, generate professional design documentation, including fabrication and test drawings and specifications, and produce and test a prototype product. Prerequisite: Engineering 4942 or consent of instructor. Laboratory, 9 hours.

4991 Engineering Seminar (1) F

A course intended to provide students with a broader view of the engineering profession in the context of society. This is an interdisciplinary course in which a variety of topics will be presented and discussed. Topics will include contemporary issues in engineering, ethics, social and professional responsibilities, life-long learning and selected technical topics. Corequisite: Engineering 4942 or consent of instructor. Seminar, 1 hour.

Engineering students build a tower in Guatemala.

Department of Computing and Information Technology

Donald R. Geddes, *Assistant Professor and Academic Chair*
Alfred L. Austelle, *Associate Professor*
Kenneth R. Mayer, Jr., *Instructor*
Steve Nordstrom, *Assistant Professor*
Michelle Putnam, *Instructor*
Becky J. Tallon, *Associate Professor*

The impact of computing on the daily life of all citizens is inescapable. Revolutionary advances in electronics have transformed the personal computer into both an essential business tool and a household appliance. At the same time, large-scale computing systems have become faster and more powerful, while miniaturization techniques have produced microchips that pervade almost every device used by the general public — automobiles, microwave ovens, refrigerators, telephones, traffic signals, watches. The list is almost endless. Students who are interested in participating in the activities that influence the use of computing resources in business, science and society will find that Lipscomb offers a variety of strong curricula to assist them in achieving that goal.

Distinctives of the Computing and Information Technology Department

The variety of curricula offered at Lipscomb provide a solid foundation on which to continue life-long learning in various computing environments. Graduates may elect to pursue graduate training at the master's or doctoral level.

Demand for career opportunities in computing-related positions will exceed the supply for the next decade and beyond. Despite media reports to the contrary, only 1 to 2 percent of low-tech computing discipline jobs are being outsourced to other countries. Graduates with computing emphases will find many employment opportunities. The latest data from the US Department of Labor show that the top seven fastest growing careers are in the computing disciplines. The Computing and Information Technology Department at Lipscomb offers extensive career development in six of those disciplines.

All of our programs offer opportunities for students to participate in mission trips to various parts of the world, internships with prominent local organizations and opportunities to participate in programming competitions. In the past, several of the internships have become permanent positions. In addition, the Computing and Information Technology Department has a 100 percent placement rate for its graduates.

Computer Science Major and Minor

The Computer Science major and minor provide the opportunity to explore the theoretical and scientific aspects of computing. The program provides preparation both for employment and for graduate programs in computing.

The Computer Science major emphasizes the analytical skills required in technical applications of computing. A student completing this major is well-prepared to enter graduate school, or to seek employment in industry, research laboratories, information technology, software development, networking, telecommunications, consulting, military and civilian government installations, etc.

The Computer Science minor introduces the concepts of data organization and software construction, and gives the student a basis to continue further study. The minor is a good partner for any of the majors offered in the Raymond B. Jones College of Engineering.

Information Technology Applications Major and Web Applications Development Major and Information Technology and Web Design Minors

Majors in Information Technology Applications and Web Applications Development, and minors in Information Technology and Web Design are offered by the Raymond B. Jones College of Engineering. These programs are designed to prepare students for graduate studies in information technology or for employment in a wide variety of commercial computing environments. Examples include banks, insurance companies, health care organizations, distribution centers, retail stores, Internet service providers, web development consultants and telecommunications, as well as small businesses, private consulting, and federal, state, and local government.

The Information Technology Applications major which requires 60 semester hours, allows students to gain expertise in many of the technical aspects of information technology (IT) thus preparing them for graduate study and the IT industry. The Web Applications Development major, which requires 60 semester hours, focuses on the design concepts necessary to develop various types of websites. This major also develops students for industry and advanced study.

The Information Technology minor is designed to provide students with a general knowledge of the requirements of commercial computing. The minor can be very helpful to business students who expect to be involved in corporate computing issues. This program matches very well with any of the majors offered by the College of Business. The Web Design minor is designed to give students a general understanding of web site development and can be very useful to business, art, and education majors who expect to be involved in web development in their careers.

Career Opportunities

Application Programmers
Database Administrators
Information Technology Administrators
Internet Consultants
Network Analysts
Operations Managers
Software Engineers
Systems Analysts and Designers
Telecommunication Analysts
Web Application Developers
Web server administrators
Website administrators
Website designers

Introductory Courses

Computer Applications –Math/Science (CSCI 1041) surveys computing tools and techniques that are useful for scientific studies and is primarily designed for students with majors or minors in the Raymond B. Jones College of Engineering. *Structured Programming* (CSCI 1513) is the primary computing language course for computing majors and minors.

Requirements for Majors

Computer Science Major
B.A. or B.S. degree program
Total hours required—75
Specific courses required—
Bible 421V (counts as general education requirement for daily Bible)
Computer Science 1513, 2113, 3113, 3213, 3353, 3513, 3613, 3703, 3803, 395V, 4213, 4613
Information Technology 2043
Six additional hours selected from:
Computing Science 3413, 350V, 4113
Information Technology 2053, 3013, 3023
Mathematics 1314, 2103, 2183 or 3123, 2314, 2903
Philosophy 3433 (counts as general education requirement for humanities)
One two-semester sequence of laboratory science (8 hours minimum)
The minor requirement in Pure Mathematics is automatically satisfied if Mathematics 3123 is selected in place of 2183; otherwise, one additional course selected from the approved list is needed to complete this minor.

Information Technology Applications Major
B.A. or B.S. degree program
Total hours required — 60
Specific courses required —
Accounting 2503, 2513
Computer Science 1513, 2113, 3213, 3613, 4613
Information Technology 2043, 2053, 3013, 3023, 3553, 395V
Management 3503
Marketing 3503
Mathematics 2053, 2103, 2183
Six hours selected from:
Computer Science and/or Information Technology courses

Web Application Development Major
B.A. or B.S. degree program
Total hours required — 60
Specific courses required —
Art 3123, 3713
Communication 2643
Computer Science 1513, 2113, 3213, 3613,4613
Economics 2503
Information Technology 2043, 2053, 3013, 3023, 3203, 3253, 3553, 395V
Information Technology Management 3013
Marketing 3503
Mathematics 2183

Requirements for Minors

Computer Science Minor
Total hours required—18
Specific courses required—
Computer Science 1513, 2113, 3113
Nine hours of electives chosen from the Computer Science and/or Information Technology offerings with approval of the academic chair.

Information Technology Minor
Total hours required — 21
Specific courses required —
Accounting 2503
Computer Science 1513
Information Technology 2043, 3013, 3553
Management 3503
Three hours selected from:
Computer Science 2113 or
Information Technology 2053

Web Design Minor
Total hours required—18
Specific courses required—
Information Technology 2043, 2053, 3203
Art 3123, 3713
Marketing 3503

COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

In addition to lecture, computing courses require appropriate programming exercises.

COMPUTER SCIENCE (CSCI)

1041 Computer Applications - Math/Science (1) F, SP
Use of computer software for mathematical and scientific applications. Problem solving with application software including graphical representation of solutions and data, equation editing, symbolic mathematics, statistical software, scientific internet resources, images, and animation. Prerequisite: Satisfaction of Information Technology Proficiency requirement. Laboratory, 2 hours.

1513 Structured Programming (3) F, SP
Structured and modular program design and introduction to standard programming techniques. Details of an object-oriented programming language. Elementary applications from several areas. Prerequisite: Information Technology Proficiency requirement and at least a 21 ACT or 500 SAT Mathematics score or Mathematics 1030 with a minimum grade of "C." Lecture, 3 hours.

2113 Intermediate Programming (3) SP
Introduction to recursion, stacks, queues, linked lists and binary trees. Sequential, random, and indexed file applications. Advanced features of the C# programming language and dynamic memory allocation. Prerequisite: Computer Science 1513 with a minimum grade of "C." Lecture, 3 hours.

3113 Data Structures (3) F
String processing, searching and sorting, stacks, queues, linked lists, trees, graphs, and file maintenance. Prerequisite: Computer Science 2113 with a minimum grade of "C". Lecture, 3 hours.

3213 Data Base Management Systems (3) SP
Data relationships. Hierarchical, network, and relational models. Data description languages and query facilities. File security and integrity. Prerequisite: Computer Science 1513 with a minimum grade of "C" and Information Technology 2043 with a minimum grade of "C." Lecture, 3 hours.

3353 Introduction to Software Engineering (3) F
This course is a survey of techniques, methods, and theories used in the analysis, design and testing of software. Prerequisite: Computer Science 2113 with a minimum grade of "C." Lecture, 3 hours.

3413 Numerical Algorithms (3)
Finding roots of equations, error analysis, simultaneous linear equations, numerical integration, least squares approximations, and numerical solution of ordinary differential equations. Prerequisites: Mathematics 2314 and Computer Science 1513 with a minimum grade of "C." Offered on demand. Lecture, 3 hours.

350V Special Topics in Computing (1, 2, or 3)
Selected topics from the field of computing are offered. The course may be either lecture or laboratory oriented depending upon the topic selected. The study represents an in-depth approach to specific areas of interest to the students. This course may be repeated for credit with departmental approval. Prerequisite: Consent of instructor. Offered on demand.

3513 Computer Organization (3) SP
Introduction to architecture of computer systems including, logic design, CPU organization, assembly language, implementation of I/O systems, memory management, and communications. Prerequisite: Mathematics 2103 and Computer Science 1513 with a minimum grade of "C." Lecture, 3 hours.

3613 Network Principles (3) SP
Overview of current computer network theory and practice. Hardware requirements, network media and topologies, protocols and access methods, Internet addressing and protocols, protocol layering (ISO model, etc.). Prerequisite: Computer Science 1513 with a minimum grade of "C." Lecture, 3 hours.

3703 Introduction to GUI Programming (3) SP
An introduction to Human-Computer Interaction and Graphical User Interface development. Discussions on theoretical and practical aspects of designing and implementing graphical user interfaces including window management, interacting with an operating system's graphics library, widgets, and event handling. Prerequisite: Computer Science 2113 with a minimum grade of "C." Lecture, 3 hours.

3803 Introduction to AI and Expert Systems (3) SP
A survey of artificial intelligence topics including advanced searching techniques, heuristics, knowledge representation, intelligent agents, and expert systems. Prerequisite: Mathematics 2103 and Computer Science 2113 with a minimum grade of "C." Lecture, 3 hours.

395V Internship in Computer Science (1-3) F, SP
Provides the opportunity to gain experience with scientific computing in a work setting. Credit is awarded according to the scale published by the Career Development Center. Prerequisites: Junior standing and permission of instructor. Repeatable for up to six hours.

4113 Comparative Programming Languages (3) SP
Formal language grammar and syntax, data types and control structures, and implementation and comparison of strengths and weaknesses of various programming languages. Prerequisite: Computer Science 3113 with a minimum grade of "C." Offered on demand. Lecture, 3 hours.

4213 Operating Systems (3) F

Dynamic procedure activation, system structure, memory management, concurrent processes, and multiprogramming systems. Prerequisite: Computer Science 2113 with a minimum grade of "C." Lecture, 3 hours.

4613 Senior Project (3) F, SP

The student will design and implement a suitable computer project. Prerequisites: Senior standing and 21 hours of computing courses from the Computing and Information Technology department including Computer Science 2113 with a minimum grade of "C." Lecture/recitation, 3 hours. This course ***may satisfy*** the SALT Tier II requirement.

INFORMATION TECHNOLOGY (IT)

1000 Basic Computer Literacy (0) F, SP, SU

Introduction to computers and the use of computer applications, including the campus network applications, word processing, spreadsheets, presentations, and internet access. Upon completion, students will be prepared to use computing resources in the university setting. Open only to students who have not satisfied the Information Technology Proficiency requirement by examination. Lecture/Laboratory, 2 hours.

2043 Information System Applications (3) F, SP, SU

Heavy emphasis will be placed upon using the microcomputer as a decision-making tool. Theory and applications of various software packages, including word processing, electronic spreadsheets, databases, and presentation software are discussed. Prerequisites: Satisfaction of Information Technology Proficiency requirement. Lecture/Laboratory, 3 hours.

2053 Web Application Development I (3) F, SU

A survey of web development techniques with emphasis on developing and maintaining websites Some of the topics presented are basic website development, HTML, XHTML and CSS coding and the use of software packages such as Dreamweaver and PhotoShop Elements. Prerequisite: Satisfaction of Information Technology Proficiency requirement. Lecture/Laboratory, 3 hours. This course ***may satisfy*** the SALT Tier II requirement.

2313 COBOL (3)

Details of COBOL language. Applications include sorting and file manipulation. Prerequisite: Satisfaction of Information Technology Proficiency requirement. Offered on demand. Lecture, 3 hours.

3013 Systems Analysis and Design (3) F

Introduction to analysis and design techniques, project management tools, data collection tools, and system documentation tools. Communication skills will be emphasized. Proper input/output design techniques, database, etc. will be included in selection of appropriate implementation. Evaluation of hardware/software options relating to feasibility will be included. Prerequisites: Satisfaction of Information Technology Proficiency requirement and either Computer Science 1513, or Information Technology 2043 or 2313, with a minimum grade of "C." Lecture, 3 hours.

3023 Project Management (3) SP

This course uses the concepts learned in Systems Analysis and Design and extends them in order to complete a realistic information system project. Students will design the project and implement it while working in a team environment. Prerequisite: Information Technology 3013. Lecture/Recitation, 3 hours. This course ***may satisfy*** the SALT Tier II requirement.

3203 Web Server Technologies (3) F

Application design using server technologies to transfer data from web sites to and from databases. Topics presented are: scripting languages such as ASP, PHP, data structuring languages like XML, and other server technologies. Prerequisite: Information Technology 2053. Lecture, 3 hours.

3253 Web Application Development II (3) SP

This course is designed to provide students with advanced skills in web application development. Topics covered include the use of Java Script, DHTML, SHTML, Action Script among others. The use of available technologies to produce a variety of web site types will be emphasized. Prerequisites: Information Technology 2053 with a minimum grade of "C" and Computer Science 2113 with a minimum grade of "C".

350V Special Topics in Information Technology (1, 2, or 3)

Selected topics from the field of Information Technology are offered. The course may be either lecture or laboratory oriented depending upon the topic selected. The study represents an in-depth approach to specific areas of interest to the students. This course may be repeated for credit with departmental approval. Prerequisite: Consent of instructor. Offered on demand.

3553 Management of Information Technology (3) F

The role of Information Technology in organizations and their strategic use for providing competitive advantage through the use of real world case studies. Use of critical thinking skills to explore methods of using information systems to increase market share in organizational settings. Prerequisites: Computer Science 1513 or Information Technology 2043 and Junior Standing

395V Internship in Information Technology (3) F, SP

Provides the opportunity to gain experience with Information Technology in a work setting. Credit is awarded according to the scale published by the Career Development Center. Prerequisites: Junior standing and permission of instructor. Repeatable for up to six hours.

Department of Electrical and Computer Engineering

John W. Pettit, *Associate Professor and Academic Chair*
Greg G. Nordstrom, *Associate Professor*
Steve G. Nordstrom, *Assistant Professor*

The Department of Electrical and Computer Engineering is responsible for the curriculum leading to the ABET accredited Bachelor of Science degree with a major in *Computer Engineering*.

A second major, *Electrical and Computer Engineering* (ECE), is now also being offered, though this new major is not currently accredited by ABET. It will be reviewed for accreditation at the regularly scheduled review in the fall of 2009.

The new ECE major will offer two tracks, or areas of concentration, specifically 1) *Computer Engineering* and 2) *Electrical Engineering*. Both are built upon a common core set of courses. Beyond this common core, each has its own concentration courses and technical electives, as detailed in the major requirements below.

Note that the Computer Engineering track within the ECE major is very similar to the pre-existing *Computer Engineering major.* Thus, it is our plan to terminate the current *Computer Engineering major*, with the last degree granting date being May, 2013. Prospective students are encouraged to pursue the ECE major and choose their concentration per their respective interest.

Both the *Computer Engineering* and *Electrical and Computer Engineering* curricula are designed to equip their graduates with the knowledge and skills necessary for entry-level engineering jobs in industry or for the pursuit of a graduate degree in electrical or computer engineering. Specifically, they provide knowledge of current electrical and computer technology, the design techniques and tools pertinent to it, and a solid grounding in the mathematics and science that underlie both the current and the future technology in this field. Knowledge of current technology is required to make our graduates valuable from their first day of employment. Knowledge of the basics is required for lifelong learning, which is necessary for career-long professional growth in a world of rapidly advancing technological complexity. We continually strive to integrate and balance these two areas.

Distinctives of the Electrical and Computer Engineering Department

Lipscomb electrical and computer engineering graduates have received numerous research and teaching assistantships at such prestigious schools as Harvard, Columbia, and Vanderbilt. Likewise, graduates have taken positions in local companies, such as Bonitron, regional companies, such as Torch Technologies and national companies, including Intel and Lexmark. Our students consistently score well above the national average on the professional engineering exam and have achieved a high placement rate upon graduation. The ECE faculty has both the academic and industrial experience to give our students the necessary preparation to be successful. On the basis of this record and the rapid growth of the electrical and computer industries, graduates have every reason for optimism regarding their professional prospects.

Program Educational Objectives

The educational objectives of the Computer Engineering and the Electrical and Computer Engineering programs at Lipscomb University are to produce graduates who will be successful in:

1. the practice of engineering as:
   - Maturing professionals employed in industrial, governmental, educational or consulting positions with ever increasing responsibilities and influence;
   - Individuals whose interaction with their employers, coworkers, and neighbors is characterized as considerate, moral, and ethical;
2. the acquisition of new knowledge and skills by:
   - Pursuing advanced degrees in engineering and related fields;
   - Actively participating in ongoing professional development;
   - Refining and adapting their fundamental skills to keep pace with a rapidly changing environment;
3. the application of their talents to serving others by:
   - Active engagement in programs and initiatives which leverage their engineering competence and other skills in ways beneficial to their community, their church, their profession, and society as a whole.

Career Opportunities

Electrical engineers design and build a wide range of electrical and electronic systems including cellular telephones, hybrid automobile motors and batteries, communication systems (including the new digital television network), electrical power transmission systems, and even alternative energy sources such as solar panels and wind turbines.

Computer engineers create next-generation computer systems by developing new computer architectures, high-speed processor chips and memory systems, digital displays, and digital networks. They design both large and small systems, from the super computers used in space and high-energy physics research to the tiny embedded microprocessors used in a wide variety of applications such as automobiles, airplanes, appliances, traffic control systems, heating and cooling systems, and many other modern products.

Both electrical engineers and computer engineers are involved in the autonomous control of mechanical systems, commonly called robotics. In the commercial world they develop consumer electronics such as MP3 players, Wii consoles, printers and similar products. In our nation's defense industry, electrical and computer engineers develop new systems to protect our freedom, while in the academic world they do research in new and innovative ways to apply technology. Also, electrical and computer engineers work to develop and deliver future green technologies to satisfy the world's increasing demand for energy while protecting and sustaining our planet's finite resources.

Requirements for Majors

Computer Engineering Major
B.S. degree program only
Total hours required - 137

I. General Education Requirements — 44 hours
See page 26 for university requirements
Specific courses required within Computer Engineering
Daily Bible: Bible 4213
Humanities: Bible 3123
Social Science: Economics 2503
History 1123 is recommended for the history requirement
Mathematics and physical science satisfied by major/minor

II. Courses for Major — 93 hours
Chemistry 1113 and 1211 or Chemistry 1144
Computer Science 1041, 1513, 2113, 3513, 4213
Electrical and Computer Engineering 2214, 2223, 3013, 3233, 3243, 3331, 3813, 4254, 4823
Engineering 1114, 1123, 4942, 4953, 4991
Mathematics 1314, 2103, 2314, 2324, 3133
Physics 2414, 2424, 2434
Technical elective - 6 hours selected from:
Computer Science 3113, 3353, 3613, 3703, 3803, 350V
Electrical and Computer Engineering 3403, 4513, 4263, 395V
Engineering 3513

Electrical and Computer Engineering Major
B.S. degree program only
Total hours required - 138 ECE Computer Engineering track
- 139 ECE Electrical Engineering track

I. General Education Requirements - 44 hours
See page 26 for university requirements
Specific courses required within Electrical and Computer Engineering:
Daily Bible: Bible 4213
Humanities: Bible 3123
Social Science: Economics 2503
History 1123 is recommended for the history requirement
Mathematics and physical science satisfied by major/minor

II. Core courses - 73 hours
Chemistry 1113 and 1211, or Chemistry 1144
Computer Science 1041, 1513, 2113, 3513
Electrical and Computer Engineering 2214, 2223, 3013, 3233, 3813, 4254
Engineering 1114, 1123, 4942, 4953, 4991
Mathematics 1314, 2103, 2314, 2324, 3133
Physics 2414, 2424

III. Concentration and elective courses
a) *Computer Engineering track:*
Concentration courses: 12 hours
Computer Sciences 3113, 4213
Electrical and Computer Engineering 4263, 4823
Technical electives - 9 hours selected from:
Computer Science 3353, 3613, 3703, 3803, 350V
Electrical and Computer Engineering 3243/3331 (combined), 3523, 4513, 395V
Engineering 3513
b) *Electrical Engineering track:*
Concentration courses: 16 hours
Electrical and Computer Engineering 3243, 3331, 3403, 4513
Engineering 3513
Mechanical Engineering 2013
Technical electives - 6 hours selected from:
Computer Science 3113, 4213
Electrical and Computer Engineering 3523, 4263, 4823, 395V
Physics 2434

The minor requirement in Pure Mathematics is automatically satisfied in both the Computer Engineering and the Electrical and Computer Engineering majors.

Mathematics 1314, Calculus I, MUST be taken during the fall semester of the freshman year in order to enroll in Physics 2414 in the spring semester. Otherwise, completion of the program may require more than eight semesters. Students who are not eligible to begin the calculus sequence should consider enrolling in Mathematics 1123 in the summer session.

It is recommended that students in the Raymond B. Jones College of Engineering satisfy the ITP requirement at the beginning of the first fall semester.

ELECTRICAL AND COMPUTER ENGINEERING (EECE)

2013 Survey of Electrical Engineering (3) SP

Electric circuit DC and AC analysis; transient circuit analysis; frequency response & filters; complex power; electromechanics. Corequisite: Physics 2424. Lecture, 3 hours.

2214 Electric Circuits and Signals I (4) F

Resistor network analysis including series-parallel, wye-delta, source transformations, node voltage and mesh current analysis. Thevenin & Norton equivalent circuits. Capacitance, inductance, mutual inductance, transformers. AC phasor analysis of RLC circuits, single phase power systems. Application of operational amplifiers. Hands-on experience with circuit performance measurement and numerical methods. Corequisite: Physics 2424. Lecture, 3 hours; Laboratory/Recitation, 3 hours.

2223 Electric Circuits and Signals II (3) SP

Transient response of RL/RC and RLC networks. Laplace and Fourier transform methods and introduction to Z transforms. Filter design, including Butterworth filters and frequency and impedance scaling. Two-port parameters. Prerequisite: Electrical and Computer Engineering 2214 with a minimum grade of "C." Lecture, 3 hours.

3013 Random Analysis for Electrical Engineers (3) F

Fundamentals of probability, statistical sampling and hypothesis testing. Probability distribution functions. Random variables and processes, response of linear systems to random processes, optimum systems and filters. Prerequisite: Electrical and Computer Engineering 2223. Lecture, 3 hours.

3233 Semiconductor Electronics I (3) F

Mathematical modeling of the p-n junction, diode circuit analysis, rectifier design. Mathematical modeling of the bipolar junction transistor (BJT) and the metal-oxide-semiconductor field-effect transistor (MOSFET). Basic NMOS and CMOS digital circuit blocks, including flip-flops and SRAM/DRAM memory. A/D conversion techniques. Prerequisite: Electrical and Computer Engineering 2214 or Electrical and Computer Engineering 2013. Lecture, 3 hours.

3243 Semiconductor Electronics II (3) SP

Quiescent and small signal analysis of BJT and MOSFET amplifiers. Power amplifiers. Operational amplifier applications. Transistor amplifier frequency response. Operational amplifier design. Feedback circuit analysis. Oscillators and special analog circuits. Prerequisite: Electrical and Computer Engineering 3233 with a minimum grade of "C." Lecture, 3 hours.

3331 Semiconductor Electronics Laboratory (1) SP

Projects requiring the design and fabrication of semiconductor electronic circuits to meet a specification. Hand analysis, computer simulation, and bench level performance testing are progressively employed to evaluate the circuit of interest. Documentation at each phase is emphasized. Corequisite: Electrical and Computer Engineering 3243. Laboratory, 3 hours.

3403 Electromagnetic Fields (3) SP

A study of electromagnetic fields beginning with Maxwell's equations. Interactions with conductors and dielectric media; waveguides, antennae. Prerequisite: Physics 2424. Lecture, 3 hours. Offered even years. Same as Physics 3403.

3523 Communication Systems (3)

The theory and design of analog and digital communications systems. Signal classification, correlation, representation, analysis and transmission methods are investigated, as are amplitude and frequency modulation, signal encoding/decoding, encryption, and error detection/correction. Prerequisites: Electrical and Computer Engineering 2223 and Electrical and Computer Engineering 3813. Lecture, 2 hours; Laboratory, 3 hours. Offered on demand.

3813 Digital Computer Design I (3) F

An introduction to the digital hardware design process and CAD tools, particularly VHDL. Review of Boolean algebra, functional optimizations, and logic gate implementations. Design of adder/subtractor units, array multipliers, multiplexers, encoders/decoders. State-machine design of sequential circuits, state assignment/state reduction, excitation, and output generation. Prerequisite: Computer Science 3513. Corequisite: Electrical and Computer Engineering 3233. Lecture, 3 hours.

395V Topics in Electrical and Computer Engineering (1, 2, 3, 4, or 5)

Topics from electrical/computer engineering in either lecture or laboratory oriented format, depending on the specific topic selected. Course may be repeated for credit. Prerequisite: consent of instructor. Offered on demand.

4254 Microprocessors (4) F

The theory and application of microprocessors, including architecture, hardware considerations, and programming methods in both assembly- and higher-level languages. Theory and practice of analog-to-digital conversion, synchronous and asynchronous communications, timing, and real-time interrupts. Laboratory design, build, and test assignments involving state-of-the-art microprocessors, sensors, and output devices. Prerequisite: Computer Science 3513 and Engineering 1123. Corequisite: Electrical and Computer Engineering 3233. Lecture, 3 hours; Laboratory 3 hours.

4263 Embedded Systems (3) SP

Special fixed purpose computing system design is considered using a combination of microprocessors (software) and custom digital logic (hardware). Design trade-offs focus on the selection and use of software versus hardware processors for optimized performance. Includes hardware interfacing, bus protocols, peripheral systems, digital control systems, real-time constraints, and networking. Design considerations include cost, performance, power, flexibility, and maintainability. Prerequisite: Electrical and Computer Engineering 4254 with a minimum grade of "C." Corequisite: Electrical and Computer Engineering 4823. Lecture, 2 hours; Laboratory/recitation, 3 hours.

4513 Digital Signal Processing (3) SP

Introduction to digital signal processing. Topics will include Sampling Theorem, z-Transform, discrete-time Fourier transform, power spectrum, discrete Fourier transform, the FFT algorithm, and digital filter design. Prerequisites: Electrical and Computer Engineering 2223 and Mathematics 2103 with minimum grades of "C." Lecture, 2 hours; Laboratory, 3 hours.

4823 Digital Computer Design II (3) SP

Provides an in-depth digital circuit design experience. Datapath and control path design concepts and practice, modeling and simulation techniques, and circuit synthesis are covered. Design analysis, verification, testing, and cost issues will be taught as well. Single-cycle, multi-cycle, and pipelined microprocessor architectures are modeled and implemented using hardware description languages and contemporary CAD tools. The course culminates in a cache-based microprocessor design project using VHDL. Prerequisites: Engineering 1123 and Electrical and Computer Engineering 3813 with a minimum grade of "C." Lecture, 2 hours; Laboratory/recitation, 3 hours.

Dr. Greg Nordstrom, Associate Professor of Engineering, works with a student in the electrical engineering lab.

Department of Mechanical Engineering

A. Fort Gwinn, *Professor and Academic Chair*
Fred T. Gilliam, *Professor and Dean* Kerry E. Patterson, *Associate Professor*
Richard Gregory, *Assistant Professor*

The Mechanical Engineering Department is responsible for Bachelor of Science degree programs in two majors: Mechanical Engineering and Engineering Mechanics. These two degrees share much in common, with a few distinctive differences. Mechanical Engineering provides a program of study covering a wide range of topics in thermal and mechanical systems while Engineering Mechanics is a program that focuses on a depth of knowledge in solid and fluid mechanics. The degree program in Engineering Mechanics is accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET). Mechanical Engineering is a new program that began in the fall of 2007 and has not yet been accredited.

During the first two years, the students in both programs are given a broad education in engineering topics along with the basic mathematics and science that underlies them. Starting in the junior year, the curriculum includes more intense engineering analysis courses with an emphasis on the relationship between analytical techniques and the engineering design process. Students in their junior and senior years pursue more specific interests by selecting between available concentrations. For the Mechanical Engineering student, the possible concentrations are Mechanical Systems and Thermal/Fluid Systems. The Engineering Mechanics major may select between concentrations in Solid Mechanics or Fluid Mechanics. Then, during the senior year the student is allowed to fully explore the "art" of engineering design through the Senior Design experience. The Senior Design experience involves students in interdisciplinary teams that are given the task of designing and producing a product that will meet a set of pre-defined requirements.

Distinctives of the Mechanical Engineering Department

Whether developing more fuel-efficient automobiles, designing robotic medical systems, or helping to put an astronaut on Mars, Mechanical Engineers will play a critical role in maintaining America's place in the world economy. The faculty in the department of Mechanical Engineering has the academic and practical experience to give our students the necessary preparation to be successful.

While at Lipscomb University, Mechanical Engineering students have the opportunity to participate in numerous extracurricular activities through student chapters of the American Society of Mechanical Engineers and the Society of Automotive Engineers, as well as annual engineering mission trips. Students are also encouraged to seek engineering internship opportunities in industry during the summers. Faculty members assist students in finding and securing engineering internships whenever possible.

Program Educational Objectives for Engineering Mechanics and Mechanical Engineering

The educational objectives of the Engineering Mechanics and Mechanical Engineering programs at Lipscomb University are to produce graduates who will be successful in:

1. the practice of engineering as:
   - maturing professionals employed in industrial, governmental, educational or consulting positions with ever increasing responsibilities and influence;
   - individuals whose interaction with their employers, coworkers, and neighbors is characterized as considerate, moral, and ethical;
2. the acquisition of new knowledge and skills by:
   - pursuing advanced degrees in engineering or related fields;
   - actively participating in ongoing professional development
   - refining and adapting their fundamental skills to keep pace with a rapidly changing environment
3. the application of their talents to serving others by:
   - active engagement in programs and initiatives which leverage their engineering competence and other skills in ways beneficial to their community, their church, their profession, and society as a whole.

Career Opportunities

Employment opportunities for those with a Mechanical Engineering degree are numerous and include careers in areas that include:

Aerospace
Automotive
Robotics
Defense
Energy Systems Development and Design
Renewable Energy Systems
Machine Design
Government and Private Research
Consulting
Manufacturing

A Mechanical Engineering degree also provides a solid foundation on which to continue learning. In addition to pursuing master's or doctoral degrees, Mechanical Engineering graduates are exceptionally good candidates for advanced degrees in the areas of business, law, and medicine.

Requirements for Majors

Mechanical Engineering Major
B.S. degree program only
Total required hours – 140

I. General Education Requirement-44 hours
- See page 26 for university requirements
- Specific courses required with Mechanical Engineering
  - Daily Bible: Bible 421 V
  - Humanities: Bible 3123
  - Social Science: Economics 2503
  - History 1123 is recommended for history requirement
  - Mathematics and physical science satisfied in major/minor

II. Courses for Major-96 hours
- Chemistry 1144
- Electrical and Computer Engineering 2013
- Engineering 1114, 1123, 2513, 3303, 3513, 4942, 4953, 4991
- Mechanical Engineering 2113, 2123, 2211, 3113, 3211, 3313, 3413, 3443, 3613, 3703, 3803, 3812, 3831, 4303
- Mathematics 1314, 2314, 2324, 3133
- Physics 2414, 2424
- Approved technical electives 6 hours
- One concentration selected from:
  - Mechanical Systems: Mechanical Engineering 4423
  - Thermal Fluid Systems: Mechanical Engineering 4513
- The minor requirement in Applied Mathematic is automatically satisfied.
- Mathematics 1314, Calculus I, MUST be taken during the fall semester of the freshman year in order to enroll in Physics 2414 in the spring semester. Otherwise, completion of the program may require more than eight semesters. Students who are not eligible to begin in the calculus sequence should consider enrolling in Mathematics 1123 in the summer session.

Engineering Mechanics Major
B.S. degree program only
Total hours required - 137

I. General Education Requirements — 44 hours
- See page 26 for university requirements
- Specific courses required within Mechanical Engineering
  - Daily Bible: Bible 421V
  - Humanities: Bible 3123
  - Social Science: Economics 2503
  - History 1123 is recommended for history requirement
  - Mathematics and physical science satisfied by major/minor

II. Courses for Major — 93 hours
- Chemistry 1144
- Electrical and Computer Engineering 2013
- Engineering 1114, 1123, 2513, 3303, 4942, 4953, 4991
- Mechanical Engineering 2113, 2123, 2211, 3113, 3211, 3313, 3443, 3613, 3703, 3803, 3812, 3831, 4303
- Mathematics 1314, 2314, 2324, 3133
- Physics 2414, 2424
- Approved technical electives 6 hours
- One concentration selected from:
  - Fluid Mechanics Concentration
    - Specific courses required:
      - Engineering 3513
      - Mechanical Engineering 4613
  - Solid Mechanics Concentration
    - Specific courses required:
      - Mechanical Engineering 4123
      - Mechanical Engineering 3413 or 4223
- The minor requirement in Applied Mathematics is automatically satisfied.
- Mathematics 1314, Calculus I, MUST be taken during the fall semester of the freshman year in order to enroll in Physics 2414 in the spring semester. Otherwise, completion of the program may require more than eight semesters. Students who are not eligible to begin the calculus sequence should consider enrolling in Mathematics 1123 in the summer session.

It is recommended that students in the Raymond B. Jones College of Engineering satisfy the ITP requirement at the beginning of the first fall semester.

MECHANICAL ENGINEERING (ME)

2013 Survey of Mechanical Engineering (F)
An overview in the basic principles of engineering mechanics from statics, dynamics, and strength of materials. This includes both static and dynamic force systems and equilibrium, area and mass properties, and general concepts in stress and strain. Prerequisite: Physics 2414. Lecture, 3 hours.

2113 Statics (3) F
Studies in the principles of statics, force systems and equilibrium analysis of structures, friction, centroids and center of gravity, and moments of inertia. Prerequisite: Physics 2414. Corequisite: Mathematics 2314. Lecture, 3 hours.

2123 Dynamics (3) SP
Studies in the principles of dynamics, rectilinear translation, curvilinear translation, rotation, plane motion, work and energy, and impulse and momentum. Prerequisite: Mechanical Engineering 2113, Mathematics 2314, Engineering 2513. Lecture, 3 hours.

2211 Experimental Methods in Engineering Mechanics (1) SP
Principles of experimental methods and procedures; measurement techniques for basic mechanical properties; Introduction to instrumentation characteristics and selection; along with proper documentation of experimental results. Prerequisites: Engineering 2513, Corequisite: Mechanical Engineering 3113. Lecture/Laboratory, 3 hours.

3113 Strength of Materials (3) SP
Studies in the principles of stress, strain, torque, bending moment, Hooke's law, torsion, shear and moment diagrams, beam theory, columns, and shafts. Prerequisite: Mechanical Engineering 2113 and Mathematics 2314, Engineering 2513. Lecture, 3 hours.

3211 Solid Mechanics and Materials Laboratory (1) F
A series of experiments which demonstrate the theory of mechanics of materials and the most important characteristics of engineering materials. Prerequisite: Mechanical Engineering 2211, Mechanical Engineering 3113. Laboratory, 3 hours.

3313 Mechanical Vibrations (3) SP
Theory of vibrations; free and forced, damped and undamped vibrations, one and two degree of freedom systems, and computer-aided simulations. Introduction to continuous systems. Prerequisites: Mechanical Engineering 2123, Mathematics 3133. Lecture, 3 hours.

3413 Dynamics of Machinery (3) SP
Kinematic analysis of plane mechanism linkages, analysis and synthesis of cam-follower mechanisms, and gear trains. An introduction to the synthesis of planar mechanisms-linkages and static and dynamic force and torque analysis of plane mechanisms with balancing using the computer. Prerequisites: Mechanical Engineering 2123. Lecture, 3 hours.

3443 Engineering Materials (3) F
Introduction to the structure and behavior of modern engineering materials. Explores the relationship between the atomic, microscopic, and macroscopic structure of materials and their mechanical, thermal, and failure properties. Prerequisites: Mechanical Engineering 3113, 3211. Chemistry 1144. Lecture, 3 hours.

3613 Fluid Mechanics (3) F
Fundamentals of fluid flow; fluid statics, systems and control volumes; continuity, momentum, and energy equations; dynamic similitude; flow in pipes and channels; flow measurements. Prerequisites: Mathematics 2324, Mechanical Engineering 2123. Corequisite: Mechanical Engineering 3703. Lecture, 3 hours.

3703 Thermodynamics (3) F
Concepts, models and laws; energy and the first law; properties and state; energy analysis of thermodynamics systems; entropy and the second law; conventional power and refrigeration cycles. Prerequisites: Chemistry 1144, Mathematics 2324, Physics 2414. Lecture, 3 hours. Same as Physics 3703.

3803 Heat Transfer (3) SP
Single and multidimensional steady-state and transient heat conduction; role of convection for internal and external forced flows and in buoyancy-driven flow; thermal radiation processes and properties. Prerequisites: Mechanical Engineering 3613, Engineering 3303.

3812 Advance Computer-Aided Design (2) SP
Advanced topics in Computer Aided Design and Analysis, culminating in the initiation of the interdisciplinary design project to be completed in the following semester. Corequisite: Mechanical Engineering 3413, Lecture/lab, 3 hours, Credit 2 hours.

3831 Fluid Mechanics and Thermal Science Laboratory (1) SP
A series of experiments which demonstrate the principles of fluid mechanics, thermodynamics, and heat transfer. Particular emphasis is placed on energy transfer in fluids. Prerequisites: Mechanical Engineering 2211, 3613. Corequisite: Mechanical Engineering 3803. Laboratory, 3 hours

395V Topics in Mechanical Engineering (1,2,3,4, or 5)
Topics from engineering mechanics in either lecture- or laboratory-oriented format, depending on the specific topic selected. Course may be repeated for credit. Prerequisite: consent of instructor. Offered on demand.

4123 Advanced Mechanics of Materials (3) F (even numbered years)
Advanced topics; fracture mechanics, fatigue and life prediction, elastic support, non-circular shafts, curved beams, thick-walled cylinders, introduction to plates, thin shells of revolution. Prerequisites: Mechanical Engineering 3113, Mathematics 2324. Lecture, 3 hours.

4223 Design of Pressure Systems (3) F (odd numbered years)
Design of pressure vessels and piping systems for stress and deflection. Emphasis will be on the use of ASME Boiler and Pressure Vessel Codes as well as the ASTM piping codes. Prerequisites: Mechanical Engineering 3113. Lecture, 3 hours.

4303 Computational Methods in Mechanics (3) F
Matrix formulations using flexibility and stiffness methods for structural analysis of skeletal structures. Application of finite element method in solid mechanics continuum; isoparametric formulation; plane stress, plain strain, axisymmetric, and solid elements and their applications; modeling considerations and error analysis. Prerequisites: Mechanical Engineering 3313, 3803, 3812. Lecture, 3 hours.

4423 Design of Machine Elements (3) F
This course equips the student with a working knowledge of components commonly found in mechanical systems. The student will learn the skills necessary to properly design and select components based on function, loading, and wear characteristics. Prerequisite: Mechanical Engineering 3113, 3413. Lecture, 3 hours.

4513 Design of Thermal—Fluid Systems (3) F
This course equips the student with a working knowledge of components commonly found in thermal-fluid systems. Examples are drawn from power generation, environmental control, and industrial processes. Students work on group projects for

integration of these components in the design of thermal systems. Prerequisites: Mechanical Engineering 3803. Lecture, 3 hours.

4613 Advanced Fluid Mechanics (3) SP (even numbered years)

Fundamental principles and equations; control volumes, continuity, compressible flow, thin airfoil theory; finite wings; wings in compressible flow; aerodynamic drag. Prerequisites: Mechanical Engineering 3613, Engineering 2513. Lecture, 3 hours.

4713 Automotive Design (3) F (odd numbered years)

The fundamentals of designing vehicles based on current and evolving technology. A broad set of topics will be addressed giving the student a basic understanding of the principles involved in vehicle design. Prerequisite: Mechanical Engineering 3703, 3413. Lecture, 3 hours.

4723 Heating Ventilating and Air Conditioning (HVAC) (3) SP (odd numbered years)

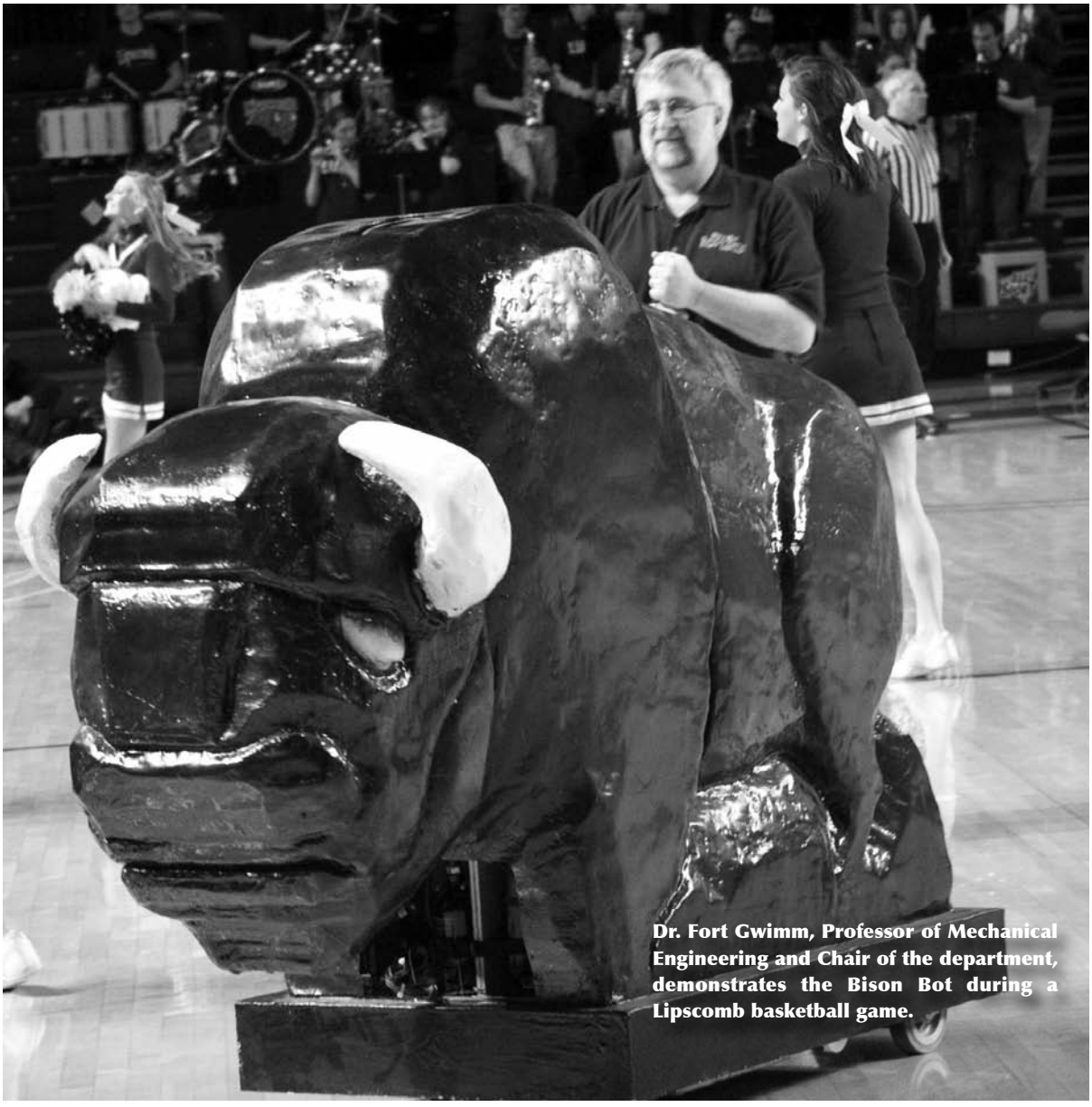
The fundamental theoretical principles and practical considerations in the design of various HVAC equipment and systems. A broad set of topics will be addressed giving the student a basic understanding of the principles involved in HVAC design. Corequisite: Mechanical Engineering 3803. Lecture, 3 hours.

4733 Alternative Energy Sources (3) SP (odd numbered years)

Fundamental principles of alternative energy. Covers the major alternative energy sources: wind, solar, tidal and wave energy, biomass, biofuels, geothermal, fuel cells and hydrogen. Prerequisites: Electrical and Computer Engineering 2013, Mechanical Engineering 3703. Lecture, 3 hours.

4743 Survey of Aerospace Engineering (3) SP (even numbered years)

Flight and flight vehicles both within and outside the atmosphere, airfoil and wing aerodynamics, aircraft performance, introduction to aircraft stability and control, orbital mechanics, atmospheric re-entry, air-breathing and rocket propulsion systems, aerospace structures and materials. Prerequisites: Mechanical Engineering 2123. Corequisite: Mechanical Engineering 3803. Lecture, 3 hours.



Dr. Fort Gwimm, Professor of Mechanical Engineering and Chair of the department, demonstrates the Bison Bot during a Lipscomb basketball game.