A Message From the Dean

Dear Reader:

At no time in the foreseeable future will the demand for engineers be met in the United States, let alone in the rest of the world. The William Rayen School of Engineering at Youngstown State University exists for the education and training of engineers. Our goal is to prepare engineers to meet the challenges and needs of this profession.

The problems of environment, energy and the growing demand for consumer goods, provide continually growing sources of opportunity for engineers. A good engineering background plus the study of psychology, the humanities, and the social sciences allows the engineer to develop an understanding of the function of society, a respect for the vocations of others, a sincere interest in the individual, and the ability to make major contributions to the solutions of the problems of mankind. The curricula of the William Rayen School of Engineering prepare our students for successful employment upon completion of the Bachelor of Engineering (B.E.) degree.

The engineering curricula depend strongly upon mathematics and basic sciences. It is therefore desirable that the incoming student have a good background in mathematics through trigonometry, and at least introductory courses in chemistry and physics. Since one of the most effective forms of communication in engineering is graphical communication, it is hoped that at least one course in engineering drawing or drafting will be taken in high school. For purposes of communication it is particularly important that the individual have a good background in English grammar and composition. The ability to read and comprehend what is read is the most important single ability that one should bring to college for any curriculum, since much of the learning in college and beyond is obtained through reading.

Students who enter without the recommended courses mentioned above may take courses at the University to make up the deficiencies. These will, however, cause delays in the engineering program so that graduation in four years may require some additional summer work.

Youngstown State University also offers, through the College of Applied Science and Technology, a number of curricula in Engineering Technology. These curricula, of two- or four-year duration, prepare persons for supporting roles in engineering as well as other areas. Course work taken in the technology area is not directly transferable to the engineering curricula, since it is generally offered at

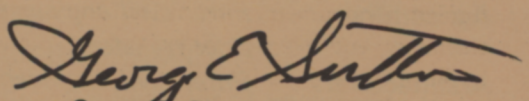
a lower mathematical level than similar courses taught in engineering. General University courses taken in the technology curricula, however, are transferable, where appropriate, to the engineering curricula. The incoming student should give careful consideration to his choice between engineering and engineering technology.

During the fall quarter of each academic year incoming engineering students will enroll in an introductory course in which each of the departments will be given an opportunity to explain in more detail the opportunities and the curricula in their departments. This will help the students who are undecided about a choice of a branch of engineering learn enough about the various fields to make an early career decision, although it is not necessary to do so until the end of the freshman year.

We feel that we have an excellent faculty who are interested in the present and future of our students, and who are willing to help the individual with career decisions in or out of engineering.

You would be most welcome as an engineering student at Youngstown State University, and we will do our best to make your stay here an interesting and worthwhile preparation for a rewarding career!

Sincerely,



George E. Sutton, Ph.D., P.E.
Dean
William Rayen School of Engineering

DEGREES OFFERED:

Baccalaureate degrees are offered in:

Chemical Engineering
Civil Engineering
Electrical Engineering
Industrial Engineering
Materials Science
(Metallurgical Engineering or Materials Science)
Mechanical Engineering

There are a number of other engineering curricula offered at various institutions in the United States for which specific degrees are not offered at Youngstown State University, or only at a small number of institutions. If you wish to pursue one of these fields you may find it desirable to enter Youngstown State University for one or two years and then transfer to one of the specialty programs. Our recommendations for each of these curricula follow.

Aerospace, Astronautical:	*Enter mechanical engineering and consider transfer.*
Agricultural:	*Enter civil engineering and consider transfer.*
Architectural:	*Enter civil engineering and consider transfer.*
Biological, Biomedical:	*It is recommended that you take a baccalaureate degree in chemical, electrical or mechanical engineering and take an advanced degree in bio- or biomedical engineering at another institution.*
Ceramic:	*Take materials science and consider transfer.*
Computer:	*Take electrical engineering undergraduate, consider graduate program in computer engineering.*
Construction:	*Take civil engineering and consider transfer.*
Electronic:	*Electrical is recommended and is very similar.*

Environmental:	*Emphasis available in chemical, civil or mechanical engineering.*
Geological, Geophysical:	*Take civil engineering with minor in geology.*
Manufacturing:	*Take industrial engineering and consider transfer.*
Marine, Naval:	*Take mechanical engineering and consider transfer.*
Mining:	*Enroll in civil engineering and consider transfer.*
Nuclear:	*Take chemical engineering with nuclear emphasis.*
Petroleum:	*Take chemical engineering and consider transfer.*
Sanitary:	*Emphasis available in civil engineering.*
Structural:	*Emphasis available in civil engineering.*
Systems:	*Recommend industrial engineering.*
Thermal:	*This is a specialty normally within mechanical engineering.*
Traffic, Transportation:	*Emphasis available in civil engineering.*
Welding:	*Take metallurgical engineering.*

GRADUATE PROGRAMS:

Upon earning the Bachelor of Engineering (B.E.) degree a qualified student may go on to Graduate School at Youngstown State University.

Master of Science in Engineering (M.S. in E.) degrees are offered in the following areas:

Civil Engineering
Electrical Engineering
Materials Science
Mechanical Engineering

In each case two options are available: the traditional program and an administrative option. The latter draws heavily upon management and industrial engineering, and is designed for the engineer who is engaged in, or expects to be engaged in, managing technical effort. The traditional program requires a thesis, but the administrative option does not. In materials science a research or industrial option is available.

chemical engineering

Chemical engineering is a profession based on sound knowledge of basic sciences such as chemistry and physics, mathematics and engineering sciences. The practice of the profession is concerned with research, development, design and operation of processes and devices involving chemical change. In a broader sense, chemical engineering is concerned with the whole range of problems which arise from the utilization of chemistry. Chemical engineers play a vital role in efforts to alleviate the energy shortage; in utilization of scarce raw materials; in increase of the world's food supply; in solution of environmental problems; and in improvement of public health through manufacture of essential medical products and development of artificial organs.

opportunities

While petroleum, chemical and metallurgical industries employ the major share of chemical engineering graduates, chemical engineering skills are needed in all industries. Chemical engineers also find employment in the public sector in federal government laboratories, regulatory agencies and state and municipal authorities.

Chemical engineering is particularly attractive to women by virtue of their individual talents and

interests. As a result, a higher percentage of women enter chemical engineering than any other engineering discipline.

One measure of value of the profession to the society as a whole is seen in the fact that new graduates in chemical engineering are usually the highest paid of degree holders.

courses of study

The Chemical Engineering and Materials Science Department offers a curriculum in chemical engineering designed to provide students with basic education to meet the technological challenges of modern society. The emphasis is placed on the mastery of principles rather than details of existing technology. The curriculum is flexible enough to meet particular needs of students who may have interest in environmental and biochemical fields, or may wish to prepare for entrance to graduate, medical or law schools.

The Department also offers a nuclear science and engineering minor open to all engineering and physical science students. This minor is particularly attractive to students who plan to seek employment with the fast-growing nuclear industry, one of the two major sources of future energy supply.

facilities

The eight chemical engineering laboratories contain all the necessary equipment and instrumentation for undergraduate instruction and faculty research. The available facilities include an analog computer, chemical reactors, fluid flow apparatus, heat and mass transfer equipment, distillation and gas absorption columns, multistage evaporators, horizontal and vertical dryers, grinding and crushing mills, various industrial filters, liquid-liquid extraction columns and a gas chromatograph.

One laboratory is specifically equipped for corrosion studies and another has been assigned to nuclear engineering studies. The Department has access to the sub-critical nuclear reactor located on the campus, and to the modern University computer facilities.

metallurgical engineering/materials science

Metallurgical engineering is the science and technology of metals including the extraction of metals from ores, their processing into useful forms, the study of their properties and behavior and the development of new alloys. Many principles of metallurgy are equally applicable to non-metallic materials; many materials used in engineering are combinations of metals and non-metals or contain no metal at all, hence, some areas of metallurgical engineering can best be called materials science.

opportunities

The graduates of metallurgical engineering/materials science programs find employment as metallurgical engineers working in minerals processing or extractive metallurgy, metals processing; as materials scientists in laboratories and manufacturing plants, doing research on the development of new materials or supervising the use of well-known ones.

One of the greatest challenges the metallurgist/materials scientist faces today is the development and production of new and better materials from low-grade raw materials using a minimum of energy without polluting the environment. To meet our future energy needs the metallurgical engineer/materials scientist will be called upon to develop better metals and alloys for high temperature, high

erosion applications in plants converting coal to gas and oil, and in the development of the new generation of nuclear plants.

The demand for engineers with background in materials will exceed supply for many years to come as only one out of 40 new engineering graduates has a degree in a materials-related field.

courses of study

The Chemical Engineering and Materials Science Department offers a curriculum in materials science/metallurgical engineering designed to meet the needs of the students and of their prospective employers. The curriculum contains, like other engineering curricula, foundation courses in metallurgical engineering and materials science and synthesis and design courses, including a senior thesis. Through the selective choice of technical electives, the student has the opportunity to meet his specific needs in such areas as powder metallurgy, nuclear materials, polymers and others.

facilities

The metallurgical/materials science laboratories include a field-ion micro-scope laboratory, an electron microscope laboratory, radiograph and X-ray diffraction laboratories, a metallographic laboratory, a spectographic laboratory, phase transformation and calorimetric laboratories, a process metallurgy laboratory, a mineral benefication laboratory and other laboratories for studies of zone melting, ultrasonic applications, welding, high pressure and high temperature effects; for single crystal preparation and for alloy preparations.

The equipment in the departmental laboratories includes a modified calorimeter with special accesories such as a quartz thermometer, an adiabatic calorimeter, heat treatment facilities such as salt pots and electric furnaces, dark room facilities, a large metallograph, microscopes, electron beam zone refiner, induction furnaces, grinding equipment, mounting presses, hardness testers and collection of over 400 prepared specimens.

civil engineering

Civil engineering is the branch of engineering that deals with the design and construction of bridges, dams, highways, pollution control facilities, irrigation systems, etc. The civil engineer may practice his profession in either local or national government, industry, private consulting, or teaching.

The goal of the Department of Civil Engineering at Youngstown State University is to provide educational opportunities for undergraduate and graduate civil engineers. A broad range of offerings is provided including one-day workshops, undergraduate and graduate day and night curricula, courses for the licensed professional engineer who needs to continue his professional development, certification curricula, public service, and continuing research sponsored by local, state and national sources.

opportunities

The following briefly describes each major civil engineering branch.

Structural engineering – analysis and design of buildings, bridges, dams, tunnels and other structures with consideration of loads, wind forces, earthquakes, materials, and economy of construction.

Hydraulic engineering – application of hydrology, meterology, fluid mechanics, and thermodynamics in the design and operation of hydraulic systems, with special attention to floods, sedimentation, tidal and wave action with hydraulic structures.

Highway and Railway engineering – provision of safe and ample water supplies; proper disposal of sewage and other wastes; the control of water, soil and atmospheric pollution; the sanitation of food and shelter; and other engineering problems involved in environmental health.

Air Transport – administration, economics, planning, design, construction, operation, and maintenance of civil and military airports.

City Planning – coordination of engineering and architecture in the planning of new communities and the redevelopment of existing cities. City planning is intimately related to municipal engineering and to city management.

Construction – application of engineering principles and economics to construction of a variety of works designed by other engineers – the culmination of other engineering endeavors.

Engineering Mechanics – a fundamental study of the basic laws governing statics, dynamics, seismic forces, elasticity, plasticity, properties of materials, fluid dynamics, and mathematical methods.

Irrigation and Drainage – technical, economic and social aspects of supply and application of water to land, and its removal therefrom.

Power – development, production, transmission, and distribution of power from water, oil, coal, and atomic reactors.

Soil Mechanics and Foundations – a fundamental analysis of the engineering properties of soils, and their relation to structures, including earth dams, engineering geology, and hydraulic flow through porous media.

Pipeline engineering – design and construction of pipelines for continuous transmission of gases, fluids and solids, and the mapping of routes for such pipelines.

Surveying and Mapping – obtaining and presenting of engineering measurements by means of precise surveys, topographic mapping, photogrammetry, leveling, and related techniques.

Waterways and Harbors – investigation, design, construction, operation, and management of canals, locks, dams, ports, harbors, and navigation facilities.

courses of study

The curriculum combines three interrelated programs: (1) in basic science; (2) in a technical field; and (3) in liberal arts. The basic science program, consisting of mathematics and the physical sciences, provides the basis for the technical program and increases the student's knowledge of the physical world around him. The technical program teaches the application of science to the problems of engineering. The liberal arts program is designed to teach the student to express himself clearly and to better understand both himself and other people, thus dealing more intelligently with the problems he will face as an engineer, as a citizen, and as an individual.

Within the civil engineering curriculum, there are three areas of concentration that the student may select: Transportation, Structures, and Environmental Engineering.

facilities

The civil engineering laboratories include the following: a concrete laboratory, an environmental engineering laboratory, an incompressible fluid mechanics laboratory, a strength of materials laboratory, and a surveying laboratory.

The concrete laboratory is equipped to do routine testing and research related to effects of static, dynamic, and impact loads.

The environmental engineering laboratory is equipped to perform bacteriological, chemical, and physical tests and research on water and wastewater.

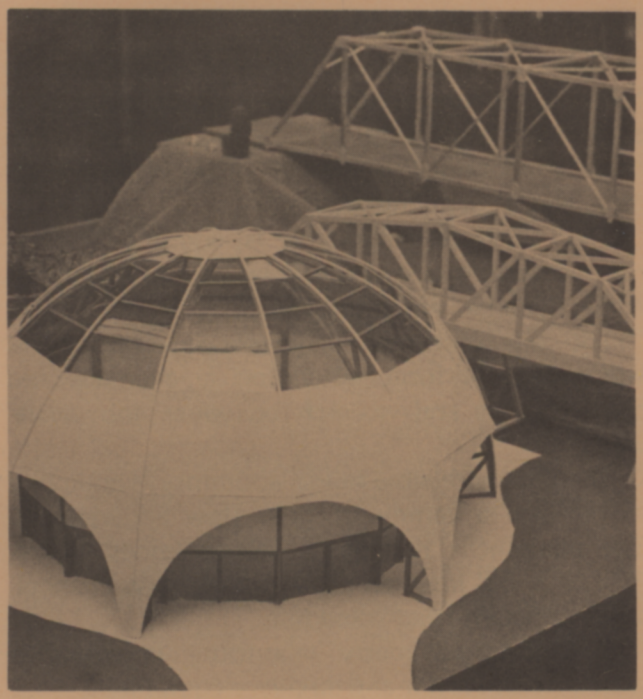
The incompressible fluids laboratory is equipped to perform a variety of fluid flow experiments. The equipment includes a self-contained flume, 4′ x 3′ x 60′ long, an 80′ x 4′ x 4′ flow channel, and a constant-head standpipe.

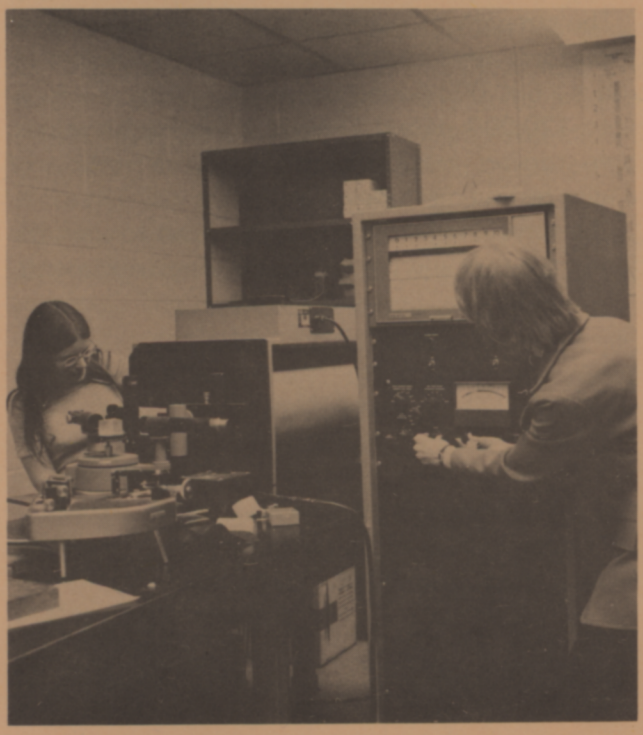
The photogrammetry laboratory is equipped with a Kelsh Plotter and auxiliary equipment.

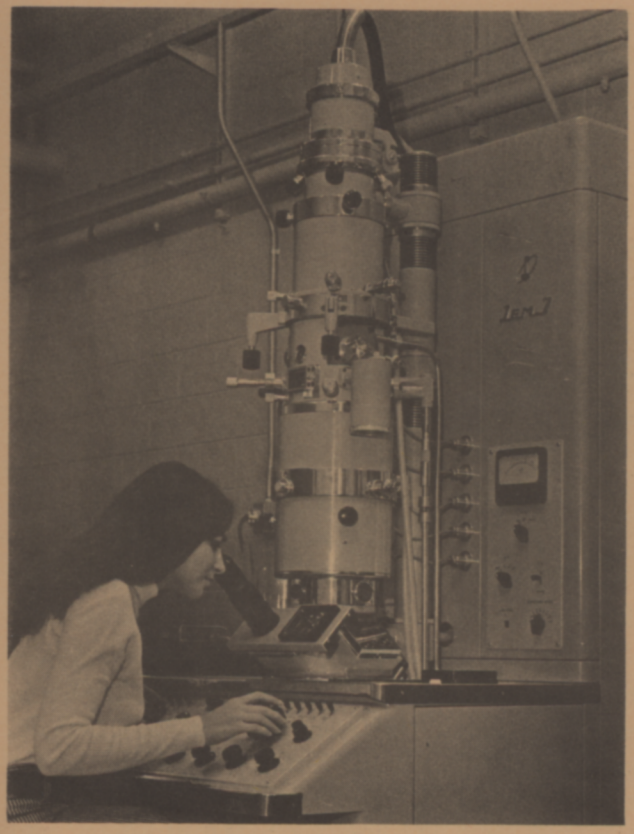
The soil mechanics laboratory is completely equipped to perform tests and research on soils.

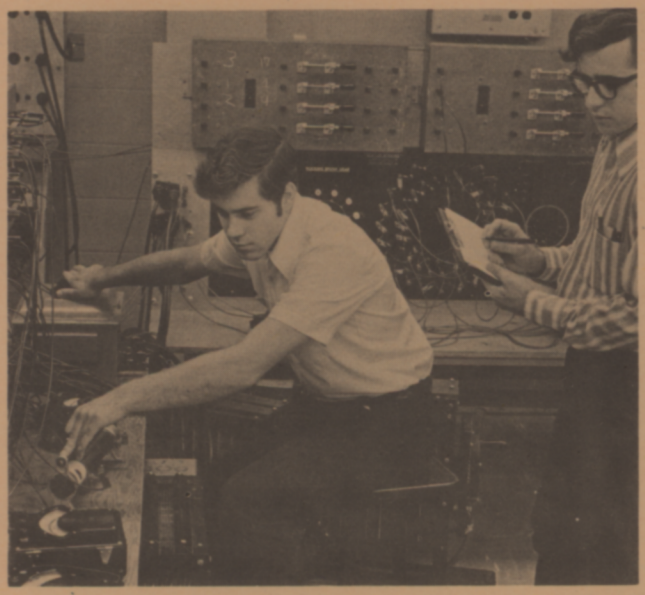
The strength of materials laboratory is equipped to perform tests and research. The equipment includes a 600,000 pound Universal Testing Machine, three 120,000 pound Universal Testing Machines, three torsion machines, as well as a variety of smaller testing machines.

The surveying laboratory is equipped for instruction in the care and use of all surveying instruments.









electrical engineering

Electrical engineering is the profession in which the sources of electrical energy in nature are made useful to man. The electrical engineer designs, builds, and brings into operation new and better devices, processes, products, structures, and systems for bringing about exchange of energy and information electrically. He may participate in any phase of the engineering function from research, development, and design through production construction, construction, sales, management, consulting, and teaching. Because he may work with mechanical, acoustical, magnetic, chemical, electronic, atomic, nuclear, plasmic, light or heat energies, the electrical engineer enjoys a unique flexibility and diversity in his profession. He may work with other engineering disciplines with relative ease, and will find his knowledge and skills in demand in every major industry.

opportunities

The space era has brought with it many important developments, discoveries, and problems for the electrical engineer to turn to man's benefit. His biggest challenges lie in the fields of energy production and pollution reduction: there is important work to be done, for example, in magnetohydrody-

namics, the conversion of sea water to a non-polluting electrical energy. Other special opportunities are available: in bionics, in the development of biological electronic instruments and life support equipment and in research . . . in aerospace, in the formulation of light control systems . . . in the power industry, where demands being placed upon power distribution networks are ever-increasing . . . in communications, in designing faster, smaller, more accurate and more versatile transmitting and receiving equipment . . . in solid state electronics . . . in computer logic . . . in ecological engineering . . . in control of systems . . . in solar energy engineering.

courses of study

Students are provided a rigorous discipline in engineering based on a sound understanding of the sciences and arts upon which engineering rests. Courses leading to the Bachelor of Engineering degree fall into four general areas of concentration: social science and humanities; mathematics, physics, and chemistry; basic engineering; and engineering electives. For the major in electrical engineering, degree requirements can be completed in four years of full-time study. Degree courses include those in: electrical circuits, networks, physical electronics, electrical communications, electromagnetic fields and waves, control systems, energy conversion, computer logic, plasmas, quantum electronics, molecular engineering, computer programming, and solar energy engineering.

facilities

Youngstown State University has one of the most modern engineering buildings in the country, with many facilities available to the electrical engineering student. In addition to the University Computer Center, the following electrical engineering laboratories are available for student use: electronic circuits; networks and communications; physical electronics; quantum electronics; energy conversion; computer logic; control systems; and electromagnetic fields and waves.

industrial engineering

Industrial engineering is concerned with the design, improvement, and installation of integrated systems of men, materials and equipment. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design; to specify, predict and evaluate the results to be obtained from such systems.

Design of facilities, including layout of buildings, machines and equipment; material handling equipment; storage facilities; development of cost control systems such as budgetary controls, cost analysis and standard cost systems; development of wage incentive systems; job evaluation; evaluation of reliability and performances; operations research; design and installation of data processing systems; office systems and plant location surveys are examples of the many activities in which industrial engineers are involved.

opportunities

Industrial engineering differs from other branches of the engineering profession in two ways. First, it applies to all types of industry, commercial and governmental. Second, it is the only major branch of engineering concerned not only with things, but with people.

Because industrial engineers are a prime source of management talent, they are in demand by a wide variety of industries, including aeronautics and aerospace, data processing, steel, automobiles, electronics, retail merchandising, metropolitan transportation, plastics and chemicals, ordnance and utilities . . . to name a few.

courses of study

Courses within the four-year undergraduate industrial engineering curriculum may be grouped into four categories. The categories and the approximate overall percentage of time devoted to each are as follows:

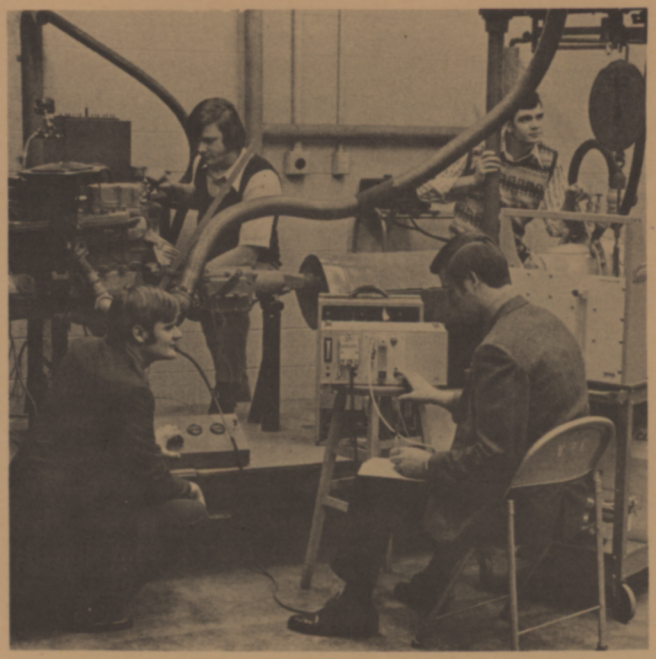
Communication, Humanities, Social Sciences and Physical Education	20%
Chemistry, Mathematics and Physics	30%
Required Engineering	30%
Engineering Electives	20%

The required engineering courses are mechanical drawing, statics, dynamics, thermodynamics, material science, elementary strength of materials, electricity and electronics, and computer programming.

Industrial engineering courses include industrial organization and management, production control, quality control, methods, job evaluation, digital simulation, operations research, linear programming, engineering economy, and value engineering.

facilities

Engineering facilities and the University Computer Center are housed in the Engineering Science Building. The Industrial Engineering Department maintains a computations laboratory which contains a variety of calculators, both manual and programmable.



mechanical engineering

Mechanical engineering is the profession that deals with the conversion and utilization of energy; the design of machines and engines of all types; and the instrumentation and control of physical processes, systems and environments. Mechanical engineers must have a good knowledge of the physical and thermal sciences, but the vast majority do not consider themselves to be scientists in search of new knowledge. Rather, their challenge is to use such knowledge to create, design and construct what people need or want. Mechanical engineers are concerned with the practical purpose and function of a machine or system, as well as its design for strength, reliability, safety, economy and appearance. Automobiles, typewriters, textile machinery, spacecraft, refrigerators, air-conditioners, automated assembly lines, artificial limbs, the heart and lung machine, pollution control devices, rolling mills, computer hardware, excavators, and nuclear reactors are but a few examples of systems that involve mechanical engineering.

opportunities

Related above are three outstanding characteristics of the profession. One – if a system involves motion of mechanical parts or fluids, it was most probably designed by mechanical engineers. Two – work that may be classified as mechanical engineering is very broad and flexible, thereby providing a great many opportunities to suit individual talents and interests. And three – mechanical engineers shoulder serious professional responsibility for the welfare and safety of people. Mechanical engineering graduates are in demand in almost every kind of industry; transportation companies, public utility companies, power-generating stations, manufacturing plants, hospitals, missile and space centers, etc. They are employed and function in research, design, product development, construction, production, sales, management, consulting and teaching.

courses of study

Course requirements of the four-year undergraduate mechanical engineering curriculum may be grouped into four categories, as follows:

English, Humanities, Social Studies, and Physical Education	20%
Mathematics, Physics, and Chemistry	25%
Required Engineering	40%
Engineering Electives	15%

Required engineering courses are mechanical drawing, graphic science and design, basic engineering concepts, statics, dynamics, thermodynamics, conduction heat transfer, incompressible fluid mechanics, engineering materials, elementary strength of materials, elementary machine design, electrical circuits and devices, computer programming, and engineering economy. Elective mechanical engineering courses include: applied thermodynamics, convection and radiation heat transfer, thermofluid processes in environmental systems, compressible fluid mechanics, refrigeration and air-conditioning, internal combustion engines, dynamics of machinery, advanced strength of materials, advanced machine design, mechanical vibrations, engineering acoustics, human factors in mechanical

engineering, biomedical engineering, engineering analysis, and control theory.

The elective courses listed offer students three general areas of specialization; mechanics of rigid and deformable solids, heat and fluid flow, and environmental studies. Curriculum modifications can also be made for students who desire minor emphasis in certain other areas, such as nuclear engineering and biomedical engineering.

Students wishing to transfer to the mechanical engineering baccalaureate degree program from any two- or four-year academic program should consult the Department chairman for special counseling. The Department has developed transitional programs designed to utilize the student's previously acquired knowledge and minimize the time required to fulfill the Bachelor of Engineering Degree requirements.

facilities

The Department of Mechanical Engineering maintains laboratories for thermodynamics, heat power, internal combustion engines, heat transfer, fluid mechanics, photoelasticity, experimental stress analysis, mechanical vibrations and acoustics. Included is a considerable array of equipment and instrumentation to facilitate education and research activities.

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