CHEMICAL ENGINEERING (CENG)

CENG 1100 Innovations in Chem Eng w/ Lab (3 Credit Hours)
This course will introduce students to the basic concepts and calculations in the field of chemical engineering. In addition to lectures, students will gain hands-on experience utilizing modern techniques and exposure to real-world applications through labs and activities. This course is limited to high school students.

CENG 1940 Transfer Coursework (0 Credit Hours)

CENG 2110 Matl & Energy Balances (3 Credit Hours)
Basic concepts in mass and energy balances are presented in this introduction to chemical process engineering. Properties of pure materials and relevant equations of state are reviewed in illustrative examples.

Prerequisite(s): (CHEM 1080, 1080, 1080 or 1080) and (MATH 1220, 1220, 1220, 1220, 1310, 1310, 1310 or 1310).

CENG 2120 Thermodynamics I (3 Credit Hours)
Concepts of energy, equilibrium, and reversibility are presented in the setting of the theoretical development of classical thermodynamics. Energy conversion cycles and elementary fluid mechanics are used to illustrate applied thermodynamics in chemical process technology.

Prerequisite(s): (MATH 2210*, 2210, 2210 or 2210) and (CHEM 1080*, 1080, 1080 or MATH 1080) and (PHYS 1310, 1310, 1310 or 1310).
* May be taken concurrently.

CENG 2230 Prof Dev for Chem Engr (3 Credit Hours)
This course is designed for students who wish to enhance the soft skills necessary for life-long success as a professional engineer. Topics include effective written and oral communication, resume building, networking, employment search strategies, the interview process, teamwork and critical thinking. Learning will be reinforced through practical activities including a mock interview, a staged networking event and oral presentations with class discussion and feedback.

CENG 2320 Transport Phenomena I (3 Credit Hours)
Principles of hydrostatics and fluid mechanics. Emphasis is on mass, energy and momentum balances. Fluid flow through pipes and other types of chemical engineering equipment are considered in detail. The fundamental operations of vector analysis and the development of basic differential equations that govern fluid flow are used to solve representative problems in which viscosity is important.

Prerequisite(s): CENG 2110 and (MATH 2210*, 2210, 2210, 2210 or 2210).
* May be taken concurrently.
Corequisite(s): CENG 2120.

CENG 2500 Intro To Biotechnology (3 Credit Hours)
This course begins with an introduction to physical and biological properties of cells through cell and molecular biology teachings, and then expands with the application of these principles to the realm of biotechnology. Theory and practice of specific laboratory techniques will be covered and demonstrated, and typical data sets will be interpreted. Applications of biotechnology in the business and medical communities will be discussed.

CENG 2505 Intro Biotech Lab (1 Credit Hour)
This course is designed to introduce students to essential laboratory skills and modern techniques utilized in the field of biotechnology. These include aseptic technique, microbial and mammalian cell culturing, flow cytometry, and engineering and analysis of genes in E. coli. Laboratory notebook maintenance, executing protocols, analyzing data and teamwork are emphasized. This course is intended for students without any prior research experience.

Corequisite(s): CENG 2500.

CENG 2780 Special Topics (1-3 Credit Hours)
Prerequisite(s): CHEM 1070, 1070, 1070 or 1070.

CENG 2890 Service Learning (0-1 Credit Hours)
Service learning component to CENG courses. See Schedule of Classes each semester for offerings. 20 or 40 hours of public service with a CPS approved community partner.

CENG 2940 Transfer Coursework (0 Credit Hours)

CENG 3020 Chem & Eng Sci in Community (1 Credit Hour)
This course satisfies the university's public-service requirement. Topics include public outreach, application of engineering principles to community issues, and educating the community on scientific and engineering issues.

CENG 3110 Thermodynamics II (3 Credit Hours)
Basic concepts in physical and chemical equilibria. Systems of variable composition. Chemical reaction equilibria. Thermodynamic analysis of processes. Principles of statistical mechanics. Partition functions.

Prerequisite(s): CENG 2120.

CENG 3120 Materials Science & Engr (3 Credit Hours)
The structure and properties of engineering materials are considered. Coverage includes basic atomic and microscopic structure, testing methods, phase relationships, and strengthening techniques. Emphasis is placed on common industrial materials. Thermodynamics and kinetics aspects of material science are discussed.

Prerequisite(s): CHEM 1080 and PHYS 1320 and (MATH 2210*, 2210, 2210 or 2210).
* May be taken concurrently.

CENG 3230 Numr Meth For Chem Eng (3 Credit Hours)
Numerical solution of linear and nonlinear algebraic equations, and ordinary and partial differential equations. Numerical differentiation and integration. Linear and nonlinear regression analysis. Optimization methods. Applications to chemical and biomolecular engineering design-oriented problems. Excel spreadsheets are used for all computations. An introduction to Visual Basic for Applications programming is included. All applications and homework problems are related to Chemical and Biomolecular Engineering. A brief introduction to MatLab is included.

Prerequisite(s): MATH 2240, 2240, 2240 or 2240.

CENG 3240 Unit Operations Lab (4 Credit Hours)
Bench scale laboratory experiments in Unit Operations. Report writing, safety, oral presentations, ethics and group activities are emphasized.

Prerequisite(s): CENG 3110 and 3390.

CENG 3340 Separation Processes (3 Credit Hours)
The analysis and design of mass-transfer based separation processes. Fundamental concepts are derived and applied to representative industrial process configurations. Subject area coverage includes the fundamentals of mass transfer, as well as the design of countercurrent operations such as gas-liquid absorption, distillation, liquid-liquid extraction and leaching.

Prerequisite(s): CENG 3390.

CENG 3390 Transport Phenomena II (3 Credit Hours)
The analysis of problems in conductive, convective, and radiative heat transfer. The formulation and solution of heat and mass transfer problems by means of shell balances. Exact and numerical solutions to heat and mass transfer problems. Correlations for convective heat transfer. Analogies between heat and mass transfer. The application of basic principles of heat/mass transfer to heat exchange, evaporation, condensation, boiling and drying operations.

Prerequisite(s): CENG 2320 and (MATH 2240*, 2240, 2240 or 2240).
* May be taken concurrently.

CENG 3420 Transport in Cells & Organs (3 Credit Hours)
Fundamental principles of fluid mechanics and mass transport will be applied to biological systems at the cellular, tissue, and organ levels. The topics of this course will be the cardiovascular and respiratory systems, transmembrane and transvascular transport, cell adhesion and intracellular transport, drug transport and pharmacokinetics, and transport-related diseases (atherosclerosis, sickle cell disease, embolism, cancer metastasis).

CENG 3890 Service Learning: CENG 3020 (0-1 Credit Hours)

CENG 3940 Transfer Coursework (1-4 Credit Hours)
Transfer Coursework.

CENG 4130 Surf. & Colloid Phenomen (3 Credit Hours)
A study of surface and colloid chemistry. Topics include characterization of particles and surfaces, stability of colloidal systems, interactions of charged particles, and electrokinetic phenomena.

Prerequisite(s): CHEM 1080 and PHYS 1320.

CENG 4150 Reactor Design (3 Credit Hours)
The design and analysis of chemical, biological, and polymerization reactor systems are achieved by application of the principles of chemical kinetics and equilibrium coupled with mass and energy transport. Specific areas of study include kinetics, ideal reactors, multiple reactor systems, nonideal flow and mixing, and catalysis.

Prerequisite(s): (MATH 2240, 2240, 2240 or 2240) and CENG 2120.

CENG 4160 Heterogeneous Catalysis (3 Credit Hours)
A study of the fundamental concepts underlying catalytic processes in the petroleum processing industry and in synthetic fuels research. Topics include molecular theories of adsorption and catalysis, catalyst design and formulation, instrumental methods of catalyst characterization, transport in catalysts, shape-selective catalysis, etc. Applications discussed include catalytic cracking, reforming, hydrodesulfurization, Fischer-Tropsch synthesis, direct and indirect coal liquefaction, etc.

CENG 4310 Chemical Process Design (3 Credit Hours)
The elements of industrial design and supporting economics are presented in the context of a representative design project. Extension of the student's early background in unit operations through practical design considerations including materials of construction is accomplished. Methods are presented for capital and operating cost estimation, raw materials and utilities pricing, and assembly of investment costs, taxes, environmental and other site requirements. Realistic design constraints are included; e.g., economic factors, safety, reliability aesthetics, ethics, and social impact.

Prerequisite(s): CENG 4150.

CENG 4400 Intro. To Gene Therapy (3 Credit Hours)
A survey into the fundamental aspects of gene delivery and their application to gene therapy. Topics include various gene carriers, carrier/DNA interaction and complex formation, complex interactions with cells and cell structures, targeting, gene therapy applications, host response. A knowledge of cell and molecular biology is not required.

CENG 4420 Survey Contemporary Poly Rsh (3 Credit Hours)

CENG 4450 Applied Biochemistry I (3 Credit Hours)
Biochemistry is the study of the chemistry and chemical processes involved with the molecules that are utilized by living organisms. This two-semester series will provide an in-depth coverage of carbon- and nitrogen-containing molecules such as proteins and DNA and certain cofactors. In the first semester enzyme kinetics and catalysis will be covered, along with carbohydrates and their metabolism. The metabolic pathways and associated bioenergetics of glycolysis and the TCA cycle will be examined in detail. The material will be related to everyday life, diet, nutrition, and exercise performance.

Prerequisite(s): CHEM 2420.

CENG 4460 Applied Biochemistry II (3 Credit Hours)
This course is a continuation of CENG 4450 (please refer to the related course description). Principles taught in CENG 4450 will be extended as they are applied to lipids and nitrogen-containing molecules, and the metabolism of each. Example molecules include fats, triglycerides, DNA, amino acids, heme, and urea. The interplay of biochemistry and molecular biology will also be examined.

Prerequisite(s): CENG 4450.

CENG 4500 Chemical Process Control (3 Credit Hours)
An introduction to linear control theory is presented in which processes are described mathematically through transfer functions and conventional three-mode controllers are specified. Other topics are introduced including inverse response, cascade control, feedforward control, dead-time compensation, and multivariable control. Automatic control systems are designed for a number of actual non-linear processes described by computer software.

Prerequisite(s): (MATH 2240, 2240, 2240 or 240) and CENG 4310 and 4150.

CENG 4710 Biochemical Engineering (3 Credit Hours)
An advanced course in biochemical engineering. Topics include enzyme catalyzed and cell-associated reactions, engineering aspects of recombinant DNA technology, cell culture, bioreactors and tissue engineering.

CENG 4750 Practice School (6 Credit Hours)
Students are placed in groups of three or four and are assigned to a project at a local industrial facility, hospital, or government agency. The project is one of current concern to the organization and may range from a study of an operating process to the development of a new process. The projects are open ended and the students are expected to apply the principles of good design practice involving realistic constraints such as economics, safety, reliability, aesthetics, ethics, and social impact. Students normally are assigned to a project which fulfils certain career goals. This internship, under the direction of a faculty member, utilizes engineers and other personnel at the host site. Students are required to submit interim and final written and oral reports.

Prerequisite(s): CENG 3240, 3340 and 4150*.
* May be taken concurrently.

CENG 4770 Advances In Biotechnolog (3 Credit Hours)
The objectives of the course are to enhance understanding of the basic principles of biotechnology and to introduce the most current biotechnology research. Topics include gene therapy, microbial pesticides, genetically engineered food, stem-cell technology and tissue engineering.

CENG 4780 Special Topics (3 Credit Hours)

CENG 4781 Special Topics (3 Credit Hours)

CENG 4810 Independent Study (2-4 Credit Hours)
Under special circumstances, course credit is granted to students undertaking independent research studies. A project adviser should be identified and permission for enrollment filed with the department chair prior to registration.

CENG 4820 Independent Study (2-4 Credit Hours)
Under special circumstances, course credit is granted to students undertaking independent research studies. A project adviser should be identified and permission for enrollment filed with the department chair prior to registration.

CENG 4870 Biomolecular & Cellular Engr (3 Credit Hours)
Introduction to genetic and environmental manipulation of cells for production of proteins and other bioproducts. Topics include biomolecular interactions (protein energetics, binding equilibria, association kinetics), protein aggregation, cloning and gene expression in different host systems, posttranslational processing, and protein engineering. Will include case studies ¿ class discussions of primary literature

Prerequisite(s): CENG 2500, 2500, 2500, 2500, 4450 or GBCH 6010.

CENG 4890 Polymer Engr & Science (3 Credit Hours)
Fundamentals of polymer science and engineering, including synthesis, characterization, properties and processing of polymeric materials. An overview of polymer structure, including classification, tacticity, conformation and configuration will be given. Synthetic techniques will be reviewed, including addition and condensation polymerization and copolymerization. Polymer thermodynamics will be described, including an introduction to Flory-Huggins theory, as well as polymer-polymer miscibility and blends. A brief overview of characterization will be given, including molecular weight and glass transition temperature determination. Properties will be discussed, including mechanical properties of semi-crystalline polymers and elastomers. The time-temperature superposition principle will be described, as well as a brief introduction to processing techniques.

CENG 4891 Service Learning: CENG 4750 (0-1 Credit Hours)

CENG 4910 Independent Study (1-3 Credit Hours)
Under special circumstances, course credit is granted to students undertaking independent research studies. A project adviser should be identified and permission for enrollment filed with the department chair prior to registration.

CENG 4920 Independent Study (1-4 Credit Hours)
Under special circumstances, course credit is granted to students undertaking independent research studies. A project adviser should be identified and permission for enrollment filed with the department chair prior to registration.

CENG 4930 Independent Studies (1-3 Credit Hours)

CENG 4940 Transfer Coursework (3 Credit Hours)

CENG 4990 Honors Thesis (3 Credit Hours)
Honors thesis research, first semester. Register in department.

CENG 5000 Honors Thesis (4 Credit Hours)
Honors thesis research, second semester. Register in department.

CENG 5380 Study Abroad (1-20 Credit Hours)
Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA.

CENG 5390 Study Abroad (1-20 Credit Hours)
Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA.

CENG 6000 Chemical Eng. Seminar (0 Credit Hours)
Students are exposed to the important research findings, presented by invited speakers as well as by professors and advanced PhD candidates of our own department.

CENG 6010 Math Meth For Engineers (3 Credit Hours)
Review of calculus and ordinary differential equations, series solutions and special functions, complex variables, partial differential equations, and integral transforms.

CENG 6130 Surf. & Colloid Phenomen (3 Credit Hours)
A study of surface and colloid chemistry. Topics include characterization of particles and surfaces, stability of colloidal systems, interactions of charged particles, and electrokinetic phenomena.

CENG 6150 Reactor Design (3 Credit Hours)
The design and analysis of chemical, biological, and polymerization reactor systems are achieved by application of the principles of chemical kinetics and equilibrium coupled with mass and energy transport. Specific areas of study include kinetics, ideal

CENG 6160 Heterogeneous Catalysis (3,4 Credit Hours)
A study of the fundamental concepts underlying catalytic processes in the petroleum processing industry and in synthetic fuels research. Topics include molecular theories of adsorption and catalysis, catalyst design and formulation, instrumental methods of catalyst characterization, transport in catalysts, shape-selective catalysis, etc. Applications discussed include catalytic cracking, reforming, hydrodesulfurization, Fischer-Tropsch synthesis, direct and indirect coal liquefaction, etc.

CENG 6210 Molec Biophysics & Polymer Phy (3 Credit Hours)
An introduction to the physics of polymers and the physical bases underlying the biofunctionality of macromolecules in living systems. Themes of molecular self-organization, conformation, complementarity, and information content are emphasized and related

CENG 6390 Transport Phenomena II (3 Credit Hours)
The analysis of problems in conductive, convective, and radiative heat transfer. The formulation and solution of heat and mass transfer problems by means of shell balances. Exact and numerical solutions to heat and mass transfer problems. Correlations for

CENG 6400 Intro. To Gene Therapy (3 Credit Hours)
A survey into the fundamental aspects of gene delivery and their application to gene therapy. Topics include various gene carriers, carrier/DNA interaction and complex formation, complex interactions with cells and cell structures, targeting, gene therapy applications, host response. A knowledge of cell and molecular biology is not required.

CENG 6420 Survey Contemp Polymers Rsh (3 Credit Hours)
Fundamentals of condensed matter are elaborated upon, namely bonding, structure, physical properties, phase equilibria and thermodynamics of solids. Characterization of condensed phases as it reviewed. Manipulation of material properties for specific applications is discussed.

CENG 6450 Applied Biochemistry I (3 Credit Hours)
Biochemistry is the study of the chemistry and chemical processes involved with the molecules that are utilized by living organisms. This two-semester series will provide an in-depth coverage of carbon- and nitrogen-containing molecules such as proteins and DNA and certain cofactors. In the first semester enzyme kinetics and catalysis will be covered, along with carbohydrates and their metabolism. The metabolic pathways and associated bioenergetics of glycolysis and the TCA cycle will be examined in detail. The material will be related to everyday life, diet, nutrition, and exercise performance.

CENG 6460 Applied Biochemistry II (3 Credit Hours)
This course is a continuation of CENG 6450 (please refer to the related course description). Principles taught in CENG 6450 will be extended as they are applied to lipids and nitrogen-containing molecules, and the metabolism of each. Example molecules include fats, triglycerides, DNA, amino acids, heme, and urea. The interplay of biochemistry and molecular biology will also be examined.

CENG 6710 Biochemical Engineering (3 Credit Hours)
An advanced course in biochemical engineering. Topics include enzyme catalyzed and cell-associated reactions, engineering aspects of recombinant DNA technology, cell culture, bioreactors and tissue engineering.

CENG 6770 Advances In Biotechnolog (3 Credit Hours)
The objectives of the course are to enhance understanding of the basic principles of biotechnology and to introduce the most current biotechnology research. Topics include gene therapy, microbial pesticides, genetically engineered food, stem-cell technology and tissue engineering.

CENG 6780 Special Topics (3 Credit Hours)

CENG 6781 Special Topics (3 Credit Hours)

CENG 6800 Special Topics (1-3 Credit Hours)

CENG 6860 Readings and Research (2-4 Credit Hours)

CENG 6870 Biomolecular & Cellular Engr (3 Credit Hours)
Introduction to genetic and environmental manipulation of cells for production of proteins and other bioproducts. Topics include biomolecular interactions (protein energetics, binding equilibria, association kinetics), protein aggregation, cloning and gene expression in different host systems, posttranslational processing, and protein engineering. Will include case studies ¿ class discussions of primary literature

Prerequisite(s): CENG 2500.

CENG 6890 Polymer Engr & Science (3 Credit Hours)
Fundamentals of polymer science and engineering, including synthesis, characterization, properties and processing of polymeric materials. An overview of polymer structure, including classification, tacticity, conformation and configuration will be given. Synthetic techniques will be reviewed, including addition and condensation polymerization and copolymerization. Polymer thermodynamics will be described, including an introduction to Flory-Huggins theory, as well as polymer-polymer miscibility and blends. A brief overview of characterization will be given, including molecular weight and glass transition temperature determination. Properties will be discussed, including mechanical properties of semi-crystalline polymers and elastomers. The time-temperature superposition principle will be described, as well as a brief introduction to processing techniques.

CENG 6940 Transfer Coursework (1-3 Credit Hours)

CENG 7010 Graduate Mentoring Seminar I (1 Credit Hour)
The graduate mentoring seminar will provide students an opportunity to improve their communication skills, develop a basic appreciation of the science of learning, and engage with faculty on a variety of professional development topics. Class Hours: (Lecture 1)

CENG 7020 Graduate Mentoring Seminar II (1 Credit Hour)
The graduate mentoring seminar will provide students an opportunity to improve their presentation skills, provide basics in lab safety, and engage with faculty on a variety of professional development topics. Class Hours: (Lecture 1)

CENG 7110 Modern Thermodynamics (3 Credit Hours)

CENG 7120 Thermo of Macromolecules (3 Credit Hours)
Thermodynamics is applied to macromolecules. Fundamentals of the thermodynamics of polymers in solution and in the melt. Topics of polymer self-assembly, polymer-surfactant interactions, and polymer nanocomposites are incorporated in the course. Students will learn methods of characterization of polymer thermodynamics using spectroscopy, microscopy and scattering techniques.

CENG 7150 Advanced Reactor Design (3 Credit Hours)
Coupled reaction and transport phenomena as they are involved in major reactor configurations are studied with attention to data resources and computational capabilities.

CENG 7320 Advanced Transport Phenomena (3 Credit Hours)

CENG 7520 Applied Statistical Mech (3 Credit Hours)
The course covers the fundamental principles and methods of statistical mechanics. Emphasis is placed on applications to thermodynamics, phase behavior, polymer science and self-assembly phenomena.

CENG 7780 Special Topics (3 Credit Hours)

CENG 7810 Adv Independent Research (1-9 Credit Hours)
Research studies performed under faculty tutelage by prior arrangement.

CENG 7820 Adv Independent Research (1-9 Credit Hours)
Research studies performed under faculty tutelage by prior arrangement.

CENG 7870 Special Topics (3 Credit Hours)

CENG 7910 Research Orientation (1 Credit Hour)

CENG 7920 Research Methods (1 Credit Hour)

CENG 7940 MA Research Orient & Methods (3 Credit Hours)

CENG 8910 Doctoral Research Seminar (3 Credit Hours)

CENG 8920 Doctoral Research Seminar (3 Credit Hours)

CENG 9980 Master's Research (3 Credit Hours)
Research toward completion of a masters degree.

CENG 9990 Dissertation Research (3 Credit Hours)
Research toward completion of a doctoral degree.