TECHNICAL ELECTIVES

(for Chemical Engineering Majors)

A minimum of 9 credits and a maximum of 12 taken from the following list.
A minimum of 6 credits must be above the introductory (*) level.

The purpose of the technical electives is to advance the scientific or engineering background of the chemical engineers. The technical electives program consists of a minimum of twelve credits taken from the College of Engineering and the College of Arts and Sciences (see below). Students should select their technical electives in the spring of sophomore year to avoid scheduling conflicts. Students should formulate an academic plan for their technical and Chemical Engineering electives with the assistance of their academic advisor.

There are courses on this list require one or more prerequisites, and may only be available and practical to students who are pursuing a double-major or a minor in the subject area. **Students are responsible for ensuring that they meet all applicable prerequisites for any course selected from this list.**

NOTE: If you would like a new course to be considered for approval as a technical elective, please contact Professor Buttrey (dbuttrey@udel.edu) or Ms. Catherine Stoner (cstoner@udel.edu) by email indicating:

- Course#
- Course description
- Reason why you believe that the class should be a Technical Elective.

(Please also let us know if this class will count towards a minor.)

ANIMAL AND FOOD SCIENCES

ANFS 305	Food Science	3*
ANFS 428	Food Chemistry	4
ANFS 429/629	Food Analysis	4
ANFS 439	Food Microbiology	4
ANFS 443	Food Engineering Technology	4
ANFS 449	Food Biotechnology	4
ANFS 644	Bioinformatics	3

BIOLOGY

BISC 207	Introductory Biology 1	4*
BISC 208	Introductory Biology 11	4*
BISC 276	Human Physiology	4*
BISC 300	Introduction to Microbiology	4
BISC 305	Cell Physiology	3
BISC 306	General Physiology	3
BISC 315	Experimental Cell Biology (Lab)	3
BISC 316	Experimental Physiology (Lab)	3
BISC 401	Molecular Biology of the Cell	3
BISC 403	Genetic and Evolutionary Biology	3
BISC 411	Experimental Molecular Biology (Lab)	3
BISC 413	Advanced Genetics Laboratory	3
BISC 471	Introductory Immunology	3
BISC 492	Human and Mammalian Cytogenetics	3
BISC 600	Biotechnology and Molecular Medicine	3
BISC 601	Immunochemistry	4
BISC 602	Molecular Biology of Animal Cells	3
BISC 604	Nucleic Acids Laboratory	4
BISC 605	Advanced Mammalian Physiology	4
BISC 612	Advanced Cell Biology	3
BISC 619	Gene Expression Laboratory	4
BISC 625	Cancer Biology	3
BISC 626	Advanced Neuroanatomy	3
BISC 627	Advanced Neurophysiology	3
BISC 654	Biochemical Genetics	3
BISC 656	Evolutionary Genetics	3
BISC 665	Advanced Molecular Biology & Genetics	3
BISC 671	Cellular and Molecular Immunology	4
BISC675	Cardiovascular Physiology	3
BISC 679	Virology	3
BISC 693	Human Genetics	3

CHEMISTRY

CHEM 334	Organic Chemistry Majors Lab II	2
CHEM 424	Quantum Mechanics I	3
CHEM 437	Instrumentation Methods	3
CHEM 438	Instrumental Methods Laboratory	1
CHEM 457	Inorganic Chemistry	3
CHEM 458	Inorganic Chemistry Laboratory	1
CHEM 527	Introductory Biochemistry (if CHEM 332 is taken as core course)	3
CHEM 603	Practical NMR Spectroscopy	1
CHEM 604	Practical Mass Spectrometry	1
CHEM 605	Spectroscopy of Organic Compounds	1
CHEM 608	Environmental Soil Chemistry	3
CHEM 620	Analytical Spectroscopy	3
CHEM 621	Chemical Separations	3
CHEM 622	Electroanalytical Chemistry	3
CHEM 623	Chemometrics	3
CHEM 624	Principles of Mass Spectrometry	3
CHEM 626	Instrumental Methods in Mass Spectrometry	1
CHEM 628	Chemical Sensors 3 Hrs CHEM629 Surface Chemistry and Analysis	3
CHEM 633	Advanced Organic Chemistry: Physical	3
CHEM 634	Advanced Organic Chemistry: Synthesis and Reactivity	3
CHEM 635	Organic Reactivity and Total Synthesis	3
CHEM 641	Biochemistry	3
CHEM 642	Biochemistry	3
CHEM 643	Intermediary Metabolism	3
CHEM 644	Mechanisms of Enzyme Catalysis	3
CHEM 645	Protein Structure and Function	3
CHEM 646	DNA-Protein Interactions	3
CHEM 651	Advanced Inorganic Chemistry I	3
CHEM 652	Organometallic Chemistry	3
CHEM 653	Bioinorganic Chemistry	3
CHEM 654	Advanced Inorganic Chemistry II	3
CHEM 671	Quantum Chemistry	3
CHEM 672	Advanced Quantum Chemistry	3
CHEM 674	Chemical Dynamics	3
CHEM 677	Chemical Thermodynamics	3
CHEM 680	Introductory Polymer Science	3
CHEM 681	Green Chemistry	3
CHEM 683	Environmental Chemistry	3
CHEM 684	Biochemistry of Nucleic Acids	3
CHEM 685	Colloid Chemistry	3
CHEM 686	Biophysical Chemistry	3

CIVIL & ENVIRONMENTAL ENGINEERING

CIEG 211	Statics	3*
CIEG 212	Solid Mechanics	3*
CIEG 213	Civil Engineering Materials Laboratory	1*
CIEG 233	Environmental Engineering Processes	3*
CIEG 301	Structural Analysis	4
CIEG 302	Structural Design	4
CIEG 311	Dynamics	3
CIEG 320	Soil Mechanics	3
CIEG 321	Geotechnical Engineering	3
CIEG 323	Soil Mechanics Laboratory	1
CIEG 331	Environmental Engineering	3
CIEG 337	Environmental Engineering Laboratory	3
CIEG 351	Transportation Engineering	3
CIEG 401	Introduction to the Finite Element Method	3
CIEG 430	Water Quality Modeling	3
CIEG 433	Hazardous Waste Management	3
CIEG 434	Air Pollution Control	3
CIEG 436	Solid Waste Management	3
CIEG 437	Water and Wastewater Quality	3
CIEG 438	Water and Wastewater Engineering	3
CIEG 440	Water Resources Engineering	3
CIEG 465	Engineers Without Borders	3
CIEG 468	Principles of Water Quality Criteria	3
CIEG 471	Introduction to Coastal Engineering	3
CIEG 498	Groundwater Flow and Contaminant Transport	3
CIEG 601	Introduction to the Finite Element Method	3
CIEG 605	Intermediate Topics in Finite Element Analysis	3
CIEG 612	Advanced Mechanics of Materials	3
CIEG 630	Water Quality Modeling	3
CIEG 632	Chemical Aspects of Environmental Engineering	3
CIEG 633	Hazardous Waste Management	3
CIEG 634	Contaminant Transport and Separation in Environmental Systems	3
CIEG 635	Air Pollution and Its Control	3
CIEG 636	Biological Aspects of Environmental Engineering	3
CIEG 637	Water and Wastewater Quality	3
CIEG 639	Ocean Fluid Dynamics	4
CIEG 641	Risk Analysis	3
CIEG 668	Principles of Water Quality Criteria	3
CIEG 670	Physics of Cohesive Sediment	3
CIEG 675	Matlab for Engineering Analysis	3
CIEG 678	Transport and Mixing Processes	3

CIEG 698	Groundwater Flow and Contaminant Transport	3

COMPUTER ENGINEERING

CPEG 202	Introduction to Digital Systems	3*
CPEG 222	Microprocessor Systems	4*
CPEG 323	Introduction to Computer Systems Engineering	3
CPEG 324	Computer Systems Design I	3
CPEG 410	Signals and Communications Design	4
CPEG 419	Computer Networks I	3
CPEG 421	Compiler Design	3
CPEG 6xx	With approval of advisor	3

COMPUTER SCIENCE

CISC 181	Introduction to Computer Science II	3*
CISC 220	Data Structures	3
CISC 260	Machine Organization and Assembly Language	3
CISC 275	Introduction to Software Engineering	3
CISC 280	Programming Paradigms	3
CISC 303	Automata Theory	3
CISC 304	Logic and Programming	3
CISC 320	Introduction to Algorithms	3
CISC 372	Parallel Programming	3
CISC 374	Educational Game Development	3
CISC 401	Elements of the Theory of Computation	3
CISC 404	Logic in Computer Science	3
CISC 410	Introduction to Numerical Analysis & Algorithmic Computation	3
CISC 411	Algorithmic and Numerical Solution of Differential Equations	3
CISC 436	Bioinformatics	3
CISC 437	Database Systems	3
CISC 440	Computer Graphics	3
CISC 442	Introduction to Computer Vision	3
CISC 470	Programming Languages	3
CISC 475	Advanced Software Engineering	3
CISC 481	Artificial Intelligence	3
CISC 483	Introduction to Data Mining	3
CISC 485	Mechatronics	3
CISC 601	Elements of the Theory of Computation	3
CISC 621	Algorithm Design and Analysis	3
CISC 636	Bioinformatics	3
CISC 670	Programming Languages	3

CISC 681	Artificial Intelligence	3
CISC 683	Introduction to Data Mining	3

ELECTRICAL ENGINEERING

ELEG 205	Analog Circuits	4*
ELEG 240	Physical Electronics	4*
ELEG 302	Introduction to Devices and Materials	3
ELEG 305	Signals and Systems	3
ELEG 306	Digital Signal Processing	3
ELEG 309	Electronic Circuit Analysis I	4
ELEG 310	Random Signals and Noise	3
ELEG 312	Electronic Circuit Analysis II	4
ELEG 320	Field Theory I	4
ELEG 340	Solid State Electronics	3
ELEG 341	Solid State Electronics II	3
ELEG 370	Engineering Electromagnetics	4
ELEG 403	Communication Systems Engineering	3
ELEG 410	Signals and Communications Design	4
ELEG 413	Field Theory II	3
ELEG 415	Electric Power and Renewable Energy Systems	3
ELEG 418	Digital Control Systems	3
ELEG 419	Multimedia Communications	3
ELEG 421	Solid State Nanotechnology	3
ELEG 422	Semiconductor Materials Processing	3
ELEG 423	Electrical Properties of Matter	3
ELEG 424	Quantum Mechanics I	3
ELEG 426	Photonic Crystal Devices	3
ELEG 427	Terahertz and Millimeter-Wave Light Generation and Detection	3
ELEG 429	Low Power Electronics and Lighting	3
ELEG 437	Energy Systems	3
ELEG 438	Theory and Design of Diffractive Optics	4
ELEG 439	Magnetism and Spintronics	3
ELEG 440	Opto-electronics	3
ELEG 441	Antenna Theory and Design	3
ELEG 444	Micro-Electro-Mechanical Systems	3
ELEG 445	Optical Communication Systems	3
ELEG 446	Nanoelectronic Device Principles	3
ELEG 447	Optical Properties of Solids	3
ELEG 449	Nanomaterials and Applications	3
ELEG 450	Semiconductor Device Design and Fabrication	3
ELEG 454	Sensor and Data Wireless Networks	3

ELEG 455	High-Performance Computing with Commodity Hardware	3
ELEG 456	Electric Power Distribution Design	4
ELEG 457	Search Engine Technology	3
ELEG 458	Advanced Mobile Services	3
ELEG 460	High Technology Entrepreneurship	3
ELEG 471	Mathematical Physiology	3
ELEG 475	Image Processing with Biomedical Applications	3
ELEG 477	Biosignal Processing	3
ELEG 478	Introduction to Nano and Biophotonics	3
ELEG 479	Introduction to Medical Imaging Systems	3
ELEG 482	Optics and Photonics	3
ELEG 493	Electric Motros and Generators	3
ELEG 6xx	With approval of advisor	3

MARINE STUDIES

MAST 616	Methods in Molecular Biology	3
MAST 617	Methods in Molecular Biology Laboratory	3

MATERIALS SCIENCE/ENGINEERING

MSEG 406	Corrosion and Protection	3
MSEG 410	Experimental Mechanics for Composite Materials	3
MSEG 425	Entrepreneurship and Risk: Meeting the Challenges	3
MSEG 441/641	Nanomaterials and Thin-Film Processes	3
MSEG 442/642	Semiconductors for Micro- and Nano-Technology	3
MSEG 460/660	Biomaterials and Tissue Engineering	3
MSEG 470/670	Solar Energy (previously MSEG 467/667)	3
MSEG 601	Structure & Properties of Polymer Materials	3
MSEG 602	Structure of Materials	3
MSEG 607	Physical Properties of Materials	3
MSEG 608	Structure and Properties of Materials I	4
MSEG 609	Structure and Properties of Materials II	4
MSEG 615	Mechanical Properties of Materials	3
MSEG 616	Chemistry and Physics of Surfaces and Interfaces	3
MSEG 624	Practical Electron Microscopy	3

MATHEMATICS

MATH 349	Elementary Linear Algebra	3
MATH 350	Probability Theory and Simulation Methods	3
MATH 366	Independent Study	3
MATH 426	Introduction to Numerical Analysis and Algorithmic Computation	3

MATH 428	Algorithmic and Numerical Solution of Differential Equations	3
MATH 460	Introduction to Systems Biology	3
MATH 503	Advanced Calculus for Applications	3
MATH 508	Introduction to Complex Variables and Applications	3
MATH 512	Contemporary Applications of Mathematics	3
MATH 529	Fundamentals of Optimization	3
MATH 535	Introduction to Partial Differential Equations	3
MATH 616	Introduction to Applied Mathematics	3
MATH 630	Probability Theory and Applications	3
MATH 672	Vector Spaces (prereq. MATH 349)	3

MECHANICAL ENGINEERING

MEEG 112	Statics	3
MEEG 211	Dynamics	3
MEEG 321	Materials Engineering	3
MEEG 413	Nanomaterials and Nanotechnology	3
MEEG 425	Automotive Powertrain Theory	3
MEEG 435	Wind Power Engineering	3
MEEG 442	Introduction to Fuel Cells	3
MEEG 482	Clinical Biomechanics	3
MEEG 483	Orthopaedic Biomechanics	3
MEEG 484	Biomaterials and Tissue Engineering	3
MEEG 485	Control of Human Movement	3
MEEG 486	Cell and Tissue Transport	3
MEEG 610	Intermediate Solid Mechanics	3
MEEG 612	Biomechanics of Human Movement	3
MEEG 613	Nanomaterials and Nanotechnology	3
MEEG 614	Analysis of Aircraft Structures	3
MEEG 615	Mechanical Properties of Materials	3
MEEG 616	Composite Materials and Structures	3
MEEG 617	Composite Materials	3
MEEG 635	Wind Power Engineering	3
MEEG 642	Introduction to Fuel Cells	3
MEEG 658	Metals and Alloys	3

NUTRITION

NTDT 400	Macronutrients	3
NTDT 401	Micronutrients	3

PHYSICS

PHYS 211	Oscillations and Waves	3*
PHYS 313	Physical Optics	4
PHYS 419	Classical Mechanics I	3
PHYS 424	Quantum Mechanics I	3
PHYS 425	Quantum Mechanics II	3
PHYS 603	Electricity and Magnetism I	3
PHYS 604	Electricity and Magnetism II	3
PHYS 607	Methods of Mathematical Physics I	3
PHYS 608	Methods of Mathematical Physics II	3
PHYS 610	Quantum Mechanics	3
PHYS 616	Statistical Physics and Thermodynamics	3
PHYS 620	Classical Mechanics II	3
PHYS 624	Introduction to Condensed Matter Physics	3
PHYS 626	Introduction to Atomic, Molecular, and Optical Physics	3
PHYS 630	Galaxies	3
PHYS 632	Astrophysics	3
PHYS 633	Introduction to Stellar Astrophysics	3
PHYS 641	Nanomaterials and Thin Film Processes	3
PHYS 645	Electrons for Scientists	3
PHYS 646	Instrumentation for Scientists	3
PHYS 660	Computational Methods of Physics	3

STATISTICS

STAT 470	Introduction to STAT Analysis I	3
STAT 471	Introduction to STAT Analysis II	3
STAT 601	Probability Theory for Operations Research and Statistics	3
STAT 602	Mathematical Statistics	3
STAT 603	Vector Spaces and Optimization	3
STAT 608	Statistical Research Methods	3
STAT 609	Regression and Experimental Design	3
STAT 612	Advanced Regression Techniques	3
STAT 613	Applied Multivariate Statistics	3
STAT 615	Design and Analysis of Experiments	3
STAT 616	Advanced Design of Experiments	3
STAT 617	Multivariate Methods	3
STAT 618	Sampling Techniques	3
STAT 619	Time Series Analysis	3
STAT 620	Nonparametric Statistics	3
STAT 635	Statistical Quality Control	3

*Introductory level course