

FISK-VANDERBILT 3-2 DUAL DEGREE PROGRAM IN SCIENCE AND ENGINEERING

Appropriate Pre-engineering Preparation

Essential Preparation, all majors

Topic	Course offered at Fisk	Similar course offered at Vanderbilt	Comments
1. Mathematics through ordinary differential equations	MATH 120-CALCULUS I , 4 credits. Topics included are limits, derivatives, and integration of algebraic, trigonometric, exponential, and logarithmic functions, with applications. The course will use technology (graphing calculators and a computer algebra system) for exploration and problem solving. Prerequisites: MATH 110 or successful completion of at least a 2-year sequence in high school algebra and high school trigonometry, and an adequate score on the mathematics placement test.	MATH 155a, First-Year Accelerated Calculus I [4]	
	MATH 130-CALCULUS II , 4 credits. The second of a 3-semester sequence. Topics included are techniques of integrations, improper integrals, conic sections, polar coordinates, parametric equations, solid analytic geometry and vectors in space, and applications. Technology use will continue to be an integral part of the course. Prerequisite: MATH 120.	MATH 155b, First-Year Accelerated Calculus II [4]	
	MATH 210-CALCULUS III , 4 credits. The third of a 3-semester sequence. Topics included are infinite series, vector valued-functions, partial differentiation, multiple integration, and topics in vector calculus (line integrals, surface integrals, Green's Theorem, Divergence Theorem, and Stokes' Theorem. A computer algebra system will be used for problem solving and to gain new insight and understanding. This three-course sequence is very important for advanced studies in mathematics and many other disciplines.. Prerequisite: MATH	MATH 175 – Second-Year Accelerated Calculus [3]	<i>Is this necessary?</i> Yes
	MATH 270-ORDINARY DIFFERENTIAL EQUATIONS , 4 credits. Linear differential equations, Integral transforms, integrating in series and system of linear differential equations with applications. Prerequisite: MATH 130	MATH 198 – Methods of Ordinary Differential Equations [3]	
2. Two semesters of chemistry with laboratory	CHEM 113-GENERAL CHEMISTRY I , 3 credits. Fundamental principles of chemistry, including atomic theory, molecular concepts, gas laws, and elementary thermo-chemistry. Requires a good background in mathematics. Students should enroll concurrently in CHEM 103 laboratory.	CHEM 102a – Introductory Chemistry (0 credit recitation section CHEM 106a required) [3]	
	CHEM 103-EXPERIMENTS IN GENERAL CHEMISTRY I , 1 credit. Review of chemical concepts, mathematical operations, and laboratory exercises to accompany General Chemistry. Students should enroll concurrently in CHEM 113.	CHEM 104a – General Chemistry Laboratory [1]	
	CHEM 114-GENERAL CHEMISTRY II , 3 credits. The chemistry of some elementary inorganic and organic substances; principles of kinetics and electrochemistry. Prerequisite: CHEM 113, 103. Students should enroll in CHEM 104 lab concurrently with CHEM 114.	CHEM 102b – Introductory Chemistry (0 credit recitation section CHEM 106b required) [3]	
	CHEM 104-EXPERIMENTS IN GENERAL CHEMISTRY II , 1 credit. Laboratory experiments to accompany CHEM 114, in which students should enroll concurrently. Prerequisite: CHEM 113 and 103.	CHEM 105b – General Chemistry Laboratory [1]	

3. Two semesters of calculus-based physics with laboratory	PHYS 130- UNIVERSITY PHYSICS I , 3 credits. Three lectures and one problem session weekly. An introductory treatment of mechanics, vibration, wave motion, sound, heat, and thermodynamics. Differentiation and integration are developed and used at appropriate points during the semester. Prerequisite: MATH 110 or departmental permission; students should enroll concurrently in PHYS 130L laboratory.	PHYS 116a or 117a, General Physics (equivalent courses; one taught in spring, one in fall). Laboratory included [4]	
	PHYS 130-L EXPERIMENTS IN GENERAL PHYSICS I , 1 credit. One laboratory weekly. Experiments cover topics in mechanics, sound, and heat, with emphasis on the use of good laboratory and research techniques to obtain and handle experimental data. Use of significant figures and evaluation of results are stressed. Accompanies PHYS 121 or PHYS 130, in which students must be concurrently enrolled or must have passed.	Part of PHYS 119a or 117a	
	PHYS 140- UNIVERSITY PHYSICS II , 3 credits. Three lectures and one problem session weekly. Continuation of PHYS 130, emphasizing electricity and magnetism, geometrical and physical optics, and topics in atomic and nuclear physics. Prerequisite: PHYS 130; students should also enroll concurrently in PHYS 140L laboratory.	PHYS 116b or 117b, General Physics (equivalent courses; one taught in spring, one in fall). Laboratory included [4]	
	PHYS 140-L-EXPERIMENTS IN GENERAL PHYSICS II , 1 credit. One laboratory weekly. A continuation of PHYS 130L, with experiments on topics in electricity and magnetism, optics, and modern physics. Accompanies PHYS 122 or PHYS 140, which students must have passed or must be concurrently enrolled. Prerequisite: PHYS 130L or equivalent	Part of PHYS 119b or 117b	
4. Computer programming, preferably in C++	CSCI 110- INTRODUCTION TO COMPUTER SCIENCE I , 4 credits. Three hours lecture and 2 hours lab. This course provides an introduction to the discipline of computing, emphasizing problem solving techniques, algorithm development, and software design concepts and their realization as computer programs. Topics will include control structures, iteration, recursion, data types, and procedural abstraction and their implementation	CS 101 – Programming and Problem Solving [3]. This is a course in C++ programming Or CS 101 – Introductory Programming for Engineers and Scientists [3]. More generic programming concepts taught using MatLab.	
	CSCI 110-L- INTRODUCTION TO COMPUTER SCIENCE I LABORATORY , Not for credit. Closely coordinated experiences in a closed, supervised laboratory to accompany CSCI 110, in which the student should enroll concurrently.		

Desirable Preparation (listed in order of preference within each anticipated major)

Biomedical Engineering:			
Topic	Course offered at Fisk	Similar course offered at Vanderbilt	Comments
1. Biology with laboratory (2 sem.)	<p>BIOL 101- GENERAL BIOLOGY I, 3 credits--lecture. This is the beginning introductory course for biology majors. Topics discussed include the chemistry of life, structure and function of the cell, biochemical pathways, cellular reproduction, and Mendelian genetics. Students are introduced to animal form and function, nutrition, circulation, respiration, reproduction and development, neural transmission and chemical signals, and ecology.</p>	<p>Closest equivalent of BIOL 101/102 with lab is BSCI 110a[3]/111a[1] followed by BSCI 110b[3]/111b[1]. However, the content may not divide in the same way, and a person should take the entire sequence either at Vanderbilt or at Fisk.</p>	
	<p>BIOL 101-L -GENERAL BIOLOGY I LABORATORY, 1 credit. Experiments and other activities are conducted to develop proficiency in use of metric values, preparation of solutions, isolation and identification of organic molecules of living systems. Cell structure and function, including cellular reproduction and other metabolic processes, are studied. Basic aspects of anatomy and physiology of vertebrates are introduced.</p>	<p>See BIOL 101, above.</p>	
	<p>BIOL 102 -GENERAL BIOLOGY II, 3 credits--lecture. This course is a continuation of BIOL 101. Topics to be considered are the molecular basis of inheritance; protein synthesis; origin and evolution of life forms; structure, function and reproduction of prokaryotes and eukaryotes. Studies will also include anatomy and physiology, reproduction, development, nutrition, control systems and evolution of selected invertebrate and plant life forms. Prerequisite: Grade of C or better in BIOL 101 and 101L.</p>	<p>See BIOL 101, above.</p>	
	<p>BIOL 102-L - GENERAL BIOLOGY II LABORATORY, 1 credit. Laboratory exercises will focus on the anatomy and physiology of prokaryotes, protists and fungi; the development, physiology, microscopic and gross anatomy of plants; and the development, anatomy and physiology of invertebrates. Molecular biology techniques are introduced which may be used by students in the conduct of individual or small group research projects to address basic problems in the life sciences. Prerequisite: Grade of C or better in BIOL 101 and 101L.</p>	<p>See BIOL 101, above.</p>	
2. Electrical circuit theory	<i>none</i>	<p>EECE 112 – Electrical Engineering Science [3] . Corequisite: Second-semester physics, third-semester calculus.</p>	
3. Mechanics (statics and dynamics)	<p>PHYS 341 THEORETICAL MECHANICS, 4 credits. An introduction to the classical mechanics of particles and rigid bodies, covering topics such as kinematics and dynamics of systems of particles, rotation properties of</p>	<p>BME 101 – Biomechanics and Biomaterials [3]. Prerequisite: First-semester</p>	

	rigid bodies, and motion under a central force. Prerequisites: PHYS 130, 130L, 140, 140L; and MATH 120.	physics, second-semester calculus.	
4. Thermodynamics	PHYS 262 HEAT AND THERMODYNAMICS, 3 credits. Temperature, gas laws, specific heats, heat transfer, first and second laws and their consequences, thermodynamic relations, phase transitions, and low temperature phenomena. Prerequisites: PHYS 130, 130L, 140, 140L; and MATH 120	BME 102 – Biomedical Engineering Thermodynamics [3]	
5. Statistics	NSCI 360- STATISTICS, 4 credits. An introduction to probability and statistical inference in an interdisciplinary setting. Limit theorems. Sampling, hypothesis -testing, regression. Non-parametric methods. Enough theory is presented to introduce the intellectual foundations of statistical method, but the main emphasis is on applications in the natural sciences. Prerequisite: MATH 130 or equivalent.	BME 160, Analysis of Biomedical Data [3] Prerequisite, third-semester calculus	
Chemical Engineering:			
Topic	Course offered at Fisk	Similar course offered at Vanderbilt	Comments
Organic chemistry with laboratory (two semesters)	CHEM 233 -ORGANIC CHEMISTRY I, 3 credits. A systematic study of the compounds of carbon, with emphasis on basic principles, aliphatic and alicyclic compounds, and stereochemistry. Prerequisite: CHEM 114, 104. Students should enroll concurrently in CHEM 203 laboratory.	CHEM 220a – Organic Chemistry [3]	
	CHEM 203- EXPERIMENTAL ORGANIC CHEMISTRY I, 1 credit. Experiments in laboratory technique and preparations for organic chemistry. Students should enroll concurrently in CHEM 233.	CHEM 219a – Organic Chemistry Laboratory [1]	
	CHEM 234 - ORGANIC CHEMISTRY II, 3 credits. Continuation of CHEM 233 with emphasis on aromatic compounds and natural products. Prerequisite: CHEM 233. Students should enroll concurrently in CHEM 204 or 206.	CHEM 220b – Organic Chemistry [3]	
	CHEM 204 -EXPERIMENTAL ORGANIC CHEMISTRY II, 1 credit. Laboratory work includes experiments in organic spectroscopy and multi-step syntheses. Designed for non-majors in chemistry. Prerequisite: CHEM 203. Students should enroll concurrently in CHEM 234.	CHEM 219b – Organic Chemistry Laboratory [1]	
Mechanics	PHYS 341 (see above)	No longer required for chemical engineers	
Electrical circuit theory	<i>none</i>	No longer required for chemical engineers	
Thermodynamics	PHYS 262 (see above)	ChE 162, Chemical Engineering Thermodynamics [3].	
Physical chemistry	CHEM 341 PHYSICAL CHEMISTRY (+LAB) I, 4 credits. Three hours of lecture and three hours of laboratory work each week. A formal introduction to equilibrium thermodynamics and its application to a number of problems that are of interest in chemistry. Examples include the (systematic) study of thermo -chemistry, phase changes, and "real" physicochemical systems. Prerequisites: CHEM 114, MATH 120.	<i>The Vanderbilt sequence in physical chemistry is in the midst of change (Summer 2003). Consult chair of chemical engineering at Vanderbilt for recommendations.</i>	

	CHEM 342- PHYSICAL CHEMISTRY (+LAB) II , 4 credits. Continuation of CHEM 341. Emphasizes solutions chemistry. The Gibbs chemical potential is the basis for most discussions. Some attention to time dependent properties such as diffusion, viscosity of gases and of macromolecule systems, and the kinetics of chemical reactions. Prerequisite: CHEM 341.		
Civil Engineering:			
Topic	Course offered at Fisk	Similar course offered at Vanderbilt	Comments
Mechanics (statics, dynamics, mechanics of materials)	PHYS 341 (see above)	CE 180 – Statics [3] . Corequisite, second semester calculus And ME 190 – Dynamics [3] . Prerequisite, CE 180 and first-semester physics. Corequisite, Ordinary Differential Equations	<i>May need to take VU course for mechanics of materials</i> Yes. MSE 232, Strength and Structure of Engineering Materials. [1] Can be taken at VU during fourth year.
Economics	ECON 230 - ECON 230, PRINCIPLES OF MICROECONOMICS , 3 credits. This is the first of a two-part Principles of Economics course. It is an introduction to the content and methods of economic theory, emphasizing the study of individual markets, the price system, production and cost theory, and market structures. Prerequisite: Completion of pre-calculus mathematics.	ECON 101 – Principles of Microeconomics [3]	
	ECON 240 -PRINCIPLES OF MACROECONOMICS , 3 credits. This is the second part of the principles course and deals with the economy as a whole. It introduces National Income accounting, national output determination, inflation, unemployment, business cycles, economic policy formulation, and some issues affecting the U.S. economy and its interrelation with other economies. Prerequisites: Pre-calculus mathematics.	ECON 100 – Principles of Macroeconomics [3]	
Computer Engineering:			
Topic	Course offered at Fisk	Similar course offered at Vanderbilt	Comments
Advanced computer courses (program design and data structure, computer organization),	CSCI 241- DATA STRUCTURES AND ALGORITHMS . 4 credits. This course continues the study of data structures and the design and analysis of algorithms. It will include an introduction to algorithm design techniques, including greedy algorithms and divide and conquer. Prerequisites: CSCI 120, Math 115.	CS 201 – Program Design and Data Structures [3]	
	CSCI 370 - SOFTWARE ENGINEERING , 4 credits. Introduction to the basic concepts and major issues of software engineering. A continued emphasis on problem solving concepts is integrated with a treatment of	CS 277 – Software Engineering [3]	

	the software life cycle, requirements, specification and verification and validation issues. The students working in teams will design, implement, and present a substantial software project. Prerequisite: CSCI 241 and consent of instructor.		
Electrical circuit theory	<i>none</i>		
Statistics	NSCI 360 (see above)	MATH 218 --- Introduction to Mathematical Statistics [3], plus lab MATH 218L [1]	
Computer Science:			
Topic	Course offered at Fisk	Similar course offered at Vanderbilt	Comments
Advanced computer courses (program design and data structure, computer organization),	CSCI 241 (see above) CSCI 370 (see above)	See above	
Statistics	NSCI 360 (see above)	MATH 218 --- Introduction to Mathematical Statistics [3], plus lab MATH 218L [1]	
Electrical Engineering:			
Topic	Course offered at Fisk	Similar course offered at Vanderbilt	Comments
Electrical circuit theory	<i>none</i>	EECE 112 – Electrical Engineering Science. [3] Corequisite: Second-semester physics, third-semester calculus.	
Advanced circuit theory	<i>none</i>	EECE 213 – Network Theory I. Prerequisite, EECE 112. Corequisite MATH 198, Ordinary Differential Equations	
Electromagnetics	PHYS 351- INTERMEDIATE ELECTRICITY AND MAGNETISM, 4 credits. The fundamental theorem in electrostatics; dielectric phenomena; magnetic fields and their association with currents; electromagnetic radiation; and introduction to Maxwell's equations. Prerequisites: PHYS 130, 130L, 140, 140L; and MATH 210	PHYS 229a-229b – Electricity, Magnetism, and Electrodynamics [3-3]. Or EECE 233 – Electromagnetics [3]	
Electronics	<i>none</i>	EECE 235 --- Electronic Circuits I [4]. Prerequisite, EECE 213.	

Mechanical Engineering:			
Topic	Course offered at Fisk	Similar course offered at Vanderbilt	Comments
Mechanics (statics, dynamics, mechanics of materials)	PHYS 341 (see above)	CE 180 – Statics [3]. Corequisite, second semester calculus And ME 190 – Dynamics [3]. Prerequisite, CE 180 and first-semester physics. Corequisite, Ordinary Differential	<i>May need to take VU course for mechanics of materials</i> Yes. MSE 232, Strength and Structure of Engineering Materials. [1] Can be taken at VU during fourth year.
Electrical circuit theory	<i>none</i>	EECE 112 – Electrical Engineering Science. [3] Corequisite: Second-semester physics, third-semester calculus.	
Thermodynamics	PHYS 262 (see above)	ME 220a-220b, Thermodynamics I and II [3-3]. Prerequisite, third-semester calculus. Corequisite for 220b, Ordinary Differential Equations.	

Date: June 28, 2003 Prepared by:	and by:
<p>Arnold Burger, PhD Associate Professor of Physics Center for Photonic Materials and Devices Department of Physics, 240 DuBois Hall Fisk University 1000 17th Ave. N. Nashville, TN 37208-3051</p> <p>Ph. (615)329-8516 FAX (615)329-8634 e-mail: aburger@fisk.edu Web: http://www.fisk.edu/~aburger</p>	<p>K. Arthur Overholser, Associate Dean Vanderbilt University School of Engineering Professor of Biomedical Engineering Professor of Chemical Engineering 5332 Stevenson Center Vanderbilt University, VU Station B 351826 Nashville, TN 37235-1826</p> <p>Ph. (615)343-3773 FAX: 615-343-8006 e-mail: k.a.overholser@vanderbilt.edu Web: http://frontweb.vuse.vanderbilt.edu/vuse_web/directory/facultybio.asp?FacultyID=43</p>