Courses that will satisfy the revised Applied Physics and Engineering Track for the Physics major

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The Applied Physics and Engineering Track for the B.S. degree for the Physics major requires the following:

1. Additional upper- and lower-division requirements (16 units).
    a) 16 units of approved Engineering electives including a minimum of 8 units at the upper-division level.

The courses listed below are all approved for the track. Courses not listed may be approved by a physics faculty academic advisor.

For some classes, important engineering prerequisites are listed so that you are aware of them when creating your course plans. Some courses allow "consent of instructor" in place of the course prerequisites. You are strongly encouraged to plan a complete 16+-unit sequence of courses for the track before you commit to the track. Make sure that it's possible to complete all of the courses before your planned graduation date. *Always check the current catalog as things may have changed since the last update of this list.*

Computer Science, lower division
Note that almost all upper-division courses will require you to take CS 010A, CS 010B, and CS 010C, which is a total of 12 units. You will still need to take at least 8 units of upper-division CS courses. If you take CS 009P instead of CS 010A, you may not be able to take any other CS courses, since you can't get credit for CS 010A after taking CS 009P.

CS 010A Introduction to computer science for science, mathematics, and eng. I (4, *Note that this is a general degree requirement for the physics major, so these 4 units do not count toward the 16 required units for the Applied Physics and Engineering Track*)
CS 010B Introduction to computer science for science, mathematics, and eng. II (4, *CS 010A*)
CS 010C Introduction to data structures and algorithms (4, *CS 010B*)
CS 030 Introduction to computational science and engineering (4, *no longer offered*)
CS 011 Introduction to Discrete Structures (4, *CS 010A*)
CS 013 Introductory computer science for engineering majors (4, *CS 010A*)
CS 061 Machine organization and assembly language programming (4, *CS 010A*)

Computer Science, upper division
CS 100 Software construction (4, *CS 010C*)

CS 105 Data Analysis Methods (4, *CS 010C*)
CS 111 Discrete structures (4, *CS 010A, CS 011*)
CS 120A Logic design (5, *CS 061*)
CS 120B Introduction to embedded systems (4, *CS 120A*)
CS 121L Laboratory in programming embedded systems (2)
CS 122A Intermediate Embedded and Real-Time Systems (5, *CS 010B or CS 013, CS 120B*)
CS 122B Advanced Embedded and Real-Time Systems (5, *CS 122A*)
CS 130 Computer graphics (4, *CS 100, MATH 031*)
CS 134 Video game creation and design (4, *no longer offered*)
CS 141 Intermediate data structures and algorithms (4, *CS 010C, CS 111*)
CS 145 Combinatorial optimization algorithms (4, *MATH 031 or MATH 131*)
CS 150 Automata and formal languages (4, *CS 010C, CS 111*)
CS 152 Compiler design (4, *CS 061, CS 100, CS 111, CS 150*)
CS 153 Design of operating systems (4, *CS 061, CS 100, CS 111*)
CS 160 Concurrent programming and parallel systems (4, *CS 061, CS 100, CS 111*)
CS 161 Design architecture of computer systems (4, *CS 120A*)
CS 161L Laboratory in Design and Architecture of Computer Systems (2, *CS 161 concurrent with CS 161*)
CS 162 Computer Architecture (4, *CS 161*)
CS 164 Computer Networks (4, *CS 100, CS 111, CS 153*)
CS 165 Computer Security (4, *CS 141, CS 153*)
CS 166 Database Management Systems (4, *CS 100, CS 111*)
CS 167 Introduction to Big-Data Management (4, *CS 100, CS 111, CS 167*)
CS 168 Introduction to Very Large Scale Integration (VLSI) Design (4, *CS 120A*)
CS 169 Mobile Wireless Networks (4, *CS 153*)
CS 170 Introduction to Artificial Intelligence (4, *CS 100, CS 111*)
CS 171 Introduction to Machine Learning and Data Mining (4, *CS 100, MATH 031*)
CS 172 Introduction to Information Retrieval (4, *CS 100, CS 111, EE 114 or STAT 155*)
CS 175 Entrepreneurship in Computing (4, *CS 100*)
CS 177 Modeling and Simulation (4, *CS 100, CS 111*)
CS 179 (E-Z) Project in Computer Science (4, *CS 100, CS 152*)
CS 179E Compilers (4, *CS 100, CS 152*)
CS 179F Operating Systems (4, *CS 153*)
CS 179G Database Systems (4, *CS 100, CS 166, ENGR 180W*)
CS 179-I Networks (4, *CS 100, CS 164, ENGR 180W*)
CS 179J Computer Architecture and Embedded Systems (4, *CS 100, CS 111, CS 120B, CS 161*)
CS 179K Software Engineering (4, *CS 180, ENGR 180W*)
CS 179M Artificial Intelligence (4, *CS 100, CS 111, CS 170, ENGR 180W*)
CS 179N Graphics and Electronic Games (4, *CS 130, ENGR 180W*)
CS 180 Introduction to Software Engineering (4, *CS 100*)
CS 181 Principles of Programming Languages (4, *CS 061, CS 100, CS 111, CS 150*)
CS 182 Software Testing and Verification (4, *CS 100*)
CS 183 UNIX System Administration (4, *CS 100*)

Engineering
ENGR 118 Engineering Modeling and Analysis (5)
ENGR 160 Introduction to Engineering Optimization Techniques (4, *ME 018A, ME 018B*)

Electrical and Computer Engineering, lower division
EE 001A Engineering Circuit Analysis I (3)
EE 001B Engineering Circuit Analysis II (4, *EE 001B*)
EE 01LA Engineering Circuit Analysis I Laboratory (1, *EE 001A concurrent*)
EE 020 Linear Methods for Engineering Analysis and Design Using MATLAB (4)

Electrical and Computer Engineering, upper division
EE 100A Electronic Circuits (4, *EE 001B*)
EE 100B Electronic Circuits (4, *EE 100A*)
EE 105 Modeling and Simulation of Dynamic Systems (4, *EE 001A, EE 020*).
EE 110A Signals and Systems (4, *EE 001B, EE 020*)
EE 110B Signals and Systems (4, *EE 110A*)
EE 111 Digital and Analog Signals and Systems (4, *EE 001B, EE 020*)
EE 114 Probability, Random Variables, and Random Processes in Electrical Engineering (4, *EE 110A or EE 111*)
EE 115 Introduction to Communication Systems (4, *EE 110B*)
EE 116 Engineering Electromagnetics (4, *EE 001B*)
EE 117 Electromagnetics II (4, *EE 116*)
EE 120A Logic Design (5, *CS 061*)
EE 120B Introduction to Embedded Systems (4, *EE 120A*)
EE 123 Power Electronics (4, *EE 110B, EE 123*)
EE 128 Data Acquisition, Instrumentation, and Process Control (4, *EE 100B, EE 120B*)
EE 132 Automatic Control (4, *EE 105 or ME 103, EE 110A or ENGR 118*)
EE 133 Solid-State Electronics (4, *EE 110A*)
EE 135 Analog Integrated Circuit Layout and Design (4, *EE 100B*)
EE 136 Semiconductor Device Processing (4, *EE 133*)
EE 137 Introduction to Semiconductor Optoelectronic Devices (4, *EE 133*)
EE 138 Electrical Properties of Materials (4, *no engineering prerequisites*)
EE 139 Magnetic Materials (4, *no engineering prerequisites*)
EE 141 Digital Signal Processing (4, *EE 110B*)
EE 144 Introduction to Robotics (4, *EE 132*)
EE 145 Robotic Planning and Kinematics (4, *ME 120*)

EE 146 Computer Vision (4, *no engineering prerequisites, consent of instructor required for physics majors*)
EE 150 Digital Communications (4, *EE 114, EE 115*)
EE 151 Introduction to Digital Control (4, *EE 132, EE 115*)
EE 152 Image Processing (4, *EE 110B, EE 111*)
EE 153 Electric Drives (4, *EE 123, EE 116, EE 153*)
EE 155 Power System Analysis (4, *EE 001B, EE 116*)
EE 162 Introduction to Nanoelectronics (4, *EE 133*)
EE 165 Design for Reliability of Integrated Circuits and Systems (4, *EE 100A*)
EE 168 Introduction to Very Large Scale Integration (VLSI) Design (4, *CS 120A orEE 120A*)

Mechanical Engineering, lower division
Note that Mechanical Engineering has a lot of prerequisites, including 14 units of lower-division courses. You will still need to take a minimum of 8 units of upper-division courses. Because of this, it is best to begin taking ME courses early (in 2nd year or beginning of your 3rd year).

ME 002 Introduction to Mechanical Engineering (4)
ME 009 Engineering Graphics and Design (4)
ME 010 Statics (4)
ME 018A Introduction to Engineering Computation (2)
ME 018B Introduction to Engineering Computation (4, *ME 018A, ME 002*)

Mechanical Engineering, upper division
ME 100A Thermodynamics (4, ME 018B)
ME 100B Thermodynamics (4)
ME 103 Dynamics (4, *ME 010, ME 018B*)
ME 110 Mechanics of Materials (4, *ME 010*)
ME 113 Fluid Mechanics (4, *ME 010, ME 018B*)
ME 114 Introduction to Materials Science and Engineering (4)
ME 116A Heat Transfer (4, *ME 113*)
ME 116B Heat Transfer (4)
ME 117 Combustion and Energy Systems (4, *ME 100A, ME 113, ME 116A*)
ME 118 Mechanical Engineering Modeling and Analysis (4, *ME 018B*)
ME 120 Linear Systems and Controls (4, *EE 001A, EE 01LA, ME 018B*)
ME 121 Feedback Control (4, *ME 118, ME 120*)
ME 122 Vibrations (4, *ME 103*)
ME 130 Kinematic and Dynamic Analysis of Mechanisms (4, *ME 009, ME 103*)
ME 131 Design of Mechanisms (4, *ME 130*)
ME 133 Introduction to Mechatronics (4, *ME 120*)
ME 134 Microstructoural Transformations in Materials (4, *ME 114*)
ME 135 Transport Phenomena (4, *ME 110A, ME 113, ME 116A*)

ME 136 Environmental Impacts of Energy Production and Conversion (4, *ME 110A, ME 113, ME 116A*)
ME 137 Environmental Fluid Mechanics (4, *ME 110A, ME 113*)
ME 138 Transport Phenomena in Living Systems (4)
ME 140 Ship Theory (4, *ME 103, ME 113*)
ME 144 Introduction to Robotics (4, *EE 132*)
ME 145 Robotic Planning and Kinematics (4, *ME 120*)
ME 153 Finite Element Methods (4, *ME 118*)
ME 156 Mechanical Behavior of Materials (4, *ME 110, ME 114*)
ME 170A Experimental Techniques (4, *EE 001A, EE 01LA, ME 018B*)
ME 170B Experimental Techniques (4, *ME 103, ME 110, ME 113, ME 116A, ME 170A*)
ME 174 Machine Design (4, *ME 009, ME 103, ME 110, ME 114*)
ME 176 Sustainable Product Design (4, *ME 103, ME 110, ME 113, ME 116A*)
ME 180 Optics and Lasers in Engineering (4)

Chemical and Environmental engineering, lower division
CEE 010 Introduction to Chemical and Environmental Engineering (1)
CEE 011 Introduction to Bioengineering (2)

Chemical and Environmental engineering, upper division
CEE 125 Analytical Methods for Chemical and Environmental Engineers (4, *CEE 010, may be taken concurrently*)
CEE 132 Green Engineering (4, *CHE 110A*)
CEE 135 Chemistry of Materials (4, *CHEM 008A*)
CEE 136 Aerosol Technology (4, *concurrent enrollment in CHE 120*)
CEE 140A Biomaterials (4, *BIEN 101 or BCH 100*)
CEE 140B Biomaterials (4, *no engineering prerequisites?*)
CEE 159 Dynamics of Biological Systems (4, *BIOL 005B*)
CHE 100 Engineering Thermodynamics (4, *no engineering prerequisites*)
CHE 102 Catalytic Reaction Engineering (4, *CHE 122*)
CHE 105 Introduction to Nanoscale Engineering (4, *CEE 135*)
CHE 110A Chemical Process Analysis (3, *no engineering prerequisites*)
CHE 110B Chemical Process Analysis (3, *CHE 110A*)
CHE 114 Applied Fluid Mechanics (4, *CHE 110A*)
CHE 116 Heat Transfer (4, *CHE 100, CHE 114*)
CHE 117 Separation Processes (4, *CHE 116, CHE 120*).
CHE 118 Process Dynamics and Control (4, *CHE 117, CHE 122, ENGR 118*)
CHE 120 Mass Transfer (4, *CHE 114*)
CHE 122 Chemical Engineering Kinetics (4, *CHE 100, CHE 110B, CHE 120, ENGR 118*)
CHE 124 Biochemical Engineering Principles (4, *BCH 110A, CHE 120, CHE 122*)
CHE 124L Biochemical Engineering Laboratory (2, *CHE 124*)
CHE/ENVE 130 Advanced Engineering Thermodynamics (4, *CHE 100*)
CHE 131 Electrochemical Engineering (4, *CHE 100, CHE 120, CHE 122*)

CHE 136 Advanced Topics in Heat Transfer (4, *CHE 116, CHE 120*)
CHE 140 Cell Engineering (4, *CHE 124*)
CHE 150 Biosensors (4, *BCH 184 or CHE 124*)
CHE/ENVE 160A Chemical and Environmental Engineering Laboratory (3, *CHE 114, CHE 120*)
CHE/ENVE 160B Chemical Engineering Laboratory (3, *CHE 116, CHE 122*)
CHE/ENVE 160C Chemical Engineering Laboratory (3, *CHE 117, CHE 118, CHE 122*)
CHE 161 Nanotechnology Processing Laboratory (3, *CHE 100*)
CHE 171 Pollution Control for Chemical Engineers (4, *CHE 117*)
ENVE 120 Unit Operations and Processes in Environmental Engineering (4, *CHE 120, ENVE 142*)
ENVE 121 Biological Unit Processes (4, *ENVE 120, ENVE 142*)
ENVE 133 Fundamentals of Air Pollution Engineering (4, *CHE 110A, CHE 114, CHEM 008B*)
ENVE 134 Technology of Air Pollution Control (4, *ENVE 133*)
ENVE 135 Fate and Transport of Environmental Contaminants (4, *CHE 120, CHEM 008B, ENGR 118, ENVE 133, ENVE 142*)
ENVE 138 Combustion Engineering (4, *CHE 114, ENVE 133*)
ENVE 140 Aquatic Chemistry (4, *CHE 100, ENVE 142*)
ENVE 142 Water Quality Engineering (4, *CHE 114 or ENVE 171*)
ENVE 144 Solid Waste Management (4, *BIOL 005A, ENSC 001, ENSC 002, ENVE 171*)
ENVE 145 Hazardous Waste Management (4, *ENVE 120, ENVE 142*)
ENVE 146 Water Quality Systems Design (4, *CHE 114*)
ENVE 171 Fundamentals of Environmental Engineering (4, *no engineering prerequisites*)

Bioengineering, lower division
BIEN 010 Overview of Bioengineering (4)

Bioengineering, upper division
BIEN 101 Quantitative Biochemistry (4, *BIOL 005A, CHEM 008A*)
BIEN 105 Circulation Physiology (4, *BIEN 110*)
BIEN 110 Biomechanics of the Human Body (4, *CS 010*)
BIEN 115 Quantitative Physiology (4, *BIEN 110*)
BIEN 120 Biosystems and Signal Analysis (4, *BIEN 105*)
BIEN 125 Biotechnology and Molecular Bioengineering (4, *BIEN 101*)
BIEN 130 Bioinstrumentation (4, *concurrent enrollment in BIEN 130L, EE 001A and EE 01LA*)
BIEN 130L Bioinstrumentation Laboratory (2, *concurrent enrollment in BIEN 130, EE 001A and EE 01LA*)
BIEN 135 Biophysics and Biothermodynamics (4, *BIEN 101*)
BIEN 136 Tissue Engineering (4, *BIOL 005A, BIOL 005B*)
BIEN 137 Advanced Biomechanics (4, *BIEN 110, BIOL 005B*)

BIEN 138 Fundamental Principles of Wound Repair (4, *BIEN 105, BIOL 005A*)
BIEN 140A Biomaterials (4, *BIEN 101*)
BIEN 140B Biomaterials (4, *no engineering prerequisites?)*
BIEN 142 Introductory Biomedical Optical Imaging (4, *no engineering prerequisites*)
BIEN 155 Biotechnology Laboratory (2, *concurrent enrollment in BIEN 175A, BIEN 101, BIEN 125*)
BIEN 159 Dynamics of Biological Systems (4, *BIOL 005B*)
BIEN 160 Biomedical Imaging (4, *BIEN 120*)
BIEN 165 Biomolecular Engineering (4, *BIEN 135*)
BIEN 166 Bioinspired Engineering for Sustainable Energy (4, *BIEN 140A*)
BIEN 167 Medical Diagnostics (4, *BIEN 130*)

Materials Science and Engineering, lower division
MSE 001 Fundamentals of Materials Science and Engineering (2, no prereq.)
MSE 002L General Materials Laboratory Spring (1, MSE 001)
MSE 003L General Materials Laboratory Fall (1, MSE 001)
MSE 004L General Materials Laboratory Winter (1, MSE 001)

Materials Science and Engineering, upper division
MSE 134 Microstructural Transformations in Materials (4, ME 114)
MSE 135 Introduction to Inorganic Material Synthesis (4, MSE 001, CHE 100, ME 114, CHEM 008A)
MSE 136 Tissue Engineering (4, BIOL 005B, CHEM 001C, BIEN 140A or CHEE 140A)
MSE 142 Corrosion Science (4, MSE 134)
MSE 143 Failure Analysis and Prevention (4, MSE 134)
MSE 148 Advanced Solidification Processing (4, MSE 143)
MSE 155 Materials Science of the Solid State (4, EE 138)
MSE 156 Atomistic Modeling of Solid State Materials (4, MSE 155)
MSE 160 Nanostructure Characterization Laboratory (4, ME 114)
MSE 161 Analytical Materials Characterization (4, MSE 160)

Data Science Courses, lower division
PHYS 050 Introduction to Applied Data Science, A Multi-Disciplinary Approach (4, no prereq.)
STAT 040 Elements of Data Science (4, no prereq., credit not awarded if already taken STAT 048, STAT 100A, or STAT 100B. May take STAT 100A and 100B after STAT 040).

Data Science Courses, Upper division
STAT 156A Mathematical Statistics With Applications for Data Science I (4, MATH 009C).

STAT 156B Mathematical Statistics With Applications for Data Science II (4, STAT 156A)

STAT 167 Introduction to Data Science (4, STAT 100B or STAT 155; CS 010A; STAT 147)

CS 105 Data Analysis Methods (4, CS 010C)

STAT 155 Probability and Statistics for Science and Engineering (4, MATH 009C)