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An undergraduate degree in physics at MIT, with its emphasis on learning to solve problems, provides an excellent basis for graduate study in physics and related fields; it is also a great foundation for careers in industry, research, finance, management, law, medicine, or public policy. The Physics Department offers two tracks to the major, Flexible and Focus, each leading to a Bachelor of Science in Physics: The Flexible track is selected by most Physics majors: it provides a series of rigorous courses in fundamental physics topics, and its options enable many of our students to complete second majors in other disciplines. Students who choose the Focus track take a greater number of specific required courses, including two terms of experimental physics, and write a research thesis. Both pathways are highly suitable for any student planning to pursue graduate school, teaching or research beyond MIT. Degree requirements for each can be found on our Physics Degree Requirements webpage. The Department of Physics has various options for fulfilling the General Institute Requirements (GIRs) of Physics I and Physics II, all based on extensive use of calculus. Video about the Physics General Institute Requirements Physics I Physics I introduces classical (Newtonian) mechanics: space and time; kinematics; Newton's Laws; particle dynamics; collisions and conservation laws; work and potential energy; universal gravitation; rigid bodies, equilibrium, and rotational dynamics. 8.01: taken by most students, this course uses the Technology Enabled Active Learning (TEAL) format, including group problem-solving and digital content; 8.012: mathematically more advanced than 8.01; is intended for students with strong physics and math background; 8.01L: longer version of 8.01, starts in the fall and continues into January, allowing students additional time to develop problem-solving skills. Appropriate placement in 8.01, 8.01L, or 8.012 is determined by the results of the Math Diagnostic for Physics Placement test taken during Orientation. 8.011: offered each spring, intended for students who need to retake a version of 8.01; its organization of small lecture sections and weekly quizzes benefits students who learn well in a highly-structured environment. Physics II Physics II introduces electromagnetism and electrostatics: electric charge, Coulomb's law, the electric structure of matter, conductors and dielectrics. Concepts of electrostatic field and potential, electrostatic energy. Electric currents, magnetic fields, and Ampere's law. Magnetic materials. Time-varying fields and Faraday's law of induction. Basic electric circuits. Electromagnetic waves and Maxwell's equations. 8.02: like 8.01, presents material using the TEAL format. 8.021: offered each fall; taught in small lecture sections with weekly quizzes. Enrollment is limited to students who have previously attempted 8.02 or 8.022. 8.022: mathematically more advanced level than 8.02; intended for students with strong physics and math background. MIT Physics offers two kind of credit for knowledge demonstrated through exams or for previous work: Advanced Standing credit can be given for successfully passing an exam demonstrating mastery of the material from an MIT course. Current subjects for which Advanced Standing Exams (ASEs) are available are 8.01, 8.02, 8.03, and 8.04. Transfer credit is given for course work completed at another university; a Validation Exam to demonstrate mastery of the material is required for 8.01 or 8.02 transfer credit. Upcoming Exams Schedule The MIT Physics Department offers ASEs twice a year (once in August and once in January). Fall 2022 Advanced Standing/Validation Exams schedule: • 8.01: Monday, August 8, 12:00 to 3:00pm (VIRTUAL) • 8.02: Wednesday, August 10, 12:00 to 3:00pm (VIRTUAL) • 8.03: Tuesday, September 6 (Registration Day), 9:00 am to 12:00 pm in 4-261 • 8.04: Tuesday, September 6 (Registration Day), 2:00 to 5:00 pm in 4-261 Accommodations for ASEs / Transfer Validation Exams in order to be granted extended time, a distraction-free space, or any other needed accommodation for the exams offered, students need to get approval from the Disabilities and Access Services Office (das-all@mit.edu). Students also need to contact the Physics Course Manager, Emma Burns (emburns@mit.edu) to coordinate the logistics of the accommodation requested. More on Advanced Standing Credit MIT's first-level Physics courses in Classical Mechanics (8.01) and Electricity & Magnetism (8.02) provide a rigorous, in-depth study of these topics at a level offered by few other schools. A student who believes that pre-MIT work has prepared the student with strong knowledge of the subject matter in 8.01 and/or 8.02 may take an Advanced Standing Exam. A passing grade on an MIT Advanced Standing Exam entitles a student to full credit for the subject, as well as placement in the next subject in a sequence. A student may only take an Advanced Standing Exam in a class for which they had never registered nor attended at MIT. Obtaining Advanced Standing Credit Incoming first-year students: Register for ASEs through the form on the Office of the First Year website. All continuing students and new transfer students: Read the "What you need to do" section of the MIT Registrar's Office website and download the ASE petition. After obtaining a signature from your Academic Advisor, send the petition to physics-undergrad@mit.edu to obtain a signature from Catherine Modica, Physics Academic Administrator. Your form will then be sent to the Registrar for verification that you have not previously been enrolled in the class. Forms must arrive at the Registrar's Office at least three weeks before the date of the exam. Additional information about MIT's Advanced Standing Exams policy and practice Advanced Standing Grading First-semester freshmen: P grade for passing the exam; no grade posted for failing the exam. Second-semester freshmen: graded on the A/B/C/No Record scale; any passing grade (C or above) appears on the student's transcript. Sophomores, juniors, and seniors (including new transfer students): letter grades will appear on transcript, but not factor into the GPA. A student who fails an advanced standing exam cannot retake it, and should enroll in the appropriate subject. More on Transfer Credit MIT's first-level Physics courses in Classical Mechanics (8.01) and Electricity & Magnetism (8.02) provide a rigorous, in-depth study of these topics at a level offered by few other schools. A student who has not yet completed the Physics GIRs at MIT may wish to take a course at another college or university (e.g., during a summer session) and apply for transfer credit; students transferring to MIT may have already taken such a course. In order to qualify for MIT credit, the course must: be calculus-based and directed toward science or engineering majors; use a text at a level comparable to that of texts used at MIT (see below); be the equivalent of one MIT term in the number of lecture hours, number of assignments, etc.; have content matching that of 8.01 (Mechanics) or 8.02 (Electricity and Magnetism). The principal topics usually included in such a course are listed below. Additional information can be found on the individual course websites. Obtaining transfer credit To request transfer credit for any Physics subject, consult with Physics Academic Administrator Catherine Modica, who serves as the Department's Transfer Credit Examiner and will determine whether the course meets MIT Physics' standards. Students requesting transfer credit should send: a copy of or link to the official catalog description of the course; a detailed syllabus including the title and author of the textbook and the chapters covered, as well as topics covered week to week; a transcript from the institution where the course was taken (NOTE: a grade of B or better is required to receive transfer credit). Requesting credit for 8.01 or 8.02: The student must "validate" the transfer credit by passing an MIT 8.01 or 8.02 Validation Exam. Exams are given during Orientation week prior to the fall term and in the last week of IAP prior to the spring term. To register for an exam, submit a petition (PDF) to the Academic Programs Office. After passing the Validation Exam, request transfer credit by submitting a Request for Additional Credit (PDF) to the Transfer Credit Examiner. Requesting credit for courses beyond the GIRs: Based on the materials sent to the Transfer Credit Examiner, a decision will be made on what transfer credit will be awarded; no exam is required for subjects above 8.02. Transfer credit may be in the form of direct credit for a specific MIT Physics subject, if the previous course covers the same curriculum with the same rigor, or may be in the form of units of academic credit, in cases where no analogous MIT course exists. Once credit has been approved, submit a Request for Additional Credit (PDF) to the Transfer Credit Examiner. Transfer Credit Grading Transfer credit appears on the transcript with a grade of "S." Transfer credit entitles the student to placement in the next subject in a sequence. A student who fails an 8.01 or 8.02 Validation Exam will have no grade noted on the transcript, but may not repeat the exam and must enroll in the MIT course. Potential Topics for Placement Exams Physics ASEs and Validation Exams are three-hour, closed-book exams covering calculus-based introductory Classical Mechanics (8.01) or Classical Electromagnetism (8.02). Exams are modeled on final exams in 8.01 and 8.02, with problems based on a selection of the topics listed below. Suggested texts for study include University Physics by Young and Freedman; Physics by Halliday, Resnick and Krane; and Physics for Scientists and Engineers by Serway. Calculators may not be used during these exams; formula sheets are often provided but are not guaranteed. 8.01 Topics Newton's Laws of Motion Work, Kinetic Energy, Potential Energy Conservation of Energy and Momentum; Collisions Circular Motion; Rotation of Rigid Bodies Torque Torque and Angular Momentum Statics and Equilibrium Universal Gravitation The Simple Harmonic Oscillator Non-inertial reference frames: linear and rotating 8.02 Topics Electric Charge and Electric Field Gauss's Law Electric Potential and Potential Energy Capacitance and Dielectrics Current, Resistance, Electromotive Force; DC Circuits Magnetic Fields and Magnetic Forces on Currents Amperes Law; Biot-Savart Law Faraday's Law of Induction Inductance RC, LR, LC, and AC circuits Displacement Current Maxwell's Equations and Electromagnetic Waves We welcome hearing from you if you are planning a visit to the Boston area and would like to visit the MIT Physics department! Visits usually involve meeting with our Undergraduate Program Coordinator, who will describe the program and undergraduate activities, and answer questions. We can also arrange for you to meet with a current student. Visit arrangements should be made in advance in order to ensure someone is available to meet with you. To request an appointment, contact physics-undergrad@mit.edu. While we do not arrange visits with faculty members, you may contact research labs and/or individual faculty directly to ask about a meeting during your visit. Visitors can also take a campus tour provided by the Admissions Office and read more information about arranging a general visit to MIT. The MIT Summer Research Program (MSRP) is an institutional effort to help facilitate the involvement of talented students in research aspects of the fields of engineering and science, in particular those from disadvantaged backgrounds such as under-represented minorities, or first-generation college students. This summer program seeks to identify talented undergraduates from around the country who could benefit from spending a summer on MIT's campus, working in a research laboratory under the tutelage and guidance of experienced scientists and engineers – MIT faculty members, postdoctoral fellows and advanced graduate students. Students who participate in this program will be better prepared and motivated to go on to a Ph.D. degree, thereby helping to curtail under-representation in critical fields of scientific investigation. Application Deadline Please visit the MIT Summer Research Program site for application deadline information. Program Features For questions or for further information, contact the MSRP staff at msrp@mit.edu. Physics Bridge Program The MIT Physics Bridge Program is a one- or two-year post-baccalaureate program at MIT to facilitate the transition to graduate school. Participation is open to physics students who have completed a bachelor's degree and have participated in the MIT Summer Research Program. Interested college seniors who have attended MSRP should apply to the MIT Physics graduate program by following the procedures given at our physics graduate study website. Physics students have access to a variety of academic support and tutoring opportunities: Peer Tutoring Program: offered to qualifying students taking sophomore core subjects (8.03, 8.033, 8.04, 8.044). For more information about this program, contact physics-undergrad@mit.edu. Physics Mentorship Programs: in response to the COVID Pandemic and many students being away from campus, mentoring programs, managed by Dr. Peter Dourmashkin, Prof. Ed Bertschinger and Prof. Kerstin Perez, were established to provide support for students in core physics undergraduate subjects. Fall Classes: 8.01, 8.02, 8.01L, 8.012, 8.021, 8.022, 8.03, 8.04, 8.041 Spring Classes: 8.011, 8.02, 8.022, 8.03, 8.04, 8.044 Tutoring in specific courses: some courses include tutors as part of their course staff; please refer to individual subject web pages for specific tutoring opportunities. Individual hiring of tutors: can be organized through a special arrangement with the Physics Academic Programs Office. The Office of Minority Education's Talented Scholars Resource Room (TSR^2): free tutoring services to all MIT undergraduate students. TSR^2 provides one-on-one tutoring sessions, p-set nights, and exam reviews.





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