


Massachusetts Institute of
Technology Bulletin

This Is MIT 1965-1966

UNIVERSITY OF TECHNOLOGY

A blue-tinted photograph of the MIT building facade. The image shows a classical architectural style with four large, fluted columns supporting a pediment. The pediment contains the text 'UNIVERSITY OF TECHNOLOGY' in capital letters. The columns are positioned in front of a large window with a grid pattern. The overall scene is captured in a monochromatic blue color scheme.

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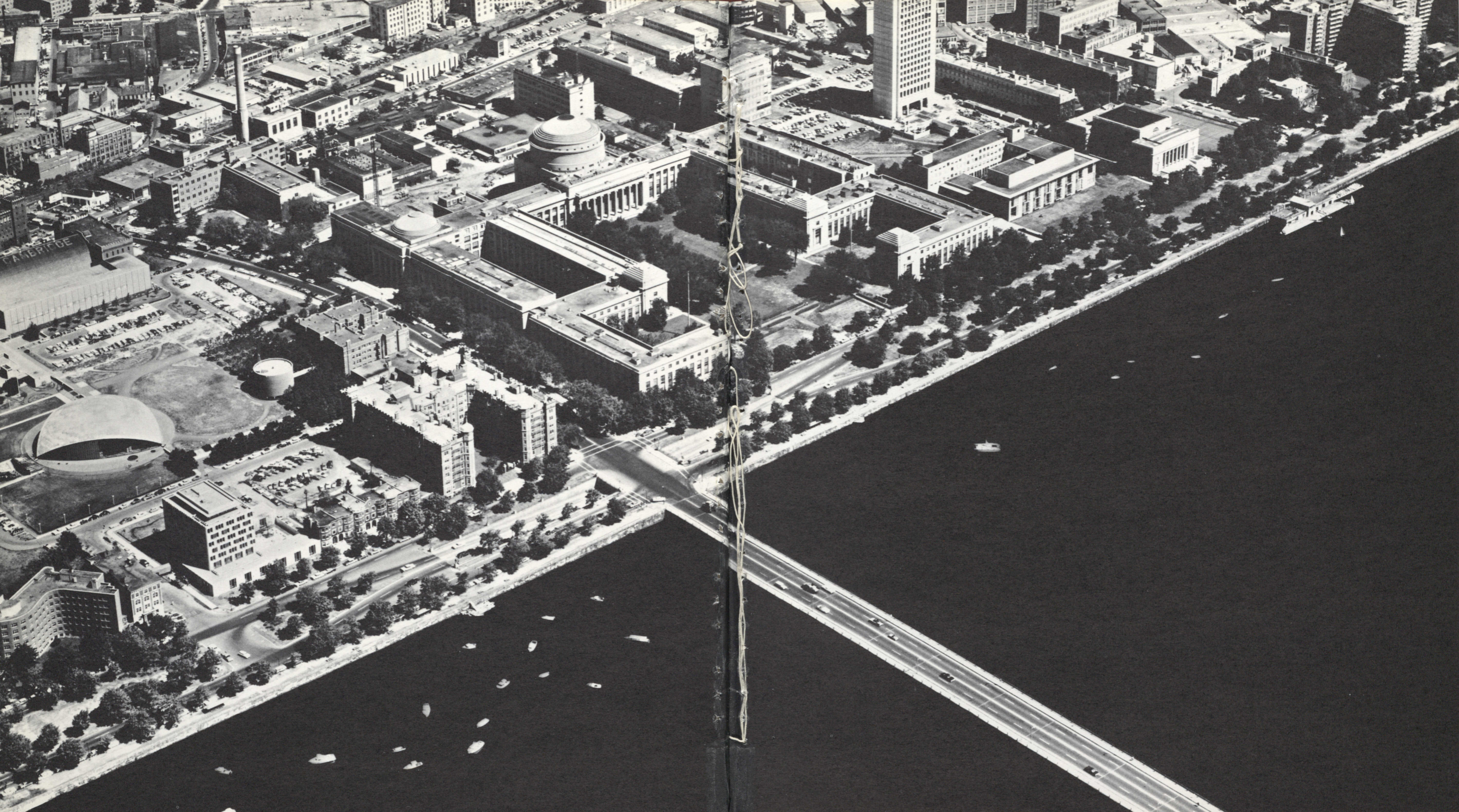
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This booklet about the Massachusetts Institute of Technology has been written especially for students who are considering their choice of a college or university. It describes many features which M.I.T. has in common with most schools—features which assure a complete college experience in an environment which fosters fellowship and growth. More important, however, are the many qualities described here which set M.I.T. apart, by which the Institute provides a unique intellectual experience especially relevant for an era when modern technology will increasingly affect all our lives.

You may want to prepare for a career in engineering, science, architecture, management, or the humanities; you may plan to become a lawyer, doctor, teacher, minister, or public servant; or you may have as yet no particular career in mind. But whether you seek a challenging undergraduate education with outstanding opportunities for preprofessional work or a more general education founded in science, you should know more about M.I.T.

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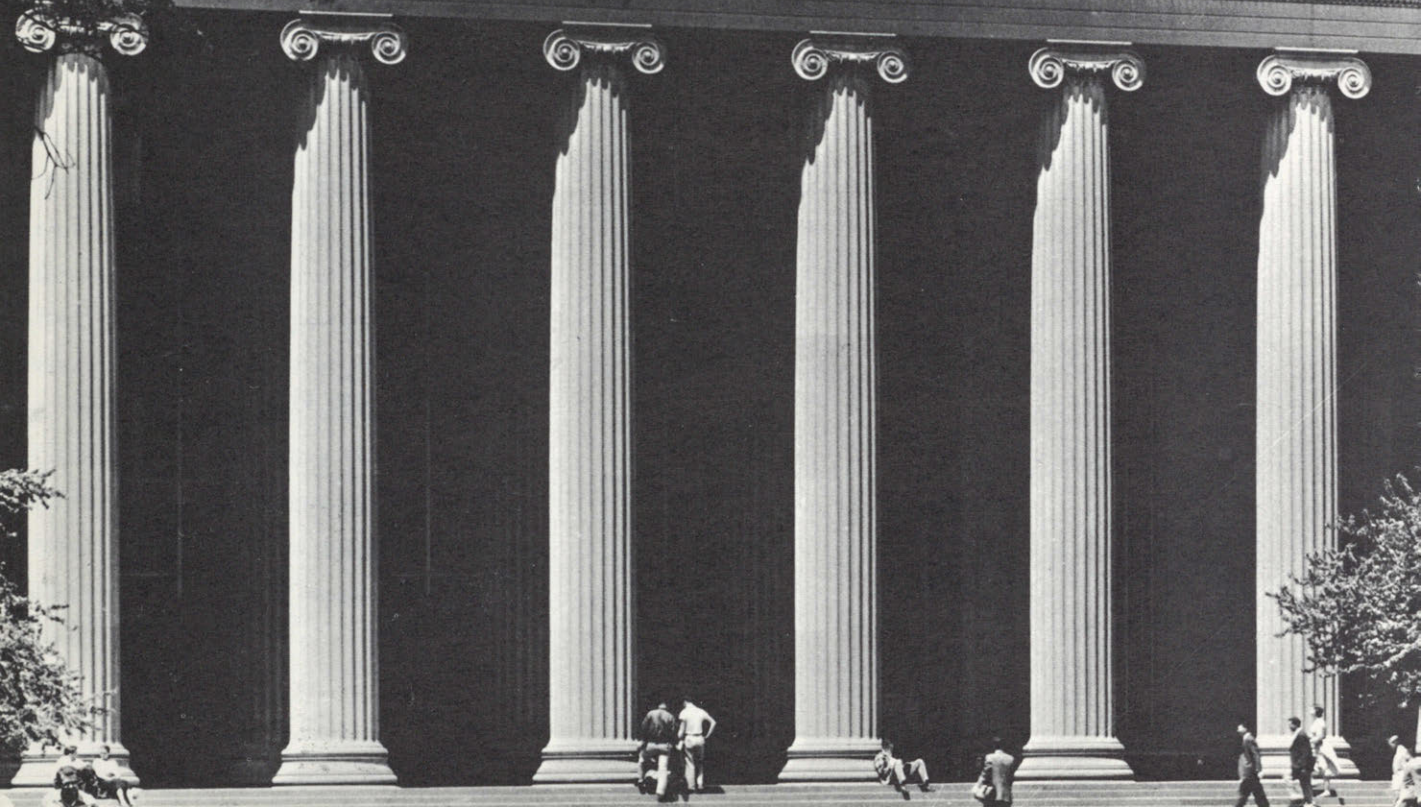
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INSTITUTE OF TECHNOLOGY



This Is MIT

M.I.T. was founded in 1861 when science and engineering were beginning to alter the character of industry, commerce, and the arts. It has grown to its present eminence in step with the increasing importance of technology in our culture. Yet M.I.T. today is far more than a school devoted to scientific and technological subjects. Dr. James R. Killian, Jr., Chairman of the M.I.T. Corporation, has described the Institute as a new kind of university—a university polarized around science, where teaching and research of the highest quality are conducted in a range of fields now deeply relevant to the world's social, economic, and political problems. M.I.T.'s growing breadth reflects its commitment to the unity of contemporary society—to a single culture in which the sciences and the humanities are together integral parts.

M.I.T. is a private institution, independently governed by its own board of trustees (the "Corporation"). Its students come from every state and from seventy foreign countries. Women have attended since 1886. With 3,500 undergraduates, 3,000 graduate students, a faculty of 750, and a supporting teaching staff of 600, the Institute is in the middle range of American colleges and universities—neither very large nor very small.

The campus borders the Charles

River in Cambridge. Here, in addition to classrooms and laboratories, are student residences (including dormitories and fraternities) for nearly 75 per cent of the undergraduates, extensive athletic facilities, a noted auditorium, and a new Student Center, to be completed for the fall of 1965, which will serve as a focus for campus government and social life. M.I.T. students also share—with those from some forty other colleges and universities—the generous academic, cultural, and recreational resources of Greater Boston.

The scope of the Institute has always been wider than the title of an institute of technology might suggest. The first faculty of ten members included professors of English and modern languages. The first president was a geologist, the second a distinguished economist. Today M.I.T. offers bachelor's and higher degrees in architecture and city planning, eight engineering departments, five fields of science, industrial management, and five fields in the humanities and social sciences.

The whole of technology now enters deeply into all our lives. M.I.T. offers an unparalleled opportunity to see the full spectrum of technology as a living and growing entity, deeply interwoven with the political, economic, and cultural development of modern societies.

Foundations of an M.I.T. Education

Throughout M.I.T.'s history, as President Julius A. Stratton pointed out at his inauguration, a distinguishing feature of the Institute has been the rigor and thoroughness of its method. "From the day he enters as a freshman, the undergraduate learns to work in depth and to be held accountable for the results. He learns also to work under pressure and to marshal and employ his knowledge under test. From this discipline and mastery of fundamentals comes an intellectual self-reliance that will stand him in good stead."

With rigor is joined an emphasis on fundamentals. Advances in science and technology have changed the world dramatically since the Institute was founded, and there will be similar or greater changes in the decades ahead. M.I.T. recognizes that the student who will be able to grow to meet tomorrow's challenges will be the one who understands the basic concepts well. Its aim is to teach what will be of permanent value to him, not what will be only temporarily useful.

Because no one can say what the future will bring, the undergraduate programs are largely unspecialized, flexible, and open-ended, giving each student wide choices to suit his particular interests and plans. In this way, for example, a student majoring in physics may pursue a side-interest

in genetics and a student in architecture may develop his knowledge of materials.

Teaching and research at M.I.T. closely support one another. "The faculty member who spends most of his time somewhere on the edges of human knowledge," one professor has said, "spends the rest of it talking to students. Even in the most elementary classes there is a steady filtering through of the newest knowledge." The curricula are continually being changed to take account of new advances and new viewpoints. There is little separation between the undergraduate and graduate schools, and most undergraduates complete the necessary prerequisites and take some classes at the graduate level before completing their undergraduate degrees. A number of the undergraduate programs continue directly to the simultaneous award of both Bachelor's and Master's degrees. It is essentially impossible for an able undergraduate at M.I.T. to exhaust the work available to him in his major field.

Scientific discovery and engineering innovation are each in their way arts, requiring imagination as well as knowledge. Actively creative themselves, the M.I.T. faculty are keen to encourage creativity in the student. Among the means used are seminars on research topics of-

ferred as electives in the freshman year and laboratory projects in the upperclass years which are frequently parts of larger M.I.T. research programs. In addition, almost every senior (it is optional only in mathematics) is required to do a thesis in which he tackles a problem in his major field on his own. With this opportunity for independent study and research under the guidance of the faculty, every undergraduate at M.I.T. is in a sense an honors student as this is understood at many colleges. Some of the most advanced equipment in the country is available for undergraduate projects, including high-energy Van de Graaff accelerators, electron microscopes, a nuclear reactor, several high-speed computers, and many other powerful tools.

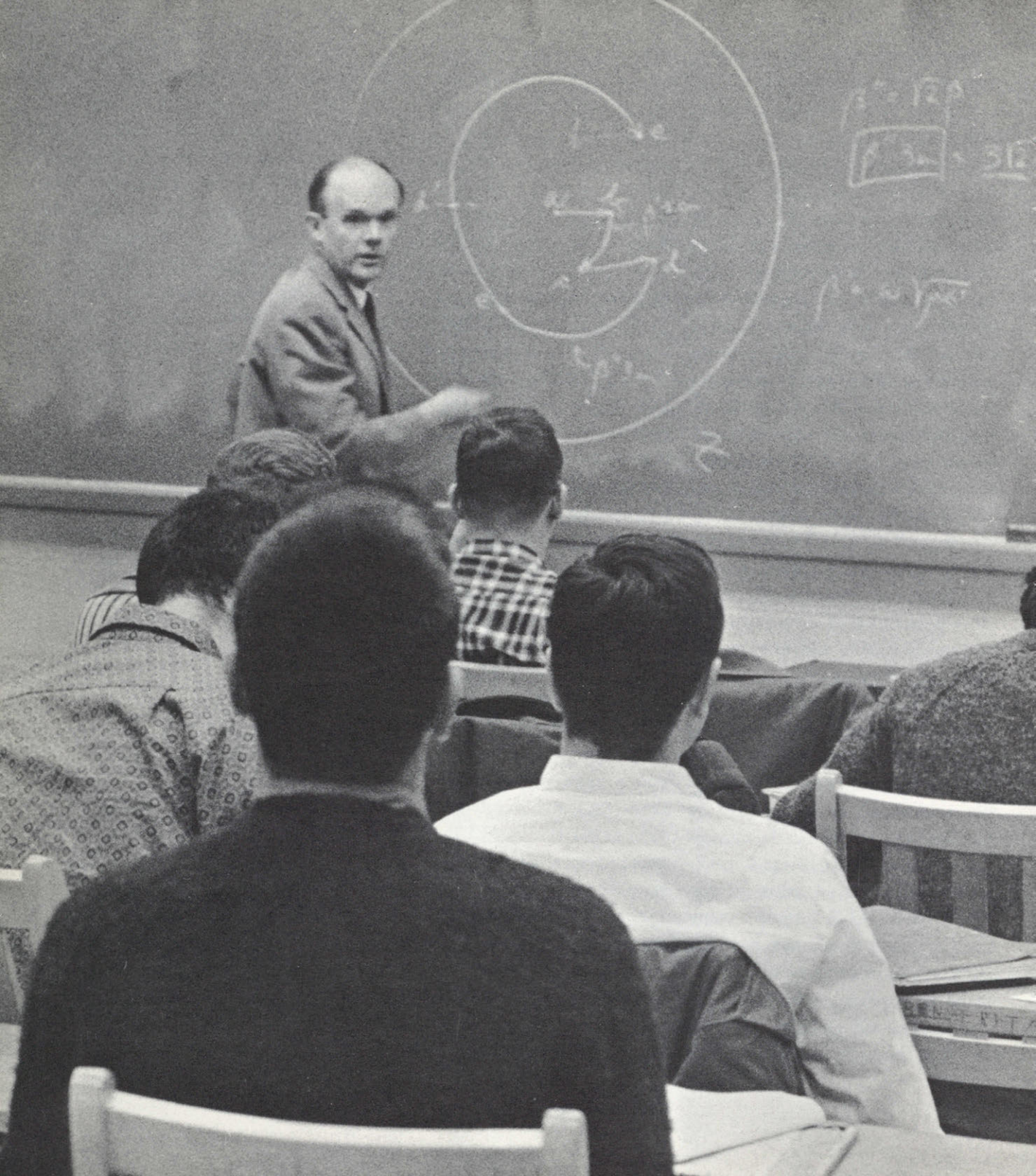
The more the world turns to the technically trained man for advice and leadership, the more important it is that he understand the problems of the world and his own place in it as a human being. The future scientist or engineer needs to have as excellent an education in the humanities and social sciences as is traditionally expected of other professional men. M.I.T. requires every undergraduate to take not less than eight one-term subjects in the humanities or social sciences. Every degree program provides room for ten, and there are programs which

allow the student to devote half his time to study in humanities and social sciences. Subjects offered include history, philosophy, literature, modern languages, music, economics, political science, labor relations, psychology, and visual arts. The student may choose his work from different fields, but he must proceed to some depth in one.

M.I.T. is not easy. Both the faculty and the students work hard. Yet M.I.T. offers more than a challenging curriculum, for the Institute does not expect a student's learning experience to take place only in the classroom and laboratory or as he prepares his homework every night. In extracurricular activities each student, depending upon his own personal inclinations, may find at M.I.T. a wealth of informal educational experience—in student government, hobby and professional clubs, and athletics. The athletic program is designed to encourage the widest possible participation, and a large proportion of the students are active in intercollegiate or intra-mural sports. M.I.T. fields 17 varsity teams. The students are responsible for their own government in the fraternities and undergraduate houses, and an Institute-wide structure of committees represents the student body as a whole. Student publications include a weekly newspaper, an engineering journal, a

humor magazine, and a literary review. An FM radio station broadcasts daily. There is a vigorous dramashop and an annual musical revue. There is a wealth of musical activity—the Choral Society, which has made several tours abroad; the M.I.T. Symphony, Concert Band, Brass Choir, and Glee Club; and the popular Logarithms and Tectonians. A highly successful debate team competes with colleges from across the nation.

Altogether there are over 80 different activities and clubs. And every student is encouraged to discover beyond the classroom within himself new skills, aptitudes, interests, and pleasures; and to discover values which may not be so apparent in the context of the curricular program.







Programs of Study

The undergraduate at M.I.T. has over 30 programs to choose from in 16 departments. As is explained in the section on the freshman year, he makes his choice by the end of his freshman year or, if he wants more time to make up his mind, during his sophomore year. Introductory work in the first two years in mathematics, physics, chemistry and the humanities provides a common starting point for all the undergraduate programs at the Institute (architecture requires no chemistry and only one year of mathematics). This section describes briefly the different departments offering undergraduate programs and the programs they offer.

Aeronautics and Astronautics

The Institute has pioneered in the scientific study of flight since 1914, when Professor Jerome C. Hunsaker introduced at M.I.T. the first graduate program in aeronautics at an American university. Today the Institute's Department of Aeronautics and Astronautics is famous for its work on instrumentation and guidance systems for aircraft, missiles, and space vehicles as well as for its contributions in structures, aeroelasticity, fluid mechanics, and propulsion. Its graduates occupy prominent positions in nearly all phases of aerospace activity.

The educational objective of the

Department is to develop graduates with the ability to make wise decisions on components and systems for flight vehicles of all types, from VTOL to space craft.

The undergraduate curriculum provides a sound foundation in mathematics and the sciences; then follow subjects in propulsion, control, aerodynamics, and structures; and finally these elements are combined in the synthesis of flight vehicles as systems problems. Through his choice of electives, a student may concentrate his study in a particular area or advance in several areas. The Department offers four-year programs leading to the degree of Bachelor of Science in Aeronautics and Astronautics with emphasis on engineering science or systems engineering and a four-year cooperative program for selected students, which includes five months in industry. There is a five-year honors course for outstanding students who want to combine work for the Master's and the Bachelor's degrees.

Architecture

M.I.T. was the first university to organize and develop formal architectural education in the United States. As part of an institution especially alert to technology's potential for improving human life, the Department of Architecture at M.I.T. is dedicated to the search

for a physical environment which expresses our culture, which encompasses the scientific outlook, and which uses modern industrial methods and materials while giving full satisfaction to our hunger for aesthetic fulfillment. The work of its graduates may be seen in many cities of the world.

The Department offers a five-year program leading to the degree of Bachelor of Architecture. The program combines a strong core in architectural design with work in visual design, art history and criticism, structures, and acoustics. Study in planning is conducted by the Department of City and Regional Planning, which awards only graduate degrees. Supplemented by practical experience, the program in architecture provides preparation for independent practice or for further study.

Biology

With small but distinguished beginnings under William T. Sedgwick, a noted bacteriologist and a pioneer in public health, the Department of Biology has seen an exciting expansion in recent years. It has chosen to lay special emphasis on the physics and chemistry of living things—molecular biology—as is fitting in an institution noted for its work in physics, chemistry, and instrumentation.

The Department offers a four-year program leading to the degree of Bachelor of Science in Life Sciences, including general biology and organic and analytical chemistry in the second year; biochemistry, microbial genetics, and physical chemistry in the third year; and developmental biology and physiology in the fourth year. Electives allow each student to pursue a special interest in analytical biology, physiology, biochemistry, biophysics, microbiology, nutrition, food science, psychology, or medicine.

Most of the students who graduate in life sciences are planning to continue with graduate work leading to the M.D. or Ph.D. degree; the Course is a popular choice for pre-medical students.

Chemical Engineering

M.I.T. was the first institution in the world to offer a program in chemical engineering. Since then chemical engineers have contributed notably to the development of modern industry, and today they are active in the fields of synthetic organics, microbiology, pharmaceuticals, plastics, petrochemicals, new metals, energy conversion, process development, combustion, catalysis, and surface chemistry. The chemical engineer is a creator of change, and a primary aim of the Department of Chemical Engineering at M.I.T. is to

cultivate its students' capacity for handling new problems with competence.

In addition to mathematics and physics, each student in the Department takes a core program in chemistry and chemical engineering, and he must complete a related professional minor which may be equivalent to about one term of full-time study. This minor may be in any one of a number of areas, including automation, biochemistry, computers, economics, electronics, fluid mechanics, geophysics, industrial management, metallurgy, pre-graduate nuclear engineering, and properties of materials. This four-year program leads to the degree of Bachelor of Science in Chemical Engineering.

Chemistry

Chemistry has been an important subject at M.I.T. since the beginning, when Charles William Eliot, afterwards President of Harvard, was Professor of Analytical Chemistry and Metallurgy. Since that time noted contributions have been made at M.I.T. in the different branches of chemistry, including in recent years the first synthesis of penicillin.

The Chemistry Department offers a four-year program leading to the degree of Bachelor of Science in Chemistry. It provides a general

education suitable for those who seek only the Bachelor's degree and for those who wish to go on to graduate study and a professional career in chemistry. The program includes a carefully planned sequence of required subjects in organic, inorganic, analytical, and physical chemistry with a choice of restricted electives in three advanced fields. There is additional free elective time and a liberal policy of substitution.

Civil Engineering

M.I.T.'s Department of Civil Engineering focuses its teaching and research in three principal areas—the applied earth sciences, involving applications of the mechanics of fluids and particles to problems in water resources and earth materials; structures and materials, involving the design of structures and the specification of the materials from which they are built; and civil engineering systems, involving the coupling of modern methods of computation to the design of large-scale engineering projects. In their four-year programs undergraduates in civil engineering may follow any one or a combination of these areas to a depth that includes advanced classroom work and research in partnership with faculty and graduate students.

All students in the four-year civil

engineering program leading to the S.B. degree begin with classes centered about the modern engineering sciences and applied mathematics. Liberal elective time in the third and fourth years makes it possible for every student to focus on areas which especially interest him, and these individual programs often include work in industrial management and the sciences as well as in other engineering departments.

Outstanding undergraduates may participate in the Department's Inter-American program, involving significant research carried out in conjunction with selected universities in Latin America.

Economics and Political Science

A long-standing interest at M.I.T. in industrial relations and industrial economics and a parallel involvement in the technical problems of military and foreign policy have developed into a wide-ranging interest in economics and political science. Taking strength from its unique position in a technical university, the Institute's Department of Economics and Social Science has made important contributions in research and in the nation's affairs.

The Department offers two four-year programs leading to the Bachelor's degree, one in Economics, Politics, and Engineering, the other in Economics, Politics, and Science.

The programs allow a student to divide his studies essentially equally between a field of science or engineering and economics or politics.

The objectives of the economics option are to develop the ability to analyze, both theoretically and quantitatively, economic problems of the firm, the industry, and the economy as a whole; to provide knowledge and understanding of modern economic and social institutions; and to promote skill in examining broad questions of social and economic policy. Graduates who do not go directly into business or government may continue with further study in either economics or their selected branch of science or engineering.

The politics option explores the nature of political behavior and the political process; examines the government's role in science and technology, both in America and abroad, and the role of technology in international relations; and studies techniques of policy formulation and decision-making on issues of public policy. There is no rigid curriculum, and individual programs of great variety may be worked out by students working with their faculty advisers. Graduates have the choice of building their careers on either or both parts of their programs, in science or engineering, in politics, or in areas in which scientific and political affairs come together.

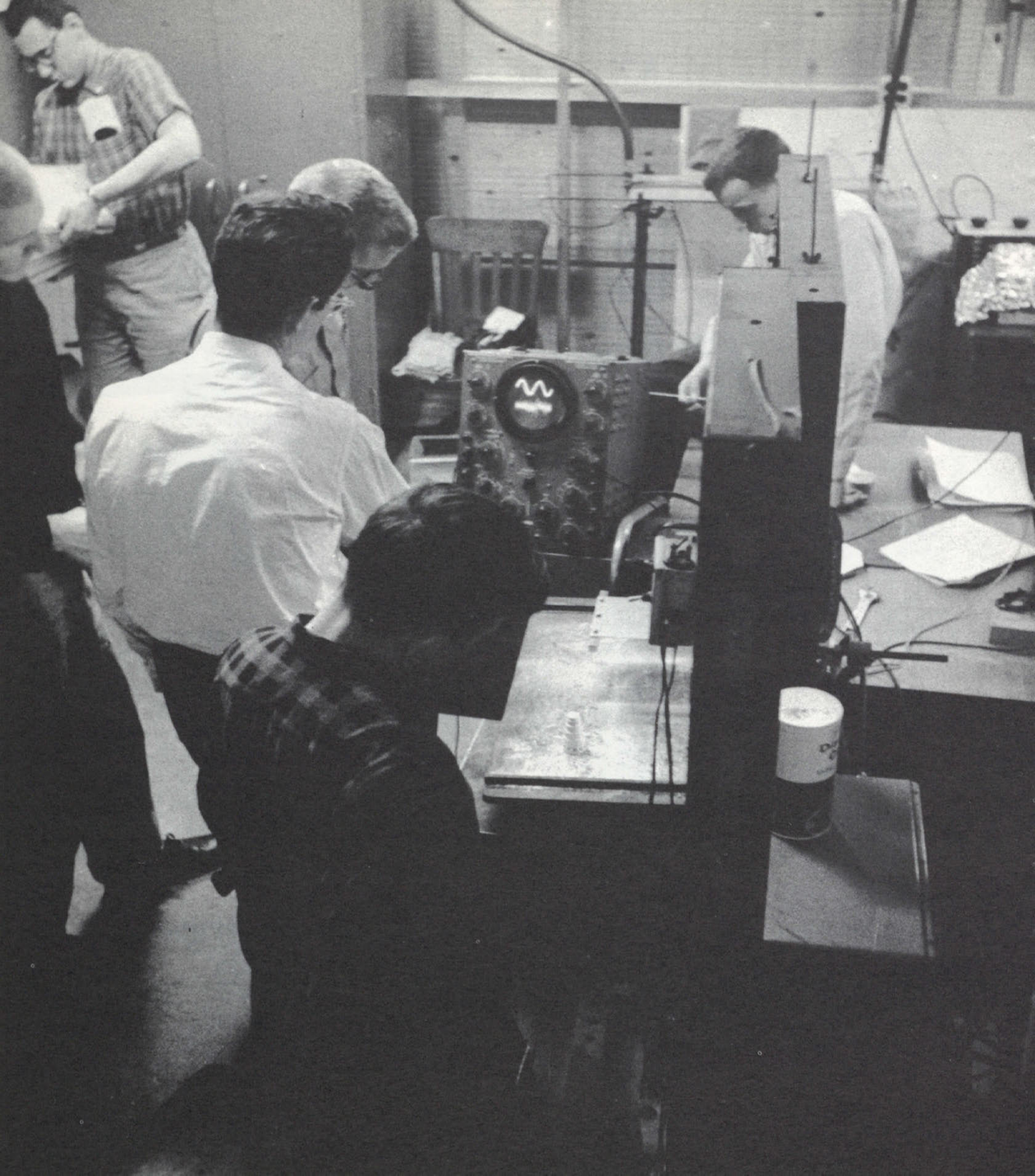
Electrical Engineering

From a modest start about a century ago, electrical engineering has become a key technology of great scope and variety. It is characterized by two main concerns: the processing, transmission, and control of energy and the processing and the transmission of information. Achievements in both fields have had a revolutionary impact on our civilization.

During World War II M.I.T. became a major center of electrical research in this country and indeed in the western world, and it has remained so since. Members of the faculty have pioneered in the development of radar, computers, servomechanisms, and the fundamental science of information theory. Work in progress today includes research in magnetohydrodynamics—the application of the interactions between electromagnetic fields and conducting fluids (e.g. a hot gas) to achieve electromechanical energy conversion—and in communications biophysics, applying the techniques and tools of communications engineering to study the electrical signals of the human nervous system.

The undergraduate programs offered by the Department of Electrical Engineering center on a core of classroom and laboratory work in circuit theory; electronic devices, circuits, and signals; field theory; energy processing; and materials. In the





core classroom courses, emphasis is placed on basic principles and methods of application. The laboratory work and elective subjects provide an opportunity to apply these principles to a broad range of specific electrical processes and equipment. A large part of the laboratory time is devoted to project activity, the major objective of which is to develop independent, creative ability, and individual study under staff guidance is encouraged. The Department has developed "take-home" laboratory kits which enable each student to experiment for himself at his home or dormitory.

The Department offers three four-year programs leading to the degree of Bachelor of Science in Electrical Engineering and two five-year programs leading to Bachelor's and Master's degrees: A four-year electrical engineering program; an electrical science program for selected students, leading to the Bachelor's degree in four years or to the Bachelor's and Master's degrees together in five years; and a cooperative program which includes thirty to sixty weeks of practical experience in industry, leading to the Bachelor's degree in four years or to both Master's and Bachelor's degrees in five.

Geology and Geophysics

The earth sciences are seeing an exciting expansion as new and power-

ful techniques enable scientists to probe ever deeper and more effectively into our environment of earth, sea, air, and space.

The Institute's Department of Geology and Geophysics offers a four-year program leading to the degree of Bachelor of Science in Earth Sciences and a five-year program for selected students which leads to the degree of Master of Science in Geology and Geophysics with the Bachelor's degree. Both programs are built around a small core of prescribed professional subjects, a large amount of work in prescribed fields within which each student has free selection of individual subjects, and a generous allocation of free electives. The programs provide a broad preparation for careers in geology, geochemistry, geophysics, oceanography, or meteorology. Undergraduate work in meteorology is offered by the Department of Meteorology, which gives only graduate degrees.

All these activities are centered in the new 20-story Green Building, M.I.T.'s only skyscraper, which provides a superb home for the interdepartmental Center for the Earth Sciences. In addition, the National Magnet Laboratory has magnets capable of continuous fields of up to 250,000 gauss which are invaluable for studies of the magnetism of the earth and of the sun.

Humanities and Engineering or Science

Besides offering work in the humanities to students majoring in architecture, engineering, science, or management as part of the Institute's regular programs in these fields, the Department of Humanities offers its own degree programs which allow students to devote equal time to a branch of science or engineering and to an area in the humanities. One part of each program is undergraduate work in one of the engineering or science departments; the other is a sequence of advanced studies in the humanities, concentrating in a particular area of the student's choice: literature and the arts, history, philosophy, or the history and philosophy of science. The work of the senior year includes a special Humanities Senior Seminar as well as the Bachelor's thesis. The program leads in four years to the degree of Bachelor of Science in Humanities and Engineering or in Humanities and Science.

This unusual program gives a student an excellent liberal education and a start on many careers: he can go on to graduate study in the humanities, or in business, law, public administration, education, theology (or medicine if he has chosen his scientific courses appropriately); he can take a fifth year to complete the work for a Bachelor's

degree in his professional subject and build a career in science or engineering; or he can start directly on a career in one of many occupations where the first call is for men and women of broad understanding.

Industrial Management

M.I.T.'s interest in industrial science and technology has been accompanied from the beginning by an interest in management. The successful engineer in industry almost inevitably moves into positions of executive responsibility, and the Institute has long recognized the need to prepare its graduates accordingly. At the same time management, although essentially an art and not a science, has leaned increasingly on the physical and social sciences. And management, now rapidly becoming a profession in its own right, needs the tools of the physical and social sciences and an understanding of modern technology.

M.I.T.'s four-year program leading to the degree of Bachelor of Science in Industrial Management combines study in a selected branch of science or engineering with work of an analytical nature in economics, behavioral science, accounting, finance, production management, and marketing. The program stresses the underlying relevance of the social sciences and also the applicability of mathematical techniques.

Students majoring in other fields at the Institute may take a Management Minor consisting of four core subjects and two optional classes in the Alfred P. Sloan School of Management.

Mathematics

Mathematics has always had a natural place at M.I.T., but it has become a subject of central importance as the need for mathematical analysis has grown in a wide range of fields, from the explanation of the properties of liquid helium in physics to the analysis of the nation's economy or the operations of a business. No longer is it true (if it was once) that the only careers open to a mathematician are in statistics or teaching.

M.I.T.'s Department of Mathematics is a large one, and it embraces both pure and applied mathematics. Each field gains strength from the other. The Department offers a four-year program leading to the degree of Bachelor of Science in Mathematics which allows each student great freedom in the choice of study. Whatever his ultimate objective—preparation for teaching, for participation in the research programs of an industrial or government-sponsored organization, or for a position in a business or in a modern high-speed computer center—the immediate aims of the program are to

provide an understanding of a substantial part of the existing body of mathematical knowledge and an ability to impart this knowledge to others. More important, the Department hopes to inspire in each student an interest in the discovery or invention of new mathematics or in the application of mathematics to new fields.

Mechanical Engineering

Mechanical engineering is a broadly based engineering discipline which is concerned with devices of all kinds for harnessing the forces of nature to the service of man. As with other engineering disciplines its progress depends on research, and the Department of Mechanical Engineering at M.I.T. has made outstanding contributions in research in many fields, including the properties of materials, the mechanics of elastic and plastic solids and of electrically charged and electrically neutral fluids, the Newtonian dynamics of moving and rotating systems, the use of computers as aids in design, and the dynamics of systems involving men and machines. Some of these fields are also of interest to mathematicians and scientists, but the starting point is a concern with devices for human use, which is the business of engineering.

The Department of Mechanical Engineering aims in its undergraduate programs to provide a firm base

in mechanics, dynamics, fluid mechanics, thermodynamics, engineering materials, and electrical theory and at the same time to introduce students to the art of engineering—the exploitation of scientific knowledge in the design of useful and efficient devices. An Engineering Projects Laboratory gives each undergraduate the opportunity to work as an intern with faculty and graduate students doing research on advanced engineering projects.

The Department offers five programs leading to the degree of Bachelor of Science in Mechanical Engineering: a four-year engineering program; a four-year engineering science program; an “advanced undergraduate program” which allows selected students to follow special curricula planned on an individual basis, with many graduate subjects included; a five-year “honors course” for selected students, leading to the award of the Master’s with the Bachelor’s degree; and a four-year cooperative program (for selected students) which includes six months of work in industry.

Metallurgy and Materials Science

An important technology since the beginning of civilization, metallurgy has become central to advances requiring new properties in metals and other materials. Examples are the alloys for jet engine blades, the

ceramics for rocket nose cones, and the extremely pure single crystals of germanium or silicon used in transistors. In many fields of engineering today, it is the industry or the country that develops the right material at the right time that makes the breakthrough. M.I.T. has always been a center for research and teaching on the structure and properties of metals and ceramics, and new developments are now extending this work to a wide variety of materials. Recognizing the crucial importance of materials, M.I.T. is building a new Center for Materials Science and Engineering which will open in 1965.

The Department of Metallurgy offers two four-year programs leading to the degree of Bachelor of Science—one in metallurgy and the other in materials science.

The program in metallurgy focuses on the relations between structure and properties in metals and the basic thermodynamics, unit processes, and mechanical operations which underlie their production. A large amount of elective time allows each student to develop his interest in a particular area.

The program in materials science, while including many of the same basic subjects in metallurgy, emphasizes the application of physics and chemistry to phenomena of the solid state, thus providing a founda-

tion for scientific understanding of the structure and properties of materials in general. There are also specific studies of metals, ceramics, semiconductors, glasses, and plastics.

Naval Architecture and Marine Engineering

M.I.T. is one of four institutions in the United States offering degrees in naval architecture. Its faculty and alumni have helped design a significant portion of ships flying the American flag, from America's Cup defenders to nuclear submarines; since 1901, most of the men responsible for the design and construction of the ships of the United States Navy have held degrees from M.I.T. The Institute's Department of Naval Architecture and Marine Engineering regards the whole realm of the oceans as its province, and the Department is interested in devices of all sorts which exploit this "inner space," from machines to harvest the resources of the ocean floor to submarines and high-speed hydrofoil craft. The Department's research facilities, which are used by undergraduates in their thesis and laboratory work and in freshman seminars, include a ship model towing tank for studies of the hydrodynamics of ships' hulls, a propeller tunnel for controlled underwater tests of model ships' propellers under simulated conditions, and a ship

structures laboratory for research in structural arrangements for ships.

The Department offers two programs for undergraduates—a four-year program in naval architecture and marine engineering which leads to the Bachelor's degree and a five-year program in shipping and shipbuilding management which leads to both Master's and Bachelor's degrees. Both programs stress fundamentals and allow considerable elective time. The first is customarily followed by those interested in the technical aspects of the marine industry—naval architects, marine engineers, and those with more specialized interests. The second, which builds on a core of technical subjects, is intended for students primarily interested in the business and management phases of the industry.

Physics

The extraordinary progress of physics in the twentieth century and its basic importance in so many related fields make it a vital subject at M.I.T. The noted physicist Karl T. Compton, who came to M.I.T. as President in 1930, devoted special attention to the Institute's teaching and research in physics, and the Physics Department today is among the foremost in the country. Its facilities for high-energy and nuclear research include a cyclotron, a linear

accelerator, several Van de Graaff accelerators, and the 6-Bev Cambridge Electron Accelerator (operated jointly by M.I.T. and Harvard). In addition to research in progress using these machines, the Department is active in research on cosmic rays, astrophysics, plasmas, and the properties of matter at very low temperatures and in the solid state. It makes effective use of the National Magnet Laboratory and of the nuclear reactor and neutron physics laboratory of the Department of Nuclear Engineering.

The Department offers a four-year program leading to the degree of Bachelor of Science in Physics. The program is a flexible one, affording each student an opportunity to acquire competence in the fundamentals of both experimental and theoretical physics. The work is of such breadth and depth that each graduate is well equipped either to build a career in the field of applied physics in industry or to enter graduate study in preparation for more advanced professional work.

Interdisciplinary Programs

Any description of M.I.T.'s educational programs tends to be misleading because it concentrates on organization, not content. It is important to realize that M.I.T. has a single campus and a single faculty. Teachers and their students tend to

group themselves according to their interest, attaching themselves to departments primarily for administrative convenience. For example, members of the Physics, Biology, and Electrical Engineering Departments work together in the Research Laboratory of Electronics; there are similar groups in operations research, automatic control, computation, molecular engineering, history of science, and others; and new interdisciplinary centers are now planned for the earth sciences, life sciences, space science and technology, communications science, and materials science and engineering. In a very real sense, every student at M.I.T. shares a dialogue with his fellows which knows no artificial walls.

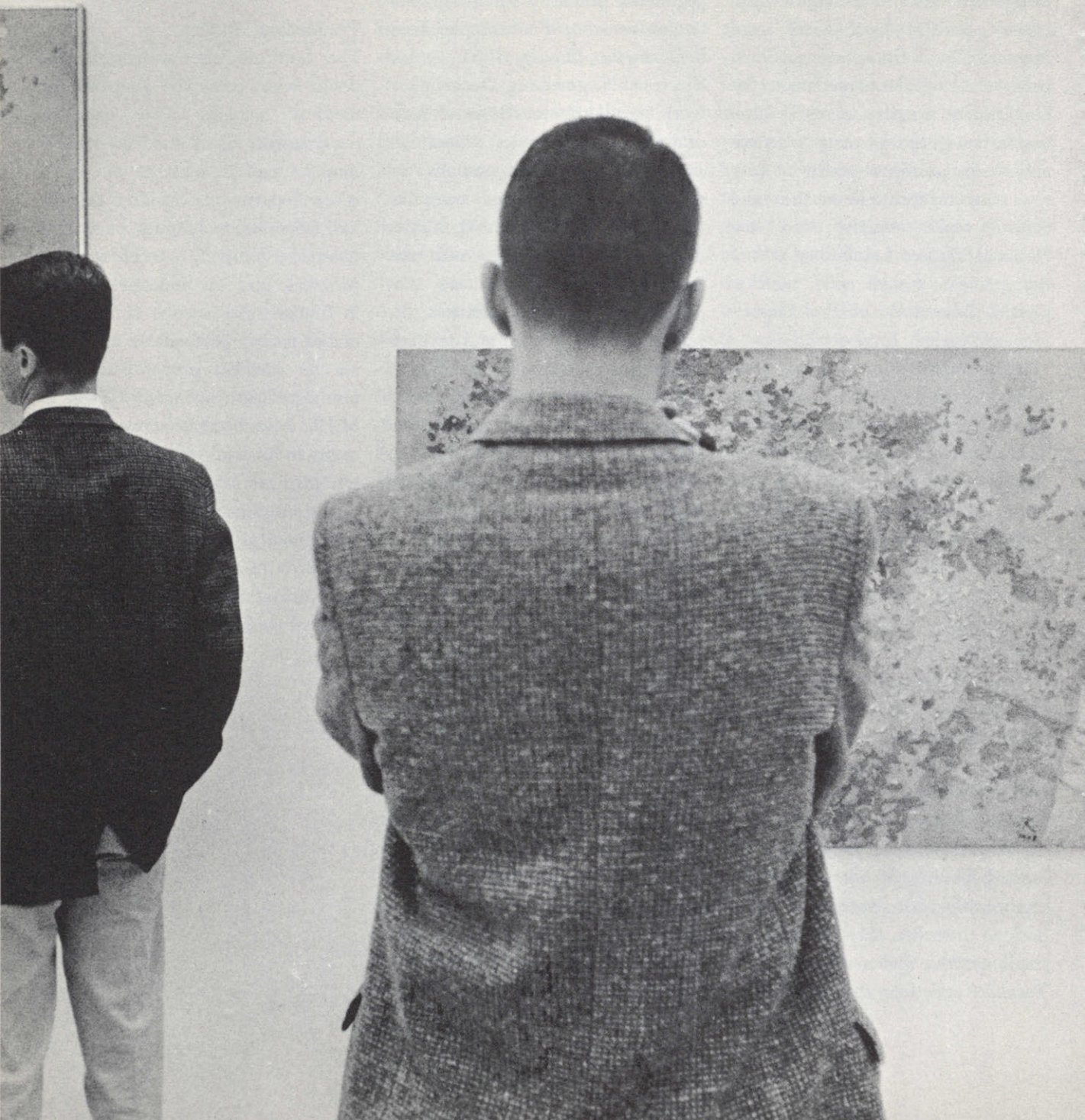
Pre-Legal Studies

A number of M.I.T. graduates go on to law school each year, and the Institute welcomes students interested in science who wish to prepare for legal careers. M.I.T.'s academic programs, based on fundamentals and including in every case serious study of the humanities, provide the kind of undergraduate preparation recommended by the leading law schools. There is no specific pre-legal program; each student chooses one of the regular majors which suits his particular interest. Professor Stanley M. Jacks of the Sloan School

of Management acts as adviser to pre-law students.

Pre-Medical Studies

The Institute also welcomes students who come to prepare for medical schools. The entrance requirements of all medical schools may be met in most of the Institute's departments. Modern science and scientific techniques have contributed extensively to recent medical progress, and an education strong in fundamental science and mathematics is now particularly appropriate for medical preparation. It is also significant that many faculty at M.I.T. have become active collaborators in medical research with Boston medical schools and hospitals, thus strengthening the Institute's ties with medical practice. Dr. Harriet L. Hardy of the Institute's Medical Department acts as adviser to pre-medical students.







Graduate Studies

Graduate programs are offered at M.I.T. in all the undergraduate fields as well as in seven other areas of specialized content. These areas are city and regional planning, linguistics, meteorology, nuclear engineering, nutrition and food science, oceanography, philosophy, and psychology.

Undergraduate preparation for advanced work in these fields is given by many M.I.T. departments, and faculty advisers help undergraduate students make appropriate plans.

City and Regional Planning

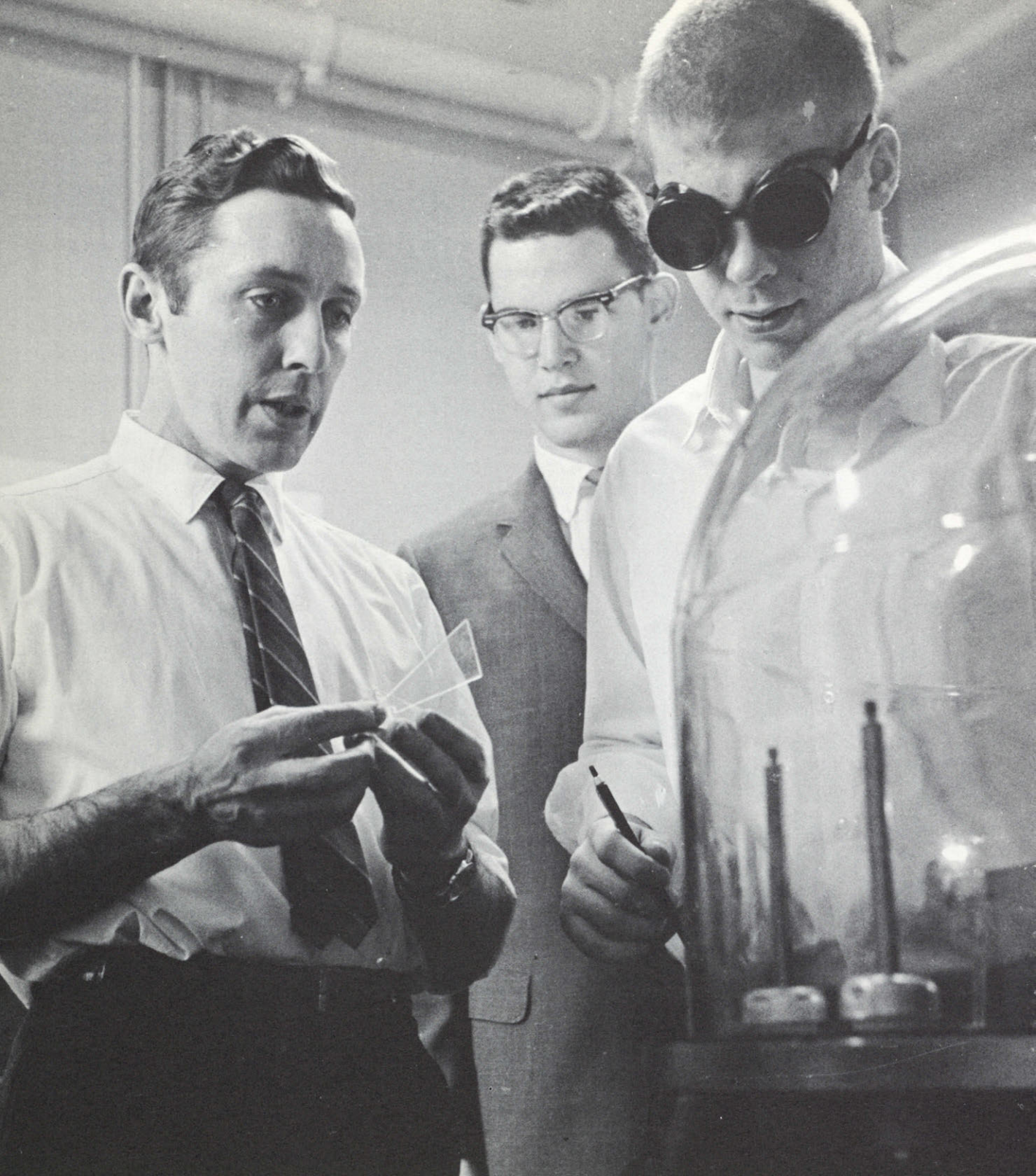
The Institute's Department of City and Regional Planning is concerned with the study of our large-scale physical environment and its interaction with our society. The Department's curriculum aims at training practitioners or staff men in the fields of city and regional planning, but it also offers opportunities for students interested in teaching and research. Suitable preparation for graduate study in the Department is offered by the undergraduate programs in architecture; civil engineering; economics, politics, and engineering; humanities and engineering; and industrial management. Prospective students are advised to plan their programs in consultation with the Department, preferably during their second year.

Linguistics

Besides offering elective courses at the undergraduate level in French, German, and Russian, the Institute's Department of Modern Languages offers a doctoral program in linguistics. The program aims to give a comprehensive knowledge of modern linguistics. In addition to linguistics proper, the Department encourages interdisciplinary programs in relevant areas of psychology, communication sciences, mathematics, philosophy, and other fields. To receive the degree a student must be competent in two languages in addition to English.

Meteorology

The Department of Meteorology is concerned with the quantitative application of the laws of physics to the study of the atmosphere. It emphasizes the theoretical approach, supplemented by empirical and experimental methods. Facilities include several radar systems and a comprehensive file of radar data; extensive files of weather data for most areas of the world, much of it in form for use on modern computing machines; desk computers for all students; and I.B.M. card equipment. Excellent preparation for graduate work in meteorology is offered by the undergraduate programs of the Department of Geology and Geophysics, but suitable prepa-



ration is also provided by other departments, particularly physics and mathematics.

Nuclear Engineering

M.I.T.'s Department of Nuclear Engineering offers a broad program of graduate instruction and research in fission reactor technology and nuclear applications of plasma physics. The Department's facilities include a 2000-kw. reactor fueled with U-235 and cooled and moderated by heavy water, a well-equipped nuclear instrumentation laboratory, a pulsed neutron source, and two subcritical natural-uranium reactors. A student may obtain an excellent preparation for graduate study in the Department by taking undergraduate programs in physics, chemistry, or any of the engineering departments.

Nutrition and Food Science

Besides offering introductory elective work at the undergraduate level, M.I.T.'s Department of Nutrition and Food Science offers a wide choice of graduate study and research with opportunities for specialization in clinical and public health nutrition, animal nutrition, physiological chemistry, food toxicology, food chemistry, flavor chemistry, food microbiology, food processing, food engineering, and biochemical engineering. The undergraduate programs in biology,

chemistry, and chemical engineering offer good preparation for graduate study in the Department.

Oceanography

The oceans, the atmosphere, and the solid earth are so intimately related that they must often be studied together as parts of a single system, and advanced work in oceanography is therefore a natural part of the work of the Departments of Geology and Geophysics and of Meteorology. This includes studies of the chemistry, physics, and circulation of the oceans as well as of their influence on our environment. M.I.T.'s work in oceanography is conducted in cooperation with the Woods Hole Oceanographic Institution, whose research laboratories and vessels are frequently made available to graduate students. The undergraduate program in geology and geophysics is the usual preparation for advanced work in oceanography, but a major in one of the many other fields of science through which oceanographers study the oceans and life in them is entirely appropriate.

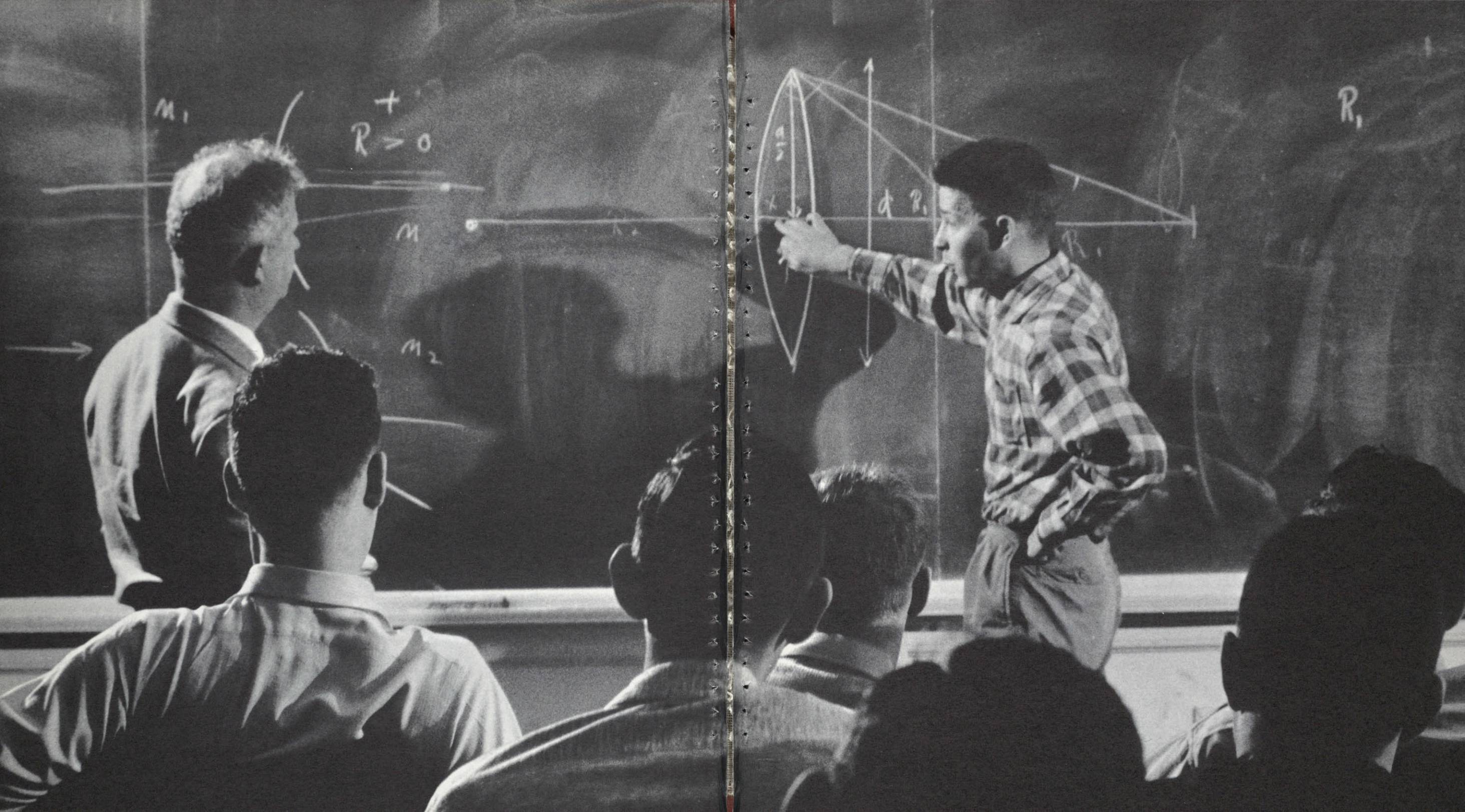
Philosophy

Graduate study in philosophy has grown naturally in the Department of Humanities at M.I.T. from two sources—the undergraduate teaching in philosophy which is part of the humanities program for all

M.I.T. undergraduates and the natural interest throughout the Institute community in the philosophical bases of the sciences. Thus the program of graduate study leading to the doctor's degree emphasizes the philosophy of science and contemporary philosophical analysis without by-passing the central areas of philosophy (epistemology, moral philosophy, philosophy of language, and logic) or fundamental historical developments. An ideal undergraduate preparation would combine work in science (mathematics, physics, and psychology tend to be the most relevant) with broad study in philosophy and the humanities.

Psychology

The Psychology Department offers a doctoral program in addition to elective undergraduate work. The graduate work provides concentration in any one of three areas: physiological psychology, general experimental psychology, and social-developmental psychology. A student may prepare for the program by taking undergraduate work in any of the basic natural sciences, mathematics, or the social sciences.





The Freshman Year

The Core Curriculum

All the undergraduate programs at M.I.T. depend on a basic knowledge of mathematics and science. In particular, all require a knowledge of calculus and of the fundamentals of physics and chemistry. Every student, therefore, takes a core of work in these subjects during the first two years and in addition takes an introductory program in the humanities. The only major with different requirements is architecture, which does not require chemistry and requires only one year of calculus instead of the usual two.

The introductory programs in calculus and physics each run through the sophomore year. The physics subjects assume one year of high school physics, and the calculus assumes that each student has taken mathematics through trigonometry and is ready to proceed without reviewing this material. The two programs get off to a fast start, and calculus is used freely in the physics program after the first half of the first term.

The program in calculus, which includes topics in probability, statistics, and linear algebra, concludes with differential equations in the second term of the sophomore year. The program in physics continues through the sophomore year for some students and through the first term of the junior year for others.

In the first year the subject is mechanics—the principles of conservation of mass-energy, momentum, energy, and angular momentum; oscillations and planetary motion; the properties of matter including elementary thermodynamics and the kinetic theory of gases, solids, and liquids; and the properties of waves in matter. In the second year there is a choice. In one option the student takes electricity and magnetism in the first term and optics and elementary atomic physics in the second; in the other option he devotes the whole of the sophomore year to electromagnetism and the electro-magnetic theory of light and takes an introduction to quantum physics in the first term of the junior year. Prospective physics majors are expected to take the latter option, as are students intending to major in a number of other science-based fields.

Thus the program in physics takes at least two years to cover intensively topics which most introductory college programs in physics cover in one. Whereas many freshmen who have taken college-level courses in high school come with credit in chemistry or calculus, it is relatively rare for a freshman to be given advanced credit in physics.

The introductory program in chemistry runs through the two terms of the freshman year. It covers the mole concept; an introduction to

the structure of atoms, molecules, ions, and solids; the principles of chemical equilibrium; the rate of attainment of equilibrium; and the application of these concepts and principles to real chemical systems. The depth of the treatment of these topics is based on the assumption that the students have had one year of high school chemistry. Particular emphasis is placed on chemical equilibrium as the coordinating theme of both terms of the program.

The introductory program in the humanities continues through the sophomore year. In the freshman year it is based upon an intensive reading of selected writings in history, literature, and philosophy from classical, medieval, and early modern times. Some background reading is required but most of the reading is of original works. Examples are the tragedies of Aeschylus, Thucydides' *History of the Peloponnesian War*, the political writings of Plato and Aristotle, the *Confessions* of St. Augustine, Shakespeare's *King Lear*, and Pascal's *Pensées*. These are works which have shaped the thinking of Western man on many of the questions that most concern him—the meaning of life, the nature of one's obligations to society, the limits of reason—and they serve as an excellent introduction to the different areas of the humanities the student may elect

to study during his upperclass years.

In the sophomore year there are two different kinds of options in the humanities. One is a choice between "The Nature of Literary Art" and "Philosophical Classics," and the second is between a history subject on the twentieth century and a social science subject entitled "The Modern World." Each set of options is intended to introduce the student to the particular perspectives and languages of two disciplines outside the fields of science and engineering and to help him choose an area for further study in the School of Humanities and Social Sciences.

While the emphasis in the humanities program is on ideas, there are frequent writing assignments and each student is encouraged to develop his writing ability. Students who want further training in English composition may take it as an elective.

For students who have had sufficient preparation in French (usually three years), the humanities program is also offered in French; Plato, for example, is read in French, and the class discussion is in French.

Electives

Besides the core in chemistry, calculus, physics, and the humanities, every student chooses two electives in his freshman year, one in each

semester. Typically, more than eighty subjects are chosen by one or more freshmen for this purpose. Some are offered specifically as freshman electives, as, for example, "English Composition," "Introduction to Automatic Computation," and "Perspectives in Life Science." Others are the regular classes offered by the Department of Modern Languages in French, German, and Russian. Still others are classes given primarily for upperclassmen, chiefly in the humanities, for which the instructor in charge thinks the freshman is qualified.

Seminars

The faculty has also instituted elective seminars in which a small group of freshmen work with a professor on an unresolved topic in his professional field. Enrollment is limited so that the association between professor and student can be closer and less formal than is possible in the classroom. Here is the description of a seminar in microbiology:

Space travel by man for extended periods of time in small "capsules" has created special problems, the solution of which is essential for success. The group will consider the role of microbiology in respect to food supply, oxygen regeneration, and waste disposal. There will be discussions, literature surveys, and laboratory studies.

Here is another from the Sloan School of Management:

Purposeful change in human institutions occurs when action is taken to alter an objective or method of the group. New relationships are often required to effect change, and the changes wrought alter relationships within the group. Many people are not content to observe and report. They want to provoke action. This usually means inducing people to do new or different things. Seminar students will study and discuss the process of inducing change and each will choose an example for study in depth leading to a term paper.

R.O.T.C.

The Air Force, Army, and Navy offer R.O.T.C. courses at M.I.T., and freshmen may enroll in them as part of the freshman elective program. Upon graduation, those who have successfully completed four years of R.O.T.C. classroom work and one period of summer training are commissioned as officers in the Reserves of their respective services. Opportunities for commissioning in the Regular forces are also available. The Air Force and Navy R.O.T.C. programs at M.I.T. are unique; the Navy's is the only one in the nation designed to produce solely "engineering duty only" officers, and the Air Force program is planned especially for science and engineering students.

Physical Education

In addition to the academic work of the first two years, every male stu-

dent is required to compile not less than 8 points of athletic credit. He may participate in a physical education class (2 points each half-term) or become a member of one of the intercollegiate freshman or varsity teams (2 points for fall or spring sports, 4 points for winter sports). Every student when he enters must complete a medical examination, a swimming test, and a physical fitness test, and those who do not meet certain minimum standards are recommended for swimming or development classes. The excellent athletic facilities are also used extensively by students for their own recreation.

How are the Freshman Courses Taught?

The freshman classes in calculus, chemistry, and physics, like introductory classes at many colleges, are taught partly by lectures and partly by classroom recitations. The 900 members of the freshman class are divided into groups of about 25 each in each freshman subject, and these groups meet separately for recitations. Here an instructor takes the small group through problems which illustrate the principles taught in the lectures, and the students have a chance to ask questions about points they do not understand. In calculus there are two lectures each week and one recitation; in chemistry and physics there are two lec-



tures and two recitations. In chemistry and physics there is also laboratory work; this amounts to three hours once every three weeks in physics and three hours in two weeks out of three in chemistry.

In the humanities, on the other hand, all the work is done in the separate sections, which meet three times a week. There is no set pattern of teaching in the electives.

The typical student is likely to spend more time in studying and preparation than he spends in class or in the laboratory. The faculty believes that a student should receive due credit for the outside work he does in preparation for his classes, and each subject at M.I.T. is rated for the amount of study and preparation required as well as for the number of hours to be spent in class and in the laboratory. In this reckoning the freshman calculus course is estimated to require six hours of preparation a week, the chemistry five hours, the physics six hours, the humanities five hours, and the elective up to five, depending on the particular class. This makes a total of about twenty-five hours of study and preparation each week, compared with a total of about twenty hours in the classroom and laboratory. (Experience suggests that the amount of time allocated for outside preparation is somewhat conservative; the *average* student may

require more time than is indicated.)

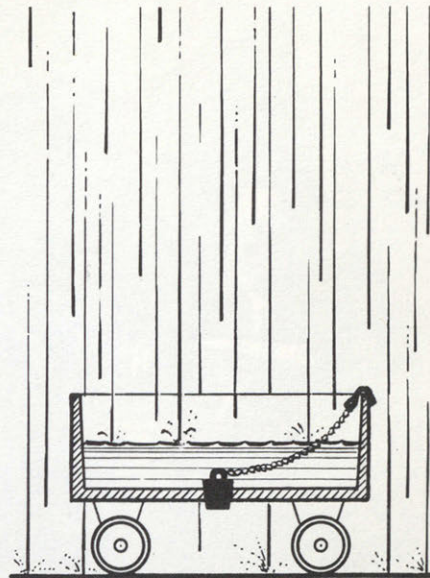
A study load of 45 units, counted in this way, is considered a regular academic program for a semester. Eight semesters of study at this rate, or about 360 units, are required for the Bachelor's degree.

A student's progress in the freshman classes is measured by periodic quizzes and by a three-hour examination at the end of each semester. In calculus, chemistry, and physics the quizzes are given in rotation, one coming each week. In the humanities the quizzes are given at the discretion of the individual instructor. In the next column is a typical question from a quiz in physics.

The following is a question from an end-of-term examination in the humanities:

"Poetry is something more philosophic and of graver import than history, since its statements are of the nature rather of universals, whereas those of history are singulars." (Aristotle, *Poetics*, 9). Discuss with reference to two of the authors you have read, one historian and one poet.

All ranks of the faculty help to teach the freshman classes, and a freshman's teachers will include a number of the senior faculty at M.I.T. In calculus, chemistry, and physics the faculty are assisted by graduate students, many of whom will later become members of the faculty themselves. A number of prizes are awarded annually to



An open car of mass M grams moves without friction on a horizontal track with a constant velocity V . At time $t=0$ it starts to rain, and the car begins to fill with water at a steady rate of b grams per second. Assume that the rain falls vertically.

(a) What time-average force must be applied to the car in order to maintain its constant velocity V ? (Assume many raindrops fall on the car during your averaging time.)

(b) At time $t=t_1$ the force is removed but the steady rain continues. Find an expression for the car's velocity as a function of time.

(c) At time $t=t_2$ the rain stops and the car's velocity is noted to be V_2 . A drain-hole in the bottom of the car is now opened. What is the velocity of the car when the water is completely drained? Explain your answer.



graduate students for particularly effective teaching.

Faculty Advisers

Every freshman has a faculty adviser who welcomes him to M.I.T., helps him to choose his first-year program, and watches over his progress. Each adviser has only half a section—roughly twelve to fourteen students—so they can get to know each other well.

The Institute tries to assign each freshman to an adviser in the major field in which he is interested, but sometimes this is not possible. In the upperclass years, however, after he chooses his major, each student is assigned to an adviser in his department. Later, for his senior thesis he has a special adviser in the field of his thesis.

At every stage there is a member of the faculty to whom the student can turn as counselor and friend. Many alumni remember M.I.T. best in terms of the faculty members who were their advisers.

Advanced Placement and Advanced Standing

Most freshmen enter M.I.T. without degree credit and take the subjects which have been described. However, an increasing number (it has reached about one third of the class) now come with credit towards the M.I.T. degree.

They acquire it by taking the College Board's Advanced Placement Examinations, by taking the Institute's own Advanced Standing Examinations before registration, or by taking college courses as part-time students while attending school. A student who comes with credit for a subject is free to take the next subject in sequence or to substitute another.

Such advanced credit is most commonly given in calculus, but many freshmen get credit in chemistry. The faculty require that all freshmen take the introductory subject in the humanities, which is rather different from most courses in secondary school, but many students are given credit for the freshman electives for Advanced Placement work they have done in history or English. Elective credit, usually without reference to class level, is also given for creditable Advanced Placement work in physics, biology, German, or French.

Credit given at entrance is not necessarily limited to the freshman year. A few freshmen each year get credit for classes usually taken by sophomores.

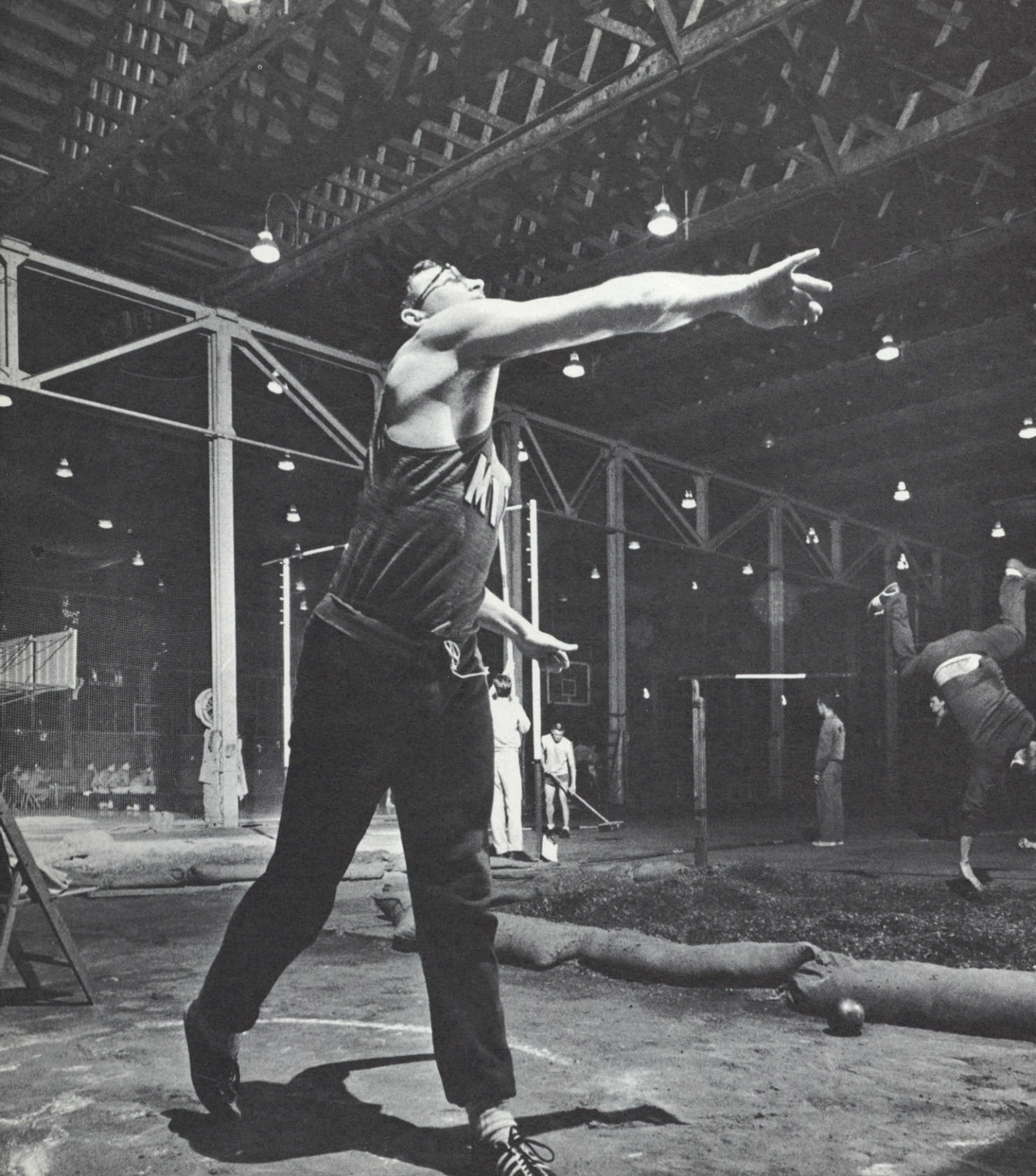
Many students get further credit after entrance by taking the Advanced Standing Examinations which M.I.T. offers throughout the undergraduate years. Like the Advanced Standing Examinations

which may be taken before entrance, they are the equivalent of regular final examinations. They allow students of outstanding ability to obtain credit for work which they have done on their own, out of class. Candidates for the examinations must have the permission of the faculty and they must not have registered for the subject or attended classes in it at M.I.T.

Students may also depart from the regular schedule by registering for more than the usual five subjects in a given term. By this means, again, they can accelerate, or take courses which they could not take otherwise. The fee for tuition is the same whether a student takes four, five, or more courses a term.

Considering the rigor of the normal five-subject program, it is noteworthy that many students find the time to study for the Advanced Standing Examinations or to take an extra subject. In a recent freshman class 105 were registered for more than five subjects and a similar number started the sophomore year with credit for upperclass subjects which they had obtained by Advanced Standing Examinations.

Detailed information about advanced placement at M.I.T. is given in a leaflet, "Advanced Placement and Degree Credit at Entrance," available from the Director of Advanced Placement at M.I.T.







Campus Life

M.I.T.'s policy is to have as few rules and regulations as are consistent with its academic purposes. The students have great freedom, and with it a commensurate responsibility for selecting their academic programs and for running their own affairs. Classroom attendance is naturally expected, for example, but the roll is not taken.

The Living Groups

Almost one-half of the undergraduates live in student residences on the campus, about one-third are members of fraternities, and the remainder live at home or in apartments near the campus.

The students in the undergraduate residences and those in the fraternities are each staunch defenders of their ways of life, and both groups invite the incoming freshmen to join them. They are vigorous competitors in academic matters, in athletics, and in other campus activities.

There are six undergraduate residences on campus. They are Burton House, Baker House, the combined Alumni Houses known as "East Campus," Senior House, and Bexley Hall, for men; and McCormick Hall, for women. All have their own student government. Student committees take the responsibility for planning social activities, fielding teams in the intramural competi-

tions, and making recommendations to the faculty and administration on house maintenance, room assignments, parking spaces, and the like. The houses have their own newspapers, their own musical groups, their own social committees, and their own program committees responsible for planning meetings with distinguished visitors on topics of general interest.

Notwithstanding the name of the Senior House, all the houses are open to members of all classes. The houses welcome freshmen as full members of the community; no distinction is made between freshmen and upperclassmen, and there is no hazing. Each house has its own character, and a freshman may indicate which he would prefer.

Burton House, Baker House, and McCormick Hall each have their own dining hall. Residents of East Campus and Senior House share a dining hall in the Walker Memorial, a student center which also accommodates many of the campus activities. Students in Bexley Hall, which is smaller than the other houses, use the dining hall in the Graduate House—if they wish.

All the undergraduate houses (and a number of the fraternities) have resident faculty or instructors who do not participate in the house government but reside in the houses as counselors and friends. In Burton

House, Baker House, and Senior House the ranking faculty member is a married professor with the title of "Master." He is assisted by an unmarried member of the faculty called the "Senior Tutor" and a number of instructors and selected graduate students called "Tutors." As their titles indicate, these teachers are ready and willing to give academic help, but their main function is simply to participate in the life of the house, sharing their experience and wisdom. They serve as an important bridge between the students and the faculty at large.

Freshmen interested in the fraternities are invited to come a few days before the beginning of the fall term for Rush Week. During this time the twenty-eight fraternities hold open house to allow the freshmen and the houses to get to know each other. "Pledge training" follows for those who "pledge" a house. There is no hazing; the emphasis is on programs which will develop the freshman's sense of membership in his house and in the Institute. Several houses have adopted the idea of a "Help Week" during which the pledges take part in a community service project, such as painting a settlement house or collecting for the March of Dimes.

Each of the fraternities is governed by its own house officers,

and the Institute-wide Interfraternity Conference, consisting of representatives from each of the houses, acts as a coordinating body for the fraternities as a group. Subcommittees of the I.F.C. handle such matters as cooperative buying of house supplies, planning the annual I.F.C. Week End, scheduling open house parties, and organizing Rush Week. Within the individual houses the members have complete control of finances and other internal affairs. Committees work on planning social functions, preparing menus, house maintenance, alumni relations, and finances. The system is structured so that many people can share in the experience of planning and executing programs fairly and expeditiously in the interests of a group.

The fraternities watch their budgets and are careful to keep their costs low. They are also watchful of the academic record of their members. A number regularly report academic averages which are above the average of all Institute students.

Besides the living groups already mentioned, there is also the M.I.T. Student House, organized by a group of alumni to provide attractive, low-cost accommodation for about 30 students. The students operate the house themselves and do almost all the chores except the cooking, thus reducing the usual cost of

board and room by almost \$400 a year. Inquiries about membership should be addressed directly to the President of the House at 111 Bay State Road, Boston (02115).

The Institute Committee

At the top of the pyramid of student committees which manage and coordinate the various activities on the campus is the Institute Committee, composed of fifteen voting members. It debates and approves projects which concern the students at large. Its Judicial Committee handles disciplinary cases involving students or student activities; its Finance Board controls the budgets and expenditures of student organizations, allocating the funds provided by the Institute for student activities (\$58,000 last year); and other subcommittees are responsible for many of the chief events on the campus during the academic year.

The Chairman of the Institute Committee is the President of the Undergraduate Association, to which all undergraduates automatically belong. He is elected each year in March by the entire student body, and his position is an important and busy one. The Institute allows him a free room on campus and he receives a grant of \$500 towards his expenses from a fund given by Dr. Vannevar Bush, Honorary Chairman of the M.I.T. Corporation.

Athletics

Athletics are a prominent part of student life at M.I.T. During the freshman year all men are introduced to athletic activities with an emphasis on those sports which may be continued throughout life. Intercollegiate athletics attract in excess of eight hundred students each year, while a large intramural program organized about the living groups annually provides recreation for some 2,000 participants. A sizable number of students prefer a casual workout at the swimming pool, the squash courts, or the ice skating rink. Regardless of their choice, all students at the Institute enjoy recreational or competitive sports.

The athletic facilities include the Alumni Pool, with adjoining squash courts; the Du Pont Athletic Center for squash, wrestling, fencing, judo, and gymnastics; the Rockwell Cage, enclosing an acre for indoor meets and work-outs; and the Briggs Field House, with lockers and showers to serve the Institute's playing fields. Adjoining the Field House is an outdoor ice rink maintained for ice skating and hockey from November to March. M.I.T.'s Sailing Pavilion, with a fleet of sixty sailboats on the Charles River Basin, provides unique recreational opportunities, and the Boat House is the center of activity for 200 students in eight-oared crews

which compete favorably with the best in the nation. The playing fields are on the door-step of students living in Burton or Baker Houses, and all the athletic facilities are an easy walk from the rest of the campus.

M.I.T. fields intercollegiate teams in baseball, basketball, crew, cross country, fencing, golf, hockey, lacrosse, pistol, rifle, sailing, skiing, soccer, squash, swimming, tennis, track, and wrestling. Supported by fine coaching, the teams have done well in recent years. Here is a summary of the 1962-63 season:

It was a season of inches for the M.I.T. heavyweight crew. In spite of losses to Harvard in the Compton Cup (9:36.3 to 9:36.4) and Wisconsin in the Cochrane Cup (identical times, decision awarded to Wisconsin), the heavyweights ended the season on a successful note by placing an impressive third behind Cornell and Navy at the National Rowing Championships.

The lightweights' record was even better: they rowed undefeated throughout the entire season, garnering the Biglin and Geiger Cups, until the Eastern Association of Rowing Colleges Regatta at Worcester; here M.I.T. was runner-up, less than a full second behind a Cornell eight that Tech had defeated earlier in the season.

The indoor and outdoor track teams brought M.I.T. their greatest season in track in recent years, including team honors for the first time in the Annual Eastern Intercollegiate Athletic Association Track and Field Championships.

The 1963 rifle team was undefeated in intercollegiate competition and shot their way to their second consecutive New England intercollegiate rifle team championship.

In 1963, the M.I.T. soccer team had their seventh straight winning season. Highlighting the soccer season were a 3-2 win over Harvard and a 1-0 victory over Bridgeport University, perennial New England soccer champions.

For the second year in a row, the wrestlers placed second in the New England championships; of fourteen contests they won ten and tied one.

Basketball continued to be the top attraction on the winter athletic program; the varsity squad won fourteen while losing only eight.

Tennis again was the most consistent winner during the spring season in 1963. Winning eleven of sixteen, the 1963 team topped the previous year's record of 11-5 plus one tie.

Winning the Geiger Trophy was the highlight of the spring sailing season.

Besides the varsity teams, nearly 500 teams from the various living groups compete in seventeen intramural sports; there are over 1,250 contests a year. To encourage wide participation, varsity athletes are excluded from intramurals during the season of their varsity sport. Trophies are given in each sport and an All-Sports Trophy goes to the house with the best over-all record.

Music

Music is also a prominent activity at M.I.T. The classes in music offered as part of the humanities program are a contributing factor. So is the Kresge Auditorium, with its remarkable acoustics and its fine Holtkamp organ. Another stimulus comes from the M.I.T. Music Li-

brary, with its large collection of printed and recorded music, its high fidelity listening rooms, and its daily record concerts.

Kresge Auditorium is the scene of numerous concerts during the year, some given by visitors like the Juilliard Quartet, others by musical groups on campus. Among these are the Choral Society, the Glee Club, the Symphony Orchestra, the Concert Band, and the Brass Choir.

The Choral Society has had a short but brilliant history. Assisted by professional soloists, it sings oratorios and other major works. Recent performances have included Bach's *B Minor Mass* and the first performance in the United States of Buchtger's *Christmas Oratorio*. It has made a number of trips to Europe. "The members are obviously devoted to their music-making," said an English newspaper in 1962. "They perform a repertoire which does not stop short at standard works of immediate public appeal but ranges across the centuries, with no inhibitions either about attempting difficult contemporary compositions."

The Glee Club, the second oldest in the nation, relies entirely on student singers. Its range extends from Gregorian chants, madrigals, and spirituals to oratorios. It holds joint concerts with choral groups from the women's colleges in New England such as Smith and Vassar.





The M.I.T. Symphony comprises a complete roster of symphonic string and wind instruments. Its repertoire consists of the standard concert literature as well as seldom-heard old and new compositions. The orchestra frequently combines with musical groups of other New England colleges, particularly Mount Holyoke and Smith Colleges.

The Concert Band has won a reputation for its performance of original compositions for "symphonic" band. It has played several times in Boston Esplanade Concerts and was invited in 1961 by Laval University to participate in Quebec's annual winter carnival. On a recent tour of upstate New York the *Buffalo News* described the Band's playing of difficult contemporary works as "spectacular."

The Brass Choir is an ensemble of about seventeen instruments which makes a specialty of 16th, 17th, and 20th century music. It shares joint concerts with other groups and often plays at ceremonial occasions.

Other active musical groups are the "Techtonians," a jazz band, and the "Logarhythms," a barbershop group which is in great demand at informal gatherings. The musical groups in the houses compete at an annual "All-Tech Sing." There are various prizes, including the surprise "Egbert" for the most original presentation.

Publications

A lively observer and critic of everything that goes on at M.I.T. is the weekly newspaper, *The Tech*. Running to sixteen pages and published entirely by students, it reports and editorializes on campus news, reviews current entertainments at M.I.T. and in Boston, and covers the Institute's athletic teams.

Engaged in constant journalistic battle with *The Tech* is *Voo Doo*, a humor magazine which is "published monthly (if we're lucky)," to quote the editors. In contrasting vein is the *Tech Engineering News*, which publishes serious articles by undergraduates on scientific and other topics. *Tangent*, a literary magazine, publishes poems, short stories, and drawings. *The Social Beaver* is a guide to life at M.I.T. for incoming freshmen, and *Technique*, the yearbook, sums up the Institute year.

Dramatics

The theater is represented at M.I.T. by the Dramashop, a student organization. Actors, directors, designers, and technicians work under the general supervision of a talented member of the faculty to produce eight one-act plays and two major productions each year. Productions, which range from the classical to the contemporary, have recently included Ben Jonson's *Bartholemew Fair*, an original version of Kafka's

The Trial, and plays by Ionesco, Beckett, Pinter, Genet, Osborne, and Chekhov.

An independent undertaking is the annual musical, Tech Show. Written and composed entirely by students, it is always a big event.

Other Activities

Altogether there are over 80 student activities on campus—too many to list here separately. They include the active and highly successful debate team, the AM and FM radio station WTBS, the "ham" station WIMX, student honorary societies, and numerous other clubs and organizations.

Technology Student Enterprises, Inc., is a new corporation which provides management facilities under which M.I.T. students may develop individual and group entrepreneurial efforts.

Students who are members of such organizations as the Technology Community Association, Alpha Phi Omega, and the Social Action Committee join to take part in social service work in many areas of Greater Boston.

Some activities reflect the international character of the Institute. M.I.T. students have taken part in "Operation Crossroads Africa," spending the summer vacation living and working in several African villages. Each year, too, the foreign

students at M.I.T. stage an International Week, with talks, films, and social events. The social club of the Latin American students, the Club Latino, is famous throughout the Institute for its "fiestas."

There are informal dances or parties almost every weekend in the various living groups, and there are formal affairs during the year like the Junior Prom and the Assemblies Ball. *The Social Beaver*, the handbook published by students through the Technology Community Association, thoughtfully includes a descriptive guide to the many women's colleges in the Boston area.

Every week there are also movies and lectures. Visiting professors give public lectures on their work, and distinguished representatives of politics and the arts make special appearances. T. S. Eliot, for example, has come to read his poems, and Jacques Cousteau has talked about his explorations under the ocean. The printed *Calendar of Events* always offers more than anyone has time for.

Religious Life

M.I.T. is by charter non-sectarian and it is open equally to students of all faiths. But in its neutrality it is not irreligious. It believes that an institution which is concerned with general as well as professional education must give attention to man's

spiritual life—to the place of religion in history, in contemporary society, and in the life of the individual.

Close to the center of the M.I.T. campus is a chapel of unique design which is used for worship by all the faiths, each in its own way. The Institute welcomes to the campus ministers of the various faiths to serve as Religious Counselors. They have offices in a house near the chapel.

The regular services in the chapel include a daily Mass, a Protestant service each Sunday, a Christian Science service each Tuesday, an Episcopal Holy Communion each Thursday morning, an Orthodox Christian service each Thursday afternoon, Jewish Sabbath services each Friday and Saturday, and Islamic and Vedanta services each Friday evening and Saturday morning. The roster of services is a witness equally to the strength and the ecumenical spirit of the religious life on campus.









Expenses and Financial Aid

As a private institution, M.I.T. depends for support on its students, alumni, and friends. Through the generosity of many benefactors, the Institute has an endowment which enables it to charge a tuition fee substantially less than the real cost of an M.I.T. education.

The tuition fee for 1964-65 is \$1,700 per academic year. This is a comprehensive fee for the use of the academic facilities, and there are no additional academic charges. The following is an estimate of the total basic expenses of a student for a year:

Tuition	\$1,700
Room and board	1,130
Books and materials	150
Health insurance	70
	—————
Total	\$3,050

In addition to these basic expenses, an allowance must be made for clothes, meals during vacations, social activities, and the extra outlay a student incurs in going away from home; the cost of travel naturally varies, but a reasonable estimate of the minimum of the other expenses is \$300 to \$400, depending on individual circumstances. For the student who will stay in Cambridge during vacations in the academic year, the total expenses from September to June will be about \$3,700.

M.I.T. recognizes that this total expense is considerable. To students and their parents who cannot meet the full amount without help it offers four types of financial aid; scholarships, low-interest loans, part-time campus work, and a deferred payment plan. These are offered separately, but they should be viewed together in considering ways of meeting the cost of attendance at M.I.T.

In general, scholarships and loans are not available to students from foreign countries in their first year at the Institute. In later years, depending on their record, they may be granted aid. However, it is likely to cover only a part of their expenses.

Scholarships

More than half of every freshman class now comes with scholarship help, about a third with scholarships from M.I.T. The grants, varying with the student's need, range from \$200 to \$2,500. The current average is about \$1,200.

The Institute's scholarships are awarded on the basis of academic and personal merit and financial need. The first two considerations determine whether a candidate should be helped. The third determines the amount he should receive. Scholarships are not awarded to students who have not demonstrated financial need.

The Institute judges the extent to which a qualified candidate needs financial help by requiring the submission of a Parents' Confidential Statement through the College Scholarship Service of the College Entrance Examination Board.

Many students come to M.I.T. with scholarships from outside sources, and a candidate for an Institute scholarship should also investigate other scholarships for which he may be eligible. Correspondingly, a student who has applied to outside sources, especially to the large national foundations, should not fail to apply simultaneously for help from M.I.T.

M.I.T.'s scholarships are listed in the General Catalogue. Some are restricted to students from particular areas or to students in particular fields, but there are large unrestricted funds. *An application for admission is not prejudiced or jeopardized by an application for aid, and no student who has the ambition to attend M.I.T. should be deterred from applying concurrently for admission and for aid.*

Most of M.I.T.'s scholarships are awarded on an annual basis, but it is expected that a student receiving assistance will qualify for continued financial aid from year to year.

Low-Interest Loans

Since 1931 M.I.T. has successfully

made loans to students to assist them in financing their education. Experience has shown that the indebtedness of the students so helped has not been a millstone. Rather, the loans have given students the opportunity to pay out of their post-graduate earnings part of the cost of a valuable education. With an annual lending capacity of about \$750,000, M.I.T.'s Technology Loan Fund is the largest of its kind in the country.

A student may borrow up to a total of \$6,000 during the period of undergraduate and graduate study, but no student may borrow more than the cost of tuition in any year.

Repayment starts six months after graduation or withdrawal from the Institute and may be scheduled over a number of years. While the student is enrolled at M.I.T. the interest is 1 per cent per annum; after he leaves it is increased to 2 per cent.

Loans are chiefly used to help meet the cost of tuition, but they may be used to defray any necessary campus expense. Often, for example, students use them to supplement their scholarships.

Because the Fund is limited, applicants must meet minimum scholastic standards; a Parents' Confidential Statement is required to give evidence of need. Otherwise, to borrow from the Technology Loan Fund, a qualified student need but budget his resources carefully, be

reasonably frugal, and have faith in himself. His character is his collateral.

Campus Employment

A large number of undergraduates at M.I.T. take jobs on the campus to improve their finances. A needy student cannot hope to pay his way by campus employment, but a job can be a useful supplement to other means of support. The standard starting pay for campus jobs is \$1.25 an hour. Working ten to twelve hours a week, a freshman can earn \$200 in a term or \$400 during the academic year. This becomes a significant amount when added to typical summer earnings of \$350 to \$400.

Deferred Payment

M.I.T. allows students and their parents to defer payment of tuition in two ways. They may, by arrangement with the Bursar, pay the tuition fee in installments during the year (the Budget Payment Plan); or they can arrange with the Director of Student Aid to defer payment of part of the tuition fee for a longer period (the Installment Credit Plan). Under this plan, which is available to all undergraduates who are United States citizens, credit is given for amounts up to \$700 in an academic year, or \$2800 over four years. Repayment is made at six-month

intervals after the first credit is extended, and interest of 6 per cent is charged on the unpaid balance. The typical entering student has six years after he receives the Bachelor's degree to complete his payments. M.I.T. underwrites the credit granted, and no collateral is required.

The Institute's financial aid program is described fully in the General Catalogue and in a leaflet on "Financial Aid for Undergraduates" issued by the Director of Student Aid. How to apply for financial aid is described in the next section of this booklet.





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Admission

M.I.T. welcomes students who by their ability, character, and interests give promise of making a contribution to the world. There is no standard M.I.T. candidate, just as there is no standard M.I.T. alumnus. Some candidates have exceptional scholarly interests, some have shown noteworthy leadership in their school or community, some have shown unusual creativity or initiative.

M.I.T. is interested not only in a student's academic record but also in what he has accomplished out of class, be it in athletics, music, publications, service enterprises, scientific or mechanical projects, or plain self-help. It regards the quality of his achievement in these areas as a significant part of his record.

A candidate's application is not affected by the number of other students applying from his school or by the part of the country in which he lives. In accordance with Massachusetts law, M.I.T. does not consider a candidate's race, color, creed, or national origin.

Subject Requirements

Most secondary schools, public and private, offer the necessary subjects for admission to M.I.T. If a student takes his work seriously and makes the most of what is available to him, even a small school can prepare him adequately. M.I.T. is careful to judge a candidate on his own merits,

not on the merits of his school. The freshman class generally represents more than 600 schools, of which 80 per cent or so are public.

The subjects which M.I.T. specifically requires for entrance are English, mathematics through trigonometry, physics, and chemistry. Four years of English are required. The mathematics should include the standard topics in elementary and intermediate algebra, plane geometry, and trigonometry, but the precise form of the mathematics curriculum is not important so long as it will prepare a student to go on directly to calculus. A good score in one of the mathematics achievement tests of the College Entrance Examination Board is an indication of satisfactory preparation. If a student has covered the standard topics before his senior year he should preferably continue further, taking perhaps calculus or such topics as solid geometry, statistics, probability, and logic.

The physics and chemistry may be covered in one-year courses or in an integrated two-year sequence in physical science. Either way, it is important that the equivalent of a full school year be devoted to each subject.

In choosing the rest of his program a student should normally make room for a foreign language and for social studies. These are

important subjects, and every student should include them if he can. Any language studied should be continued long enough to gain some mastery in it.

A course in graphics can be helpful for a student going into engineering. Graphics, like language and mathematics, is a tool for the manipulation and communication of ideas, and an engineer should be able to turn to it, when this is appropriate, as readily as he does to mathematics and language in tackling a problem. It can usefully be studied at the high school level, leaving time in college for other subjects. A prospective engineering student can also profit from technical courses at school, provided they do not displace other work he should take. However, neither graphics nor shop courses are required for M.I.T. admission.

Leaflets on language study and preparation in mathematics are obtainable from the Admissions Office.

Entrance Tests

M.I.T. requires every candidate to take the Scholastic Aptitude Test of the College Board (testing verbal and mathematical aptitude) and the achievement tests in (1) Advanced Mathematics *or* Level I *or* Level II Mathematics, (2) Physics *or* Chemistry, and (3) English Composition *or* American History and

Social Studies *or* European History and World Cultures.

Foreign candidates should take the Scholastic Aptitude Test and the achievement tests in Level I *or* Level II Mathematics, Physics, and Chemistry.

The tests may be taken at any time and any number of times but should be completed not later than January of the senior year. The tests will be offered at centers throughout the world on the following dates during the coming year: July 8, 1964; December 5, 1964; January 9, 1965; March 6, 1965; and May 1, 1965. (The Level II examination in mathematics is offered only on January 9 and May 1, 1965.) The March and May testing dates are for candidates for admission in 1966. A student who completes the tests after the January test date may be considered—as a “late applicant”—for admission the following September. A few places are reserved for such “late applicants,” but most can be admitted only as vacancies may occur in the admitted class. Such “late applicants” cannot be considered for financial aid.

A candidate should take the individual tests at the best time for him, when he will be most likely to do himself justice. If a student takes any test more than once, M.I.T. takes note only of the higher score in evaluating his application. Thus

a student completing physics or chemistry in his junior year at school is strongly advised to take the achievement test in that subject in May or July, when the subject is fresh in his mind. A student starting chemistry in September of his senior year will find it awkward to take the test in that subject in December or January when he is only halfway through the course. If a student misses taking the test in his junior-year science in May or July, it is probably to his advantage to take this test in December or January rather than the test in his senior-year science. However, when a test in the senior-year science is taken in December or January, M.I.T. will make allowance in interpreting the score.

A student who has studied in mathematics the standard topics in elementary and intermediate algebra, plane geometry, and trigonometry would probably take the Level I Mathematics examination. A student who has gone beyond these and has covered topics selected from statistics, probability, analytic geometry, or calculus would probably take the Level II examination in mathematics. The admission decision will not be prejudiced by the test taken, but any student who plans to apply for advanced placement in calculus should take the Level II examination. An Advanced Mathe-

matics achievement test taken in March, May, or July, 1964, will also meet the mathematics test requirement for admission in September, 1965.

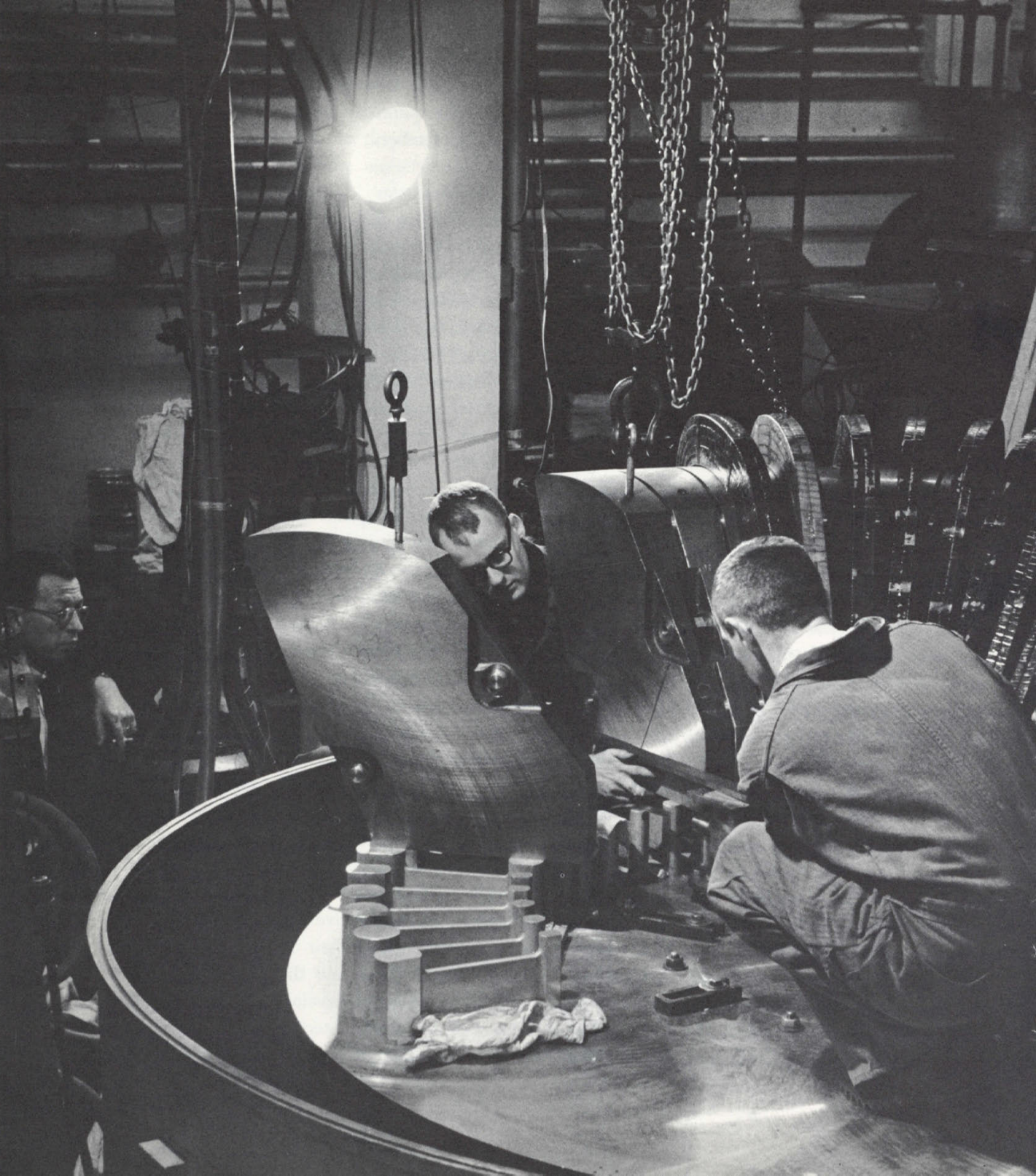
A student should plan his tests in consultation with his director of studies or guidance counselor and should apply to take the tests by writing directly to the College Entrance Examination Board, Box 592, Princeton, New Jersey. (Students in the Mountain and Western States, in Western Canada, and in countries in the Far East should write to the College Entrance Examination Board, Box 1025, Berkeley 1, California.) Application to take the tests should be made not later than four weeks before the test date; there is an extra fee for applications received later than this. A student who applies later than two weeks before the test date may not be admitted to the tests.

Application Procedure for Admission

A student may file a Preliminary Application for Admission at any time, and every applicant is encouraged to do so before or during his junior year in high school. Filing a Preliminary Application assures each applicant that he will receive current information, including publications, interview instructions, and Final Application materials.

Students who have filed a Preliminary Application are sent Final Application material in September, at the start of their last year in school. This material includes a Final Application form, which the candidate completes and returns himself, two Teacher's Personal Evaluation forms which he is asked to give to two teachers to complete and return, and a School Report form which he is asked to give to his principal or guidance counselor. The material should be returned promptly, preferably by January 15. The School Report form need not be held for mid-year grades, because the Institute will send for these later. There is a \$10 Final Application fee (not required of candidates from overseas).

Candidates who live close to Cambridge are asked to come for an interview at the Admissions Office. Other candidates are referred to representatives of the Institute in their area. These representatives are members of the M.I.T. Educational Council, a group of alumni who assist the Admissions Office and Student Aid Center by interviewing and counseling prospective students. They are chosen for their interest in advising students, and they are familiar with current developments at the Institute. The interview is intended to be a friendly exchange in which the student and



the Institute can learn something about each other. (Foreign candidates are not required to have an interview unless specifically requested to do so.)

The appropriate time for the interview is between May 1 of the junior year and January 15 of the senior year. However, a student with questions he would like to discuss is encouraged to have an interview before then. If a student has had an interview before May 1, he is asked to arrange another nearer the time for filing the final application.

Members of the Admissions Office are always pleased to talk with interested students who want to see the Institute and discuss college plans. The Office is open from 9 to 5 every weekday, Monday through Friday, except on holidays, and student-conducted tours of the campus start from the Office each day at 10 and 2. Appointments are not necessary for an interview or the tour.

Overnight accommodations in student living groups can be arranged for prospective students during the fall and spring terms; write in advance to the Admissions Office, indicating the day and time when you expect to arrive.

The Admissions Committee completes the selection of the freshman class after the January College Board scores are received. Most candidates are informed of the de-

cision on their applications before the end of March. A small number, however, are held on a waiting list of qualified alternates for a decision at the end of April. No candidate who is offered admission is required to reply to the offer before May 1, the Candidates' Reply Date established by the College Board. Students who accept a place in the freshman class are sent housing information during the summer.

The Admissions Committee prefers to consider all the candidates in a given year together, after the last College Board scores are available; it feels that this allows for the fairest selection. However, if a student has completed all of the required tests before his senior year, the Committee will, if he so requests, review his application early in his senior year. If his test scores, school grades, and other qualifications are so excellent that he is clearly acceptable, it will offer him admission then. If his qualifications are not so outstanding, it will hold his application for consideration with the rest at the usual time. A qualified student who seeks early consideration under this scheme is free to file applications at other colleges, and he is not required to reply to any offer of admission he may receive from the Institute until May 1.

Each year some students apply for admission directly from their junior

year in secondary school. The Admissions Office does not encourage this practice; but such applications are accepted and carefully reviewed at the same time, and under the same conditions, as other applications. To be accepted for admission to M.I.T. after his junior year, a student must be found to be well qualified academically, socially mature, and unable to work out a meaningful and challenging curriculum for a senior year in his secondary school.

Application Procedure for Financial Aid

A candidate for admission who wishes to be considered for financial aid must file a separate application with the Director of Student Aid not later than January 15. Applications for aid filed after that date cannot be considered. Financial aid application forms are not issued after January 7.

A candidate may request financial aid application material by writing directly to the Director of Student Aid at M.I.T. or by returning a post card issued for this purpose by the Admissions Office.

Please note that applications for admissions and for financial aid are to be made on *separate* forms and are to be sent to separate offices.

Every student who submits an application for financial aid is required to file a Parents' Confidential



Statement with the College Scholarship Service, Box 176, Princeton, New Jersey (or Box 1025, Berkeley 1, California). The form may be obtained in most schools through the guidance office, or it may be obtained directly from the College Scholarship Service or from the Director of Student Aid at M.I.T.

The Student Aid Committee announces its decisions in early April, after the decisions of the Admissions Committee but well in advance of the Candidates' Reply Date.

For Further Information

Further information about M.I.T. is given in the Institute's General Catalogue, which is mailed to all those receiving Final Application forms. Special brochures describing the programs and career opportunities in some departments are available. For these, and for answers to special questions about admission and curricula, write Professor Roland B. Greeley, Director of Admissions, Room 3-108, Massachusetts Institute of Technology, Cambridge, Massachusetts, 02139. For information about advanced placement and advanced standing, write to the Director of Advanced Placement, Room 3-108, Massachusetts Institute of Technology, Cambridge, Massachusetts, 02139

Send questions about financial aid to Jack H. Frailey, Director of the

Student Aid Center, Room 5-115, Massachusetts Institute of Technology, Cambridge, Massachusetts, 02139.

Principal Academic Officers

Julius Adams Stratton, SC.D., D.ENG., LL.D., L.H.D., *President*
Charles Hard Townes, PH.D., D.LITT., SC.D., *Provost*
Carl Frederick Floe, SC.D., *Vice President, Research Administration*
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Jerome Bert Wiesner, PH.D., *Dean of the School of Science*
Harold Locke Hazen, SC.D., *Dean of the Graduate School*
Kenneth Robert Wadleigh, SC.D., *Dean of Student Affairs*

A Note About Visiting M.I.T.

The Institute welcomes visits from prospective students.

Institute offices are open from 9 to 5 on weekdays; they are closed on Saturdays, Sundays, and holidays. (Note that, in addition to the usual holidays, M.I.T. is closed on Washington's Birthday, Patriots' Day (April 19), Memorial Day, Columbus Day (October 12), and Veterans' Day.)

Prospective students should go to the Admissions Office; advance appointments are not necessary. Student-led tours of the Institute leave the Admissions Office each weekday (except holidays) at 10 and 2. Overnight accommodations in dormitories or fraternities can be arranged during the regular term for prospective students who write in advance to the Admissions Office.

M.I.T. is easy to reach. Three highways (U.S. route 1 and Massachusetts routes 2 and 28) pass in front of the campus, and public transportation is available from Boston and other parts of Cambridge.

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