

THIS IS M.I.T.

Massachusetts Institute
of Technology Bulletin,
Cambridge, Massachusetts.
Undergraduate Catalogue
Issue for 1961-1962



MASSACHUSETTS INSTITUTE OF
TECHNOLOGY BULLETIN

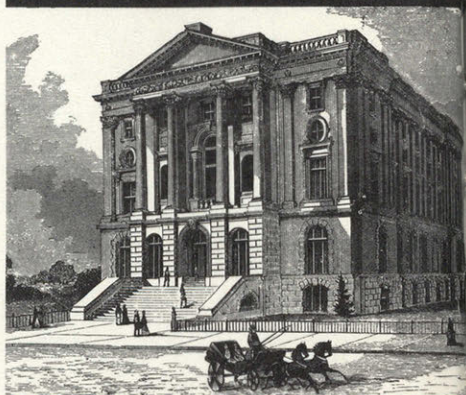
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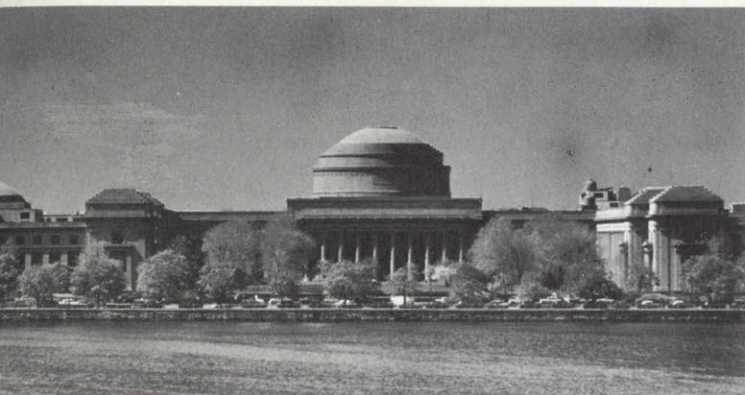
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This Catalogue is published at the beginning of M.I.T.'s Centennial year, 100 years after the signing of the Act of the Massachusetts General Court by which the Institute was chartered. Founder William Barton Rogers wrote, "The true and only practicable object of a polytechnic school is, as I conceive, the inculcation of those scientific principles which form the basis and explanation of the arts of the workshop." Today, this basic emphasis on fundamentals remains unaltered. The sharply increasing pace of technological advance serves only to give it new relevance.



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ACADEMIC CALENDAR

1960

<i>September 15</i>	FIRST TERM 1960 BEGINS FOR FRESHMEN
<i>September 19</i>	FIRST TERM BEGINS FOR UPPERCLASSMEN
<i>October 12</i>	COLUMBUS DAY (HOLIDAY)
<i>November 11</i>	VETERANS' DAY (HOLIDAY)
<i>November 24 through November 27</i>	THANKSGIVING VACATION
<i>December 22 through January 3</i>	CHRISTMAS VACATION

1961

<i>January 18</i>	LAST EXERCISES OF THE FIRST TERM
<i>January 19 through January 21</i>	READING PERIOD
<i>January 23 through January 27</i>	EXAMINATION PERIOD
<i>February 6</i>	SECOND TERM BEGINS
<i>February 22</i>	WASHINGTON'S BIRTHDAY (HOLIDAY)
<i>April 3 through April 9</i>	SPRING VACATION
<i>April 19</i>	PATRIOTS' DAY (HOLIDAY)
<i>May 23</i>	LAST EXERCISES OF THE SECOND TERM
<i>May 24 through May 26</i>	READING PERIOD
<i>May 27 through June 2</i>	EXAMINATION PERIOD
<i>May 30</i>	MEMORIAL DAY (HOLIDAY)
<i>June 9</i>	COMMENCEMENT DAY
<i>September 14</i>	FIRST TERM 1961 BEGINS FOR FRESHMEN
<i>September 18</i>	FIRST TERM BEGINS FOR UPPERCLASSMEN
<i>October 12</i>	COLUMBUS DAY (HOLIDAY)
<i>November 11</i>	VETERANS' DAY (HOLIDAY)
<i>November 23 through November 26</i>	THANKSGIVING VACATION
<i>December 21 through January 2</i>	CHRISTMAS VACATION

1962

<i>January 17</i>	LAST EXERCISES OF THE FIRST TERM
<i>January 18 through January 20</i>	READING PERIOD
<i>January 22 through January 26</i>	EXAMINATION PERIOD
<i>February 5</i>	SECOND TERM BEGINS
<i>February 22</i>	WASHINGTON'S BIRTHDAY (HOLIDAY)
<i>March 26 through April 1</i>	SPRING VACATION
<i>April 19</i>	PATRIOTS' DAY (HOLIDAY)
<i>May 22</i>	LAST EXERCISES OF THE SECOND TERM
<i>May 23 through May 25</i>	READING PERIOD
<i>May 30</i>	MEMORIAL DAY (HOLIDAY)
<i>May 26 through June 1</i>	EXAMINATION PERIOD
<i>June 8</i>	COMMENCEMENT DAY

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1 | *This is M. I. T.*

The Massachusetts Institute of Technology is an independent, endowed, coeducational institution which has concentrated its resources in certain broad areas: science, engineering, architecture and planning, industrial management, and the related humanities and social studies.

Through this principle of concentration M.I.T. brings to the areas of its major interests the services of a distinguished faculty, together with physical facilities of unparalleled variety and completeness. Indeed, Dr. James R. Killian, Jr., Chairman of M.I.T.'s Corporation, has described the Institute as a "new kind of university"—a school polarized about science where teaching and creative activities of highest professional stature are pursued in a limited range of fields now deeply relevant to the world's social, economic, and political opportunities.

On the next pages are excerpts from the inaugural address of Dr. Julius A. Stratton, M.I.T.'s eleventh President, restating as he sees them the philosophy and grand plan to which M.I.T. is now devoted.

An alumnus of M.I.T., after recently revisiting the Institute, has written: "The moment you are inside M.I.T., its calm exterior is forgotten. You are in a world of intense activity. Along five miles of corridors flows a constant tide of students, resolutely moving on urgent business. Through hundreds of doors you see shirt-sleeved professors and students working together at desks and benches. The air pulses with life."

“ . . . the measure of our greatness is our capacity to educate for leadership.”

In these excerpts from his Inaugural address as its eleventh President, Dr. Julius A. Stratton describes M.I.T.'s essential character and purpose.



This institution was created by William Barton Rogers as an expression of faith in certain new concepts of professional education, and from the very outset our academic policies have been directed by a few central ideas. In essence, Rogers maintained that there is dignity and importance in the mastery of useful knowledge; that the foundations of a professional life may profitably be laid in the undergraduate years, combining with and contributing to a liberal education, to the enrichment of both; and that science and engineering can be the legitimate foundations of a higher education.

M.I.T. has been built upon these convictions. The contributions of our graduates over the years both at home and abroad provide ample proof of their essential worth.

* * *

Throughout the entire history of the Institute, much of the strength of our educational plan has been derived from the rigor and thoroughness of our 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.

But the formal instruction of lectures and classroom is properly only part of the educational process. The intellectual discipline of tests and problems must be supplemented and enlivened by other forces that will arouse and stimulate the impulses of originality latent in every student. We seek to stir our students' imaginations, to encourage them to break free from the channels of conventional thought, and to teach them to bring to bear upon their problems the facts and methods acquired in the classroom.

From his earliest history, man has been driven to build and to do, and the fulfillment of this urge finds its highest expression in the work of the engineer. The engineer is concerned with making and with producing, with converting the yields of pure science to useful products and services. His function is to adapt knowledge to beneficial ends, to find ways and means of solving the practical problems of human existence. There is there-

fore in the education of the engineer the most compelling reason to develop by all possible means the creative and constructive powers of each student.

* * *

The contributions that the humanities and social sciences have to make to the education of the architect, the scientist, and the engineer have been clearly established. Over the past decade the Institute has won wide recognition for the support that has been given to these more liberal aspects of our curricula.

The range of our professional activities at M.I.T. has for some time been steadily widening. We are concerned not alone with architecture, science, and engineering for their own sake, but increasingly with fields on which these disciplines have a direct impact in contemporary society. In addition to the obviously related fields of management and economics, we are also active in such areas as psychology, political science, international relations, and other social studies.

* * *

M.I.T. is a professional school and as such we have an obligation to impart to our students an understanding of both the privileges and responsibilities inherent in the professional estate. Above and beyond all technical competence, the truly professional man must be imbued with a sense of responsibility to employer and client, a high code of personal ethics, and a feeling of obligation to contribute to the public good.

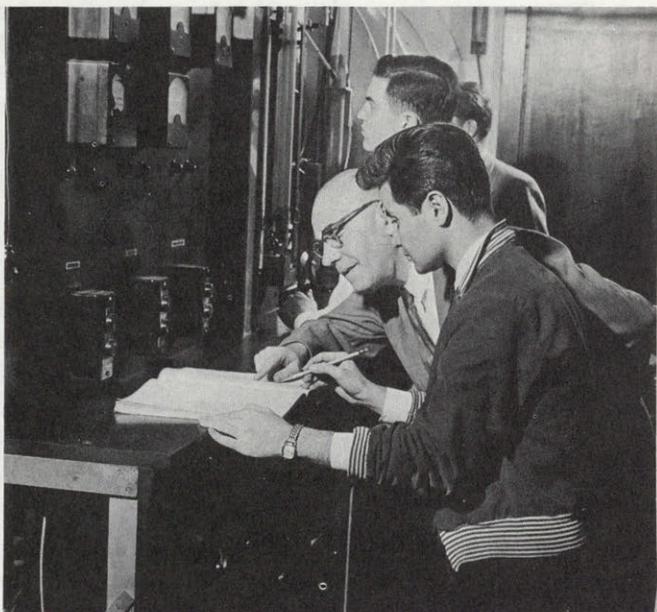
As a great educational institution, we shall fall short of our mission if we fail to inspire in our students a concern for things of the spirit as well as of the mind. By precept and example we must convey to them a respect for moral values, a sense of the duties of citizenship, a feeling for taste and style, and the capacity to recognize and enjoy the first-rate.

* * *

M.I.T. is a product of our age. By its aims, its methods, and its ideals it is keyed to the needs and problems of the contemporary world. Today, more than ever, the measure of our greatness will be determined by our capacity to educate for leadership.



CREATIVE EDUCATION: "... a feel for materials, an experimental attitude, theory tested by reality."





THESE ARE THE CONCEPTS

The typical M.I.T. student enters his freshman year directly from high or preparatory school; he follows a program of four years for the bachelor's degree (in architecture, five years). He finds an environment at once friendly and extraordinarily stimulating, one which will help him develop his interests and powers to the fullest extent.

His educational experience results from these concepts upon which M.I.T.'s program is built:

1. ADVANCEMENT OF KNOWLEDGE

By charter and in spirit, M.I.T. exists for the purpose of advancing knowledge. Teaching and research go hand in hand here, each strengthening the other, in fulfilling this purpose. The Institute's primary duty is to provide young men and women with a sound and well-ordered education.

2. CREATIVE EDUCATION AND RESEARCH

M.I.T. is restless, ever-changing. "Dynamic" and "creative" are time-worn adjectives used here for lack of fresher words to describe the environment created by top-flight teaching and pioneering research. Here are undergraduates learning for the first time the fascinating disciplines of science and engineering; graduate students beginning to discover in detail one field of special interest; and faculty, at once exploring new knowledge and teaching the fundamentals which underlie it. Dr. George R. Harrison, Dean of the School of Science, believes this creative professional atmosphere to be "the quality that most distinguishes undergraduate education at M.I.T."

3. EDUCATION BASED ON FUNDAMENTALS

Today's rapid changes in science and technology emphasize the value of fundamentals. The scientists, engineers, architects, and managers who can grow to meet tomorrow's challenges are those who understand basic concepts so well that they can return to them again and again as the foundations of new structures. Some students find the first years at M.I.T. disappointing and frustrating because they never seem to reach the exciting frontiers of their fields. But these years of rigorously learning fundamentals are the best insurance against obsolescence this faculty knows, insurance that students can stay with today's fast-moving frontiers, once they reach them.

4. LEARNING BY DOING

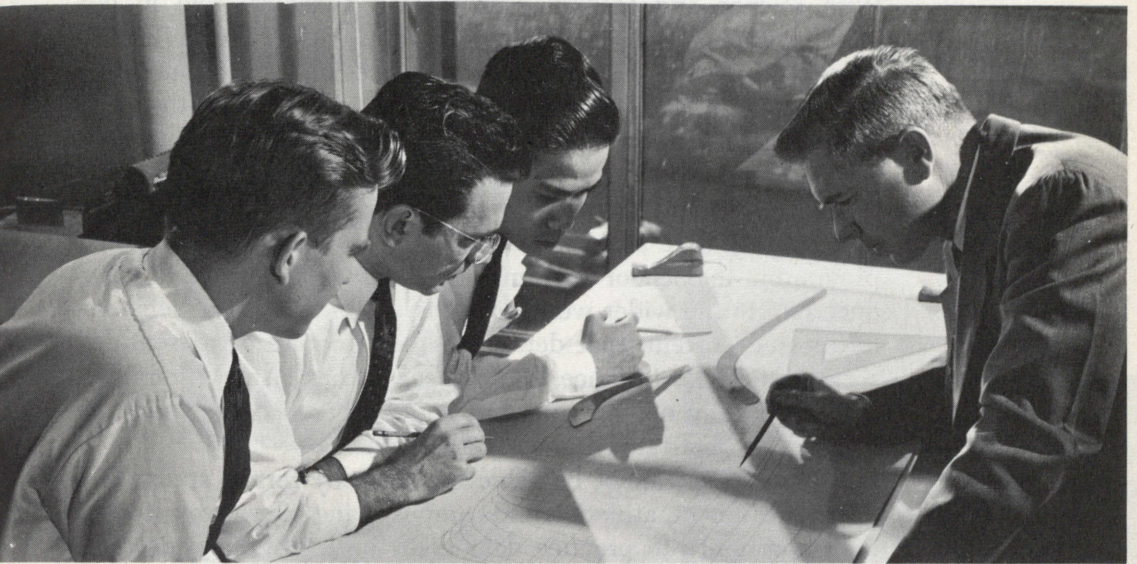
"Learning by doing" was an important concept in founding M.I.T., when experimental laboratories were uncommon in higher education. It is still a basic concept at M.I.T.; today "learning by doing" means learning by *thinking about* what one is doing. It is an expression of the interdependence of the theoretical and the practical, of the lecture room and the laboratory. The questions "Why does it work?" and "Why does it happen?" are discussed in the lecture room; the questions "How does it work?" and "How does it happen?" are answered in the laboratory, where students themselves construct the practical application of a theory and watch it work. The Geology Camp, practice schools, Cooperative Courses,¹ and many opportunities for students of M.I.T. to visit industrial plants carry further this idea of learning by doing.

An alumnus has recently written that "the core of M.I.T.'s success is its power to vitalize its students' hidden reserve of energy and imagination. Constant association with experiment gives them the habit of vigorous attack upon any problem—a habit that soaks into their bones and serves them for the rest of their lives."

5. THE IMPORTANCE OF USEFUL KNOWLEDGE

The man doing research in nuclear physics, the engineer in the field, the executive in industry, and the architect of the city are all holding responsible positions; their work affects the entire structure of society. No one needs much imagination to see these effects. Science has brought visible changes in towns and cities, and engineering has revolutionized the pattern of everyday living. Advances in transportation and communication have created a smaller world, which in turn has influenced national and international politics and culture; the atomic age has influenced the world of ideas as well as the course of world events. Constant examples of the effects of scientific progress on society emphasize for those who teach and study at M.I.T. the importance and worth of their work.

¹M.I.T. uses the words *Course* and *subject* as follows: *Course* refers to an organized curriculum—sequence of studies—approved as leading to a specified degree; *subjects* are the individual classes. The so-called "Cooperative" Courses are described in Section 2.



6. DEVOTION TO THE HIGHEST STANDARDS

A basic characteristic of the Institute is its devotion to the highest standards. There is what Dr. Killian has described as a "traditional and established role of stressing excellence." M.I.T. students expect hard work; no one can achieve the highest standards without it. But this is an environment in which hard work can be challenge—and in which it is combined with non-professional activities of great intensity and variety.

7. EDUCATION FOR CITIZENSHIP

With science and technology assuming a central role in our culture, graduates of such institutions as M.I.T. are certain to have great influence. This new role requires of scientist and engineer a new form of leadership, one which is based on a thorough knowledge of the entire cultural environment of which his work is a part.

To prepare students for these great responsibilities is a primary objective at M.I.T. Every student takes an integrated program in the School of Humanities and Social Science to introduce him to the wider world of ideas, attitudes, and beliefs, historical and current, that determine the structure of present-day society. Here, for instance, an engineer studies history, literature, and philosophy not as ornaments but rather because today he cannot be a first-rate engineer without them.

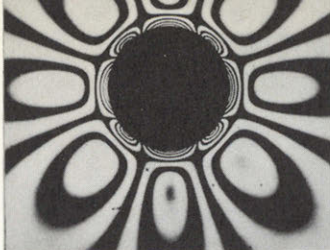
This aim cannot be achieved solely by formal study. Student government, athletics, and campus living offer every student the opportunity to practice democracy on a campus-wide scale and provide all the members of this community with a chance to exercise responsibility and leadership.

Professor John T. Rule, Dean of Students at M.I.T., believes that other students who have developed successfully are one of the best sources of general education for a student body. "We are certain," he says, "that the acceptance by students of the responsibility for managing their own affairs most effectively develops their judgments and understandings of the world of action within which they will always live."

Studying at M.I.T. is thus a broad gauge undertaking. Undergraduates find a thorough basic knowledge of their professions; a concept of the effects of their work in its social context; and preparation for the non-professional demands of life to fulfill *more than adequately* the new requirements of good citizenship.



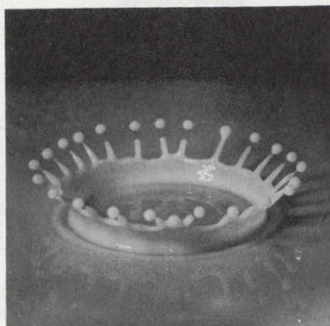
Dean John T. Rule



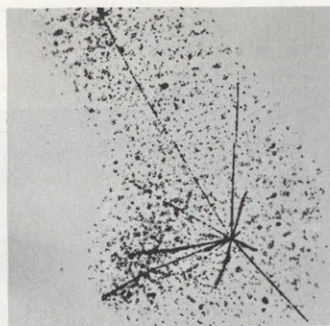
Stress analysis by photoelasticity.



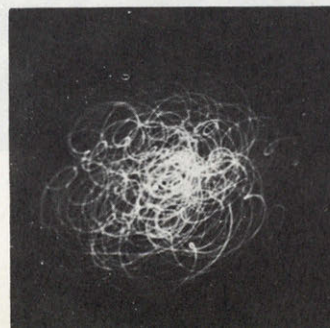
Crystals of a new nickel-chrome alloy.



High-speed camera: sculptor of liquids.



A cosmic ray in a nuclear emulsion.



Sound pictured on an oscilloscope.



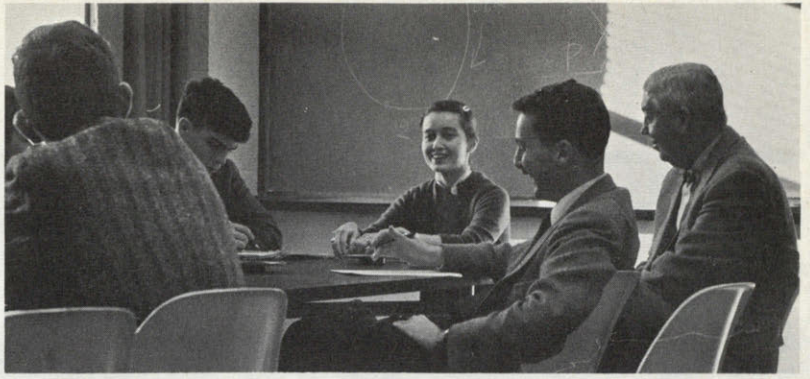


Music: a rehearsal of the M.I.T. Concert Band

"AS LONG AS YOU LIVE, KEEP LEARNING TO LIVE"

Sports: M.I.T. dinghies on the Charles River Basin





Community: learning to work together.



Fellowship: student and teacher share experiences.

Parties: the annual Junior Prom.







Members of the visiting committee of the Department of Aeronautics and Astronautics watching a wind tunnel demonstration.

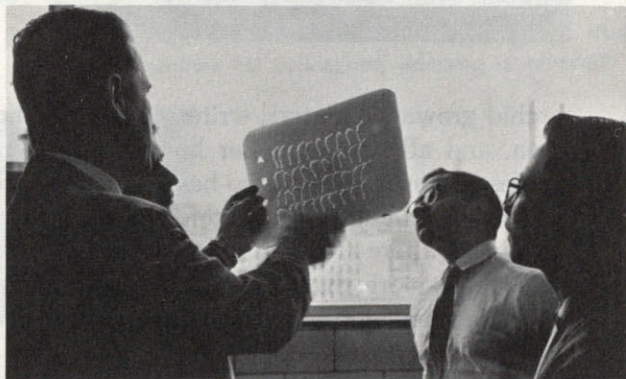
THESE ARE THE PEOPLE

M.I.T. is a privately endowed institution. Its Corporation—a group of more than sixty distinguished citizens—is legally responsible for the Institute's academic standards and for its financial soundness.

M.I.T.'s academic departments are grouped for administrative purposes into five schools—Architecture and Planning, Engineering, Humanities and Social Science, Industrial Management, and Science—each with a Dean as its chief administrator. Department heads are responsible for the teaching and research programs carried on in their own departments. Each department has a visiting committee of men from outside the Institute who have broad experience in the field and who confer with the department and administration on its total program.

The Dean of the Graduate School supervises graduate study at M.I.T., and the Dean of Students is directly concerned with student life and welfare. Students elect their own government, administer their own out-of-class affairs, and take their share of responsibility for problems of direct concern to the student body.





THE FACULTY

The teaching staff of the Institute totals about 1,100, of whom about 600 professors, associate professors, and assistant professors are members of the faculty. Since teaching is done not only by the faculty but also by instructors, technical instructors, teaching assistants, lecturers, and others, there is in general more than one teacher to every five students. This proportion, unusual in university education, assures the personal relationship between teachers and students which is an essential part of M.I.T.'s philosophy of education.

Teachers at M.I.T. are a varied and interesting group. Many are scholars of distinguished achievement; at least 30 are members of the National Academy of Sciences. Some are scientists and engineers internationally known for applications of science and engineering knowledge in enterprises of great magnitude. Some are theorists who are working daily on the most remote frontiers of new knowledge. All bring into the classroom and lecture hall a wide range of firsthand professional experience which helps render their teaching immediate and compelling.

A special committee of M.I.T. faculty members has recently reported that "effective teaching in all its aspects can flourish only when fed by continuous, active contact with research and with the realities of our industrial, economic, and social life. It is safe to assert that the Institute owes its educational position to a large extent to the possibility of such variegated activities."

A versatile group as well—with broad interests outside their professional lives—the M.I.T. instructing staff includes



orchid growers, painters, writers, sculptors, boat builders, woodsmen, and all sorts of other hobbyists. There is a mathematics professor, for instance, who has pitched professional baseball and a mechanical engineering professor whose paintings have carried off prizes. There are scores of people who are interesting as people and who—more than that—are interested in people, responsive to friendship, and ready to go more than half way in helping their students.

THE STUDENTS

In selecting its students, the Institute seeks quality rather than numbers. Only a limited number of students can receive education of high calibre with a given number of teachers, laboratories, and libraries. Such a limitation on the number of students, coupled with the large number of applications for admission each year, makes it certain that those who attend M.I.T. will be young men and women outstanding as students and also as people.

If there were an “average” freshman, he would be an 18-year-old graduate of a public or independent secondary school. He would be like students at any other top-ranking college. He would have a good basic intelligence, perhaps a more-than-average interest in mathematics, and a conscientious attitude toward all his work; he would enjoy athletics and campus activities.

In all, there are about 3,500 undergraduate and 2,700 graduate students at M.I.T. They come here from every state and virtually every country of the world; indeed, the Institute’s proportion of foreign students is the largest in any college in the nation.



“ . . . a wide diversity of interests from Bach to Boltzmann to Bugatti . . . ”

The editor of the Freshman Week-end Issue of the student government's newsletter describes his colleagues, advising a neophyte Techman.



Who am I? Never mind my name—that's unimportant. I'm one of those "faces in the crowd" you see pass. I may be that fellow with the slide rule doing a dangling dance by his side, or the bleary-eyed chemist with the sulfur deodorant, or the management scholar with all the Brooks Brothers labels sewed on the outside. No matter what form I take, it is worth your while to get to know me. I am a fellow M.I.T. student.

You will find that I am a pretty interesting chap once you take the opportunity to introduce yourself. Like yourself, I am of superior intelligence, have a wide diversity of interests from Bach to Boltzmann to Bugatti, and enjoy a good time.

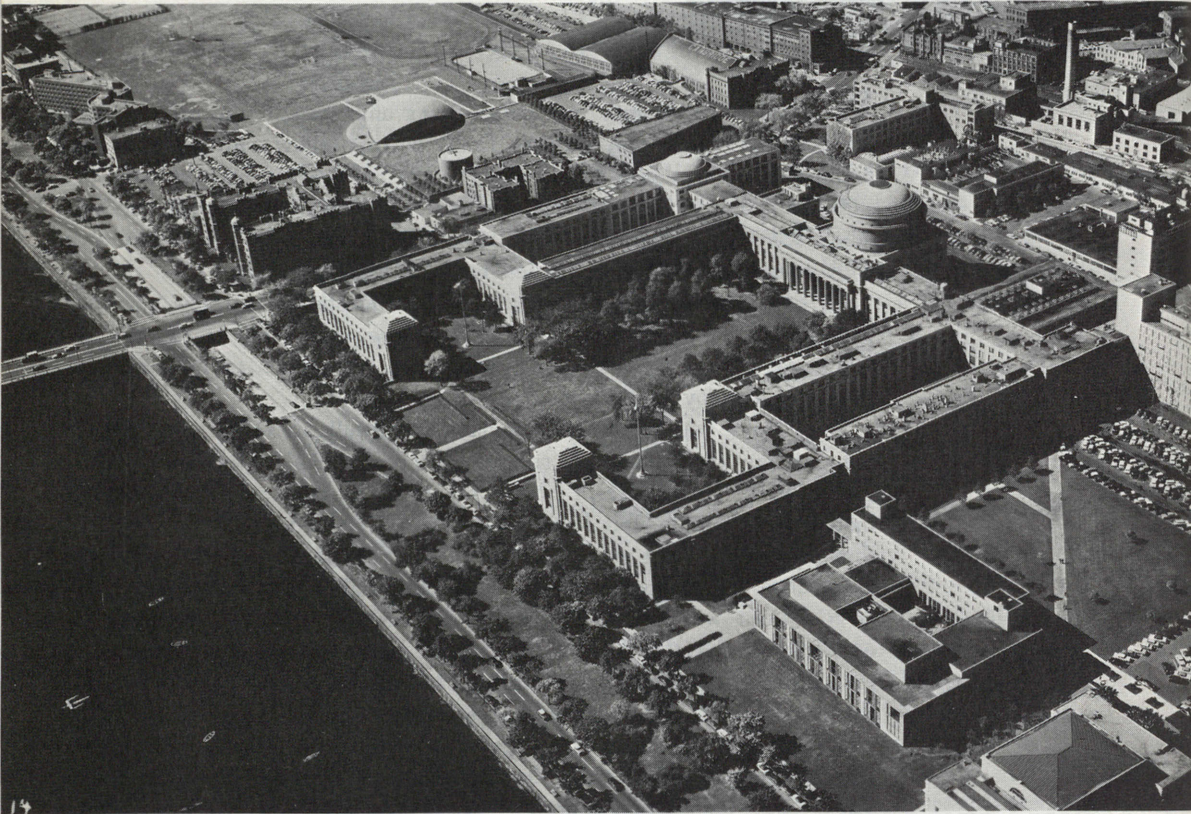
Sure, you will find that I have my peculiarities, but who doesn't? Some of my ideas may seem strange to you, especially if my social background was a little different from yours, or if the shade of my skin doesn't match yours exactly. But I will never be able to understand your way of thinking if we do not get to meet each other—somebody smart somewhere once called that the most productive part of education.

You will notice, however, that we always have one thing in common. We have come to M.I.T. in the honest pursuit of knowledge—to develop a way of thought that will characterize us as analytical, productive thinkers, people who can attack problems in an unprejudiced frame of mind and establish solutions by applying logical principles. We are in that search together, and we will develop ourselves together. However, if we are to learn to be unprejudiced in our scientific thought, we must insure that we are unprejudiced in our social thinking.

The M.I.T. campus is the most cosmopolitan in the United States. It offers unequalled opportunities to learn about people from people, in a direct and comprehensive way.

It offers everyone an opportunity to learn by exchanging ideas with those of divergent as well as similar backgrounds and attitudes.

It offers such an understanding of others as could be acquired at few places in the world. Yet it demands of us that we recognize the right of each man to live the way he believes that he should.





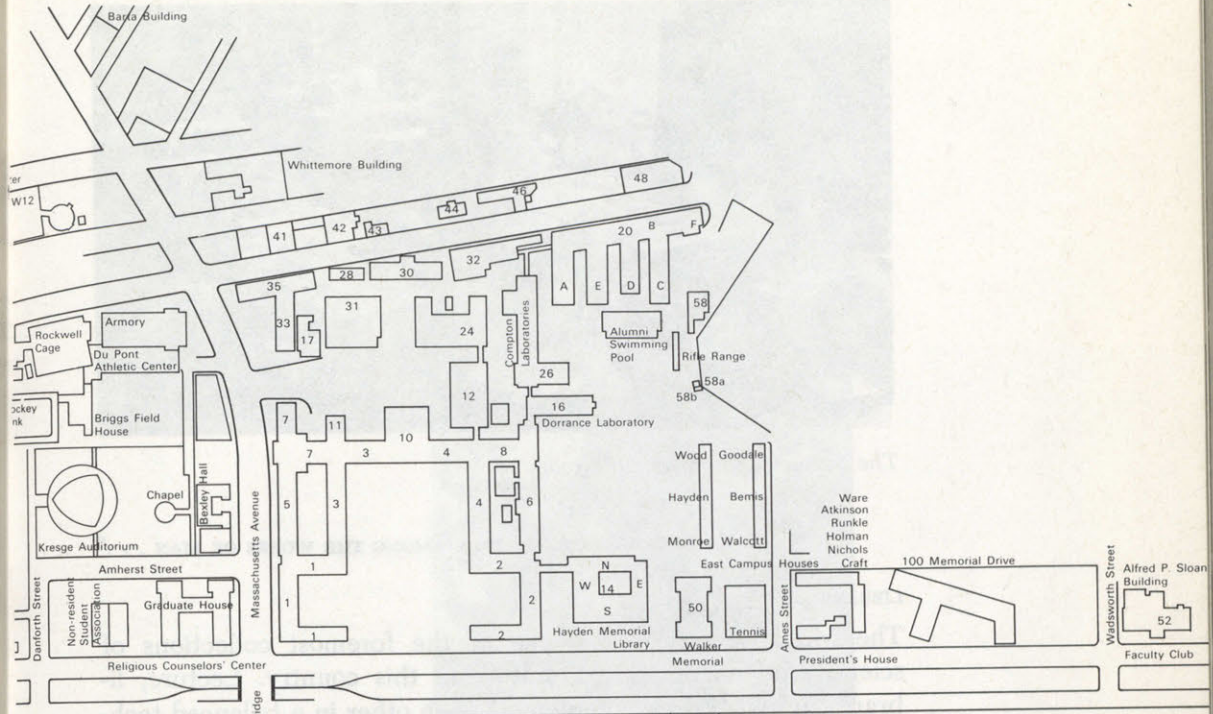
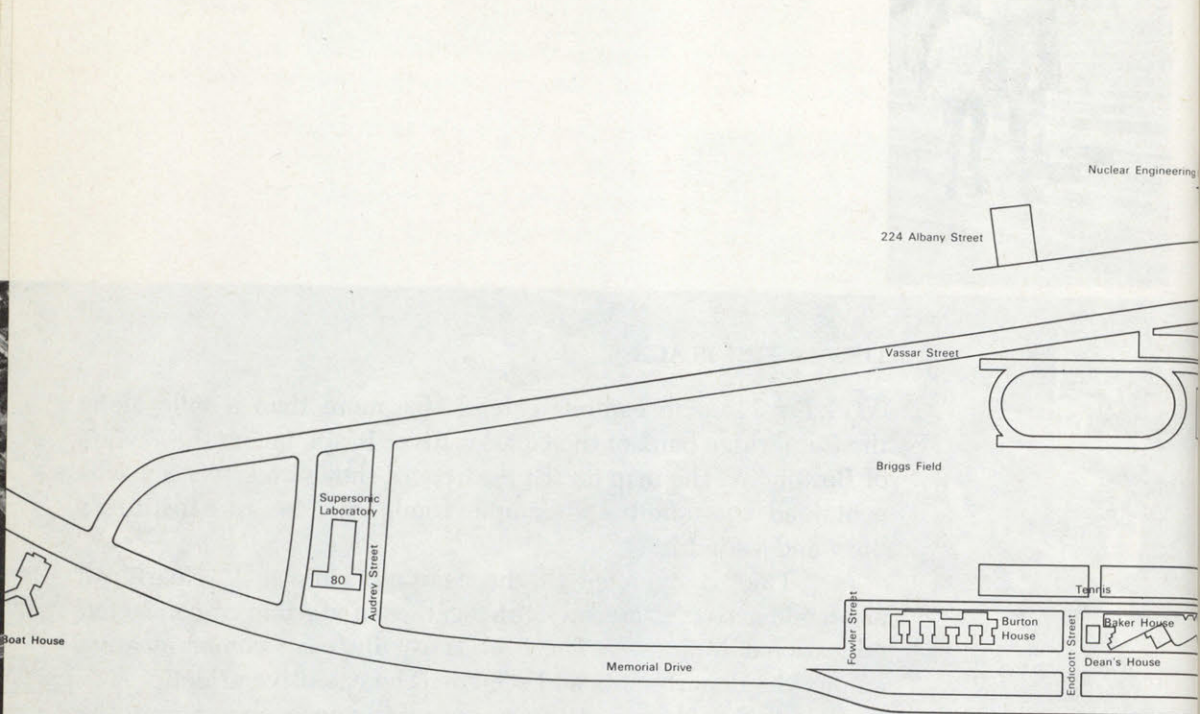
THIS IS THE PLACE

M.I.T.'s 115-acre campus extends for more than a mile along the Cambridge bank of the Charles River Basin, facing the skyline of Boston. As the map on the next pages shows you, this is a self-contained community—an ample framework for the Institute's busy and varied life.¹

The arrangement of the campus is unusual. Nearly all academic activities are brought together in a group of connected educational buildings. There is unusually easy communication among the departments and schools. The extensive athletic plant and playing fields are on the campus, fully accessible. So are the recreational buildings, dormitories, and dining halls.

This convenient arrangement of the campus is no accident. It is an expression of the unity that pervades the Institute—unity among the sciences and humanities, among faculty, students, and administration, among the intellectual, social, and recreational aspects of living. M.I.T. was built to contain, in harmonious grouping, a single intellectual family.

¹ Some of M.I.T.'s diversified technical activities spread beyond Cambridge. The School of Chemical Engineering Practice operates two field stations—in Bound Brook, New Jersey (at the American Cyanamid Company); and Linden, New Jersey (at the Bayway Refinery). There is an Engineering Practice School at Oak Ridge, Tennessee, and the Department of Geology and Geophysics shares in the Nova Scotia Centre for Geological Sciences near Antigonish, Nova Scotia. Projects in meteorology and other fields are carried on at Round Hill near South Dartmouth, Massachusetts. The Institute operates the Lincoln Laboratory in Lexington, Massachusetts, and aircraft used in meteorology, instrumentation, and other studies are based in an M.I.T. hangar at Bedford Airport, near Lexington.



Directory

3-108	Admissions Office
33-207	Aeronautics and Astronautics
20E-111	Air Science
1-280	Alumni Association
7-345	Architecture
Du Pont	Athletic Association
16-519	Biology
4-106	Bursar
10-180	Cashier
52-555	Center for International Studies
12-155	Chemical Engineering
2-325	Chemistry
1-163	Civil and Sanitary Engineering
26-152	Computation Center
Bldg. 44	Cyclotron
7-104	Dean of Residence
7-133	Dean of Students
52-373	Economics and Social Science
3-333	Educational Council
4-202	Electrical Engineering
52-6th fl.	Faculty Club
11-100, 11-300	First Aid
16-325	Food Technology
14W-111	Gallery
24-304	Geology and Geophysics

5-1st fl.	Hart Nautical Museum	5-228	Naval Architecture and Marine Engineering
14N-407	Humanities	20E-125	Naval Science
52-474	Industrial Management		Non-resident Student Association (318 Memorial Drive)
11-3rd fl.	Infirmary	4-111	Nuclear Engineering
7-111	Information Office	Bldg. NW-12	Nuclear Reactor
50-110	Institute Committee	24-109	Personnel
14S-216	Libraries	6-113	Physics
33-304	Aeronautics and Astronautics	1-181	Placement
7-238	Architecture and Planning (Rotch)	14N-325	Political Science
10-550	Engineering (Vail)	3-208	President
14S-200	General		Radio Station WTBS (Ware House basement, East Campus)
14S-200	Humanities	7-142	Registrar
52-360	Industrial Management and Economics (Dewey)		Religious Counselors (317 Memorial Drive)
14E-109	Music	24-312	School for Advanced Study
14S-139	Science	3-234	Secretary of the Institute
24-117	Lost and Found	5-119	Student Aid
14S-139	Map Room	7-103	Summer Session
2-263	Mathematics	24-036	Synchrotron
1-206	Mechanical Engineering	50-302	Tech Engineering News
11-1st fl.	Medical Department	50-309	Technique
8-309	Metallurgy	50-2nd fl.	Technology Community Association
24-516	Meteorology	50-basement	The Tech
20E-126	Military Science		
14N-307	Modern Languages		
14N-236	Music		



The Science Library reading room

“ . . . A PLEASURABLE VENTURE AMONG THE WORKS OF MAN . . . ”

LIBRARIES

The M.I.T. libraries have one of the foremost collections of science and engineering literature in this country. Lecture, library, and laboratory complement each other in a balanced technical education. Discovering the delight of great books and learning one's way around among them, as well as learning to use the research facilities of a truly great library, are important parts of an M.I.T. education.

*The Charles Hayden
Memorial Library*



The Music Library



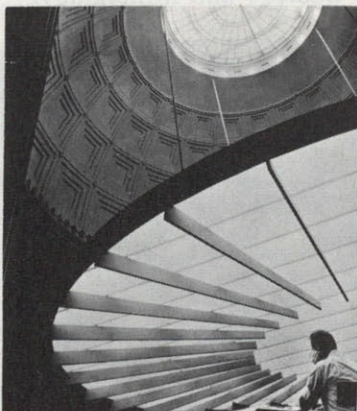


In the Central Library reading room

The Map Room

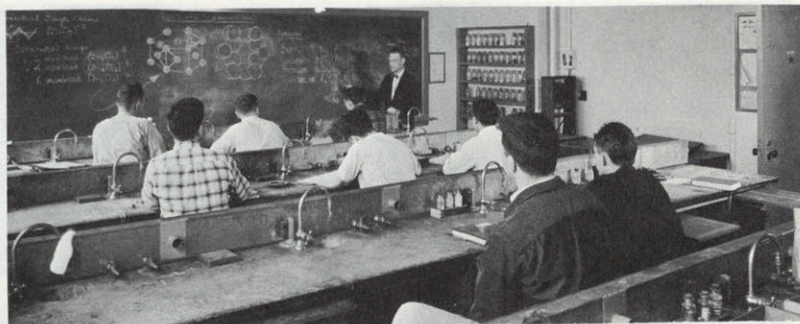


The Engineering Library



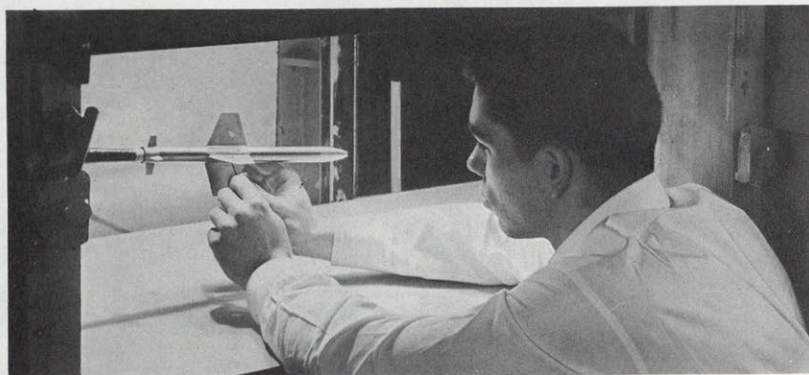
The Hayden Library Court



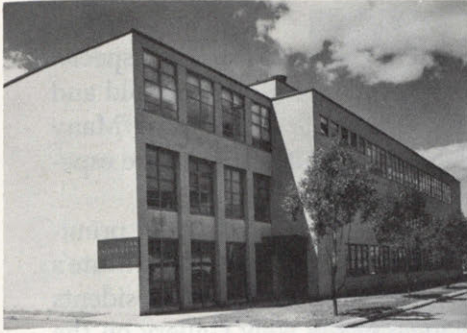


LABORATORIES

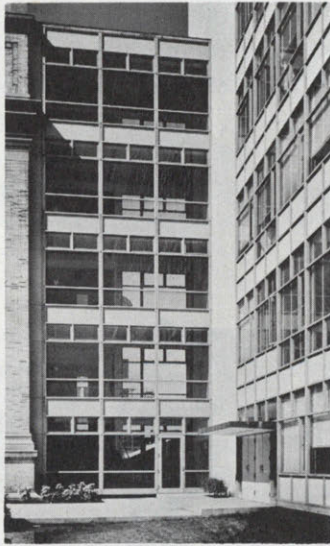
Most of the laboratories which have brought national fame to M.I.T. are devoted to teaching as well as research and so are familiar to many M.I.T. students. There are more than 70 such special laboratories—among them the Laboratory for Nuclear Science, the Research Laboratory of Electronics, the Gas Turbine Laboratory, the Insulation Research Laboratory, the Materials Processing Laboratory, the Prescott Laboratories of Food Technology, the Spectroscopy Laboratory, the Guggenheim Aeronautical Laboratory, the Wright Brothers Memorial Wind Tunnel, the Supersonic Wind Tunnel, the Eastman Laboratories for chemistry and physics, the Sloan Automotive and Aircraft Engine Laboratory, the Nuclear Engineering Laboratory and nuclear reactor, the Electronic Systems Laboratory, the Computation Center, and the Laboratories of Steam and Compressed Air, Refrigeration, Testing Materials, Hydrodynamics, Ceramics, High Voltage, Physical Chemistry, Applied Physics, Insulation Research, Corrosion, and Geology and Mineralogy.



THESE VARIED EXTERIORS SPEAK FOR THE DIVERSE ACTIVITIES OF M.I.T. LABORATORIES . . .



. . . for aircraft and automotive engines



. . . for biology and food technology



. . . for high-energy nuclear particles



. . . for aeronautics and astronautics

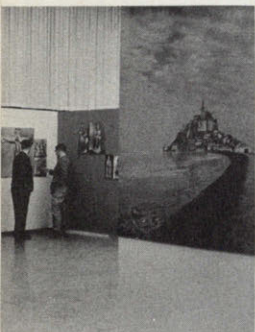
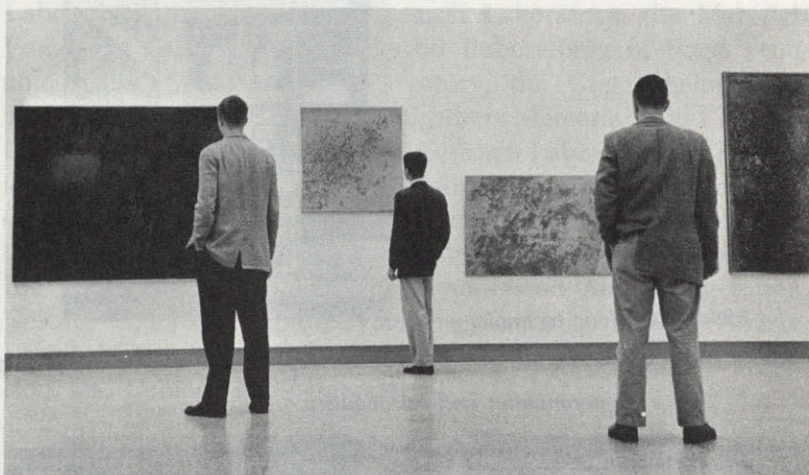


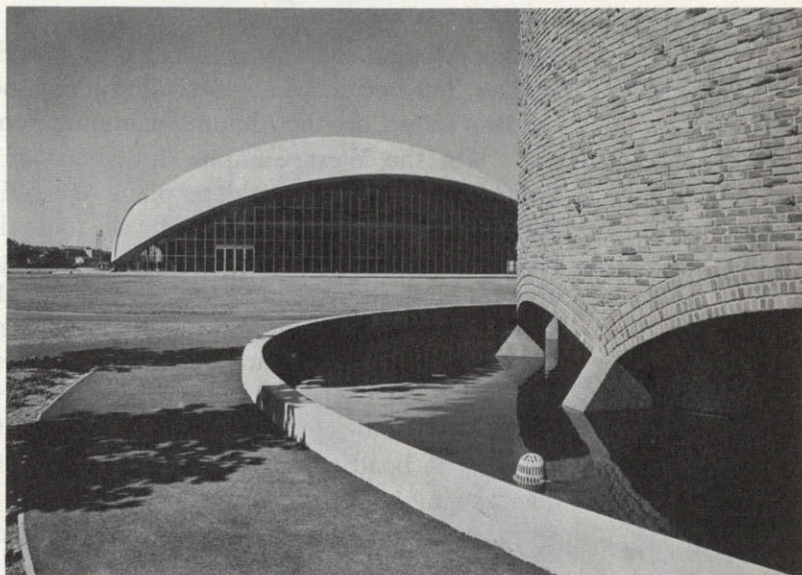
MUSEUMS

The Hart Nautical Museum, other permanent exhibits, and special exhibitions at M.I.T. present a wide variety of ideas, both old and new, to enrich the life of the entire Institute community. Many have a direct bearing on the studies in humanities and so are especially relevant to undergraduate purposes.

Everything from handcraft to machine craft, from primitive through contemporary art, may turn up in the Institute's monthly exhibitions, which draw many Greater Boston residents to M.I.T. These exhibitions are shown in the New Gallery on the first floor of the Charles Hayden Memorial Library—a spacious, well-lighted room designed with a simplicity that enhances the appeal of its exhibitions.

The Exhibition Gallery of the Charles Hayden Memorial Library.





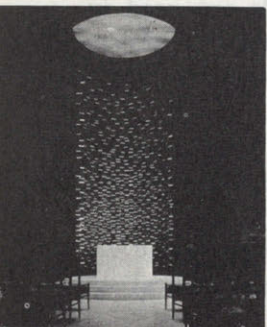
KRESGE AUDITORIUM

The Institute's interest in the contemporary point of view is nowhere better demonstrated than in the Kresge Auditorium and its neighboring chapel, widely recognized for their distinctive design. The finest public performances of music and drama are given in the Auditorium, as are lectures and many less formal events. A typical week's schedule, including play readings, rehearsals, concerts, and movies, would go far to suggest the varied interests of this academic community.

M.I.T. CHAPEL

The M.I.T. Chapel is the center of many religious activities. It is open to—and used by—all religious groups for daily, weekly, or monthly services.

Dr. Killian has recently written of M.I.T.'s responsibility to maintain an atmosphere of religious freedom and, within this environment of freedom, to provide "adequate opportunity for its students to deepen their own understanding of their spiritual heritage and freely to pursue their own religious interests and to worship God in their own way."



RECREATIONAL FACILITIES

Walker Memorial, built in memory of President Francis Amasa Walker, has become the center of student social life. Nearby, as the map shows, are the Alumni Swimming Pool and squash courts.

On the West Campus, the du Pont Athletic Center is the focus of a complete athletic plant. West of it are playing fields for soccer, lacrosse, baseball, softball, football, track, and tennis. Here, too, are the John Rockwell Athletic Cage, which has a large area for wintertime recreational and varsity athletics—including a portable basketball floor and stands; the Briggs Field House, with lockers and showers; and an outdoor artificial-ice skating rink, which is used from November through March. Dressing rooms and other facilities for women are located in the du Pont Center.

The boathouse on the Charles River is supplied with indoor rowing machines as well as eight-oared shells, and any undergraduate may learn this sport under competent coaching. Any undergraduate, too, may learn to sail by joining the Nautical Association at the Sailing Pavilion on the Charles River in front of Walker Memorial.

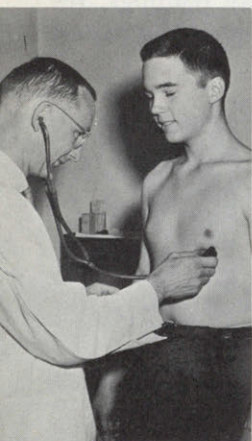
A Hobby Shop provides students with tools for wood-working, metal working, gem polishing, bookbinding, radio, photography, electroplating, printing, and telescope making.

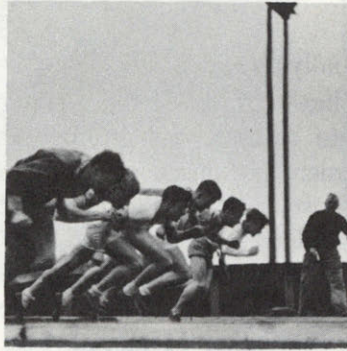
MEDICAL FACILITIES

The Institute maintains a well-equipped Medical Department, centrally located in the Homberg Memorial Infirmary, a wing of M.I.T.'s main buildings. On the first two floors are doctors' offices and special facilities for minor surgery, ophthalmology, otolaryngology, dentistry, x-ray, and laboratory diagnosis. An infirmary of 21 beds and an operating room are located on the upper floors. Facilities of the Boston and Cambridge hospitals are used in cases involving major operations or complicated medical procedures, after which students may return to the infirmary for convalescence.

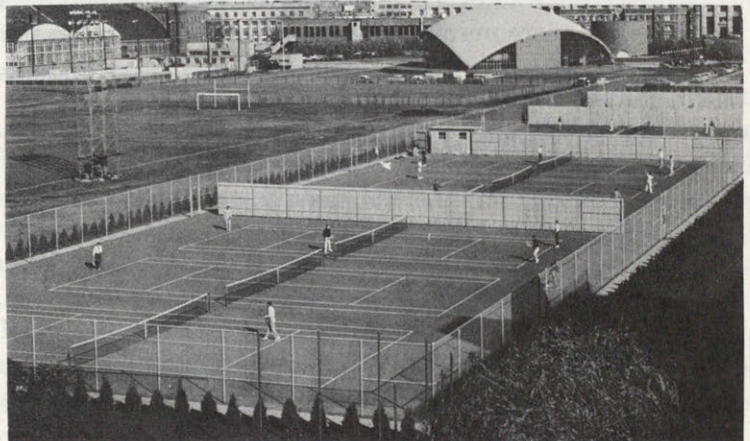
The clinic is staffed by about 30 doctors, four of whom are on a full-time basis. Charges for medical services are described fully in Section 3 of this book.

In addition to treatment services, the Department cooperates with the Athletic Association in providing medical supervision for contact sports.





M.I.T.'s recreational assets include swimming pool, skating rink, sailing pavilion, and playing fields.



RESIDENTIAL PLAN

M. I. T. is essentially a residential college.

On the basis of its living arrangements, the student body divides into three major groups. The largest, consisting of about 2,000 men, is housed on the campus in the Institute houses: Baker House for 350 students, with dining service; Burton House for 339 and Conner Hall for 230, with dining service; the Graduate House for 452 graduate students, with dining service; and the East Campus Residence Houses for 618, with dining service adjacent in Walker Memorial. The Women's Dormitory has comfortable rooms for 17 first-year co-eds, and 33 upperclass and graduate women live in Bexley Hall. Members of the faculty live with their families as Faculty Residents in these Institute houses.

Second, about 800 undergraduates live in the 28 fraternities, all of which serve meals for their members. Freshmen who elect, upon invitation, to join fraternities commonly do so early in their first year; they usually take up residence immediately in the chapter houses.

The third group consists of those students who live away from the campus—either at home or in lodgings or apartments in the Cambridge and Boston areas.

In order that freshmen may enjoy to the fullest the associations and benefits of campus living, they are expected to live in the undergraduate houses (up to the limit of capacity) unless they live at home or in fraternities. Upperclassmen may make whatever living arrangements they choose; rooms on the campus are normally available to nearly all who wish them.

Campus housing for married students is not available, but the Dean of Residence maintains a listing of off-campus apartments and houses.

WOMEN AT M.I.T.

The opportunities for women in science, engineering, and management are clearly increasing. And, although the women at M.I.T. are far outnumbered by the men, they have an important part in Institute life. Co-eds at M.I.T. participate in every aspect of the academic program and in almost every student activity, and they use all the facilities for athletics, including swimming and sailing.



Women at M.I.T. share with men all of the Institute's academic life.



In addition to the dormitory facilities for M.I.T.'s women students, there is a lounge in the main educational buildings where a large living room, kitchen, study, rest room, and locker room provide a pleasant place for teas and dinners and for business meetings of the Association of Women Students. Between classes women students often stop here for a snack, for an hour of study, or for conversation and relaxation.

Upperclass women are designated to help introduce freshmen to the Institute during Freshman Weekend. Women freshmen who do not live at home are required to live in the Women's Dormitory, nearby in Boston.

THE ENVIRONMENT

Boston and its suburbs contribute richly to the facilities and experiences which await M.I.T. students.

There are still many reminders of colonial days: Faneuil Hall, the "Cradle of Liberty"; the narrow, winding streets of a more leisurely age; the Old North Church, where Paul Revere's warning lanterns were hung; his home just around the corner; and Boston Common, first set aside in 1634 as a cow pasture and training field.

Nearby are many other places whose names have been in history books for generations . . . Concord, Lexington, and Salem . . . The House of the Seven Gables, Plymouth Rock, Wayside Inn, Walden, John Alden's home, and Sleepy Hollow Cemetery.

But Boston is not living in the past. Today it has as wide a spread of cultural interest as can be found anywhere else in the United States, outside of New York. Many important musicians, chamber groups, and symphony orchestras give yearly concerts here; there is an active and varied theatrical season; and local organizations—the Museum of Fine Arts, the great Boston Symphony Orchestra, and many others—have real breadth and strength. Here, too, are educational institutions with a diversity perhaps unique in the United States. Going to college in Boston offers an unparalleled adventure outside the classroom.

Nearness to many large industries, too, gives students a chance to supplement academic work by visits to plants and discussions with business leaders. New England is one of America's famous vacationlands, and students here explore the attractions of mountains, beach, and rock-bound shore.



This remarkable aerial photograph shows M.I.T. (at the bottom right), Boston, the islands of the harbor, the picturesque South Shore, and—in the far distance—the hook of Cape Cod.



THESE ARE THE OUTCOMES

Few of the activities of mankind are so constantly changing as the fields of the scientist, the engineer, the architect, the economist, and the executive. Few are so secure from the monotony of repetitive routine, and few make so many stimulating new demands. Here is interesting and useful work for many temperaments and minds.

PLACEMENT

Our national and industrial progress cannot continue unless we continue to know more and more about science and its applications to human affairs. There has never been a time when more was expected of graduates in these fields and when such a wide range of important work awaited them. A student majoring in fields represented at M.I.T.—science, engineering, architecture, humanities, economics, political science, and management—today has opportunities which were never before so great. Industry, education, and government call on M.I.T. for graduates to fill many responsible posts, and their representatives come here to interview seniors. An M.I.T. graduate normally may choose among several positions and thus find the job for which he is best suited. One-third of M.I.T.'s undergraduates go on to school, at the Institute or elsewhere, for advanced work.

M.I.T.'s Placement Bureau helps students plan for placement and brings them together with prospective employers and their representatives. Students who wish summer work will find similar help here.


SELECTIVE SERVICE

M.I.T. students who may be subject to selective service will wish to know of the Institute's Military and Selective Service Office, which helps students in their dealings with their draft boards. A Selective Service College Qualification Test is given each year at M.I.T., and students should consult the Military and Selective Service Office about taking this test. They should report to this Office upon receiving a classification questionnaire from their local boards, in order to complete Forms 109. Class 2-S deferments are advised, now that men 26 and over are not being inducted.

ALUMNI

One way to appraise an M.I.T. education is to study the record of the Institute's 50,000 alumni. Most of them find their way into careers associated with science and engineering, and the professional records of these alumni are an important part of M.I.T.'s greatness. Two trends in this group have attracted recent attention: many M.I.T. graduates in science and engineering find themselves in executive positions within a few years; and many are doing technical work in fields other than those of their undergraduate majors. These facts serve to emphasize the importance of M.I.T.'s concept of a basic education without overspecialization and with the richness and breadth which only a great college community can provide.

Newcomers on the M.I.T. scene are invariably surprised at the wide range of activities which alumni represent. The roster includes such artists as Charles H. Woodbury, Daniel Chester French, and Samuel Chamberlain; bankers and economists such as Charles Hayden and Roger Babson; public figures like Charles Edison; and Arthur Farwell and Frederick Field Bullard, composers. One M.I.T. graduate is the author of two song-bird guides recommended by the Audubon Society, and another is Director of Social Sciences at a great Eastern university. Such diversity as this emphasizes that, though M.I.T. is a professional school, there is much of general education in its program.



*Alumni reunions
on Kresge Plaza*



2 | *Education at M. I. T.*

By giving mankind a new mastery over nature, technology is transforming our environment and our culture in a manner literally unparalleled in history. Today the rate of change is very high indeed. The rocket which was in yesterday's headlines already has a successor on the launching platform; the computer of today must be replaced by a larger, faster, and more versatile machine.

Commenting on this great and rapid change in technology, Dr. Julius A. Stratton, President of M.I.T., recently told a meeting of M.I.T. students, "It is incumbent upon M.I.T.'s faculty to provide you with a solid foundation upon which you can build. It is not enough merely to fit you for the industrial demands of today; you must be ready to cope with the science and technology of the next thirty years.

"The first two years of an M.I.T. education concentrate on mathematics, physics, and chemistry, because on their mastery depends the power to attack with confidence the most difficult problems of the engineering and scientific professions. The professional subjects, which most students start in their sophomore year and emphasize in their junior and senior years, count heavily on this foundation of mathematics and the basic sciences. By applying basic principles learned in the first two years, these professional subjects give depth, unity, and purpose to the whole.

“The roots of a profession go deep into our cultural soil; this of course is the meaning of our humanities program. We believe that “Introduction to the Humanities” ought to be as truly a professional subject as a course in thermodynamics or structures. And we hold that a course in thermodynamics need be no less a contribution to general or “liberal” education. If you thus view our M.I.T. curricula, you may be able to see with us how, without departing from the original idea of a school with a central focus on science and technology, we are indeed developing our undergraduate plan into a modern form of liberal education, indigenous to our country and relevant to our times.”

THE PROFESSIONAL COURSES

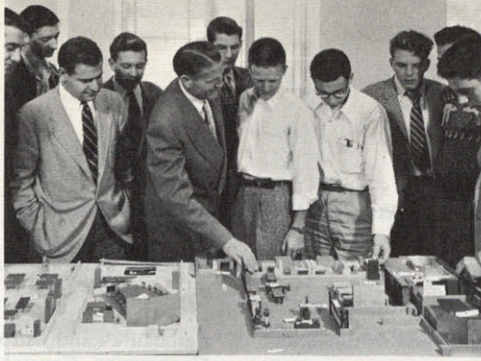
There are 21 academic departments at M.I.T., organized into five schools. Of these departments, 16 award Bachelor of Science (S.B.) degrees, which require four years of study. The Department of Architecture offers a five-year undergraduate program leading to the Bachelor in Architecture (B.Arch.).

The degree programs are arranged in “Courses” according to major fields of study. Much flexibility is provided within these Courses by “options” and electives, and individual students will find opportunity to pursue special interests as they work to meet the degree requirements.

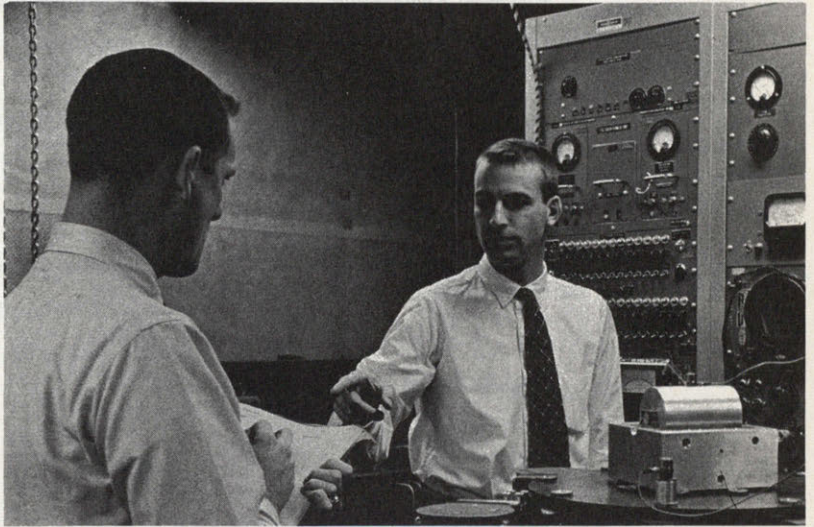
Among these options are the *Cooperative Courses*, in which a student’s time, after his second year, is divided between academic work at M.I.T. and practical experience at leading industrial plants. Some of the plant work is carried on in the summer. These Courses represent “learning by doing” carried to its fullest development, and many students find great value in the combination of on-the-job experience with academic study.

M.I.T. offers graduate degrees—but no undergraduate degrees—in Building Engineering and Construction, Ceramics, City and Regional Planning, Meteorology, Nuclear Engineering, Sanitary Engineering, and Textile Technology. However, students may follow undergraduate programs which give them excellent preparation for graduate study in any one of these fields. More information may be found in the General Catalogue, which each student receives soon after his arrival in Cambridge.

The chart on pages 40 and 41 lists *all* the departments and *all* the undergraduate Courses; it should help to guide you



Aeronautics and astronautics, industrial management, and nuclear engineering—many disciplines meet in the M.I.T. community.



through the more detailed description of the fields at M.I.T. which appear in the section on "Educational Opportunities" at the back of this book. Look in this section for a "bird's-eye view" of each M.I.T. undergraduate Course. Most departments give advanced degrees as well as the Bachelor's degrees shown on the chart.

CHOICE OF COURSE

Many students enter M.I.T. with a decided preference for a particular field of study but experience shows that a large number of these students later find another field to be more to their liking. Every student who comes here, therefore, should be prepared to examine with an open mind *all* the educational opportunities at M.I.T. Students are encouraged to attend departmental orienta-

(text continues on page 42)



DEPARTMENTS AND PROFESSIONAL COURSES

<i>Department</i>	<i>Undergraduate Courses</i>	<i>Degree</i>
SCHOOL OF ENGINEERING		
Aeronautics and Astronautics	Aeronautics and Astronautics	S.B.
	<i>Cooperative Course</i> [°]	S.B.
Chemical Engineering	Chemical Engineering	S.B.
	<i>Chemical Engineering Practice</i> [°]	S.B.
Civil and Sanitary Engineering	Civil Engineering	S.B.
Electrical Engineering	Electrical Engineering	S.B.
	<i>Cooperative Course</i> [°]	S.B.
	Electrical Science and Engineering	S.B.
Mechanical Engineering	Mechanical Engineering	S.B.
	<i>Cooperative Course</i> [°]	S.B.
Metallurgy	Metallurgy	S.B.
	Materials Science	S.B.
Naval Architecture and Marine Engineering	Naval Architecture and Marine Engineering	S.B.
	Shipping and Shipbuilding Management	S.B., S.M. ^{°°}
Nuclear Engineering		
SCHOOL OF SCIENCE		
Biology	Quantitative Biology	S.B.
Chemistry	Chemistry	S.B.
Food Technology	Food Technology	S.B.
	Biochemical Engineering	S.B.
Geology and Geophysics	Geology and Geophysics	S.B.
	Geology and Geophysics	S.B., S.M. ^{°°}
Mathematics	Mathematics	S.B.
Meteorology		
Physics	Physics	S.B.

[°]Including several months of work and study with leading industries.

^{°°}Requires five years, at the end of which both bachelor's and master's degrees are awarded.

<i>Department</i>	<i>Courses</i>	<i>Degree</i>
SCHOOL OF ARCHITECTURE AND PLANNING		
Architecture	Architecture	B.Arch.***
City and Regional Planning		
SCHOOL OF HUMANITIES AND SOCIAL SCIENCE		
Economics and Social Science	Economics, Politics, and Engineering	S.B.
	Economics, Politics, and Science	S.B.
Humanities	Humanities and Engineering	S.B.
	Humanities and Science	S.B.
Modern Languages		
SCHOOL OF INDUSTRIAL MANAGEMENT		
Industrial Management	Industrial Management	S.B.
Air Science		
Military Science		
Naval Science		

***Requires five years of study.

(text continued from page 39)

tion programs and to seek out and talk with faculty and others who have experience in fields of potential interest to them. For many students this examination will reinforce existing convictions, but for others it will open up new avenues of interest; in either instance the result will be beneficial.

Each student has an opportunity to indicate his choice of Course at the end of his first year, and he must do so by the end of his second year. If beyond this point in his career at M.I.T. a student finds from his own increasing knowledge of himself and of the things he is studying that he wishes to change his Course, he will almost always find that he can do so with little loss in time.

Though there is much variety in M.I.T. curricula, there is a basic interrelationship among most fields of study here. This common meeting ground deeply influences the life of every undergraduate. In fraternity house and dormitory, at noon-time luncheon or evening bull session . . . everywhere, the naval architect and the biologist swap ideas, the thinking of the prospective metallurgist is stimulated by that of the future architect. This opportunity for understanding the problems of fields other than one's own and for contributing one's special view to a general discussion with keen minds from other fields is a valuable part of education at the Institute.

COMPETENCE AND VERSATILITY

Today's professional opportunities demand of *every* student the great competence in basic science and versatility in its exploitation which will enable him to move easily across the familiar fields of specialization. M.I.T. education is responding to this need by providing deeper and more penetrating studies in the basic sciences and more emphasis on the scientific content of engineering. The boundaries between M.I.T. Courses are softening. Their similarities are far more important than their differences.

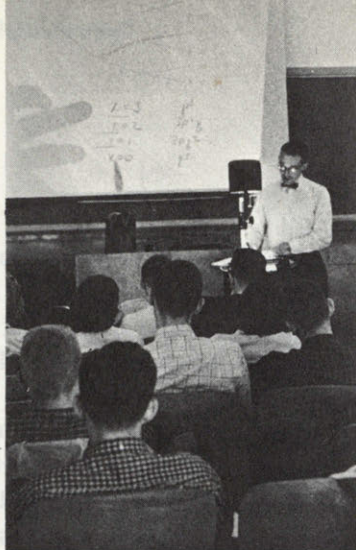
You will find everywhere in all M.I.T. Courses the basic instead of the specific, the broad instead of the narrow. There are no subjects in highly specialized industrial practices. Because engineers and scientists, like administrators and managers, work more with their brains than with their hands, the emphasis in professional Courses is on the larger aspects of subjects—the



thermodynamics which makes a Diesel engine possible and the wave theory which lies behind a dish-shaped radar antenna.

Manual skill is near the bottom of the list of qualities a student should possess if he is to be successful at M.I.T. Dexterity in assembling a radio transmitter is a good thing, of course; but far more important than handiness with pliers and screw driver is the ability to master the theory of why the set works. More important still, and much rarer, is the quality of mind that can evolve new concepts out of which still other useful things can be developed, or that can administer large undertakings involving scientific processes and control. The number of M.I.T. graduates holding positions of major responsibility in industry and government evidences the soundness of the Institute's emphasis on breadth rather than on technical detail.



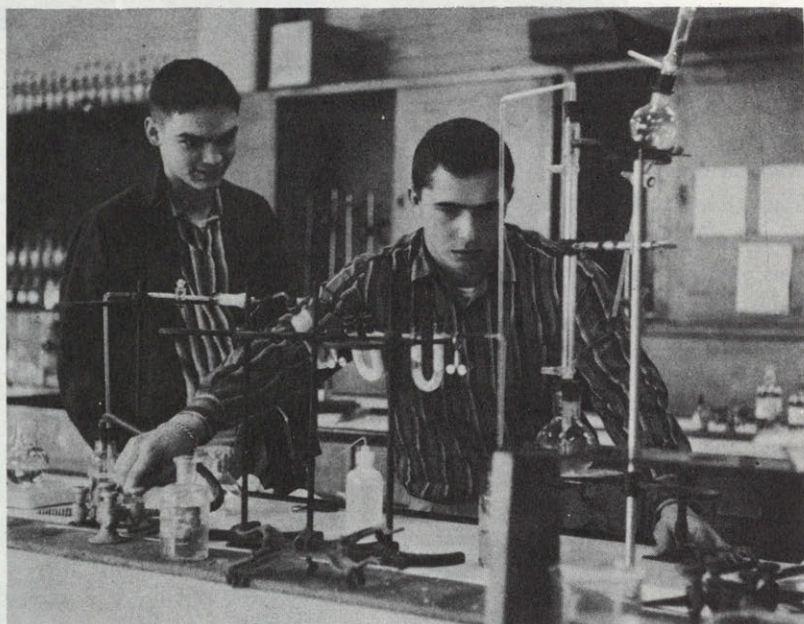
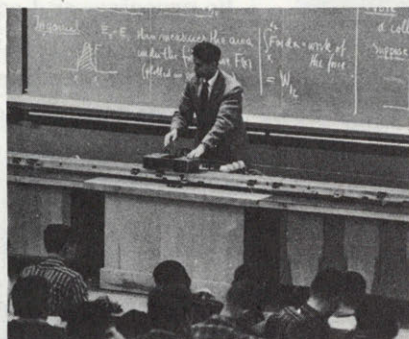
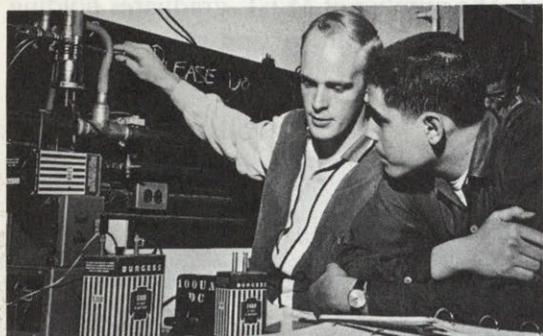


"BASIC INGREDIENTS OF ANY MODERN
LIBERAL EDUCATION . . ."

. . . *mathematics*

. . . *physics*

. . . *chemistry*



THE FOUR-YEAR PATTERN

Each Course curriculum leading to a Bachelor's degree at M.I.T. consists of a program of general education emphasizing science, mathematics, and the humanities and social sciences (the General Institute Requirements) and a grouping of subjects in the areas of one professional interest (the Departmental Program). The General Institute Requirements comprise about half of the work for a Bachelor's degree and are essentially the same for all Courses. The Departmental Programs build directly on the basic subjects of mathematics, physics, and chemistry and proceed to develop special competence in the field which each student has chosen.

Here is a generalized outline of the four years in most M.I.T. Courses:

THE FIRST YEAR

All freshmen (except those planning to enter the Course in Architecture) follow programs of study containing in common: humanities, mathematics, physics, and chemistry. The Course in Architecture replaces chemistry with two one-semester subjects in graphics. In addition, all students, except those in the Navy or Air Force R.O.T.C. programs, are required to earn 12 units of credit (22 units in Architecture)¹ in elective subjects designed for freshmen or in upperclass elective subjects for which they are qualified. Students are urged to use this elective requirement to explore fields of potential interest. Freshman elective subjects are described in detail at the end of this book.

This is the program for the two terms of the first year:

First Term:

GENERAL CHEMISTRY (5.01)²

PHYSICS (8.01)

CALCULUS (18.01)

INTRODUCTION TO THE HUMANITIES (21.01)

Elective subject

Second Term:

GENERAL CHEMISTRY (5.02)²

PHYSICS (8.02)

CALCULUS (18.02)

INTRODUCTION TO THE HUMANITIES (21.02)

Elective subject

¹ The system of credits at M.I.T. is described in Section 5.

² Students who plan to enter the Course in Architecture are not required to take CHEMISTRY (5.01 and 5.02), but GRAPHICAL CONCEPTUALIZATION AND ANALYSIS (2.721) and DESCRIPTIVE GEOMETRY (2.722) are required. Chemistry may be taken as an elective.

Some entering students will have taken subjects in their secondary schools which will allow them to obtain credit for one or more of these first-year core subjects. Those who have done so will have time available at M.I.T. to go on to other subjects of their choosing.

Because of its general nature, this first-year curriculum is adapted to the requirements of all M.I.T. Courses; but this adaptability does not prevent the basic program from being a rigorous and thorough foundation for later work.

In mathematics, first-year students build on their basic knowledge of algebra and trigonometry to master the calculus and pertinent portions of analytic geometry. One object of the calculus is to develop methods of studying rates of change, such as velocity and acceleration. Another goal is the study of the inverse problem—to find a function from its given rate of change. The climax comes in the discovery of the connection between these processes and the method of summation of many small bits (for example, of area, of volume, of arc length, or of work) to find an integrated whole. These ideas are basic to all science and engineering.

In physics, freshmen hear two lectures a week, illustrated with experiments and demonstrations. To supplement these, each student has two meetings with an instructor in a small section where he has ample opportunity for questions and discussion. Once every three weeks he spends half a day in the physics laboratory, performing experiments designed to acquaint him thoroughly with the experimental foundations of physics.

In chemistry, first-year students follow a similar program of two lectures and two section meetings each week, with a weekly laboratory period supervised by the section instructor and a laboratory assistant.

In humanities, the teaching is carried out entirely in discussion sections. Scheduled conferences with instructors offer still more opportunity for individual learning and personal involvement with the teaching materials.

A first-year student spends about 20 hours per week in class and laboratory. If he has learned to plan and use his time well, he will find that these first-year studies allow him time to pursue other interests. There is no conventional "cut system" at M.I.T. Occasional absences are assumed to be for valid reasons,

and a student who is making satisfactory progress does not have to account for them. Freshmen soon learn that they are out of the schoolboy atmosphere of rigid restrictions. They respond quickly to the challenge of a mature university system, where students must take responsibility for planning their own time.

THE SECOND YEAR

In the second year, students continue in physics, mathematics, and humanities to fulfill General Institute Requirements. In addition, they may begin studies in the particular Course of their choice, if their choice has been made. If they have not chosen a Course, they should use their electives during the sophomore year to help them define their interests and so to choose their Course before the end of the year; Faculty Advisers will have detailed information on elective subjects and will help students plan their programs.

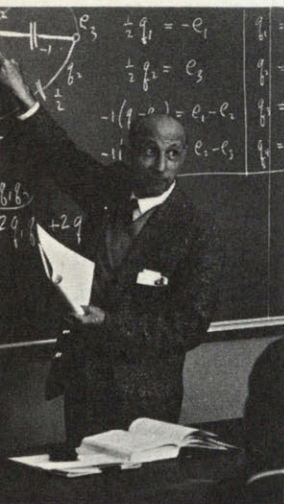
THE THIRD AND FOURTH YEARS

The more specifically professional subjects within each Course come in the third and fourth years, when students fulfill most of the requirements of the Departmental Programs. Every student will find that within these Programs there are electives which enable him to follow his own special interests within the broad field.

HUMANITIES AND ECONOMICS

The four-year pattern is somewhat different in the case of M.I.T.'s Courses in Humanities and Engineering or Science and in Economics, Politics, and Engineering or Science; these are distinctly less specialized than many of the professional curricula. In these Courses students devote about half of their time to basic work in one of the fields of science or engineering and half to the humanities and social sciences. Students may, if they wish, use a fifth year to gain the Bachelor of Science degree in the science or engineering field of their earlier concentration.

These Courses are significant because, while they prepare a student to go on with work in the engineering or science field of his choice, they also give him ample background for further study in law, public administration, writing, personnel work, economics, or other humanities and social science fields, if he prefers to follow one of these directions.



THE UNDERGRADUATE THESIS

An undergraduate thesis—a report on a special project or an original investigation—is a graduation requirement in all Courses except Mathematics. The booklet of instructions to seniors about their theses says, simply, “The thesis gives you a chance to show what you can do on your own with a genuine man-sized problem in the field you have chosen; instead of learning and practicing the basic principles of your chosen profession, you will now use your education to do a piece of real professional work. You are judged as the practicing engineer or architect or surgeon is judged—by how well you can do one complete job.”

Each senior has a member of the faculty as a consultant for his thesis, and he picks his topic with the help of this adviser. But, say the instructions, “The initiative is yours throughout this project. You should come to your adviser with a well-formulated question or plan of action. You are in charge of this job yourself.”

FOR PREMEDICAL STUDENTS

Each year from fifteen to twenty students enter medical school from M.I.T. Most premedical students take the Biology Course, but the specific requirements for entrance into medical school can be met in almost any of the Institute's Courses by proper planning. This type of premedical program fully meets the specifications of the Association of American Medical Colleges.



The flexibility and diversity of the programs available to premedical students at M.I.T. make it desirable that each student have individual guidance. If you are interested in entering medical school after graduating from M.I.T., you should consult Dr. James M. Faulkner, Adviser to Premedical Students.

HUMANITIES AT M.I.T.

As an undergraduate at M.I.T. you study the humanities, as do college students throughout the western world, primarily to explore such vital topics as these: ethical, spiritual, and aesthetic values . . . the reconciliation between liberty and order in a free society . . . the temptations of complacency and conformity. You are encouraged to respond as you will to the past experiences about which you learn; you are required to think, talk, and write about those experiences. Indeed, the program continually provides exercises in expression, constructed to help you command and organize data; for the faculty knows that clear thinking must precede clear writing. Clear writing is at once the mark of the educated and the indispensable tool of the successful. The first- and second-year subjects have an additional purpose: to introduce you to the kinds of materials which you may choose for further study in upperclass subjects in the humanities and social sciences.

The required first-year subject, Introduction to the Humanities, combines materials from history, literature, philosophy, and the arts in four topics, which focus successively upon Athens, Rome, the Medieval Christian perspective, and the Renaissance. Readings, selected for their significance and interest, are from works of such men as Sophocles, Thucydides, and Plato; St. John, St. Augustine, and Dante; Machiavelli, Calvin, and Shakespeare¹.

Sophomores continue their studies in a subject which deals with "Modern Western Ideas and Values."

Then, familiar with the substance of these introductory subjects and practiced in oral and written expression, M.I.T. upperclassmen are prepared to begin more specialized and advanced

(text continues on page 52)

¹ Students who come to M.I.T. with sufficient background in French may enter a special group which studies the first- and second-year humanities subjects in the French language, using French-language source materials. If you are interested in this group, you should write to Professor William N. Locke, head of M.I.T.'s Modern Language Department.

“... The vastness of man’s experience and his limited knowledge of himself ...”



Dean John E. Burchard of the School of Humanities and Social Science explains M.I.T.'s concern for helping its specialists develop a sense of proportion.

Specialization is here to stay. It is essential to our complex contemporary life. And for the individual there is a deep satisfaction in really knowing about something, in being able to deal with an explicit problem with force and elegance. So specialists are likely to be among the happiest of educated men.

Yet to have specialized competence today requires a formidable amount of specialized knowledge.

Needing to know so much about so little, there is always a risk that those who choose to be specialists may end by knowing—and caring—very little about anything else. In the long run the specialist will have to develop most of his sensitivities and his sense of proportion about the whole of society from a long experience in living. He will have to develop his own interest in and knowledge of the forest beyond the trees which he has been taught so sharply to identify. His undergraduate education can at best provide only a start.

By no means all of this start will come from his non-specialized subjects. Indeed, one of the largest forces for developing a sense of dignity and integrity will build up from within the specialty. Moral and ethical attitudes, for example, are rather more likely to develop from the codes of fellow scholars in the specialty than from sermons delivered in general courses.

The program of liberal education at M.I.T. has been arranged on the premise that specialists will not be made into men of wide vision through exhortation. Even a very learned modern man cannot hope in a lifetime to acquire a universal familiarity with all the fields of humanities and social sciences. Any undergraduate curriculum which undertakes to provide a comprehensive introduction to such a hope is bound to be inordinately superficial. We go at it differently. We look, for instance, at a few brief moments of time under a microscope rather than trying to run the course of history from Asoka to Eisenhower.

Every undergraduate at M.I.T. will study an average of at least one subject in this School during every semester of his residence with us. He may study more. An important part of the plan is that he does this study in all his years and not just his early ones.

We require our freshmen and sophomores to participate in two years of common experience in humanistic study. This part of the program tries to provide each student with some sense of the vastness of man's experience and some appreciation of the limited knowledge man has acquired about himself. It may lead our students to recall from time to time that there have been great nations before ours, that there have been great problems, great successes, and great failures, and to find some of the possible reasons for these successes and failures. It may influence them not to ignore their past on the silly premise that nothing that has ever happened to anyone before can be of any value to us now.

After this common experience, every upperclassman must elect a sequence of subjects in one or another field of concentration, a field of his choice. Here we are seeking to have him do a little "deep digging" in an area quite different from that of his specialty but one which has exerted some fascination on him. As the first part of the program tries to make him realize that there were great men before him, the second might show that there are great fields of current experience other than the one that he will follow, that there are great men in professions other than his own. This is more than a matter of creating an atmosphere of mutual tolerance and respect, although this is not a trivial objective. Once one can understand that there is a rigor in respectable study of history, though a different rigor from that of experimental physics, one is less likely to be taken in by shoddy history.

We must pay a great deal of attention, and do, to the quality of the works selected for study, to the nature of our library and our art exhibitions and our concerts. But we still could not succeed if we did not have a first-rate faculty, scholars of talents equal to those of their colleagues in science and engineering. We would not have such scholars unless their opportunities were in every direction equal to those enjoyed by their colleagues in their own fields in other universities. That this has been achieved at M.I.T. is symbolized by the fact that this faculty is assembled in a School. The existence of this effort as a School is unusual in engineering education and is of the utmost significance.

(text continued from page 49)

work in economics, psychology, political science, labor relations, history, literature, philosophy, music, modern languages, or the visual arts. They have begun to understand something about the heritage and the shaping of their society, its present problems, and their future roles as decision-makers in it.

Upperclassmen in the professional Courses must choose at least four one-semester subjects in the School of Humanities and Social Science during their junior and senior years. Three of these must be in one general area of study and the fourth must be out-

Professor Theodore Wood, Jr. entertains with folk music.



side this area. The list on the next pages shows the upperclass humanities subjects as they are divided into ten fields and indicates the usual sequence of three subjects within each field. Subjects which are marked by a dagger (†) may also be taken as the single "distributional" subject which is required in a different field.

Students who are interested in additional work in humanities and social sciences in the context of modern technology may wish to register in the Courses in Humanities and Engineering or Humanities and Science or in the Courses in Economics, Politics, and Engineering or Science.

OUTLINE OF HUMANITIES SUBJECTS

FIRST YEAR

First Term

21.01 Introduction to the Humanities

Second Term

21.02 Introduction to the Humanities

SECOND YEAR

First Term

21.03 Modern Western Ideas and Values

Second Term

21.04 Modern Western Ideas and Values

THIRD AND FOURTH YEARS

Any one of the following combinations of subjects may be taken without the approval of a humanities adviser. Other combinations are not prohibited but must be specifically

approved by a humanities adviser.

Subjects indicated by a dagger (†) may be taken as a single subject to satisfy the distributional requirement.

1. HISTORY

Any three of the following:

- The United States: Making of the Nation, 1760-1865 (21.41T)†
- The United States: Industrial and World Power, 1865-1960 (21.42T)†
- American Economic History (21.43)†
- Economic Leadership in the Industrial World (21.44)†
- American Intellectual History (21.46)†
- Technology and Economic Growth (21.48)†
- Modern Europe, 1500-1815 (21.51T)†
- Modern Europe, 1815-1960 (21.52)†
- The Revolt of Asia (21.53)†
- Russian Revolution and the Soviet Union (21.54)†
- History of Engineering (21.55)†
- History of Engineering (21.56)†
- Special Topics in History (21.591)
- Special Topics in History (21.592)

2. PHILOSOPHY

Any three of the following:

- Philosophy as System and Tradition (21.61)†
- Philosophy as System and Tradition (21.62)
- Problems of Philosophy (21.63)†
- History of Philosophy: Ethics (21.64)†
- Classical Philosophy (21.65)†
- Philosophies and Religions of the East (21.67)†
- Major Religions of the West (21.68)†
- Problems in Contemporary Philosophy (21.69)†
- Philosophy of the Social Sciences (21.70)†
- Philosophy of History (21.71)†
- Philosophy in Literature (21.72)
- Philosophy of the Arts (21.73T)†
- Metaphysics (21.74)†
- Moral Philosophy (21.75)†
- Symbolic Logic (21.76)†
- History of Political and Social Thought (21.77)†
- Political and Social Philosophy (21.78)†
- Nature of Man (21.79)†
- Existentialism (21.80)†
- Science and Philosophy from Antiquity to Copernicus (21.81)†
- Science and Philosophy from Copernicus to the Present (21.82)
- Philosophy of Science (21.83)
- Topics in the History and Philosophy of Science (21.84)
- Special Topics in Philosophy (21.891)
- Special Topics in Philosophy (21.892)

(continued on the next page)

*(continued from the previous page)***3. LITERATURE**

- Introduction to Literature (21.11)†
- plus any two of the following:*
- Literary Criticism (21.12)
- The Epic (21.13)
- Comedy in the Theatre (21.15)
- Tragedy and Modern Drama (21.16)
- Shakespeare (21.17)
- Non-Western Literature (21.18)
- Major British and Continental Writers of the 19th and Early 20th Centuries (21.19)
- The Bible (21.20)
- Dostoevsky, Tolstoi and Modern Russian Literature (21.21)
- The Nature of Poetry (21.22)
- The Nature of the Comic (21.24)
- The Modern Novel (21.25)
- Major Writers of the English Renaissance (21.26)
- American Folklore (21.31)
- Literature and Society (21.33)
- Twentieth-Century American Literature (21.34)
- Special Topics in Literature (21.391)
- Special Topics in Literature (21.392)
- Language and Society (L75)
- Linguistic Structure (L78)

4. MODERN LANGUAGES**a. German:**

- Intermediate German (L14)
- or*
- Introduction to Literature (21.11)†
- plus any two of the following:*
- German Literature 1900-1960 (L15)†
- Literature of Nineteenth Century Germany (L16)†
- Great Books and Authors in German Literature (L20)†

b. French:

- Intermediate French (L54)
- or*
- Introduction to Literature (21.11)†
- plus any two of the following:*
- Contemporary French Literature (L55)†
- French Literature of the Third Republic (L56)†
- Great Books and Authors in French Literature (L59)†

c. Russian:

- Intermediate Russian (L94)
- or*
- Introduction to Literature (21.11)†
- and*
- Great Books and Authors in Russian Literature (L95)†
- and*
- Modern Russian Literature (L96)†

d. Study of Languages:

- Language and Society (L75)†
- and*
- Problems of Phonology (L76)
- and*
- Linguistic Structure (L78)

5. MUSIC

- Introduction to Music (21.91)†
- and*
- Western Music from the Middle Ages to the Baroque (21.92)
- plus one of the following:*
- Western Music in the Classic Era (21.93)
- Western Music in the Romantic Era (21.94)†
- The Opera (21.98)
- Twentieth Century Music (21.95)
- The String Quartets of Beethoven (21.96)

6. ECONOMICS

- Economic Principles I (14.01)†
and
 Economic Principles II (14.02)
and one of the following:
 Prices and Production (14.03)
 Industrial Organization and Public Policy (14.04)
 Economic Fluctuations and Growth (14.05)
 Structure of the American Economy (14.06)
 Comparative Economic Systems (14.07)
 Economic Problems Seminar (14.09)
 Economics of Innovation (14.21)
 Monetary and Banking Policy (14.40)
 Public Finance (14.43)
 International Trade (14.54)

7. POLITICAL SCIENCE

Any three subjects in one of the following groups, or approved combinations of groups:

- a. Economic Principles I (14.01)†
 The American Political Process (14.91)†
 Seminar: Issues in Contemporary American Politics (14.93)
 Government, Politics, and Technology (14.94)
 Structure of Urban Life (14.99)
- b. Comparative Political Systems (14.92)†
 Politics, Society, and Policy Making (14.95)
 Influences on Policy Decisions (14.96)
- c. International Relations (14.51)†
 Principles and Problems of American Diplomacy (14.52)
 Seminar in International Politics (14.53)
- d. Basic Ideas of Western Politics and Ethics, 500 B.C.-1500 A.D. (14.55)
 Rise of Modern Political and Social Science, 1500-1914 (14.56)
 Contemporary Ideas on Political and Economic Development (14.57)
 Nationalism and National Development (14.58)

8. LABOR RELATIONS

- a. Economic Principles I (14.01)†
or
 Organization and Communication in Groups (14.73)†
and
 Labor Relations (14.63)
and
 Labor Economics and Public Policy (14.64)
- b. Labor Relations (14.63)
and
 Labor Economics and Public Policy (14.64)
and
 Labor Problems Seminar (14.64)

9. PSYCHOLOGY

Introductory Psychology (14.70)†
plus any two subjects, at least one in Group A:

- a. Psychology of Language and Communication (14.77)
 Learning (14.79)
 Psychology of Perception (14.81)
 Psychology of Motivation (14.82)
- b. Theories of Personality (14.84)
 Social Psychology (14.85)
 Behavior in Groups (14.86)
 Mass Communication (14.87)

(continued on the next page)

10. VISUAL ARTS

Any three of the following, providing both groups are represented:

- a. Visual Design Problems (4.031)†
Visual Design Projects (4.032)
- b. Architecture of Cities (4.61)†
Introduction to Art and Architecture (4.65)†
Modern Art and Architecture (4.66)†

THE ADVISORY COUNCIL

When you come to M.I.T. for the Freshman Weekend preceding the beginning of classes, one of the first events of the program is a meeting with your faculty adviser. He will be one of seventy members of the M.I.T. faculty who comprise the Freshman Advisory Council, and he will be chosen as your adviser because his work is in a field related to your interests.

The principal reason for having a Freshman Advisory Program is the sincere desire of the faculty to help make each student's career at M.I.T. interesting, enjoyable, and productive. The faculty is aware that an entering freshman may very well feel bewildered and somewhat lonely upon first coming to this new environment, and thus its members wish to extend a personal hand of welcome, to point out that the essence of M.I.T. is not the classrooms and buildings but the students and teachers who people them. The faculty wants to be on friendly terms with those with whom they associate and to establish this relationship as soon as possible. And—as do all members of this community—the faculty has a clear interest in working together with freshmen to develop their capabilities.

There will be some individual conferences with your adviser, since he will also be your registration officer—the person with whom you discuss your program of studies and who will approve any changes you may decide to make in your program. Your adviser will also undoubtedly try to see you under more informal circumstances, perhaps at his home, perhaps somewhere at M.I.T. Remember that half of the initiative for developing the relationship between student and adviser rests with each student; only when you contribute your share can a relationship of interesting substance develop.

You will continue to work with your Freshman Adviser until you have selected the course in which you will major at M.I.T.; thereafter, you will work with a Registration Officer from that department.



AIR, MILITARY, AND NAVAL SCIENCE

The Institute offers Air Force, Army, and Navy R.O.T.C. programs which lead upon graduation to commissions as reserve officers in the respective services. The Air Force program offers commissions in technical fields involving both flying and non-flying duties; the Army R.O.T.C. program offers commissions in the Corps of Engineers, Quartermaster Corps, Chemical Corps, Ordnance Corps, and Signal Corps. The Navy program, which is unique with M.I.T., offers commissions in the Restricted Line (engineering duty only) category of the Naval Reserve.

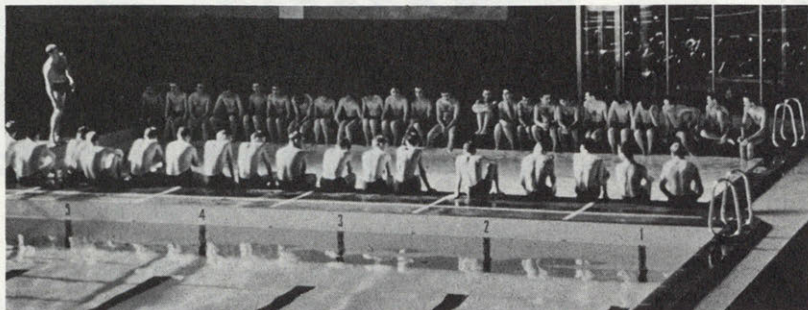
The Army program begins with basic training which can be completed in two years; students must complete an additional two-year advanced course to obtain a commission. The Navy and Air Force programs consist of a four-year sequence, and students who enter it in the freshman year should be prepared to pursue it to completion.

The Army program is open to students in any Institute Course. All applicants can usually be accommodated. Applications are accepted until Registration Day.

The Navy program is open to students in all Institute Courses except Architecture, Biology, Chemical Engineering Practice, Economics, Food Technology, and Geology and Geophysics, and the cooperative Courses in Aeronautics and Astronautics and Electrical and Mechanical Engineering. Registration is limited, and applications should be made by August 15 or as soon thereafter as possible before the beginning of the fall term.

The Air Force program is open to students in any Institute Course. Enrollment is limited, and interested students are urged to submit their applications three weeks before Registration Day. Late applications will be considered for selection if circumstances warrant. For further information write directly to the Professor in

charge of the appropriate department as shown at the back of this book.



A swimming class in the Alumni Pool.

PHYSICAL EDUCATION REQUIREMENTS

The objective of M.I.T.'s physical education program is to develop good health through skill in physical activities which may be enjoyed both in college and in later life. The physical education requirements are based upon a point system, a flexible arrangement designed especially so that every student may satisfy his own personal preferences. Each male student must compile a minimum of eight points through some phase of the physical education program by the end of his second year. Points may be acquired by participating in any one of the many freshman and varsity sports or in physical education classes. For example, members of intercollegiate teams acquire two points for fall or spring sports and four points for winter sports. Two points are awarded for each physical education class; there is a wide variety of such classes, including sailing, tennis, golf, basketball, badminton, squash, swimming, gymnastics, volleyball, skating, bowling, archery, lacrosse, and judo.

Upon entering M.I.T., each student must complete a medical examination, swimming test, and a physical fitness test. Those who do not meet certain minimum standards are recommended for swimming or development classes. If the medical examination indicates any disability which might limit physical activities, the requirements are modified accordingly.

Although there are no specific requirements for women students, women are encouraged to participate in the class and intercollegiate programs suited to their abilities and interests.

ACADEMIC REGULATIONS

M.I.T.'s policy is to have as few rules and regulations as are consistent with its academic purposes. The day-to-day affairs of students are in general the responsibility of student government, and the following—which you should have in mind before you come to M.I.T.—are the only regulations which are of major concern.

The Institute expects regular and prompt attendance in classes.

M.I.T. reserves the right to dismiss at any time a student whom it deems unsatisfactory for any reason.

It is the aim of the faculty to maintain the highest standards of integrity. The attempt of any student to present as his own any work which he has not honestly performed or to pass any examination by improper means is regarded by the faculty as a most serious offense and renders the offender liable to immediate expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Conduct inconsistent with general good order, wherever it may occur, is held to be grounds for dismissal.

Damage caused to any building, or to furniture, apparatus, or other property of the Institute, will be charged to the student or student group known to be immediately concerned; but if those who cause the damage are unknown, the cost of repairing it may be assessed equally upon all students.

Final examinations are held at the end of each term. No member of the faculty is empowered to grant excuse from a final examination, and absence is equivalent to complete failure except as a student may present to the Dean of Students a valid medical or other reason for not attending.

The Institute's grading system includes four passing grades—A, B, C, and D—representing work of descending degrees of quality. The last of these, although barely passing for an individual subject, is not regarded as of satisfactory average quality.

EDUCATION IS ALSO EXTRACURRICULAR

The concept that learning has no artificial boundaries is basic to education at M.I.T. Learning extends beyond the classroom walls to living and working in an environment which stimulates intellectual and extracurricular activities. M.I.T. has a full program



of such activities, managed (and we are very proud of this) with great independence by the students themselves. "Visitors to M.I.T. who are not acquainted with Institute life," says Dean Rule, "again and again express astonishment at the wealth of opportunities our students have—far beyond those offered not only by similar institutions but by most liberal arts colleges."

MUSIC AT M.I.T.

Musical events are a case in point. Klaus Liepmann, Professor and Director of Music at M.I.T., calls special attention to the fact that students disciplined to concentration and conditioned to scientific thinking turn out to be ardent music lovers and music makers.

The subjects in music are among the most popular of the Department of Humanities' offerings: "Introduction to Music" is intended for those with little or no knowledge of music; "Western Music from the Middle Ages to the Baroque," "Western Music in the Classic Era," and "Western Music in the Romantic Era" bring a detailed analysis of musical masterpieces by old and new composers; and several music seminars for a limited number of students draw on previous experiences to study in depth Beethoven's string quartets, for example, or twentieth century music, or the history of opera.

But where do these classrooms end? On this campus there are unusual opportunities for those who want to hear or help make fine music. The campus radio system, WTBS, carries music from the Music Library to all the dormitories and nearby fraternities throughout the day—and so successfully that the Radcliffe College radio has joined the network. Spontaneous barbershop singing and "jam sessions," hi-fi fans, serious music a best-seller at the campus record store . . . all are evidence that M.I.T. is a musical community.





"You will never believe how much enthusiasm, talent, and skill exist among young Americans, especially among those whose mental curiosity and searching minds drive them to study science and engineering, until you have given them opportunities to make music in their free time."

PROFESSOR KLAUS LIEPMANN

(left) The Choral Society sings Mozart's Requiem in Weikersheim, Germany.



Danny Kaye clowns
with the Glee Club,
Boston Pops, 1959

The Combined Musical Clubs include a Glee Club, Choral Society, Symphony Orchestra, Concert Band, and a Woodwind and Brass Ensemble—all out-of-classroom activities which draw a large following among the musicians in the student body. All of these organizations give public concerts in Boston and the neighboring communities—frequently in combination with musical groups of other colleges. The Choral Society joins with members of the Boston Symphony Orchestra for several major concerts; the Glee Club appears with the Boston Pops Orchestra in Symphony Hall. In 1956 and 1958 the Choral Society made summer tours in Europe, singing with European orchestras, including the Orchestra of the Darmstadt Technische Hochschule and of the Paris Conservatory. The Concert Band has the unique feature of playing only original band music, and it has given many premiere performances of contemporary compositions. Its schedule during the school year 1959-60 included three formal concerts at M.I.T., a Sunday afternoon concert in the Hatch Memorial Shell on the Boston Esplanade, a concert tour in the New York City vicinity between terms, concerts at neighboring schools, and two half-hour television broadcasts.

Many of these are concerts of highest professional standards. Here is what newspaper reviewers have said about some recent ones:

The Choral Society in Bach's B Minor Mass: "*The presentation amounted to a celebration, not merely a performance . . . The group has a transparent brilliance and buoyancy that lifted the noble Latin text to a higher plane.*"—THE CHRISTIAN SCIENCE MONITOR (1959).

The M.I.T. Concert Band at Smith College: "*We were fortunate in having an organization of highest caliber; the M.I.T. group plays good music and plays it well.*"—SMITH COLLEGE SOPHIAN (1953).

The Choral Society at the 1958 International Choral Week in Munich, Germany: "*One is inclined to ask oneself whether in this country technological students would be able to find as much enthusiasm for intensive work at choral music as Klaus Liepmann achieves with this layman's chorus. Intonation and discipline seem taken for granted.*"—MUNCHNER MERKUR (1958).

A number of chamber music concerts in the Humanities Series, guest artists brought by the Choral Society and Baton So-



ciety, and additional recitals in the Music Library give M.I.T. audiences a varied season of outstanding instrumental and vocal music.

PROFESSIONAL SOCIETIES

Professional activities, too, extend beyond the classroom at M.I.T. All the principal professional societies have student chapters here, and there are local professional clubs as well. The scientific and engineering honor societies are represented. (There is a full list in the chart on the following page.) In lectures, plant trips, and general fellowship these groups bring to M.I.T. students professional experience of a vitality unusual to American undergraduates.

STUDENT GOVERNMENT

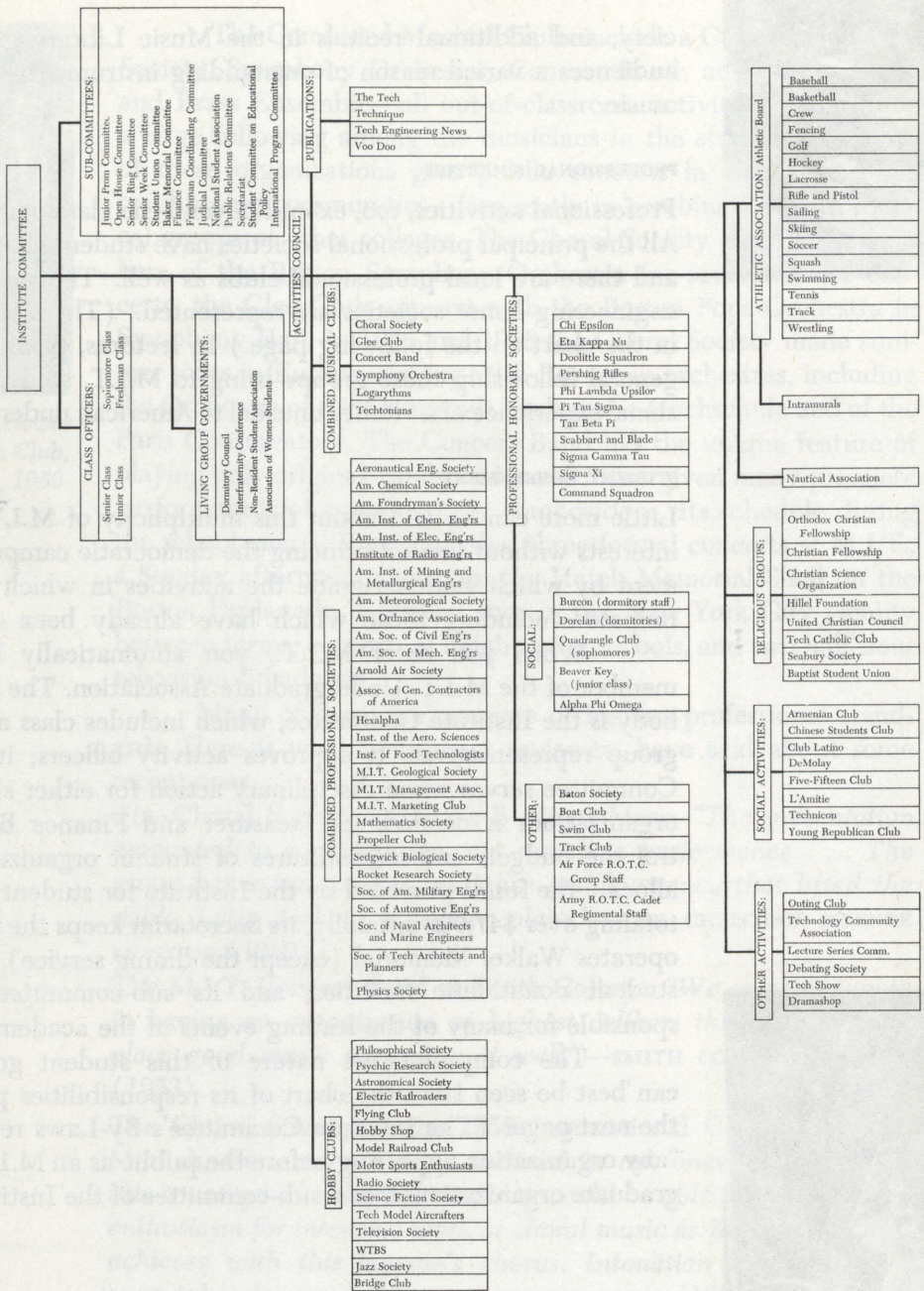
Little more can be said about this multiplicity of M.I.T. student interests without first introducing the democratic campus government by which students guide the activities in which they participate—including those which have already been described.

When you enter M.I.T., you automatically become a member of the M.I.T. Undergraduate Association. The legislative body is the Institute Committee, which includes class and living-group representatives. It approves activity officers; its Judicial Committee serves when disciplinary action for either students or organizations is needed; its Treasurer and Finance Board control the budgets and expenditures of student organizations and allocate the funds provided by the Institute for student activities, totaling over \$47,000 annually; its Secretariat keeps the books and operates Walker Memorial (except the dining service) and other student nonathletic facilities; and its sub-committees are responsible for many of the leading events of the academic year.

The comprehensive nature of this student government can best be seen from the chart of its responsibilities printed on the next page. (The Institute Committee's By-Laws require that "any organization appearing before the public as an M.I.T. undergraduate organization or as a sub-committee of the Institute Com-



Dr. Killian speaks at a student government leadership conference.



mittee must first be granted this privilege by the Committee.”) In fact as well as theory, students run all their activities . . . including in a very large degree the management of athletics. There are advisers, coaches, and faculty and alumni committees, but these act at the request of the student government. To make all this more effective, there are each year a series of weekend off-campus conferences for detailed, relaxed study of the problems of student leadership.

The government of the dormitories is in the hands of a Dormitory Council, which promotes social and sports activities within the dormitories and administers rules of dormitory life. Interfraternity Conference, the central governing body of the fraternities, sets a general policy—social, scholastic, and administrative—which each fraternity may assume as a standard. The Non-Resident Student Association, with headquarters in a comfortable lounge, includes all students who do not live in dormitories or fraternities; and The Association of Women Students, of which all women students automatically become members when they enter the Institute, serves as their government association and as a center for their group social life.

ATHLETICS AT M.I.T.

Athletics at M.I.T. demonstrate effectively the principles of M.I.T. student activities: the responsibility of students in student affairs, the intimate relation of the academic and extracurricular, and the value which M.I.T. students place on the diversity of a full college experience. The purpose, says Athletic Director Richard L. Balch, is “to provide individual opportunity to choose and participate in an athletic program designed to meet individual needs.” Thus the program is based on the concept that athletic competition—competition to win—is good for everyone. You will never see a salaried athlete here, never hear of an athletic scholarship.

There is no room at M.I.T. for an athletic program that exists outside the broad boundary of recreation. This does not mean that we do without intercollegiate competition. But it does mean that all athletic activities—intercollegiate and intramural alike—serve the purposes of recreation in the present and of building skills on which life-long recreational activities can be based.

Here are the details of M.I.T.’s varsity and freshman intercollegiate teams:





BASEBALL ranks high, from the first crack of the bat early in March until the final inning, late in May. Rockwell Cage is used for practice in bad weather, and varsity and freshman teams play their home games on Briggs Field. The varsity squad participates in the strong Greater Boston Intercollegiate Baseball League; in addition, the schedule includes such teams as Bowdoin, Wesleyan, Colby, and Coast Guard.



BASKETBALL has always enjoyed a place of prominence at M.I.T. With the facilities of Rockwell Cage and the Armory M.I.T. teams now have ample practice space for the 16-game schedule. The varsity, junior varsity, and freshmen start work-outs early in November, finishing their season early in March.



CREW brings out more than 100 men to compete with all the major college crews in the country. Six separate teams—"heavy" crews for varsity, junior varsity, and freshman teams, and "light" (or 150 pound) crews for varsity, junior varsity, and freshman teams—give plenty of opportunity for every candidate to have intercollegiate experience.

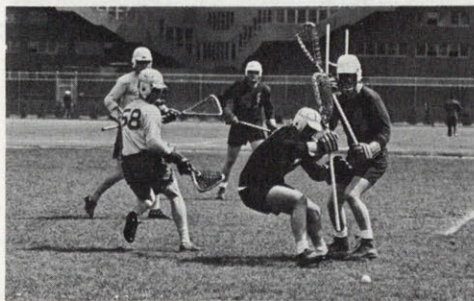


FENCING teams at M.I.T. have commanded respect in eastern fencing circles for years. The varsity participates against strong independent eastern college teams such as Cornell, Harvard, and Columbia.

GOLF offers opportunity for interested students to practice at a local golf course. There is a full varsity schedule, climaxed with the New England Collegiate Championships.



HOCKEY has been introduced in recent years to many students from all parts of the country. With our own rink, immediately adjacent to the new David Flett du Pont Athletic Center, interest in hockey increases each year.



LACROSSE, a sport only now growing into national popularity, has a long history at M.I.T. The game appeals especially because previous experience is not necessary. M.I.T. holds membership in the United State Intercollegiate Lacrosse Association. There is a spring schedule for varsity and freshmen, with the New England League and annual competition for the Briggs Cup highlighting the season.



RIFLE AND PISTOL teams from M.I.T. traditionally contribute members to the annual All-American Rifle and Pistol teams. A well-balanced schedule of shoulder-to-shoulder and pistol matches starts in December and extends to April. Annual shoulder-to-shoulder competition is held with the three leading intercollegiate teams in the country—Army, Navy, and the Coast Guard Academy.



SAILING at M.I.T. offers a Sailing Pavilion fleet of Technology-designed dinghies, 110-class sloops, olympic fireflies, and olympic finns. Sailing, under the direction of the Nautical Association, can be for recreation as well as competition; informal racing goes on all week, and formal races are held regularly every weekend during the season. There are regular courses of instruction for beginners; some of M.I.T.'s most successful skippers never sailed a boat before they came to Cambridge.



SKIING is represented at M.I.T. by an intercollegiate ski team through the cooperation of the Athletic Association. Competition and competitive sites (including the Winter Carnivals of New England colleges) are close at hand, and the intercollegiate season extends from the middle of January to early April.

SOCCKER has always been a favorite at M.I.T., and formidable teams are fielded by the Institute each year. The squad is a member of the New England Intercollegiate Soccer League and plays a full varsity and freshman schedule. Brown, Dartmouth, Springfield, Harvard, and Connecticut are among the annual competitors in a season extending through October and November.

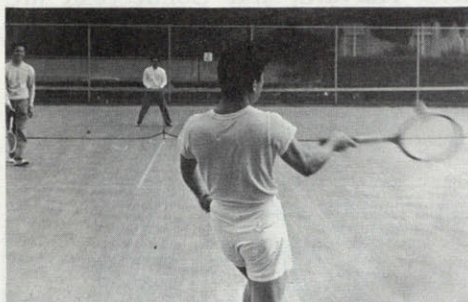


SQUASH, a winter sport which requires no previous experience, provides excellent intercollegiate competition. The fourteen courts at M.I.T. are among the best in the area.



SWIMMING is high in the intercollegiate sports program. A normal schedule consists of eight or ten meets for the varsity team and six or eight for the freshman team between December and March, climaxed by the New England Intercollegiate Swimming Association Championships. M.I.T. has for years produced well-balanced teams, meeting some of the best competition in the East—Harvard, Brown, Bowdoin, Trinity, Springfield, R.P.I., Wesleyan, Tufts, and others.

TENNIS is part of the M.I.T. athletic program as a competitive and recreational sport. Varsity and freshman intercollegiate schedules include top teams from New England: Williams, Wesleyan, Harvard, Amherst, Dartmouth, and others.



TRACK at M.I.T. includes cross-country and indoor and outdoor track. Practice sessions and intra-squad, inter-class, and intramural meets are scheduled throughout the school year. More than 125 men are usually on the roster; they practice and compete in the leading meets of the East. Briggs Field has an excellent quarter-mile outdoor track and a new portable wooden track; the Rockwell Cage has full indoor facilities.



WRESTLING is increasing in popularity, both from the participant and spectator point of view. Varsity and freshman teams compete in dual-meet schedules with Brown, Harvard, the Coast Guard Academy, Dartmouth, Tufts, Springfield, and others. The climax of the season is the New England Intercollegiate Wrestling Tournament.



INTRAMURAL ATHLETICS

Though you may not be a member of any of these intercollegiate teams, you are still part of the M.I.T. athletic picture. All the athletic facilities are available for recreational use, and experience proves that practically every M.I.T. student thus makes use of them.

For many M.I.T. men, intramurals are a fortunate combination of the competitive and recreational in sports. Intramurals at the Institute include touch football, basketball, volleyball, softball, swimming, tennis, track, table tennis, bowling, sailing, badminton, hockey, and golf. Students administer the program with a vice-president of the Athletic Association in charge. Intramural interest in these thirteen sports provides opportunity for 2,400 participants.





CLUBS AND ACTIVITIES

There is no need—and insufficient space—to describe here all the student clubs and activities which are shown on the chart. But a few need descriptions, which follow:

The weekend is rare when the **OUTING CLUB** is not conducting a rock-climbing or skiing expedition, a cycling trip to Walden in cooperation with Wellesley or Radcliffe, or an over-night camping trip to the White Mountains. The club is a member of the Intercollegiate Outing Club Association, which means that M.I.T. students are a part of many joint outings of New England colleges. Thanksgiving dinner on the slopes of Mount Katahdin, Maine's highest peak, is an M.I.T. Outing Club tradition; so is spring white-water canoeing, and so are the square dances with all the Boston members of the I.O.C.A.



The LECTURE SERIES COMMITTEE sponsors a program of lectures, recitals, forums, and films which is enjoyed by the entire M.I.T. community. Recent guests have included Mrs. Franklin D. Roosevelt, E. E. Cummings, Pierre Mendes-France, Captain Jacques-Yves Cousteau, and Pete Seeger.



The Dramashop in the Elizabethan comedy, *The Alchemist*.

DRAMASHOP is the organization of students interested in producing contemporary and classical plays. It also presents evenings of experimental and original plays on a workshop basis. There is a corresponding organization of faculty and staff—the M.I.T. Community Players—which presents more traditional and tested productions. A separate student organization presents *Tech Show*, the annual student musical. As a result, there is an M.I.T. season of important dramatic productions each year.

STUDENT PUBLICATIONS at M.I.T. include *The Tech*, bi-weekly newspaper; *Technique*, yearbook; *Tech Engineering News*, the monthly of the engineering school students; *Voo Doo*, the humor magazine; and *Tangent*, a literary review. There are other outlets for journalism talents in the newspapers of the undergraduate houses and in departmental newsletters of many kinds.

The DEBATING SOCIETY takes part in many varsity inter-collegiate debates, practice debates, special forums, and tournaments. An annual M.I.T. tournament attracts up to thirty leading college teams for its unique "M.I.T. style" of cross-examination rebuttals.

The MODEL RAILROAD CLUB builds and operates the Tech Nickel Plate, a complete and most elaborately controlled model railroad. There is a Christmas-season open house each year for faculty and their families.

The ROCKET RESEARCH SOCIETY studies and builds rocket models, tests them in its own facilities, publishes results in its own quarterly journal, and cooperates with other amateur groups throughout the world.

The TECHNOLOGY COMMUNITY ASSOCIATION has a diversified program of service to the Institute community. With the help of a permanent staff, it conducts a book exchange and a travel and ticket service. Work with Boston boys' clubs, a handbook for new arrivals on the campus, Tech House for weekend outings, and annual blood donor and clothing drives are a few of the activities sponsored by the student members. The Technology Community Association maintains a circulating gallery of prints to brighten the rooms in M.I.T. dormitories.

Religious activities at M.I.T. center in many religious groups which have programs of worship and study. Chaplains from each denomination have regular office hours at the Institute and conduct services in the Chapel. Neighboring churches welcome student membership.

T.C.A. boys' club work.





" . . . NEVER A DULL MOMENT ON THIS CAMPUS . . . "



- ... the Lecture Series chairman with Mrs. Eleanor Roosevelt.
- ... Tech Show on a spy chase.
- ... Open House visitors.
- ... operating the Tech Nickel Plate.

SOCIAL LIFE

"Numbers mean many things at M.I.T.," says the handbook for freshmen published by the Technology Community Association. "Besides the values of π and e ," continues the editor, "you'll need to know the telephone numbers of Wellesley, Radcliffe, and Simmons."

The M.I.T. social season begins each fall with a series of "acquaintance dances," at which the Institute is host to newcomers at all the women's schools in Greater Boston. From that time on things gain momentum; there are dances nearly every weekend, and some sequences of social activities are formed into a full weekend program to provide a special appeal for students' guests.

In winter comes the "All-Tech Sing"—a competition in barber-shop singing by all the dormitories, fraternities, and classes sponsored by the honorary music society—and in the spring the Carnival, where you can win prizes for marksmanship and strength while helping contribute to international student funds. There are "big name" dances in all the seasons: the Junior Prom and the Nautical Association Dance in the fall, Christmas Formal and Military Ball in the winter, Assemblies Ball and Senior Dance in the spring. The dormitories and fraternities have their own parties throughout the year.

Social activities for married students center in the organization of wives of M.I.T. students, called the Technology Dames.

NO DULL MOMENTS

The editor of the T.C.A.'s handbook for freshmen gives this advice: "Join some of the activities you have read about, be active in your living group, get a Saturday night date and talk about something besides engineering. You are going to be a lot happier." The opportunities to follow this advice (which everyone at M.I.T. thinks is excellent) are so manifold that truly "there is never a dull moment" on this campus.



... Dr. and Mrs. Stratton in the grand march.

... crowning the military queen.

... square dance has followers, too.

... fraternity costume party.



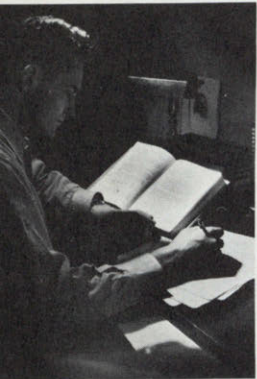


3 Entering M.I.T.

By now you have learned that the M.I.T. student body is made up of young men and women from many backgrounds and having many abilities, ideas, interests, and goals. There is no typical M.I.T. student; and even if there were, and even if you were just like him, no one could say that you would be interested in applying for admission to M.I.T. But if the description of the Institute in this catalogue—its ideas and purposes, its faculty, its students, its Courses, its student activities, its campus—has included concepts which are provocative and appealing to you, then it is likely that you may be interested in entering M.I.T.

If, furthermore, you possess a good basic intelligence, if you have taken subjects in secondary school which demonstrate that you are interested in science and mathematics—and also in the wide range of humanities,—if your marks indicate that you work consistently well and are seriously and conscientiously concerned with your studies, if your personal record shows that you are an active person whose interests and experiences include many aspects of living beyond the classroom and textbook . . . if these things are true, then M.I.T. invites you to apply for admission to this community.

In considering your application for admission, M.I.T. will try to study, insofar as possible, your entire record and personality. School marks, although important, are only a part of the things to be considered; a straight A average is *not* prerequisite.



HIGH SCHOOL BACKGROUND

Any good high school or preparatory school in the United States, and equivalent schools in other countries, will give you adequate preparation for entering M.I.T.—if you take full advantage of the opportunities before you. A broad secondary education—the kind of education that encourages you to think, to learn, and to express yourself clearly—is most desirable. M.I.T. does not recommend specialized technical preparation.

An interest in and an aptitude for mathematics and a general motivation to go further than a superficial introduction to the sciences are of primary importance; a familiarity with history and literature helps to achieve the understanding necessary for meeting the professional as well as the non-professional demands of modern citizenship.

Some suggestions to entering students are formalized in specific requirements established for all entering freshmen.¹ These specific requirements are:

English	three units
Algebra	two units
Plane Geometry	one unit
Physics	one unit
Trigonometry	one-half unit

By one “unit” is meant one full year’s study—four or five times a week—in a high school subject (except for English, where four years of study are counted as only three units). In some states, algebra is completed in one and one-half years; this will satisfy the algebra requirement for candidates from those states. The plane geometry requirement may be met either by a course of the traditional type or by a one-year course which is mostly devoted to plane geometry but which includes some work in analytic geometry, solid geometry, or other fields, as suggested by the Commission on Mathematics of the College Entrance Examination Board. The inclusion of some topics from solid geometry is particularly recommended.

In addition to these subjects, M.I.T. recommends that among high school “electives” should be one year of chemistry

¹ If you have been unable to complete all these requirements but have an especially good record in those you have studied, special provisions can sometimes be made.

and one or more years' study of history. Although there is no language requirement for admission, the study of a modern foreign language in secondary school is desirable and is strongly recommended. No limitations are imposed with regard to languages, except that if a language is offered at all it should total at least two units. The choice of languages should be guided by the student's own interest, by the educational opportunities open to him, and by the nature of his probable future work. For example, those who expect to have contacts with Latin America may need Spanish or Portuguese. Those who look forward to advanced work in research or design in a scientific or engineering field may eventually need a knowledge of German, Russian, or French, since there is an extensive and important technical literature in each of these languages.

ENTRANCE EXAMINATIONS

All applicants are expected to take the test program of the College Entrance Examination Board, which is administered at various times each year in many centers in the United States and abroad. All candidates may obtain from this organization an *Information Bulletin* giving the test dates, locations, and fees for the current year.

If you are applying to M.I.T., you should take the following Board tests: in the morning, the Scholastic Aptitude Test; in the afternoon, three one-hour tests: Advanced Mathematics, English Composition, and either Physics or Chemistry. You may take the tests on any date you wish, or you may divide them among different dates, as you prefer. One or more College Board tests may be taken as early as the eleventh grade. These might well include the Scholastic Aptitude Test and one or two achievement tests. Any of these tests may be repeated in your senior year, if you wish.

To apply for the tests, write to the College Entrance Examination Board, Box 592, Princeton, New Jersey (or, in Western states, to the College Entrance Examination Board, P. O. Box 27896, Los Angeles 27, California). You should request that the College Entrance Examination Board send your test scores to M.I.T.

THE COST OF ATTENDING M.I.T.

The Institute is an independent, endowed institution. The tuition paid by each student, \$1,500 per academic year, covers less than one-half of the costs to the Institute of providing its first-rate facilities and faculty; the difference is met by income from endowment and annual gifts of alumni and friends.

The following is an estimate of an average student's costs for an academic year.

Tuition	\$1,500.00
Board	610.00 ¹
Room	370.00
Books and materials	100.00
Health insurance	36.00
Total	<u>\$2,616.00</u>

In addition to these costs, a reasonable allowance (probably \$200 per academic year) should be made for personal expenditures which include personal necessities, laundry, clothes, and miscellaneous items. It should be understood that this total will vary according to individual tastes and requirements.

During the freshman year there are certain non-recurring expenses such as drawing equipment and slide rules, for which \$40 should be allowed. Freshmen must make a deposit of \$50 to cover breakage, repair of military uniforms, and laboratory equipment. Refunds on this deposit or bills for excess charges are mailed at the close of the year. Institute health insurance, \$18 per term, is required unless a waiver is signed.

Here these items of expense are explained in detail:

ACADEMIC EXPENSES

The regular tuition fee, \$750 per term, is all-inclusive; there are no extra assessments such as matriculation fees, extra charges for extra subjects, or activity fees (with the exception of sailing).

This tuition is the same for all years of all Courses, with the exception of certain terms during the Cooperative Courses, when students are working at industrial plants. If you find, after arriving at M.I.T., that you are interested in a Cooperative

¹This figure does not include the cost of board during vacation periods.

Course, you will want to consult with the Bursar for tuition information. Special tuition fees are established for subjects given during the Summer Session, and these figures are given in the Summer Session Catalogue each year.

LIVING COSTS (BOARD AND ROOM)

The rent for rooms in M.I.T. undergraduate houses ranges in 1960-61 from \$150 to \$235 per person per term, payable in advance. Freshmen who do not live at home or in the fraternity houses are required to live in the undergraduate houses up to the limit of accommodations available; a large number of upperclassmen also choose to live on the campus. All students living in Baker and Burton Houses are required to take their meals in the House dining rooms Mondays through Fridays. Similar service is available in Walker Memorial—on an optional basis—for residents of the East Campus. The present fee for these “commons meals” is \$12.50 per week (\$212.50 for the fall term and \$200.00 for the spring term), providing three substantial meals each week day; similar dining facilities are available on a cash basis on Saturdays and Sundays and during vacations, but many students choose to explore the famous restaurants in Boston and the surrounding countryside for weekend meals.

HEALTH INSURANCE AND MEDICAL EXPENSES

A health insurance plan is available to students of the Institute for a premium of \$18 per term. In return for this sum the insurance agency agrees, with certain limitations, to pay up to \$2,000 toward meeting the cost of each injury or illness during the term. If any student does *not* wish to be enrolled in this plan, he must sign a waiver; insurance is not necessary for Army, Navy, or Air Force students or for those veterans enrolled under Public Law No. 894. Any student registering after the official Registration Day will be insured only from the date on which he files registration material.

Any student may receive routine medical care in the clinic without charge. The health insurance policy covers the fees charged for the special clinics; uninsured students are charged a moderate fee. The charges for students in the Infirmary are low. Food and nursing care in the wards cost \$14 a day. For insured students the cost of these services, too, is borne by the insuring agency.

In cases of serious illness or contagious disease, students are sent for treatment and care to hospitals outside the Institute in the Boston area; fees at these hospitals, up to \$16 per day, are paid by the insuring agency. If a student is not insured, these fees, of course, are the patient's responsibility.

PAYMENT OF BILLS

Registration instructions issued before the beginning of each term (and sent automatically to all admitted students) specify the date on which payments of tuition, board, room, and insurance premium are due. *No bills are sent*; meeting these deadlines is each student's responsibility.

FINANCIAL AID FOR STUDENTS

To help meet the cost of attending M.I.T. there are four types of financial aid available through the Institute—scholarships, loans, part-time campus work, and deferred payment plans. These are administered under a coordinated program of financial aids, the purpose of which is to assist well-qualified young people with limited funds and resources who wish to study at the Institute. In addition, there are liberal plans for budget and installment payments, described in the paragraph immediately above.

Each student should make an accurate estimate of his year's college expenses, including the basic expenses outlined in the previous pages, the variable personal expenses, and the needs for transportation. This estimate of expenses should be considered carefully in the light of the funds which he has available: the amounts he may expect to receive from his parents or guardian, savings he may have accumulated, and earnings expected during the summer. His application for financial assistance from M.I.T. should be made only after his estimate is complete.

SCHOLARSHIPS

Approximately one-quarter of the members of M.I.T.'s entering class receive scholarship grants ranging from \$300 to \$2,200 for the academic year. Although most of these scholarship grants are for the first year only, the Student Financial Aid Committee has funds for the renewal of grants in succeeding years to those who show academic and extracurricular achievement during the freshman year and who demonstrate continued financial need.

The principal four-year scholarships—the William Barton Rogers Scholarships, the Alumni Fund National Scholarships, the Sloan National Scholarships, and others, including industrial grants—are open to all entering freshmen. In addition, there are a substantial number of Freshman Competitive Scholarships for the first year only, with stipends varying according to need. Other scholarship awards depend upon a candidate's meeting some special qualifications in addition to showing evidence of scholastic ability, such as that he come from a particular locality or be a graduate of a certain school. For instance, Alumni Regional Scholarships, for the first year only, are limited to students from 19 metropolitan areas. A full list of the Freshman scholarships available at M.I.T. appears on the next pages; when you apply for scholarship aid, you should indicate on the application *all* the scholarships for which you believe you may be qualified. Full information, applications, and instructions for the various scholarships may be obtained from the Director of Student Aid, Student Aid Center, Room 5-119, Massachusetts Institute of Technology, Cambridge 39. Completed application forms must be filed early in February preceding the fall term in which the scholarship is to be effective.

Most of these scholarships specify that they be awarded on the basis of achievement and financial need. Selection is made by the Student Financial Aid Committee, on the evaluation of such factors as your secondary school record, College Board test scores, qualities of character and personal bearing, professional promise, participation in school and community affairs, and need as demonstrated by statements supplied through the College Scholarship Service.

In granting scholarships, the Committee expects that holders will qualify through achievement for continuing assistance beyond the freshman year if needed.

There are often individual problems in connection with scholarships which are best discussed as such. The Director of Student Aid will be pleased to hear from you. Your questions should be sent as soon as possible, since the final date for scholarship applications is quite early.

(text continues on page 88)

SCHOLARSHIPS FOR FRESHMEN

Alumni Regional Scholarships, carrying an award based on demonstrated ability and need for the freshman year, are offered in Chicago, Denver, Detroit, District of Columbia, Kansas City, Los Angeles, New York City, New Jersey, Northern Ohio, Philadelphia, Pittsburgh, Portland (Oregon), Rochester (New York), St. Louis, San Francisco, Schenectady, Seattle, Southern Ohio, and Westchester County (New York).

Army and Navy Scholarships are for sons of regular Army, Navy, Air Force, Marine Corps, or Coast Guard officers, who may receive up to one-half tuition throughout their undergraduate years, depending upon need. (Applications should be accompanied by documentary evidence that the applicant's father is a commissioned officer in the regular Army, Navy, Air Force, Marine Corps, or Coast Guard.)

Lawrence D. Bell Memorial Scholarship was established by the Bell Foundation, Inc., in honor of the late president and founder of the Bell Aircraft Corporation. A tuition grant is awarded to an entering freshman who is a citizen of the United States, with special consideration for children of employees of the corporation.

John B. Bezazian Fund provides grants to cover tuition assistance towards living expenses according to demonstrated need for male students in engineering or science, with first preference to American male students of Armenian extraction and second preference to male students from metropolitan or suburban Chicago.

Bridgeport Scholarship (the Horace T. Smith Scholarship Fund), carrying a stipend based on demonstrated need with a maximum of full tuition for the freshman year, is annually offered to a graduate of the high schools of Bridgeport, Connecticut.

Cabot Foundation Scholarships provide funds for children (sons and daughters) of employees of Godfrey L. Cabot, Inc., and its subsidiary and associated companies. (Candidates must establish their eligibility by first applying to the Personnel Office of Godfrey L. Cabot, Inc.)

Cambridge Scholarships are granted to graduates of schools in Cambridge and children of legal residents of that city. These scholarships carry a stipend up to full tuition and may be continued in the second, third, and fourth years.

Class of 1895 Scholarship is for qualified descendants of members of the Class of 1895, donors of the fund.

Class of 1922 Scholarship provides awards with preference given to children of members of the Class. (Beneficiaries are expected to issue notes agreeing to repay the face value, without interest, of amounts received.)

Class of 1931 Compton Memorial Freshman Scholarship, a memorial to Dr. Karl Taylor Compton, is open to all freshmen applicants.

Class of 1938 Scholarship, made possible by gifts from the Class of 1938, is open to all freshmen.

W. A. Conant Scholarship is intended for native-born Protestant graduates of New England schools, with first preference to graduates of schools in Brookline, Massachusetts. It is a four-year grant, offered annually to an entering freshman.

Thomas C. Desmond Scholarship for the freshman year is available to a student who plans to study civil engineering.

Development Fund Scholarships consist of four-year grants to students who maintain academic ranking in the top quarter of the class and demonstrate continued need for financial assistance.

William H. Donner Prize Scholarships are prize awards for the freshman year, carrying a stipend of \$2,200, limited to students who are planning to study aeronautical engineering.

East Bridgewater Scholarship (Horace T. Smith Scholarship Fund) is annually offered to a graduate of the high school of East Bridgewater, Massachusetts; the maximum award is full tuition.

Elks Scholarship for a student who plans to study in science or engineering, resident of Massachusetts, American citizen, is a grant of up to \$2,500 renewable each year for four years.

Fall River and Swansea Scholarships (the Albert G. Boyden Fund), for the freshman year only, are annually offered to qualified applicants residing in Fall River or Swansea, Massachusetts.

Freshman Competitive Scholarships vary according to need, cover the first year, and are awarded without geographical restrictions of eligibility.

General Motors Scholarships are four-year grants, established under the General Motors College Scholarship Plan, intended for outstanding entering students.

Humphrey M. Haley Scholarship is awarded with first preference to students from St. James Parish, Salem, Massachusetts.

Charles Hayden Memorial Scholarships are given in memory of the late Charles Hayden, '90.

Jakobson Scholarship carries a grant of \$1,000, for which first preference is to a son of an employee of Jakobson Shipyard, Inc.; second preference to graduates of high schools in Glen Cove, Huntington, Manhasset, Oyster Bay, Port Washington, Roslyn, or Sea Cliff, New York; and third preference to entering students from elsewhere on Long Island, excepting the counties of Kings or Queens.

Knapp Memorial Scholarships are for students entering M.I.T. from the Buffalo area and Erie County.

Amelia S. Kneisner Scholarship is awarded with preference to graduates of the high schools of Danbury, Connecticut.

Jacob and Jennie Lichter Fund is "for the aid of students who shall satisfy all entrance requirements of the Institute and be endorsed as to character and personality."

Littmann Foundation Scholarship is available in alternate years (1960). A four-year grant up to the amount of tuition is given depending on demonstrated financial need to a well-qualified male student for study either in engineering or management as related ultimately to the field of manufacturing. First preference is given to residents in the general areas of St. Louis, Missouri, or Charles City, Iowa.

Charles E. Locke Memorial Fund provides grants with preference to descendants of members of the Class of 1896, including freshmen.

Lockheed Leadership Fund Scholarships are for United States citizens under 25 years of age who plan to major in a field of engineering applicable to the aircraft industry. Grants are for full tuition plus \$500 toward living expenses, renewable for the total undergraduate period.

Martin Aircraft Scholarships are for male students planning to pursue Courses most applicable to the activities of The Martin Company, with preference to residents of Maryland (including the District of Columbia) and especially to sons of employees of The Martin Company.

Waldo A. Martin Scholarship, for the freshman year only, is awarded with first preference to friends or relatives of Waldo A. and Eleanor P. Martin and second preference to graduates of Milton High School, Milton Academy, or residents of Milton.

H. W. McCurdy Scholarship (Puget Sound Foundation) is for an entering freshman who plans to follow a career in naval architecture or mechanical engineering, with preference to a student from the Seattle area.

McDermott Scholarships provide four-year grants of \$200 to \$2,500 to superior students who expect to study in the earth sciences and allied fields. The grants are limited to students residing in the southwest with first preference to those from Texas, Arizona, New Mexico, and Oklahoma.

M.I.T. Alumni Fund National Scholarships were established by the M.I.T. Alumni Fund Board to give opportunity to well-qualified young people from throughout the United States to come to the Institute; continued awards depend upon achievement and need.

M.I.T. Boston Stein Club—New England Scholarships provide one or more awards for the freshman year only to New England residents.

M.I.T. Club of Chicago Scholarships are restricted to entering men who reside in the area of the club membership.

George H. May Fund provides a scholarship to assist graduates of the Newton High School. (Beneficiaries under this fund are expected to issue notes agreeing to repay, without interest, the amounts received.)

Milton High School Fund, founded by the Institute in recognition of contributions from residents of Milton, provides a scholarship for former students of the Milton High School.

Joseph R. Minevitch Memorial Scholarship is to assist public high school graduates, with first preference to graduates of the Boston English High School and second preference to graduates of any other Boston public high school.

Frederick Taft Moses Scholarship provides assistance commensurate with financial need to young people of superior talent and promise.

Naval Architecture and Marine Engineering Scholarship, established by the Society of Naval Architects and Marine Engineers, is given each year to a secondary school graduate who plans to enter the field of naval architecture and marine engineering; each grant may be renewed for three additional years.

Niarchos Scholarships provide opportunities for higher education to the sons of merchant seamen. Holders of these scholarships are given opportunities to work in the marine field during summer vacations.

Procter and Gamble Scholarships are four-year grants open to entering students who plan to study engineering or science; they cover tuition plus an added amount for books and supplies.

Willis Ward Reeves, Jr., Fund provides scholarship aid with preference to undergraduate students from Kentucky.

William Barton Rogers Scholarships are four-year grants established in honor of the founder of the Institute, providing full tuition plus \$300 for the first year and full-tuition awards for the remaining undergraduate years.

Frederick J. Shepard, Jr., Fund (Lewis-Shepard Fund) is used to assist needy and worthy young men from New Hampshire with first preference to graduates of Pinkerton Academy, Derry Village, New Hampshire.

Frank Arnold Sherman Scholarship. The income from this bequest is awarded with first preference to a male graduate of Westerly High School, Rhode Island, or of other Rhode Island high schools.

Sloan Foundation Scholarship and Loan Fund provides a limited number of tuition grants made up of part scholarship and part loan for well motivated young men of good promise.

(list continues on the next page)

(list continued from the previous page)

Sloan National Scholarships provide aid for outstanding students in science and engineering. Sloan National Scholars hold positions of academic honor at the Institute. Grants range from a \$200 prize scholarship to \$2,000 and are renewable each year.

G. H. Miller Smith Fund provides scholarship aid with preference to undergraduates from Tennessee.

Albert F. Sulzer Scholarship is designated for first-year students who are non-residents of Massachusetts.

Union Carbide Engineering Scholarships provide four-year tuition grants in either mechanical, chemical, or metallurgical engineering from the Union Carbide Education Fund.

Vermont Scholarships are given with first preference to residents of Vermont.

Granger Whitney Fund provides scholarship aid with first preference to students nominated by the Detroit M.I.T. alumni club.

Arthur Williams Scholarship is used to assist men studying in the engineering professions or business administration.

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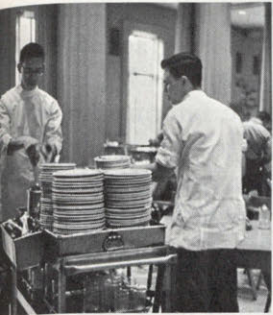
LOAN FUNDS

The Technology Loan Fund, one of the largest college loan funds in the nation, is available for entering freshmen in amounts less than full tuition for the first year, as a supplement to scholarship awards. After one year of residence, any undergraduate with a satisfactory record may apply for direct grants up to the amount of tuition or to supplement scholarship awards. These loans bear interest at one per cent per year during enrollment and are repayable in semi-annual installments of \$150 beginning six months after graduation; the interest rate after graduation increases to two per cent per annum. The maximum loan to an individual may not exceed \$5,000 during his undergraduate period or \$6,000 during his undergraduate and graduate periods.

The Boston Stein Club Loan Fund, established by alumni members of the M.I.T. Boston Stein Club to help students from Greater Boston, is available only to first-year students who show good promise. Grants, in general, are for less than full tuition. Recipients will be required to sign notes to repay the amounts granted, without interest, after graduation.

STUDENT EMPLOYMENT

Through the Office of Student Personnel, M.I.T. stands ready to help and encourage students who must earn part of their expenses during the college year. Although a new student should not commit himself too heavily until he has fully adapted to his academic program, experience has shown that young people of good ambition can do a reasonable amount of outside work without detracting from their total education. It is not advisable nor practicable for a new student to anticipate that he may earn *all* of his living expenses during his first college year.



Positions are available in the dormitories, dining services, and other divisions of the Institute. The time that may be devoted to these positions is limited, with slight variations, to between ten and twelve hours per week as a maximum, and income may be somewhat more than \$200 per term and more than \$400 for the academic year.

BUDGET PAYMENT PLAN

Payment of tuition, room, and board on a monthly budget plan may be arranged with the Bursar; this spreads the payments due at the beginning of each term over the four months of the term. Make your plans with the Bursar *before* the beginning of each term—not later than the Wednesday before Registration Day.

INSTALLMENT CREDIT PLAN

Under a special installment credit plan, M.I.T. tuition in excess of \$1,000 each year may be financed at low interest on a ten-year payment program. This plan, operated in conjunction with a Boston bank, may thus be used to obtain credits totaling \$2,000 during a four-year undergraduate Course. Repayment begins six months after the first credit is granted and continues at six-month intervals; the total is repaid within ten years of enrollment as a freshman at M.I.T.

Credit extension under this installment plan requires a semi-annual payment of \$6.72 for each \$100 of credit. This rate of repayment represents an apportioning of interest and principal per \$100 of credit for a ten-year period based on an interest charge of 6 per cent on the unpaid balance.

Your application for credit under this plan should be made to the Director of Student Aid no later than one week before the beginning of each year. No collateral is required, but if you are under 21 you must have a parent or guardian co-sign your application; no Parents' Financial Statement need be submitted.

BANKING FACILITIES

Students are encouraged to maintain their own checking accounts in commercial banks, either in their home communities or in the Boston area. The Institute maintains a Personal Deposit Office where students may deposit their personal funds in amounts up to \$1,000 and draw upon them without charge or interest.



DORMITORIES AND FRATERNITIES

Freshmen may live in any of the Institute's undergraduate houses. As soon as you are admitted to M.I.T. you go on a list to receive, when it is ready in mid-summer, complete information about the facilities available, the rates which apply to each room, the equipment and service offered, the regulations which apply to dormitory residents, and dormitory application material. Room assignments will be made by the Dean of Residence on the basis of applications received following this mailing. In general, rooms in the houses are provided with the furniture needed for a comfortable year, and there is telephone service. Residents supply their own blankets, bed linen, soap, and towels. There are attractive lounge rooms in each house, and an active social life centers around each of the Institute's dormitories. Many of the rooms overlook the Charles River, giving attractive views of the basin and the Boston skyline beyond. Faculty residents in each of the houses welcome informal and friendly discussions with students and their friends.

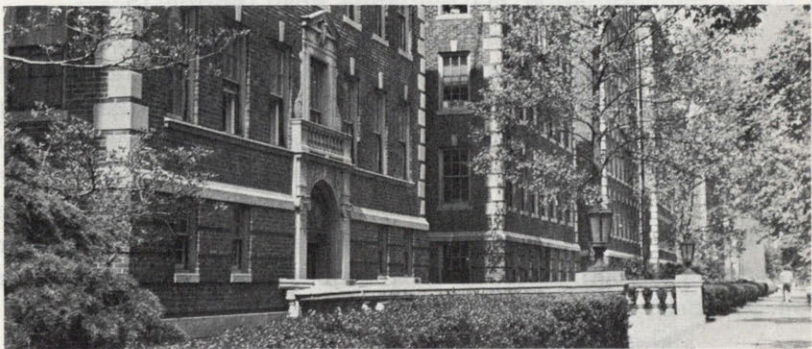
You may wish to consider joining one of the 28 fraternities which have active chapters at M.I.T. But whether or not you expect to join a fraternity, you should apply for accommodations in the undergraduate houses. When you are accepted for fraternity membership you can withdraw your dormitory application without penalty—if you do it promptly. Fraternity membership is by

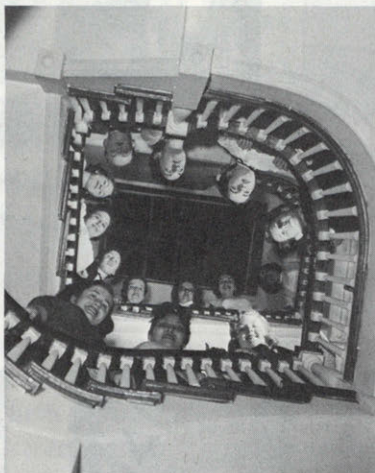




"The educational experience afforded by a great university comprises more than the material of classrooms, lectures, and laboratories. We at M.I.T. are also deeply concerned for those qualities which contribute to character, sensitivity, human understanding. We seek an environment in which the wholeness of education can thrive."

PRESIDENT JULIUS A. STRATTON





In the Women's Dormitory



Bexley Hall apartment

invitation only, after the formalities of a Rush Week before the fall term begins each year. Costs in fraternities are not very different from those in the dormitories. Information about fraternities at M.I.T. reaches each admitted freshman several months before the fall term, from the Interfraternity Conference.

There is also, in this group of private accommodations, the M.I.T. Student House, organized by a group of alumni to provide attractive and unusually economical living arrangements. Students living here operate the house themselves and do much of their own work—aside from cooking and certain items of maintenance—thus reducing the total of board and room expense by as much as \$250 a year. For information about membership in this group you should write directly to the President of the House at 111 Bay State Road, Boston 15.

The Women's Dormitory, at 120 Bay State Road in Boston, accommodates 17 freshmen in an attractively furnished house with a home-like atmosphere. Residence here is required for first-year women who do not live at home. There is a House Mother in residence, and breakfast and dinner are served by the residents of the house in accordance with a schedule planned in advance. The girls also have the privilege of preparing their lunches with food provided by the house. Bexley Hall, in Cambridge, is an apartment dormitory for upperclass and graduate women, with a Faculty Resident and his family.

HOW TO APPLY TO M.I.T.

As soon as you know that you may be interested in coming to M.I.T., you should file with the Director of Admissions (Room 3-108, Massachusetts Institute of Technology, Cambridge 39) a preliminary application. This will put you on the mailing list for all current information about M.I.T.—including new editions of this catalogue. With a preliminary application on file, you will also automatically receive your final application material in the fall preceding the year you wish to enter.

You should complete the final application form and forward it with a non-returnable application fee of \$10. (A check or money order is preferred.) The endorsement forms included should be given to two of your teachers who are in a position to tell us of your personal characteristics and interests as they relate to your qualifications for the Institute.

The school report should be given directly to the principal or headmaster of the secondary school which you are now attending; it is to be returned by him directly to the Institute. The Institute will send school report forms directly to any other high or preparatory schools you may have attended.

If you are applying for financial aid, you should note the directions for obtaining application forms as well as the deadline for filing applications—these are given earlier in this section, under "Financial Aid for Students."

INTERVIEWS

Each applicant for admission to the freshman class is expected to have a personal conference either with a member of the Admissions Office staff or with a designated member of the M.I.T. Educational Council who is near his home.

Council members are alumni who have been selected for their ability to represent M.I.T. and for their interest in and liking for young people. These men welcome the opportunity to meet students interested in M.I.T. and to help them with their educational plans.

Each applicant will be referred to a member of the Council at the time of his Preliminary Application for admission. The conference should take place not later than mid-February of the senior year and preferably early in the fall.



President's reception

Applicants and other interested students and their parents will be welcome at the Admissions Office on Mondays through Fridays between 9 and 5; an appointment is not necessary. Visitors may wish to include a student-guided tour of the campus, available at 10 and 2 o'clock each day that the Admissions Office is open.

ADMISSION

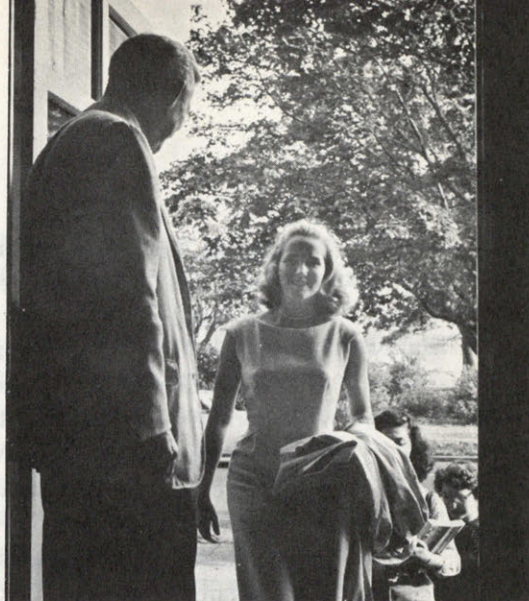
Early in May of each year the Admissions Office reports on their status to most applicants for the class entering the following fall. During the summer, after you have an official admission statement, will come information about registration, dormitory room selection, and Rush Week and fraternities—and a medical form for your family doctor. Dormitory room assignments are completed only after admission has been secured.

ADVANCED PLACEMENT

College-level courses designed for selected groups of students of better-than-average ability are offered in the eleventh and twelfth grades of many secondary schools. M.I.T. has traditionally encouraged students to move ahead academically according to their capabilities, and we are anxious to cooperate with these plans for talented students. There are now two procedures by which entering high school graduates may establish their readiness to pursue advanced subjects here.

If you take college-level courses offered in high school in conjunction with the Advanced Placement Program sponsored by the College Entrance Examination Board, you should plan to take the appropriate subject matter tests given by the Board each year in May. The results of these three-hour examinations will be sent to M.I.T. by the Board, and when you arrive here to begin your first term the amount of credit for advanced subject placement which fits your scholastic development will be determined in consultation with the appropriate subject examiner and with the approval of your faculty adviser.

If you are unable to take the College Board Advanced Placement Tests you may, with permission of the Director of Admissions, take Advanced Standing Examinations given by the Institute. Examinations for advanced standing in subjects having laboratory work or in languages and the humanities may be taken only with the additional consent of the instructor in charge of



FRESHMAN WEEKEND . . . *the Dean's welcome*

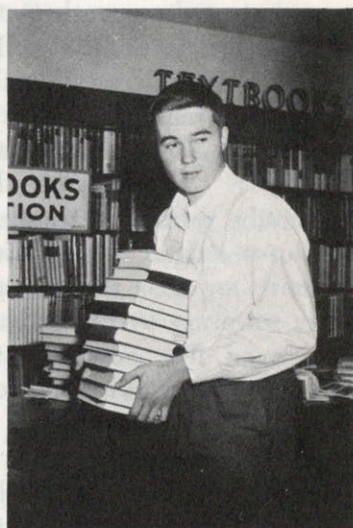
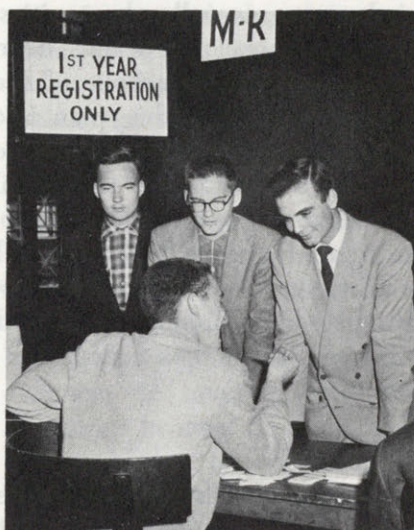
the subject. The examinations are given during the week prior to registration for the fall term; students who plan to enroll for the first time in September should write to the Director of Admissions about these tests before August 1.

COLLEGE TRANSFERS

Most M.I.T. students enter the Institute directly after graduation from high or preparatory school. Each year, however, a few

. . . *signing in*

. . . *bookstore patrol*



enter as "college transfers," following one or more years of college elsewhere. The Committee on Admissions reviews the records of such applicants just as they do those of prospective freshmen. Transfer students are expected in every case to have completed the academic preparation required for admission directly from secondary schools, and their college records should give evidence of ability in higher-level studies. Detailed information about transfer students' admission is available from the Director of Admissions.

ADVANCED ACADEMIC CREDIT

Students admitted by transfer may expect to receive advanced credit for subjects completed at other colleges which are substantially equivalent to M.I.T. subjects; a grade above the lowest passing grade is the minimum necessary for the transfer of credits.

A student who contemplates transfer to M.I.T. from another college should plan his program of study so that he covers the basic subjects of the Course he expects to enter. At least one year each of college mathematics and physics should be included.

THE TWO-DEGREE PLAN

A number of liberal arts colleges grant their bachelor's degrees to students who have attended for three years and who have then gone on to qualify for bachelor's degrees in engineering, science, or architecture at M.I.T. or a similar institution. A student who plans his three college years carefully to include the requisite mathematics and science, as well as humanities and social studies, can usually obtain the Bachelor of Science degree at M.I.T. in two additional years (three for the Bachelor of Architecture).

Students interested in this plan should communicate directly with the college they wish first to attend and secure admission there. Later acceptance at M.I.T. will depend, as with all transfer applicants, on the quality of the college record.

College transfers are, in general, not eligible for financial aid during their first year of attendance. Exceptions may be made for students of outstanding promise who are designated as members of a two-degree plan by their college and are already receiving financial aid there.

HOW TO BEGIN AT M.I.T.

The fall term begins for freshmen on the Thursday before Registration Day—which in turn is the next to the last Monday



Registration Day

in September. (First-year students are not admitted at other times of the year.) Dormitory rooms for entering students are ready on Wednesday afternoon. Upperclassmen are not due before Registration Day; this means that first-year students arrive on the campus in time for four days of special programs which are designed to help them get acquainted with their classmates and with M.I.T. There are general introductions by members of the faculty, administration, and student organizations; there are social activities so that you may get acquainted with your classmates; there are tours and visits to introduce you to the campus; and there are conferences with faculty advisers to help you plan your program.

You will have further information about registration itself during the summer before you arrive at M.I.T.

Every entering student is required to be immunized against tetanus and smallpox before he arrives at M.I.T. Soon after you register you will have a complete physical and dental examination, including a chest x-ray.

Your registration is not considered complete until you have paid the tuition, board, room, and other fees at the times specified in the registration instructions. Since no bills are sent by M.I.T., this is a matter of your own personal responsibility; a charge of \$5.00 is made if any one of these payments is late.

WHAT TO BRING

The Institute doubts the need of telling you what clothing to bring to M.I.T. (this is a pretty informal place in that respect), what decorations you will want for your room, and to bring your skis or ice skates. But some other things that may not at once occur to you are even more important. Here are a few suggestions:

Bring an open mind. A dormitory newsletter editor once warned new arrivals here, "Some of the best engineers-to-be in the world are your buddies, but they cannot keep you from falling into a rut." If you arrive with an active curiosity and a determination to discover for yourself, you will have many chances to investigate all these things; and if you are a beginner in most of them, as you probably are, you will have plenty of time to look around and to learn the fundamentals of any new field of activity in which you decide to take part.

(text continues on page 101)

“. . . choose the important aspects of life and live in accord with them.”



Bostwick F. Wyman of Columbia, South Carolina, reports on his first year as a member of M.I.T.'s Class of 1962.

I first reached Boston late one afternoon, at the beginning of Rush Week. Although I didn't join a fraternity, I'm still glad I came then, because everyone was very helpful, and I was pretty well fixed by the beginning of Freshman Orientation Week.

The Orientation Week helped, though. I saw more of the Institute than I've seen since—the reactor, out-of-the-way research labs, the little back alleys. Gradually I learned which way is up.

Two things about M.I.T. impressed me most. First, the people, millions and millions of them (it seemed) from all over. Variety of personalities is evident in classes, in the halls, and in the dormitories. Second was the lack of rules and regulations. It's advisable not to have a hot plate in the dorms; otherwise, only you, and perhaps your roommate, care how you live. You must choose the important aspects of life and live in accord with them. I find I'm a harder taskmaster than my family ever was.

Don't believe anyone who tells you that M.I.T. men are illiterate engineers. Courses here are such that one can take almost anything he wants; the choice is tremendous. Freshman advisers are nice to have around, since they know more about available courses than we benighted freshmen. When I needed an extra course in the second term, my adviser suggested 14.01, Economics—normally a sophomore subject. I like the course a lot, but I probably would not have taken it on my own, mainly because I had just barely heard of it.

It's hard to really judge how much homework one is doing. I have the general impression that I'm working hard, but I get bogged down when I try to count hours. About 20 hours a week, according to the Institute, and slightly more than this by my stopwatch. Institute work will be quite a bit more than high school for most people; but I don't think homework would really bother anyone, unless he has a long-standing "I don't need to study" complex. The important thing is to keep up: most of the courses require absorption of material, and it's difficult to learn a month's work in one night.

Concerning sports and extracurricular activities—the trouble is staying out, not getting in. Name it; we've got it. If you're very imagina-

tive and think of something that isn't available, start it yourself. It's easy to do.

My two activities are writing and chess. There are three regular publications on campus and several annual literary magazines and competitions. The M.I.T. Chess Club is fairly strong, despite the fact that the Institute is more of a bridge-playing school.

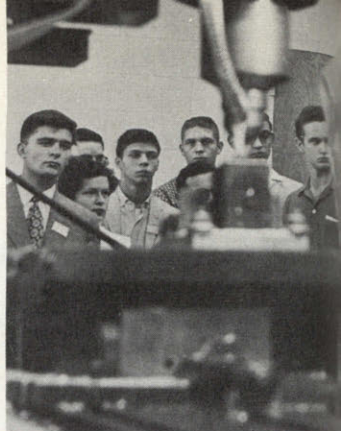
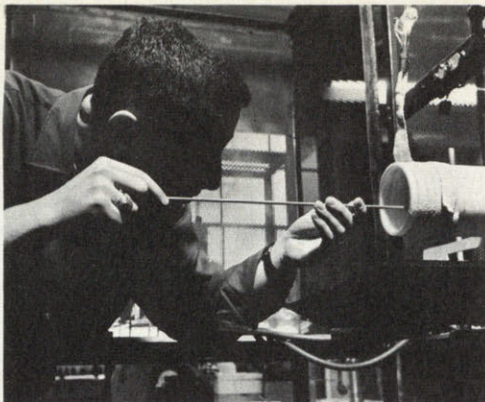
Statistics say that girls in Boston outnumber the boys. This is easy to believe, since there are many small girls' schools around as well as the big-name colleges, and the M.I.T. man is in a pretty sound position socially. There are dances about once a week during the year, with flurries of acquaintance dances in the fall and spring. Once you meet a girl there is never any problem: Boston reeks of cultured (and uncultured) night life.

Sports are varied and a lot of fun. There is room in the system for Tarzan of the Apes, but in general it is set up for the average player. The point is to enjoy yourself. I did, and I had undisputed possession of the cellar position on the squash ladder.

When one applies to M.I.T., he is requested to choose a Course of study. Don't think you are bound by your choice; there's nothing holy about it. Courses aren't even punched on freshman roll cards (the I.B.M. 704 is supreme here), and one may change conveniently up to the end of the sophomore year.

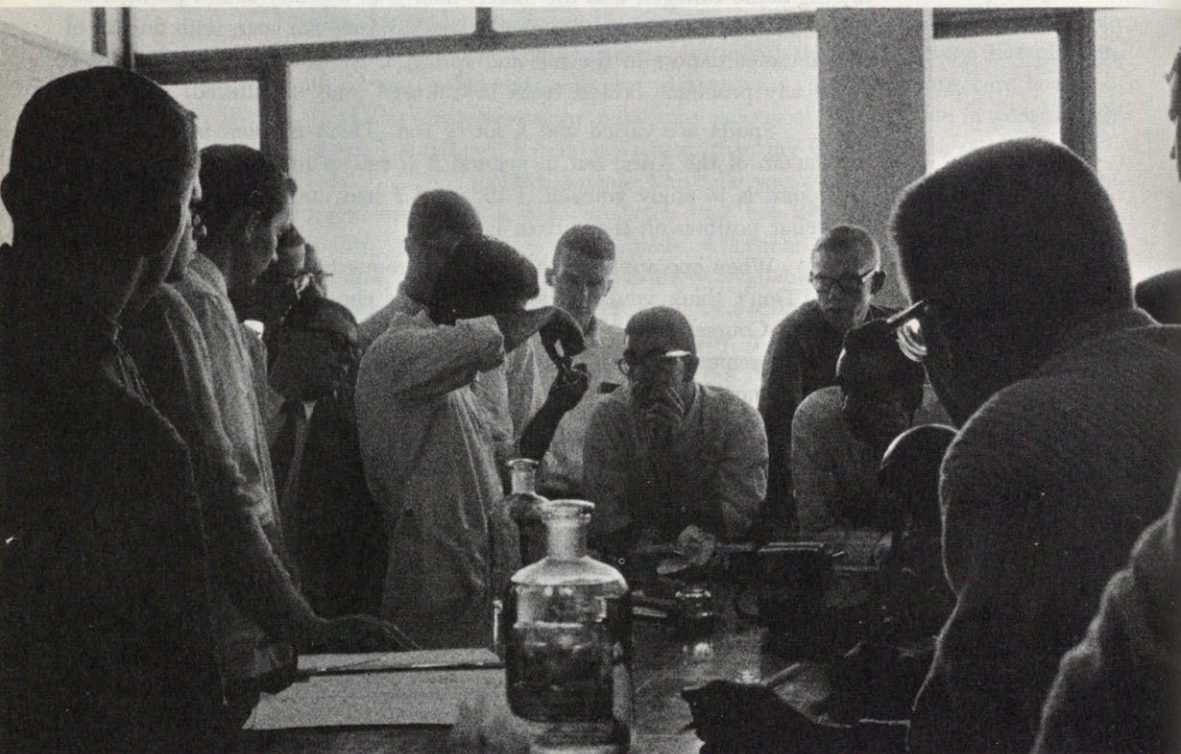
If you expect to do basic research with expensive equipment, you may be temporarily disappointed. A special program was started this year to give freshmen a chance to work on research with a faculty member in a field of their choice; but mostly the emphasis in the first year is on the necessary fundamentals.

Success at M.I.T. probably depends on the ability to make valid, independent decisions. One whose ambition is to escape as much work as possible will probably conclude that "Tech is hell." My guess is that a student who comes here to learn, and keeps that goal throughout his stay at M.I.T., will develop an approach to things that will stand by him all his life.



"What is important in the education of an undergraduate is that we stir his imagination, encourage him to break free from the channels of conventional thought, and teach him how to bring to bear upon his problems the facts and methods acquired in the classroom."

PRESIDENT JULIUS A. STRATTON





(text continued from page 97)

You may gain perspective by exploring your own particular aptitudes as they are revealed by your progress during the first year. You will have time to learn which fields at M.I.T. most closely satisfy your own abilities. You will have a chance to discuss these matters with your fellow students, with your instructors, and often with men in industry; you may be able to find out what specific opportunities exist for the combination of ability and application you have discovered in yourself. The initiative is your own.

Self-confidence is important. You will find yourself a beginner in the midst of many people at various stages of progress in learning and research. There is nothing wrong with being a beginner; and a beginner who shows enthusiasm and eagerness to learn, who demonstrates his good attitudes by hard and careful work, and who rewards friendship with an interested and interesting personality . . . such a freshman earns as much respect here as an expert in research or an established leader in campus activities.

A sense of responsibility is essential. As a freshman you will probably have more freedom in managing your own affairs and in making your own decisions than you are used to. There are few rules at the Institute. The key to freedom for everyone lies in the limitations each individual places upon himself in order not to infringe on the freedom of others. At M.I.T. you can establish a foundation for good citizenship throughout your life.

Be assured that everyone at M.I.T. is looking forward to meeting you and to hearing what you have to say. Friendship is one of the cornerstones of the Institute; even before you arrive, you have friends here waiting for you.



4

Educational Opportunities at M.I.T.

The broadly gauged professional education which M.I.T. offers to undergraduates is structured into Courses offered by seventeen departments. Each Course leading to a Bachelor's degree consists of a program of general education emphasizing science, mathematics, and the humanities and social sciences (the General Institute Requirements) and a group of subjects in an area of professional interest (the Departmental Program).

The subjects designated as General Institute Requirements provide the fundamentals of mathematics, physics, and chemistry on which later work largely depends, and they also contain the ingredients of a liberal education appropriate to today's world. These subjects are pre-professional, but in no narrow sense. They aim to provide a rigorous knowledge of fundamentals, an informed awareness of the human and social dimensions of science and engineering, and a lively sense of personal, social, and civic responsibility. Including the subjects of the common freshman year, they comprise about half of each curriculum and are essentially the same for all Courses.

The subjects of most Departmental Programs constitute work in depth in a field of engineering, science, architecture, or management. Their aim is special competence, the development of creative and constructive powers, the professional and scholarly commitment. Their scheduling is not rigid. Flexibility is provided by electives, by the possibility of substituting other subjects for certain of those specified, and by the Institute's plan of examinations for advanced standing. These examinations enable students of superior ability or unusual experience to progress more rapidly or to include extra elective subjects in a four-year program.

SELECTION OF COURSES

The chart in Section 2 listing M.I.T.'s professional Courses shows that an M.I.T. education may focus on any of a large number of fields. You will learn more about each of these fields by studying the statements on the following pages, prepared by the heads of the various Departments. Here, too, you will find the curriculum for each Course, showing both the General Institute Requirements and the particular Departmental Program.

You will do well to examine these Courses with an open mind, and you will be expected to spend your first year, at the minimum, gaining perspective and judging your aptitudes for the work of the various Courses. You may be one of many entering students with a well-defined preference for a specific field. You may be one of many who have interests in several areas and have not yet decided upon a field of concentration. M.I.T. seeks to accommodate both types. It offers the opportunity for early specialization by the student whose choice is clear. It provides ample time for others to explore their interests, assess their abilities, and choose a Course which satisfies both.

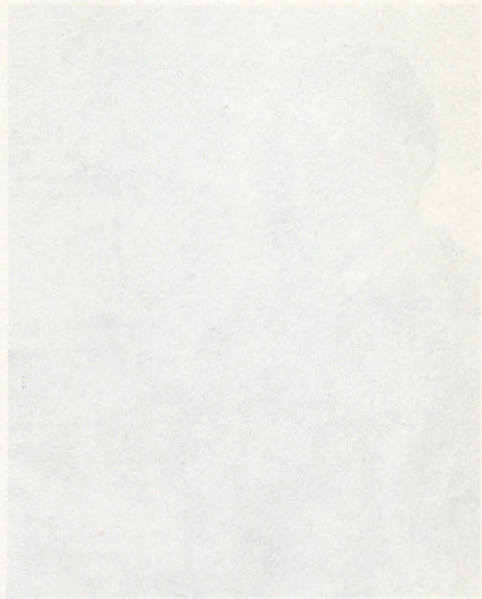
A student may select his Course as early as the end of his first year, and he must do so by the end of his second year. All Courses are organized to permit those who postpone selection until the end of the second year to graduate in four years, provided that, as sophomores, they make reasonable choice of electives. Change of Course, even after the second year, is possible and not unusual. Thanks to the extent to which M.I.T. education is general and common and to the considerable degree of elasticity available in many curricula, students who change Courses after the second year are often able to meet the degree requirements with little or no loss of time.

However, the gains from study in depth in an area in which a student has clear interest and marked aptitudes are large. You are therefore urged to select your field at the end of the first year if you can realistically do so.

In the last analysis, the responsibility for choosing a curriculum for study at M.I.T. will be your own. No one else can do it for you. You should be aggressive in seeking the knowledge on which to base this choice. Discussion with fellow students, conferences with instructors and advisers, whom you will be seeing frequently, and departmental orientation programs will stretch

your awareness of available opportunities. Go to your instructors in their offices; visit laboratories and plants; accumulate experience through summer jobs; talk with those who are experienced in fields of both old and newly developing interest to you. A sound choice of specialization will bring rich satisfactions in your college years; and, in turn, it will ensure that when you enter your profession you will be equipped to find in that new environment the satisfaction and continuing interest that come with solid accomplishment.





Dean Belluschi

"The architect must be a competent and imaginative technician. He must also be a man to whom people and life in all its facets and mysteries are objects of fascination and concern. His task in society is not merely to refurbish old styles or create new ones but to give meaningful interpretation in physical terms of our complex civilization, to reflect the esthetic aspirations of our time and the substance of our culture."

—DEAN OF ARCHITECTURE AND PLANNING PIETRO BELLUSCHI, May, 1960.



ARCHITECTURE

Professor Lawrence B. Anderson

Architecture today, as always in history, is the art of creating structures and spaces that can enhance the dignity and meaning of human life.

The architect is trained to provide his community with the physical environment that fosters more orderly and creative civic life. Towards that end, leading citizens throughout the community—in industry, education, finance, religion, medicine, law, and government—require the services of the architect. He works with energetic, practical, and imaginative designers; he integrates the work of many specialists; and his colleagues are members of a dynamic profession which promotes urban, national, and international exchanges of ideas about techniques and social objectives of architecture.

In working towards the constructive, humanitarian goals of his profession, the architect must rely both on craftsmanship and theory. He uses his technical skill to make protective shelters perform well, to design buildings that will be safe, convenient, comfortable, durable, economical, in visual harmony with their surroundings, and esthetically satisfying. He uses his understanding of people and institutions to develop cultural aspirations in visual form, to analyze and interpret the needs of his clients, to imagine arrangements in space that will translate these needs into structural form, to develop his concepts verbally and graphically, and to win their acceptance.

Consequently, the architect who has been educated both in engineering technology and in broadly scientific and humanistic ideas will best solve architectural problems. Only then will he be prepared to coordinate effectively the work of the special design consultants upon whom he relies for detailed analyses, to instruct the contractors in the execution of his designs, and to represent and guide his clients until the work is completed.

At M.I.T. the Department of Architecture offers an education in both the craftsmanship and theory of architecture. The general subjects in the humanities and in the pure sciences provide a foundation in history, in ideas and

verbal expression, in people and social structure, and in methods of scientific investigation. To this is added the special contribution of the Institute: technological training in related engineering fields such as structures, materials, heating, lighting, and acoustics. Another branch of studies, visual design, encourages students to develop their visual experience by learning to think in three dimensions; to investigate the vast resources in the organization of lines, planes, textures, and colors; and to bring visual order to their structural inventions. Throughout the Course these specialized fields are coordinated in the design classes where the students, with the aid of instructors, solve modern, realistic architectural problems of many kinds.

This five-year program emphasizes the processes and the educational climate that develop in each student the techniques and goals of the professional architect. The internationally recognized achievements of alumni indicate the scope of the architectural education that has been developing for almost a century at M.I.T. In each drafting room students work individually upon a whole problem; each is assisted by instructors and distinguished visiting architects; and each discusses his drawings or models before a group of critics. This experimentation with solutions proposed by individual students from differing backgrounds encourages vigorous, productive thinking.

The graduate is equipped to perform a supporting role in an architectural office, where experience accumulates the practical skills that lead to professional licensing. Later he will decide whether to seek independent commissions in order to be more free to develop his personal design signature or to remain as part of the team, where he can also, in a different way, learn excellence in the task that best suits his talents. He may choose to become a specialist or to enter teaching or research.

In the United States today, architects capable of imaginative innovation and leadership form a small group with great responsibilities. In twenty-five years, expanding population and industry will require a great building program; this larger responsibility will be that of the architectural graduates of the next few years.

Architecture (Course IV-A)

GENERAL INSTITUTE REQUIREMENTS

GRAPHICAL CONCEPTUALIZATION AND ANALYSIS

DESCRIPTIVE GEOMETRY

PHYSICS (Mechanics)

PHYSICS (Mechanics: Heat and Kinetic Theory)

PHYSICS (Electricity and Magnetism)

PHYSICS (Optics and Atomic Physics)

CALCULUS (*two terms*)

Humanities (*four core subjects and four upper-class elective subjects*)

First-year electives (*two subjects*)

THESIS

DEPARTMENTAL PROGRAM

FORM AND DESIGN

LIGHT AND COLOR

ARCHITECTURAL DESIGN (*six terms*)

ARCHITECTURAL FORM AND STRUCTURE

STRUCTURAL ANALYSIS (*two terms*)

MECHANICS OF SOLIDS I

HEATING AND VENTILATION (*two terms*)

MATERIALS—WOOD, PLASTICS, AND FABRICS

MATERIALS—MASONRY AND METALS

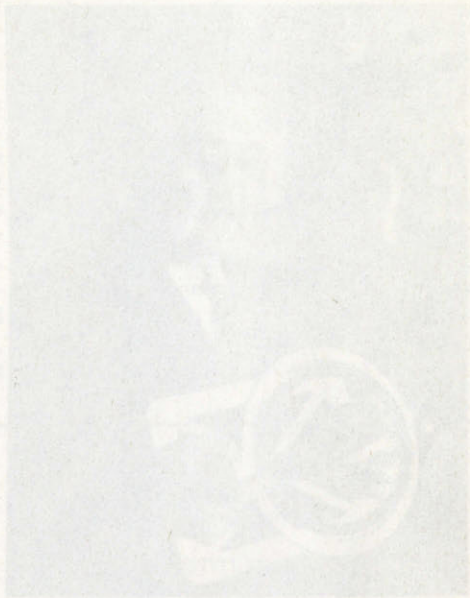
CITY PLANNING PRINCIPLES

INTRODUCTION TO ART AND ARCHITECTURE

MODERN ART AND ARCHITECTURE

Electives (*six to eight subjects*)





Dean Brown

The engineer is the revolutionist in today's revolution in technology. Increasingly, his achievements derive more from a mature shaping of today's scientific knowledge than from skillful backyard invention. And while he is the instigator of change in his own profession, he is the efficient cause of rapid change in the economic, social, and cultural environment of the world in which he lives.

—DEAN OF ENGINEERING GORDON S. BROWN, June, 1959.



AERONAUTICS AND ASTRONAUTICS

Professor Charles S. Draper

Aeronautics as a field of technology began just over fifty years ago, when Wilbur and Orville Wright's plane flew at Kitty Hawk. Today aircraft carry man over the face of the earth at twice the speed of sound, and we predict without hesitation their penetration of space. No other field of technology has ever before progressed so far, so fast.

Aeronautical and astronautical engineers are called upon to take charge of developing, manufacturing, and operating many vehicles, including helicopters; subsonic, transonic, and supersonic aircraft; air-supported guided missiles; ballistic missiles; earth satellites; and interplanetary vehicles. At M.I.T., education for these exacting and complex tasks is based on knowledge of science and ability to use mathematics, combined with judgment developed by personal contacts with faculty members who are experienced engineers.

We think of undergraduate education in aeronautics and astronautics at M.I.T. as a period of grounding in fundamentals and a time to acquire habits of learning and patterns

of thought. During the first two years, the undergraduate curriculum is devoted almost entirely to a strong preparation in the basic sciences, the engineering sciences, and mathematics. This is because a working mastery of mathematics, chemistry, physics, thermodynamics, mechanics, material science, and electrical science is necessary for the professional subjects which follow in the later years.

In selecting these professional subjects, each student has a wide area of choice. He should use this freedom to select a program which corresponds with his own aptitudes and interests, constrained only by the necessity of pursuing a well-balanced program of adequate depth. Many combinations are possible, but the Department suggests two general types of programs which prepare students especially well for aeronautics and astronautics today. These are termed the Engineering Program and the Engineering Science Program; both lead to the degree of Bachelor of Science in Aeronautics and Astronautics.

Beyond the four-year programs that lead to the bachelor's degree, properly qualified students may continue studies in master's degree or professional engineer degree programs or may plan a longer period of graduate study leading to the doctorate. Because this education provides a wide range of knowledge and abilities, men holding degrees in aeronautics and astronautics often find that they are well qualified to work in many other fields.

THE ENGINEERING PROGRAM

Unlike most engineering curricula, aeronautical and astronautical engineering has the distinguishing feature of being polarized around a common theme that is the flight vehicle. To be sure, the vehicle considered may range from a helicopter to a space craft; but all such devices may be said to have five elements in common: structures, fluid dynamics, propulsion, control, and guidance.

Professional subjects which embrace these five common elements form the heart of our Engineering Program. By the end of the Program, each student, working under the close supervision of the staff, employs his creative skills to devise a vehicle which satisfies given mission requirements. His critical technical judgment is challenged in making the necessary

compromises among many conflicting technical requirements.

THE ENGINEERING SCIENCE PROGRAM

The period since World War II has been one of intense change in flight vehicle technology. Research and development have become integral and highly important parts of flight vehicle technology. Our Engineering Science Program is planned to prepare students for work at the frontiers of this research for improved flight vehicles. The principal distinguishing feature is the emphasis on increased depth in physics, mathematics, gas dynamics, and solid mechanics. Since every student must

have a proper balance between theory and experiment if he is to progress in research and development, there is also strong emphasis on laboratory experience.

THE COOPERATIVE COURSE

Students may elect a cooperative plan which provides about six months of experience in an industrial organization before the professional work of the senior year. Students in this program become regular employees during their periods at aircraft plants, and they are paid at prevailing rates. Continuous contact with industrial problems helps them to discover and develop their aptitudes and interests.

Aeronautics and Astronautics (Course XVI)

Engineering Program

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upperclass elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM¹

FLIGHT VEHICLES
 ENGINEERING MATERIALS
 SOLID MECHANICS I
 FLIGHT VEHICLE STRUCTURES I
 HEAT ENGINEERING I
 AERODYNAMICS
 FLIGHT VEHICLE AERODYNAMICS AND DYNAMICS
 PROPULSION
 DYNAMICS
 INTRODUCTION TO ELECTRICAL SCIENCE (*two terms*)
 PRINCIPLES OF AUTOMATIC CONTROL
 EXPERIMENTAL PROJECTS I
 FLIGHT VEHICLE ENGINEERING
 Electives (*four to six subjects*)

Engineering Science Program

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electromagnetism)
 PHYSICS (Electromagnetism and Electromagnetic Theory of Light)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upperclass elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM¹

FLIGHT VEHICLES
 ENGINEERING MATERIALS
 SOLID MECHANICS I
 SOLID MECHANICS II
 HEAT ENGINEERING
 GAS DYNAMICS
 DYNAMICS
 EXPERIMENTAL PROJECTS I
 EXPERIMENTAL PROJECTS II
 INTRODUCTION TO ELECTRICAL SCIENCE (*two terms*)
 ATOMIC AND NUCLEAR PHYSICS
 ADVANCED CALCULUS FOR ENGINEERS (*two terms*)
 Electives (*four to six subjects*)

¹ INDUSTRIAL PRACTICE subjects (*six months*) are added to the Departmental Programs for the Cooperative Course in Aeronautics and Astronautics (Course XVI-A).



CHEMICAL ENGINEERING

Professor Walter G. Whitman

Applying the principles and theories of chemistry to meet great human needs is the job of chemical engineers: to utilize physics and chemistry in mass production, to improve on nature with synthetics, and to process raw materials for highest yields of chemical products.

The chemical and petroleum industries start with coal, petroleum, natural gas, salt, sulfur, limestone, and other raw materials and convert them by chemical reactions into a wide variety of useful things: synthetic polymers and fibers, fuels, drugs, detergents, synthetic rubber, surface coatings . . . The chemical industry supplies fertilizer and insecticides to the farmer; synthetic fibers to the textile industry; and fuels for automobiles, aircraft, and rockets. The synthesis of giant molecules of increasingly precise structure is leading to the manufacture of plastics of such strength, toughness, and long life as to become formidable competition to such conventional materials as wood, metal, and glass.

The early college training of chemical engineers is similar to that of chemists, since both must have a thorough knowledge of chemistry as well as of physics and mathematics. The chemist and chemical engineer are close partners in industry, too, but the engineer is concerned with large-scale and expensive equipment; he must carry out with larger quantities the chemical reactions and separations which the chemist has pioneered on a small scale. The chemical engineer is usually more closely associated with the business operations of his company than the chemist, and he must be constantly aware of costs and economics.

The chemical industries as a group are growing three times as rapidly as the rest of U.S. industry. They spend large amounts of money on new products and new manufacturing processes. Chemical engineering education must therefore prepare its students to handle competently the new and unfamiliar situations they will constantly face in this kind of industry.

Chemical engineering students at M.I.T. must learn to think for themselves. Since their opportunities will be so varied and changing, the undergraduate program of studies is along fundamental lines without emphasis on any particular field or any one special group of chemical problems. The undergraduate work provides basic studies in physics and mathematics, a major concentration in chemistry, and a strong core of chemical engineering.

In addition to his work in the basic sciences, chemistry, and chemical engineering, each student takes a significant professional minor, which may be equivalent to as much as one-and-one-half terms of full-time study, in an area such as automation, biochemistry, computers, economics, electronics, fluid mechanics, geophysics, metallurgy, industrial management, pre-graduate nuclear engineering, or properties of materials.

The flexibility of the chemical engineering curriculum makes possible great variety in both major and minor fields of study to meet many students' special interests.

The Course in Chemical Engineering Practice gives M.I.T. chemical engineering students a unique opportunity to spend the second half of the senior year at two practice schools which M.I.T. maintains in the plants of two companies. Here they can learn to apply principles toward improving equipment under actual industrial conditions, with the guidance of members of the M.I.T. academic staff who are in residence at the plants.

America's first curriculum in chemical engineering was organized here at M.I.T. in 1888; since then, members of this faculty have been responsible for many of the basic concepts of chemical engineering, and graduates of the course have become leaders in the chemical industries.

Most chemical engineers are employed by industry, although a few are teachers, consultants, or operators of their own businesses. Some supervise production, some develop ways of making new chemicals or better ways of making present products, some design plants, some

are technical salesmen. Many chemical engineers have advanced to positions in administration and management. Because of their technological background, many chemical engineers have become effective administrators and managers in these technically complex industries. The rapid and continuing growth of the chemical process industries assures challenging problems and good opportunities.

Chemical Engineering (Course X)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism or Electromagnetism)
 PHYSICS (Optics and Atomic Physics or Electromagnetism and Electromagnetic Theory of Light)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upperclass elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

ORGANIC CHEMISTRY I
 ORGANIC PREPARATIONS I
 CHEMICAL ENGINEERING
 THESIS REPORTS
 Electives *including five or six subjects in Chemistry,¹ seven to nine subjects in Chemical Engineering,² four or five subjects in a professional minor, and four to six other subjects*

¹ *Elective subjects in Chemistry usually include ORGANIC CHEMISTRY II, PHYSICAL CHEMISTRY I, PHYSICAL CHEMISTRY II, PRINCIPLES OF INORGANIC CHEMISTRY I, and ANALYTICAL CHEMISTRY I.*

² *Elective subjects in Chemical Engineering normally include CHEMICAL ENGINEERING THERMODYNAMICS, FLUID MECHANICS, CHEMICAL ENGINEERING (two terms), STRUCTURE AND PROPERTIES OF NON-METALLIC SUBSTANCES, INDUSTRIAL CHEMISTRY, and INDUSTRIAL CHEMISTRY LABORATORY or CHEMICAL ENGINEERING LABORATORY.*



CIVIL ENGINEERING

Professor John B. Wilbur

Civil engineering has been called the foundation of modern civilization. You need only think of the modern city of today to see why this is true. Can you imagine a city without its transportation systems—without highways, expressways, and parking facilities—without railroads and rapid-transit facilities—without airports—without transmission systems and pipelines—and without sanitary facilities—without a water-supply system with its dams, aqueducts, and treatment plants that bring water from distant points and purify it for domestic and industrial use—and without a disposal system that collects, treats, and disposes of the in-

dustrial and domestic wastes of the city? Can you imagine a city without large structures such as skyscrapers and industrial buildings? These things are all built by civil engineers, and without them cities—as we know them today—could not exist.

Civil engineering is the planning, design, and construction of the fixed structures and ground facilities that provide the arteries of transportation, that control the use of water, and that provide protection against the elements of nature. The reference to *fixed* structures is important; it means structures that do not move. For example, the civil engineer builds the superhighways with bridges and tunnels, but not the automobiles that are driven over them; he builds powerhouses, but not the power generating equipment that they shelter.

The civil engineer deals with things that are big in stature. He truly changes the landscape when he builds a Boulder Dam to create a new lake miles in length, when he builds a George Washington Bridge that spans a great river, when he builds an aerial expressway such as the Boston Central Artery through the heart of a metropolitan area, or when he builds the framework of an Empire State Building.

These and similar projects cost vast sums of money, often running into millions or even hundreds of millions of dollars. Planning, designing, and constructing such ventures is a great responsibility. It requires not only technical knowledge of a high order but great personal character and integrity as well. The civil engineer probably spends more money than any other kind of engineer; but in the main he is spending other people's money, and he must always strive to get full value for every dollar spent.

Because these large projects have such major effects on the lives of so many people, they are frequently built for some branch of the government—either city, state, or federal. For this reason some civil engineers are employed by government. Others, however, work for private organizations such as railroad or power companies. They may work in the offices of consulting engineers and eventually become engineering consultants themselves. They may work for construction companies and later operate their own contracting businesses. Throughout

this whole range of employment opportunities there is a distinct shortage of civil engineers that shows no sign of lessening.

Perhaps our greatest asset in the Civil Engineering Department at M.I.T. is our faculty of men who are themselves leaders in the field—men who combine teaching ability with engineering achievement—who themselves have planned and designed great highway systems, for example, or major hydroelectric plants, or important sanitary projects. Equally important is the fact that among these are many men leading the way to new developments in civil engineering through research . . . in our structures laboratories, hydraulics laboratory, soil mechanics laboratory, sanitary engineering laboratory, highway and traffic center, and aerial surveying laboratory.

For those who are challenged by outdoor life and the romance of faraway places, civil engineering in the many underdeveloped portions of the world may be appealing. But even greater opportunities lie in our own country—and, in fact, in our own cities—where slum areas, building shortages, water shortages, industrial waste pollution, and traffic congestion are all demanding attention.

Expenditures for construction represent one-tenth of our total national income. To spend this money wisely is the challenge to the civil engineer.

The undergraduate curriculum in Civil Engineering at M.I.T. is designed to develop lasting values in terms of engineering accomplishment; it provides a strong background for continuation into the graduate school but is also adaptable to the needs of a four-year program.

The Departmental Program may be classified into the following five areas:

1. A strong core in the engineering and physical sciences;
2. Subjects in the engineering of the "environmental sciences"—the earth, life, and social sciences;
3. Two terms of advanced mathematics for engineering design;
4. Two terms of engineering with emphasis on civil engineering components and systems; and
5. The electives which, while normally used for professional subjects in civil engineering such

as structures, transportation, construction materials, and hydraulic engineering, also provide flexibility for students who may want to take subjects in areas such as city planning, industrial management, modern physics, or electrical engineering.

Civil Engineering (Course I)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upperclass elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

Environmental Sciences:

GEOTECHNICAL SCIENCE
 BIOLOGICAL FACTORS IN ENGINEERING
 SOCIAL AND POLITICAL FACTORS IN ENGINEERING

Mathematical Methods:

ELEMENTARY STATISTICS
 MATHEMATICAL METHODS IN CIVIL ENGINEERING

Engineering Science:

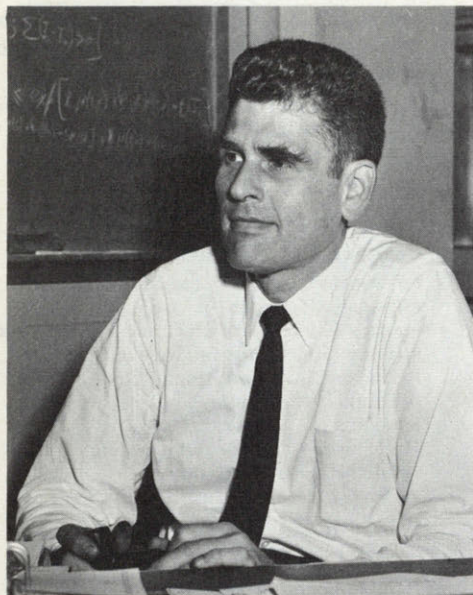
MECHANICS OF SOLIDS I
 MECHANICS OF SOLIDS II
 FLUID DYNAMICS
 PARTICULATE MECHANICS

Engineering:

ENGINEERING I
 ENGINEERING II

Electives (*six to ten subjects, including one in Electrical Engineering, one in Materials Engineering, and one in Thermodynamics*)¹

¹ Civil Engineering subjects available as electives include INTRODUCTION TO PHOTOGRAMMETRY, TRANSPORTATION ENGINEERING, ROUTE LOCATION, GROUND FACILITIES FOR AIR TRANSPORTATION, SOIL BEHAVIOR, SPECIAL STUDIES IN SOIL ENGINEERING, ADVANCED MATERIALS, STRUCTURAL ANALYSIS AND DESIGN, HYDROLOGY, HYDRAULIC ENGINEERING, SANITARY ENGINEERING, BUILDING CONSTRUCTION, DWELLING HOUSE CONSTRUCTION, CONSTRUCTION ANALYSIS SEMINAR, MATERIALS: WOOD, PLASTICS, AND FABRICS, and CEMENTITIOUS MATERIALS.



ELECTRICAL ENGINEERING

Professor Peter Elias

The field of electrical engineering has become one of great variety and scope. Its products and services influence the daily living and business of most of the world's population. Much of its growth has been compressed into such a short period of time that the changes appear almost revolutionary. The growth and change that will prevail for many years to come offer young men a wide range of interesting and expanding professional careers with rich intellectual and spiritual rewards.

Electrical engineering at M.I.T. supports two major human motivations: to transmit and process information; and to convert, control, and utilize energy. The former involves such things as radar, radio and wire telephony, measurement, electronics, computation, and control. The latter furnishes the means to substitute machines for human muscle and to keep the wheels of industry turning—power, light, heat, and control—and so provides the basis of our

modern civilization; here the issue is to exploit energy for energy's sake. This barely suggests the widely diversified areas with which M.I.T. electrical engineering students are familiar.

To provide an *enduring* basis upon which to establish successful careers in any of the rapidly changing professional, industrial, or business areas which depend upon electrical technology, students in electrical engineering must first develop a working mastery of the basic sciences of mathematics and physics. On these is built study of the principles of electrical engineering and their applications.

An electrical engineer's career is influenced quite as much by his understanding of people, his judgment, his sense of values, and his breadth and responsibility of outlook as by his technical competence. The humanities and social studies therefore form an important and integral part of our program.

A major feature of the professional studies of the second, third, and fourth years is the group of eight classroom-laboratory subjects which are required for all students. In the classroom we emphasize basic principles and methods of analysis; then we consider their applications to a broad range of specific electrical processes and equipment. Students discover that these principles and applications form a closely integrated body of electrical science. By applying it in elective subjects and thesis research, they achieve a still deeper understanding of that basic science.

While the laboratory program is coordinated with the work of the classroom, its objectives go beyond the mere mastery of experimental facts, methods, and techniques. Here students encounter the need for engineering judgment, team work, and careful planning. The major objective is to develop independent, creative thought and initiative through a program which requires students to assume progressively increased responsibility for the planning and execution of their work.

The Department offers two undergraduate degree programs: Electrical Engineering (Course VI), and Electrical Science and Engineering (Course VI-B), which emphasizes a broad and deep mastery of the engineering sciences. For either program cooperative work may be taken (Course VI-A) which interweaves

industrial or research experience with education.

The program in Electrical Engineering (Course VI), leading to the degree of Bachelor of Science, is believed best suited to the student who desires to defer his decision on graduate study until late in his program. This Course permits each student to choose among elective subjects in his senior year and hence to prepare for many different careers.

For a selected group of students who feel relatively confident at the sophomore level that their interest will lead them to go on to graduate school and who wish to take advantage of an early opportunity to build up the required background in the engineering sciences, we offer Course VI-B in Electrical Science and En-

gineering. Students may apply for admission to this Course up to the first term of the junior year and as early as the beginning of the sophomore year.

For another selected group of students who want to combine industrial or research experience with education in electrical engineering, we offer cooperative Course VI-A—an interlinking of classroom and laboratory work with sixty weeks of experience in one of nine industrial organizations. Selection for this cooperative Course comes at the end of the sophomore year; this practical experience in industry may be taken in conjunction with either the Electrical Engineering or the Electrical Science and Engineering Course.

Electrical Engineering (Course VI)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electromagnetism)
 PHYSICS (Electromagnetism and Electromagnetic Theory of Light)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

INTRODUCTORY CIRCUIT THEORY (*two terms*)
 ELECTRONIC DEVICES AND CIRCUITS
 ELECTRONIC DEVICES AND CIRCUITS LABORATORY
 FIELDS, ENERGY, AND FORCES
 ELECTRONIC CIRCUITS AND SIGNALS
 ELECTRONIC CIRCUITS AND SIGNALS LABORATORY
 ELECTROMECHANICAL ENERGY CONVERSION
 ENERGY TRANSMISSION AND RADIATION
 MOLECULAR ENGINEERING
 MECHANICS OF SOLIDS II
 ATOMIC AND NUCLEAR PHYSICS
 ADVANCED CALCULUS FOR ENGINEERS
 Electives (*five to seven subjects*)¹

Electrical Science and Engineering (Course VI-B)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electromagnetism)
 PHYSICS (Electromagnetism and Electromagnetic Theory of Light)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year elective (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

INTRODUCTORY CIRCUIT THEORY
 ELECTRONIC DEVICES AND CIRCUITS
 FIELDS, ENERGY, AND FORCES
 ELECTRONIC CIRCUITS AND SIGNALS
 ELECTROMECHANICAL ENERGY CONVERSION
 ENERGY TRANSMISSION AND RADIATION
 MOLECULAR ENGINEERING
 PROJECT SEMINAR (*two terms*)
 MECHANICS OF SOLIDS II
 STRUCTURAL CHEMISTRY
 ATOMIC AND NUCLEAR PHYSICS
 INTRODUCTION TO SOLID STATE AND MOLECULAR PHYSICS
 ADVANCED CALCULUS FOR ENGINEERS
 PROBABILITY
 Electives (*three or four subjects*)¹

¹ Students in the cooperative Course (Course VI-A) substitute INDUSTRIAL PRACTICE (*two terms*) for some elective subjects.



MECHANICAL ENGINEERING

Professor Joseph H. Keenan

The expansion of the interests of the mechanical engineer has left very little of applied science and technology outside his sphere of activity. Traditionally, mechanical engineering has been differentiated from civil engineering in that it deals with moving machines rather than standing structures, and from electrical engineering in that it emphasizes materials, processes, and design rather than electrical circuits and electronics. As he looks into the future, however, the mechanical engineer sees as his province essentially all of industry and all of science as it is applied to man's purposes. He must play a leading part, not only in the perfection of the older aspects of engineering, but also in developing nuclear power, high-speed transport, missiles, and travel in space.

Undergraduate study in mechanical engineering at M.I.T. is planned with all these objectives in mind, because the student of today

will be doing the as-yet-unthought-of engineering tasks of tomorrow. He works in an atmosphere peculiar to mechanical engineering, however, because it is created by a group of faculty members who are leaders in the profession of mechanical engineering. They and their students carry on research and design on a wide range of basic subjects such as thermodynamics, heat transfer, refrigeration and cryogenics, fluid and gas dynamics, magnetohydrodynamics, lubrication, properties of materials, metal processing, automatic control, elasticity, plasticity, and dynamics. The applications of these subjects to the machines and devices of the foreseeable future are limitless.

Engineers differ from scientists not so much in their knowledge of science as in their reasons for knowing about science. The engineer uses science to make or devise something that somebody wants; the scientist uses science to learn more about nature. The engineer aims to satisfy social needs, the scientist to understand.

In addition, therefore, to learning science, the engineer must learn how to bridge the gap between science on the one hand and its applications on the other. This is the art of engineering. To teach the art is the primary objective of our subjects in laboratory and in engineering design, in which students work under the critical and sympathetic eyes of men skilled in the art. Laboratory experience, which takes many forms, is intended to show how the experimental method is used in the solution of engineering problems. Design experience includes the devising of means to perform certain specified tasks. It may be the design of a device or the synthesis of a system made up of parts having known characteristics. Either experience may culminate in a senior thesis.

The Department encourages each student to propose a program of studies to suit his own tastes. Such a program may be heavily weighted toward science or toward the arts of engineering, as long as it satisfies the registration officer that for the student in question it is a sound educational program.

Two programs, one emphasizing science and the other engineering, are accordingly offered to undergraduates in mechanical engineering.

In either program, the work in the first two years lays a thorough foundation in mathe-

matics, physics, and chemistry, with some introductory study in the engineering sciences. Students in the Engineering Program then choose a coherent set of subjects in some particular technological area. The object is not specialization but rather a development of skill in joining the scientific with the creative aspects of engineering for useful ends. Examples of such programs are power and propulsion, including nuclear power; design, manufacturing, and controls; and materials, including textiles. Students who wish to work out programs with their faculty advisers may choose other areas for concentration.

The Engineering Science Program arises out of the rapidly accelerating pace of technological change: a man who wants to work at the frontier of engineering development must be

prepared to learn continuously throughout his career and to make marked shifts in direction. Such a man must have a broad education deeply rooted in the sciences. This is the objective of the Engineering Science Program. The distinctive features of this program are more advanced work in mathematics and physics, engineering subjects which build on this additional background, and association with research which is an essential part of the education of the engineering scientist.

A cooperative program (Course II-B) offers the same curricula and includes in addition some six months of actual plant experience, mostly during the summer. This Course is especially valuable for students who would otherwise have no first-hand experience in industry before they graduate.

Mechanical Engineering (Course II)

Engineering Program

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upperclass elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM¹

MECHANICS OF SOLIDS I
 MECHANICS OF SOLIDS II
 DYNAMICS
 FLUID MECHANICS
 THERMODYNAMICS (*two terms*)
 ENGINEERING MATERIALS
 MECHANICAL BEHAVIOR OF MATERIALS
 FUNDAMENTALS OF ELECTRICAL ENGINEERING
 ENGINEERING DESIGN AND MANUFACTURE
 ENGINEERING DESIGN
 EXPERIMENTAL ENGINEERING
 ENGINEERING PROJECTS
 Electives (*four to six subjects*)

Engineering Science Program

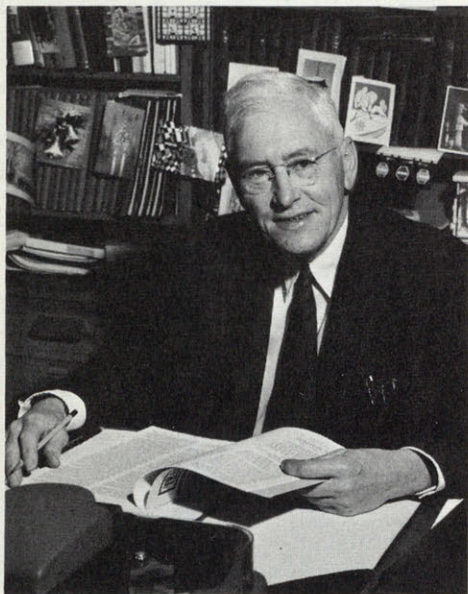
GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electromagnetism)
 PHYSICS (Electromagnetism and
 Electromagnetic Theory of Light)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upperclass elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM¹

MECHANICS OF SOLIDS I
 MECHANICS OF SOLIDS II
 DYNAMICS
 FLUID DYNAMICS (*two terms*)
 THERMODYNAMICS (*two terms*)
 ENGINEERING MATERIALS
 MECHANICAL BEHAVIOR OF MATERIALS
 ELEMENTARY ELECTRIC CIRCUT THEORY
 ATOMIC AND NUCLEAR PHYSICS
 ADVANCED CALCULUS FOR ENGINEERS
 ENGINEERING DESIGN AND MANUFACTURE
 EXPERIMENTAL ENGINEERING
 ENGINEERING PROJECTS
 Electives (*four or five subjects*)

¹Students in the Cooperative Course in Mechanical Engineering (Course II-B) may choose either of the programs above, and in addition to the curricula shown spend a period of about six months in INDUSTRIAL PRACTICE.



METALLURGY

Professor John Chipman

Metallurgy is an engineering science that deals with the production, utilization, and behavior of metals and their alloys. The field is quite broad because it is based on physics and chemistry, which are necessary for an understanding of the metallic state; it also relates to chemical engineering in the extraction of metals from their ores and to mechanical engineering in the fabrication of metals into useful forms for ultimate service. There are three main reasons for focusing these disciplines on metals: metals comprise about three-fourths of the elements in the periodic system, and thus are of immense scientific interest as fundamental matter of the universe; metals have remarkable properties as a class of materials that make them particularly useful to mankind; and many metals are available in nature in such quantity and form that they can be produced at reasonable cost in pure or alloyed condition. Accordingly, to a large extent, metals have become the "working substance" of modern industry; it has been estimated that 40 per cent of all the jobs in America are connected directly or indirectly with

the manufacture and use of steel alone. Moreover, the field is a lively one in research and development because it is now clear that the efficient operation of such complex devices as gas turbines, jet engines, guided missiles, and nuclear reactors will depend not only on the design but also on the materials of construction.

The course in Metallurgy (Course III-A) offers opportunity for study in all phases of the science and engineering of metals.

Materials science is a study of the structure, properties, and behavior of materials of all kinds but especially of those engineering materials which are useful in structures, machines, or devices. Modern manufacturing operations utilize materials of many sorts, metallic and nonmetallic. Advanced engineering developments depend upon materials having highly specialized properties such as strength, toughness, elasticity, resistance to oxidation, or specific electrical or magnetic characteristics. Such properties must be maintained under extremes of high or low temperatures, under intense radiation, or in outer space. The ability to select the right material for a given demand or to invent and develop a new material depends upon knowledge of materials science.

The Course in Materials Science (Course III-B) provides a basis for scientific understanding of the structure and properties of materials. There is emphasis on the applications of physics and chemistry to phenomena of the solid state, with opportunity for studies of metals, ceramics, semi-conductors, glasses, and plastics and other polymers, and of the properties of materials in general.

Both curricula are based upon a core of science and engineering subjects including mathematics, physics, and chemistry, along with an introduction to materials science and the engineering principles involved in the extraction and application of metals and other materials. Students learn the basic thermodynamics, unit processes, and structure of solids as a foundation for understanding their properties and for selecting the right materials for a certain job; they also learn and use the principles for developing alloys of metals and composite structures containing nonmetals.

The large block of elective time permits each student to direct his studies according to his in-

terests, which may mean further studies in metallurgy or the broadening studies of non-metallic materials. Students who are interested in ores and their beneficiation will choose subjects in mineral engineering and geology. A combined program of metallurgical and chemical engineering is feasible for those who wish to concentrate more on the production of metals. Students who are mechanically inclined may elect sequences of subjects leading to machine design, stress analysis, and metal forming. The curriculum in Materials Science offers excellent preparation for graduate study, especially for those students who would like to become broadly trained materials engineers. Either curriculum may include additional subjects in mathematics, physics, and chemistry.

Graduates in metallurgy and materials science find many kinds of jobs. Some enter the metal-producing field in companies that make copper, brass, aluminum, titanium, special alloys, or that giant among industries, steel. Metallurgists and engineers trained in materials science are needed in selecting, testing, and supervising the application and use of metals in all kinds of manufacturing industries. Many problems remain to be solved, and the rewards for their solution will be great.

The world needs more metallurgists and materials scientists. Only half of the known metals have been brought into commercial use today. Much remains to be done in developing these new metals and a host of nonmetallic products. Truly the horizon is a wide one.

Metallurgy (Course III-A)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

HEAT AND FLUID FLOW
 CHEMICAL METALLURGY
 METALLURGICAL PLANT VISITS
 THERMODYNAMICS
 MATERIALS SCIENCE I
 X-RAY METALLURGY
 PRINCIPLES OF MATERIALS SEPARATION
 MECHANICS OF SOLIDS I
 PHYSICAL CHEMISTRY I
 PHYSICAL CHEMISTRY II
 STRUCTURAL CHEMISTRY
 Electives (*eight to ten subjects*)¹

Materials Science (Course III-B)

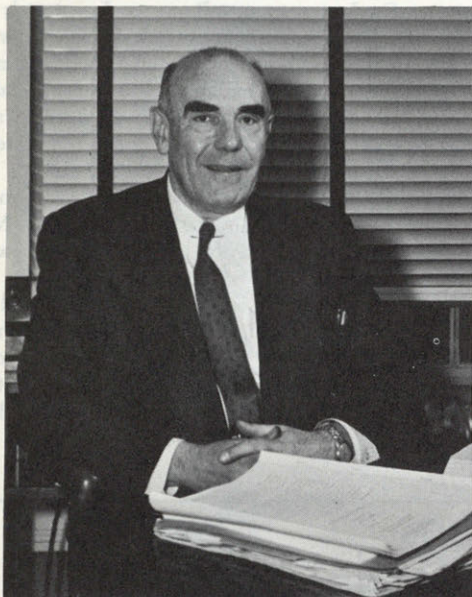
GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electromagnetism)
 PHYSICS (Electromagnetism and Electromagnetic Theory of Light)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

HEAT AND FLUID FLOW
 MATERIALS PROCESSING
 THERMODYNAMICS
 MATERIALS SCIENCE I
 MATERIALS SCIENCE II
 MECHANICS OF SOLIDS I
 PHYSICAL CHEMISTRY I
 STRUCTURAL CHEMISTRY
 FUNDAMENTALS OF ELECTRICAL ENGINEERING
 ATOMIC AND NUCLEAR PHYSICS
 Electives (*eight to ten subjects*)¹

¹The following subjects within the Department of Metallurgy are among the recommended electives for the third and fourth years: METALLURGICAL ENGINEERING, FOUNDRY ENGINEERING, WELDING ENGINEERING, POWDER METALLURGY, PLASTIC WORKING OF METALS, PHYSICAL METALLURGY, ELECTRO-CHEMISTRY, PHYSICS OF METALS, ELECTRIC AND MAGNETIC MATERIALS, CERAMICS, MINERAL ENGINEERING, QUANTITATIVE MINERAGRAPY, and ORE TESTING. Students are also expected to choose subjects from other departments.



NAVAL ARCHITECTURE AND MARINE ENGINEERING

Professor Laurens Troost

The ship is the biggest moving object that man has devised. Its design and construction is a problem without parallel in modern engineering: ships must move efficiently through water; they must be structural entities capable of taking on severe forces at sea; they must perform their transportation service with unmatched efficiency; they must provide such diverse services as water supply, refrigeration, ventilation, sewage disposal, communications, and cargo handling; they must contain specially designed power plants, often of hundreds of thousands of horsepower. This power must be produced and transmitted efficiently with regard to cost of construction, space, weight, and fuel consumption.

Designing a ship is indeed a demanding profession—yet one as fascinating as the stories and folklore of the men and ships that sail the sea.

At M.I.T., we begin education in naval architecture and marine engineering with the fundamentals of basic subjects, including applied mechanics, fluid mechanics, heat engineering, and structural theory. The emphasis on fundamentals in a deliberately broad area is continued throughout the four years. This is accompanied by an application to problems pertinent to ships and their machinery. In the latter part of the curriculum the ship as a complete entity is examined, bringing together all the technical and professional background of the previous subjects. In this manner the ability to apply the formal disciplines of the classroom to the diverse and as-yet-unthought-of problems of the future is developed. The elective part of the program, which for an average student will comprise eight to ten subjects, may be made up of subjects of general or specialized interest within or outside the Department, or may be chosen to best satisfy students with well-defined objectives in such special fields as hydrodynamics, structures, oceanography, noise and vibration, and hydroelasticity.

Business management and economics play a very important role in all phases of the ship-

building and maritime industry, and there is a need for competent men with a basic knowledge of naval architecture and marine engineering as well as of the fundamentals of various areas of business management and economics. To provide this background for students interested in the business phases of shipbuilding and shipping, we offer a five-year Course in Shipping and Shipbuilding Management, Course XIII-B, in association with the Department of Economics and the School of Industrial Management. This Course in shipping management begins to differ from the Naval Architecture and Marine Engineering Course only in the senior year, when students enter subjects that are necessary for advanced study in business management and economics. The fifth year of work in these fields and in Naval Architecture and Marine Engineering leads to both S.B. and S.M. degrees.

The Department's laboratory facilities are an important factor in both these Courses, and there are excellent opportunities for theses and research. These facilities include the Ship Model Towing Tank, for studies of the hydrodynamics of ships' hulls; the Propeller Tunnel, for controlled underwater tests of model ships' propellers under simulated ship conditions; and the Ship Structures Laboratory, for research in structural arrangements for ships.

Modern ships are large and fast. New ship construction materials are being used for strength and lightness. Seagoing nuclear power plants are already afloat. The *S. S. United States* represents a triumph in modern naval architecture and marine engineering. Today there are serious studies in progress on submarine tankers, semi-submerged hulls, and hydrofoil boats. All these things suggest the creativeness which will be demanded of tomorrow's ship designers, builders, and managers; they further indicate the breadth of interest and ability required in this field. M.I.T. is one of a handful of American universities preparing men for the future of this profession.

Naval Architecture and Marine Engineering (Course XIII)

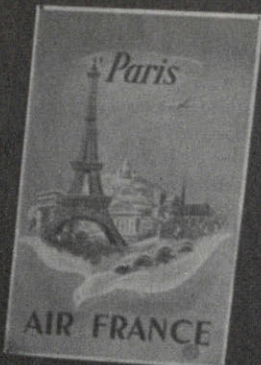
GENERAL INSTITUTE REQUIREMENTS

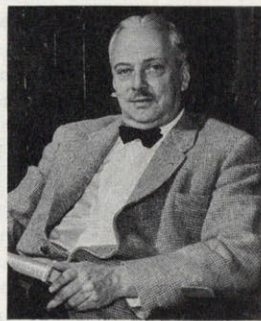
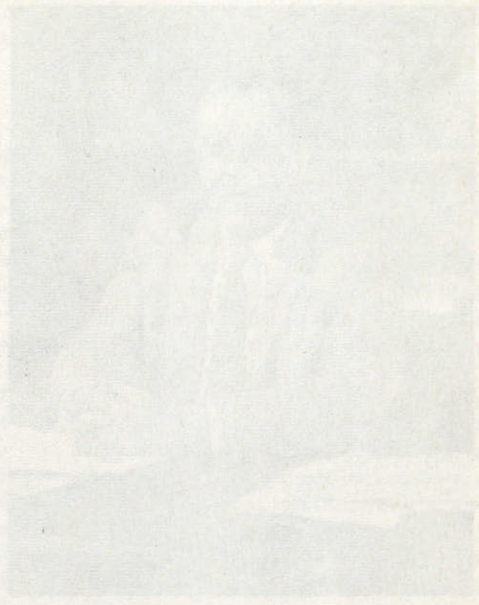
CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Energy)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Energy)
 CALCULUS (three terms)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS¹

DEPARTMENTAL PROGRAM

PRINCIPLES OF NAVAL ARCHITECTURE
 SHIP STRUCTURAL ANALYSIS AND DESIGN
 ENERGY CONVERSION SYSTEMS AND COMPONENTS
 MECHANICAL VIBRATION
 INTRODUCTORY SHIP DESIGN
 MECHANICS OF SOLIDS I
 MECHANICS OF SOLIDS II
 FLUID MECHANICS
 THERMODYNAMICS
 ENGINEERING MATERIALS
 ADVANCED CALCULUS FOR ENGINEERS
 Electives (*eight to ten subjects, including at least three subjects in Engineering or Science*)¹

¹ Students in the five-year Course in Shipping and Shipbuilding Management (Course XIII-B) follow the same program as those in Course XIII during their four undergraduate years, *except* that in place of the undergraduate thesis they choose additional professional electives.





Dean Burchard

"The informed citizen who declines to do his democratic duty is no doubt more despicable than the ignorant citizen who tries to do his duty with ardor, but he is not more dangerous. Ardor and knowledge must go hand in hand."

—DEAN OF HUMANITIES JOHN E. BURCHARD, Wheaton College Commencement Address, June, 1958.



ECONOMICS, POLITICS, AND ENGINEERING OR SCIENCE

Professor Robert L. Bishop

The Courses in Economics, Politics, and Engineering or Science are another evidence of M.I.T.'s pioneering role among technological institutions. These two Courses were designed to combine study in the social sciences with concentrated work in a selected field of engineering or science . . . once more emphasizing the Institute's interest in developing graduates who can help effect a melding of technology with the environment in which it operates.

These are the essential features which we think distinguish these Courses from other offerings at the Institute—and from offerings at other schools:

1. Our students in these Courses are ordinarily those who have innate curiosity both about technical and scientific matters and about social problems. They ask, for instance, questions like this: "What are the probable consequences of the automation of a factory in terms of the impact on the use of economic resources, on prices and employment, on particular industries

and the firm, and on the well-being of the employees involved?"

2. Our students in the Economics Program are typically interested in going into industry after graduation, because they are aware of the particular challenge to be found there for the man who understands technical processes and who can also think along the broadest analytical lines in seeking to understand social processes.

3. Students taking the Political Science Program are trained broadly on policy matters, to fit them for work in government or in professional careers associated with public issues.

4. While at M.I.T., students choose one engineering or science field in which to major. Whatever field is chosen, we adhere to this one general rule: this technical work will involve the fundamental subjects included in the curriculum of students taking their degrees in that field. There are no special "watered-down" subjects for Course XIV students.

5. Approximately half of our students' course work is done in social science, including certain required work in economics, humanities, and political science. In addition, there is a wide choice of electives in economics and political science. In economics these deal with the economic structure within which business is conducted and technologic change takes place; in political science, with the increasing range of problems arising in connection with government which are of direct concern to scientists and engineers.

M.I.T. does not claim to have found the best way to bridge what is often a wide gap between technology and the social sciences. But our experience in these Courses suggests that all concerned—students, teachers, and employers—can afford to be very optimistic. Industry in particular has watched the program develop with special interest; this synthesis of economics and technology promises to be a valuable one for the training of future corporate and government officers.

These Courses in the Department of Economics provide undergraduate students with a twofold selection. For that portion of their studies devoted to a technical field, they may choose between a field of engineering (Course XIV-A) or a field of science (Course XIV-B).

In either case, they may choose to concentrate within this Department in either economics or in political science.

ECONOMICS PROGRAM

The elementary subjects, ECONOMIC PRINCIPLES I and II, are an introduction to the whole field of economics. The intermediate subjects, PRICES AND PRODUCTION and ECONOMIC FLUCTUATIONS AND GROWTH, deepen this knowledge: the first in industry analysis and price formation and the second in the study of economic fluctuations and growth. The quantitative side of economics is stressed in ELEMENTARY STATISTICS and in STRUCTURE OF THE AMERICAN ECONOMY.

With this general background each student goes farther in particular fields by his choice of junior and senior electives. The program specifies that a minimum of five subjects is to be elected in economics, with at least four of these subjects in one of three areas: (1) the general problems of an economy; (2) the particular problems of different industries and of labor relations; or (3) the more technical field of quantitative analysis, through further study in mathematics, statistics, and econometrics.

In the senior year research experience is provided in an economic research seminar in the first term and by the writing of a thesis in the second term.

POLITICAL SCIENCE PROGRAM

There is no rigid program of subjects of instruction in the political science curriculum. The subjects group themselves into a number of fields. A student will normally take three or four subjects in some field that interests him particularly and one or two subjects in each of the other fields. One field, for example, is international relations, in which the introductory subject is followed by a subject in PRINCIPLES AND PROBLEMS OF AMERICAN DIPLOMACY and a SEMINAR IN INTERNATIONAL POLITICS. A comparative government field includes, among other subjects, AMERICAN GOVERNMENT, COMPARATIVE POLITICAL SYSTEMS, and a SEMINAR ON ISSUES IN CONTEMPORARY AMERICAN POLITICS. Another field covers political philosophy. In the field of public policy, subjects include POLITICS, SOCIETY, AND POLICY MAKING; GOVERNMENT, POLITICS, AND TECHNOLOGY; and THE STRUCTURE OF URBAN LIFE.

Economics, Politics, and Engineering (Course XIV-A) or Science (Course XIV-B)

Economics Program

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

ECONOMIC PRINCIPLES I
 ECONOMIC PRINCIPLES II
 PRICES AND PRODUCTION
 ECONOMIC FLUCTUATIONS AND GROWTH
 STRUCTURE OF THE AMERICAN ECONOMY
 ELEMENTARY STATISTICAL ANALYSIS
 ECONOMIC RESEARCH SEMINAR
 Electives (*seven subjects in a field of Engineering or Science, five subjects in Economics, and two other subjects*)

Political Science Program

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

POLITICAL SCIENCE SEMINAR (*two terms*)
 Electives (*seven subjects in a field of Engineering or Science, nine subjects in Political Science, and three other subjects*)



HUMANITIES AND ENGINEERING OR SCIENCE

Professor Howard R. Bartlett

The broad objective of M.I.T.'s Courses in Humanities and Engineering and Humanities and Science is to provide a general education firmly based on science or engineering. At the same time, either Course provides the foundation for graduate work in science or engineering, in medicine, law, business, or public administration, and even in some fields of the humanities.

Dean John E. Burchard of the School of Humanities has written, "Surely many American citizens are becoming aware of the dilemma of a democracy which is more and more dependent upon a technology which in turn is more and more specialized and intricate. We can foresee a day when policy problems can hardly be trusted to the intuitions of those whose knowledge of the modern technological world is limited. The nation can clearly benefit from the services of men who have solid training in specialties other than science but whose understanding and grasp of science is real. It is on this basis that we believe these undergraduate Courses provide an unusual opportunity for some thoughtful young Americans."

Each of these Courses provides a balanced educational experience. About 50 per cent of each program is the undergraduate curriculum of one of the departments in the School of Engineering or the School of Science, shortened through omission of some of the more specialized or technical subjects. The other 50 per cent is a sequence of advanced work in humanities with a concentration in one particular humanities discipline of the student's choice: literature and the arts, history, philosophy, or the history and philosophy of science. This concentration in the humanities begins with two basic subjects in the area elected for study. Thereafter each student is able to follow his own interests in the development of his program through elective subjects in humanities and in his professional field. Only two specific requirements are made: HUMANITIES SENIOR SEMINAR and the undergraduate THESIS; both these have the purpose of integrating the previous studies, bringing into focus the insights

and techniques developed in both professional and humanistic studies.

In the first two years come the basic subjects in both humanities and science which are familiar to all M.I.T. students. In the last two years come the specialized work in the science or engineering of each student's choice and a series of subjects in one or more fields of the humanities.

We speak of this Course as a "double major," because it includes concentrated studies in one field of humanities *and* one field of science or engineering. As such, it encourages students to probe deeply in two fields. Under the rigorous standards characteristic of M.I.T., students in this Course acquire a thorough grounding in science and technology and a knowledge of humanities commensurate with that required of students in a liberal arts college.

Both curricula lead in four years to the Bachelor of Science degree in the School of Humanities and Social Science, without specification of science or engineering department. In a fifth year any graduate of this Course who has correctly arranged his program of technical subjects may complete the requirements for an additional S.B. degree (and in some cases an S.M. degree) in the engineering or science department in which he has concentrated his technical studies. Or, after his four years at M.I.T., any graduate of this Course should be able to enter liberal arts graduate study in the area of his humanities concentration.

This Course appeals to undergraduates who want a broader education than is possible when one is concentrating in one technical or scientific field. The Course is unique, for example, as preparation for law or medical school; there are very few attorneys who have the background for dealing with the complex legal matters touching upon science in industry. For doctors, a good scientific background is becoming increasingly necessary if they are to benefit fully from the new developments in biology and physics.

For students who are interested in careers in teaching high school science and mathematics, five-year programs combining studies at

the Institute and at the Harvard Graduate School of Education may be arranged. Work at the Institute typically follows the curriculum in Humanities and Science, but the arrangement may also be made for students in other Courses; education subjects at Harvard begin in the third year, and the fifth year includes practice teaching. Such programs usually lead to the Bachelor of Science degree from M.I.T. and the Master of Arts in Teaching degree from Harvard.

Humanities and Engineering (Course XXI-A) or Science (Course XXI-B)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)

PHYSICS (Mechanics)

PHYSICS (Mechanics: Heat and Kinetic Theory)

PHYSICS (Electricity and Magnetism)

PHYSICS (Optics and Atomic Physics)

CALCULUS (*three terms*)

DIFFERENTIAL EQUATIONS

Humanities (*four core subjects and four upper-class elective subjects*)

First-year electives (*two subjects*)

THESIS

DEPARTMENTAL PROGRAMS

HUMANITIES SENIOR SEMINAR (*two terms*)

Electives (*six to eight subjects in one field of Engineering or Science, at least six subjects in a single Humanities discipline, and six to eight other subjects*)

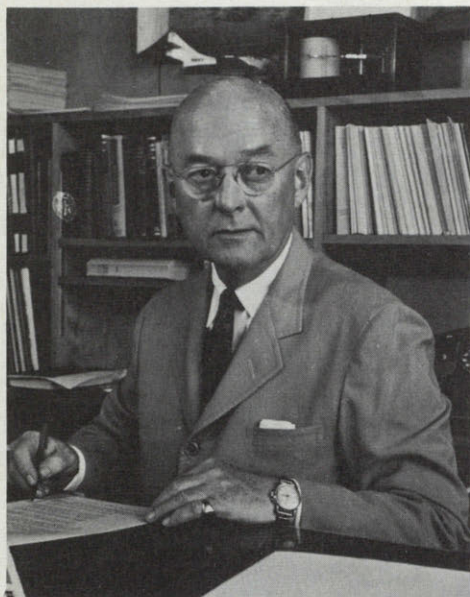




Dean Johnson

The rapid technological and social shifts around us will force continuing and far-reaching changes in management: in the techniques and methods of management; in the environment in which business must operate; in the tastes and needs of every market; and, indeed, in our understanding of the role and purpose of organization itself. There will be unsurpassed opportunity and challenge for the manager of tomorrow who can deal with these changing streams of data.

—DEAN OF INDUSTRIAL MANAGEMENT HOWARD W. JOHNSON, June, 1960.



INDUSTRIAL MANAGEMENT

Professor Houlter Hudgins

The dominant characteristic of our society is rapid change. Among those chiefly responsible are the scientist, the engineer, and the manager. Today, the manager of both private and public enterprise plays a major role in making effective the work of scientists and engineers.

M.I.T.'s undergraduate Course in Industrial Management is specifically designed for the student who wishes to make his contribution to society as a manager of people rather than of things. Dealing with people as a variety of interested groups—owners, employees, customers, and the "body politic"—and acting effectively through people are essential, fascinating, and demanding elements of administration. And while much is known about a theory of administration, the fact that so much of management rests upon many as-yet-unknown elements of human behavior makes it certain that management should still be classed among the "lively arts."

This program in management might be called a "breadth" program. It requires a grounding in basic physics, chemistry, and mathematics. Furthermore, it demands a rigorous exposure to the fundamentals of technical application in a chosen field (for example, the field of chemical sciences). It demands an investigation of a field of humanities. Finally, it calls for a study of both the analytical aspects of management decision-making and the practical or human problems of administration.

Although the mathematics, science, and engineering subjects which together make up about one-half of the content of the undergraduate program provide in themselves a basic education in today's technology, they have a more important purpose. They are crucial for the sound administrator who would manage today's industry; this administrator need not know a great deal about the specific engineering involved, but he should have studied enough in some area of technology to have an understanding of the needs of the engineer and the scientist.

There is a further purpose in the engineering and science base in this Course. Much has been learned about mathematically oriented decision-making techniques in many areas of

business. Our students are peculiarly qualified to learn about the use of statistics, mathematical models, and modern data-processing concepts. Men who know these fields will increasingly be among those who contribute to the development of scientific methods of administration.

The study of management in this undergraduate program rests upon the underlying disciplines of the social sciences and especially economics. Students who plan to study management should anticipate their future work by taking a basic subject in economics during their sophomore year. This lays the foundation for prescribed subjects in advanced economics, accounting, finance, marketing, and personnel administration. In all of these subjects, the emphasis is on the application of the social sciences to the analysis of business problems and the understanding of managerial principles. Much of the work in management is quantitative, and several prescribed subjects offer an immediate introduction to the use of the many rapidly developing mathematical and statistical techniques for solving industrial problems. The management curriculum provides for flexibility by allowing five or six electives, about half of which would ordinarily be taken in management or related subjects.

We think it especially important that our students approach problems from a point of view which takes into account social forces and individual human impulses as well as economic and engineering considerations. Our students are expected to develop an appreciation of the intangibles of modern industry while they are learning to reduce the number of these intangibles. They are expected to recognize the shortcomings of many business practices as well as their uses. To the fullest extent possible, Industrial Management undergraduates come into contact with experimental administrative techniques and methods of analysis which are advanced well beyond the current practice of industry.

We emphasize contacts with experienced management people. Students typically spend a good portion of their time in our advanced subjects studying live problems in cooperating industrial plants, and they must work with the men actually responsible for the operations of these firms. We have many seminars, most of

which are organized by the undergraduate professional society, at which special visitors bring a particular competence or problem to us.

As in any other profession, the possibilities for individual growth are determined primarily by the growth of the field as a whole. The phenomenal past and projected growth of the national economy, especially in its technologically dominated sectors, will create an even faster-growing demand for technologically oriented managerial talents.

Industrial Management (Course XV)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)

PHYSICS (Mechanics)

PHYSICS (Mechanics: Heat and Kinetic Theory)

PHYSICS (Electricity and Magnetism)

PHYSICS (Optics and Atomic Physics)

CALCULUS (*three terms*)

DIFFERENTIAL EQUATIONS

Humanities (*four core subjects and four upper-class elective subjects*)

First-year electives (*two subjects*)

THESIS

DEPARTMENTAL PROGRAM

INDUSTRIAL MANAGEMENT I

INDUSTRIAL MANAGEMENT II

PERSONNEL ADMINISTRATION

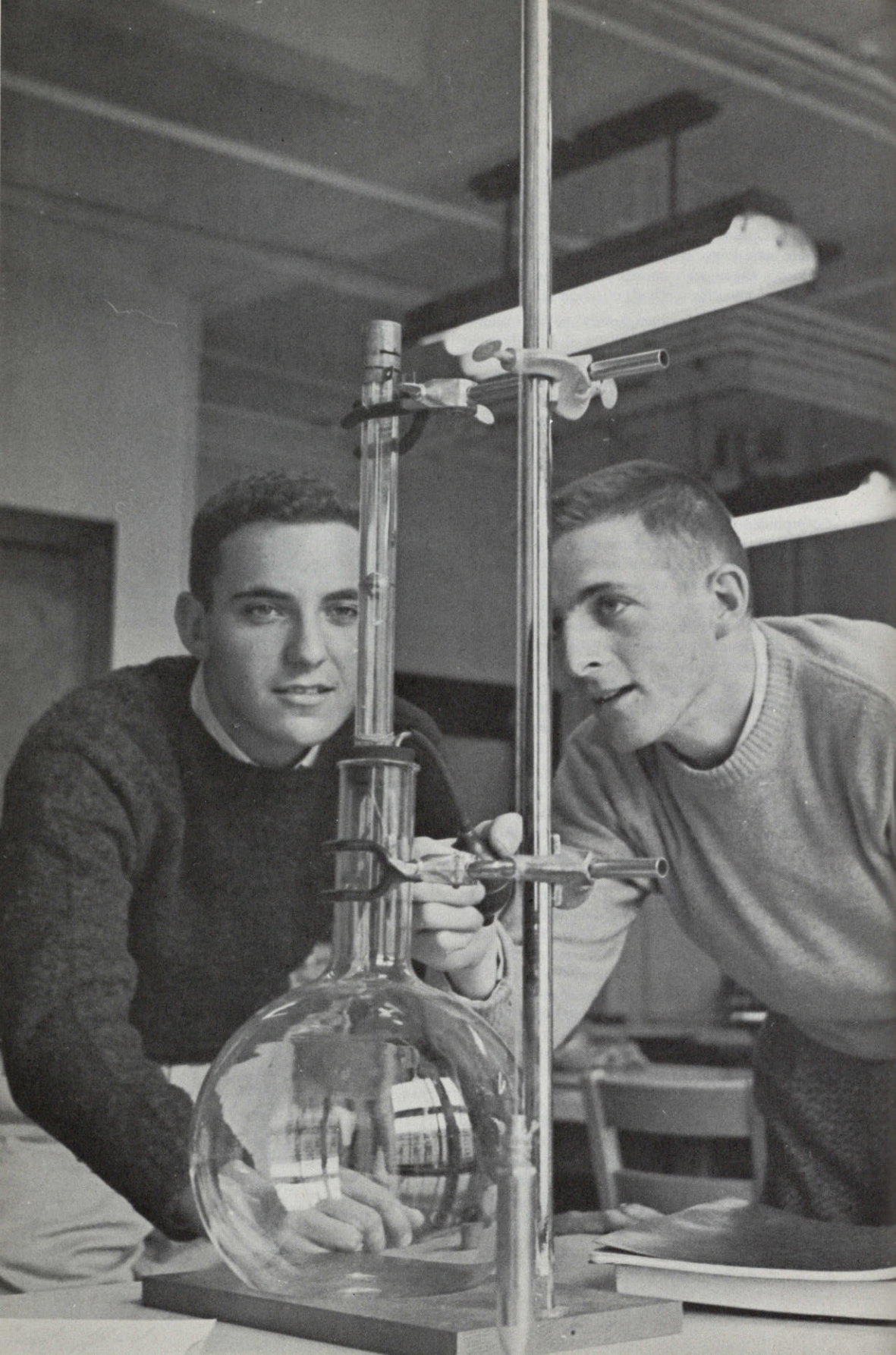
FINANCIAL MANAGEMENT

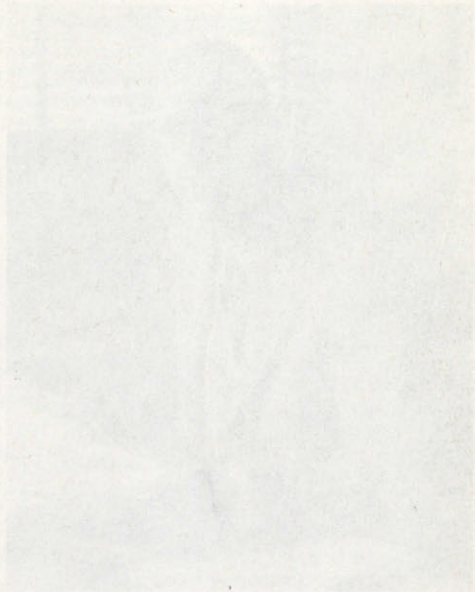
ACCOUNTING

PRODUCTION MANAGEMENT

MARKETING

Electives (*five to eight subjects in one field of Engineering or Science and five or six other subjects*)

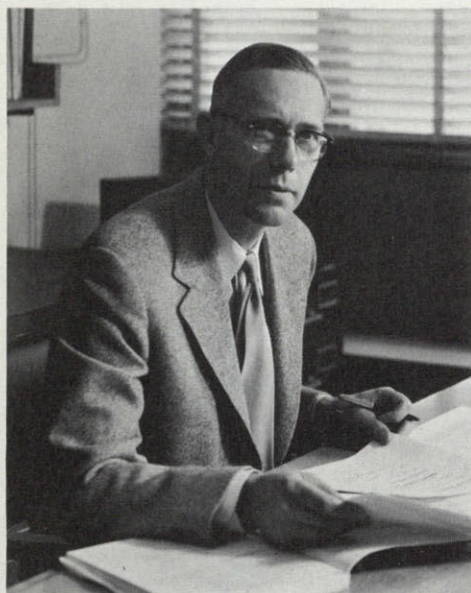




Dean Harrison

“To a considerable degree, our form of government is determined by our economics, our economics by our industry, our industry by our technology, and our technology by our science.”

—DEAN OF SCIENCE GEORGE R. HARRISON in *Life*, January 4, 1954.



BIOLOGY

Professor Irwin W. Sizer

Biology is the science of *life*—of all living organisms from the smallest microorganism (we still do not know whether the tiny viruses are “alive” in the usual sense!) to the giant trees and the large mammals and fish. The subject matter has been conveniently divided into these five categories:

1. Molecular biology—a study of the molecules which make up living things, what they do in life and how they do it. Included in this category are biophysics and biochemistry.

2. Genetic biology—including genetics, evolution, and all the aspects of reproduction of the countless forms which life displays in our world.

3. Developmental biology—the science of individual development from embryo to death—through growth, maturity, and aging.

4. Regulatory biology—how organisms regulate themselves, including, indeed, such apparently simple phenomena as how humans feel hunger and so are led to periodically replenish their energy.

5. Environmental and group biology—the mutual relations among organisms, and between organisms and their environment.

The undergraduate curriculum in Biology (Course VII) provides an introduction to all of these fields in the subjects taken in the sophomore and junior years. We at M.I.T. have chosen to lay special emphasis on the physics and chemistry of living organisms—molecular biology. This is a natural emphasis in the M.I.T. environment, where the skills of chemistry, physics, and instrumentation are the special concern of many of our colleagues. This emphasis is reflected in the subject in General Biochemistry and Physiology and in the elective subjects which we offer. Students will ordinarily take General Biology and Organic and Analytical Chemistry in the second year; Genetics and Cytology, Developmental Biology, and Physical Chemistry in the third year; and Biochemistry and Physiology in the fourth year. Both professional and general electives may be taken during the last two years.

From the standpoint of its contribution to the welfare of man, this analytical approach is

richly justified. Experimental biology of this sort provides the basis of modern medicine and man's attempt to adapt more successfully to his environment. This kind of undergraduate experience is therefore the most popular selection of premedical students who come to M.I.T.—although they may also fulfill premedical requirements in many of the other Courses here. From one-half to two-thirds of the undergraduates who major in biology are premedical students; the record of our alumni in the medical field is an impressive one.

With advancing knowledge of tissues and microorganisms, biological scientists are making discoveries of ever-increasing importance in fighting disease, in understanding fermentation, and in providing new sources of food. The keys to this kingdom—the key molecules in living organisms—are the proteins and nucleic acids which form the basis of the genes which determine heredity, the enzymes which catalyze all energy-giving reactions in the body, and the structural proteins which make up the machinery of such tissues as muscle, skin, and tendon. So it is most important that we discover the intimate structure of the proteins and nucleic acids; and to do this we are applying the full armamentarium of biophysics, using electron microscopy, X-ray diffraction, polarization optics, ultracentrifugation, and other physical chemical tools as well as advanced analytical biochemistry. Biology seeks to become an exact science devoted to learning about living things in terms of the basic processes which occur in their most elementary units.

The Biology Department at M.I.T. is a world center for this type of work. Graduates occupy key positions in these fields in universities, research institutions, and industry. It is this combination of biophysics, biochemistry, physiology, and microbiology which gives the Department its particular stamp and reputation.

Quantitative Biology (Course VIII)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL REQUIREMENTS

GENERAL BIOLOGY I
 GENERAL BIOLOGY LABORATORY I
 GENERAL BIOLOGY II
 GENERAL BIOLOGY LABORATORY II
 GENETICS AND CYTOLOGY
 DEVELOPMENTAL BIOLOGY
 GENERAL BIOCHEMISTRY AND PHYSIOLOGY I
 GENERAL BIOCHEMISTRY AND PHYSIOLOGY LABORATORY I
 GENERAL BIOCHEMISTRY AND PHYSIOLOGY II
 GENERAL BIOCHEMISTRY AND PHYSIOLOGY LABORATORY II
 ANALYTICAL CHEMISTRY I
 ANALYTICAL CHEMISTRY LABORATORY I
 ORGANIC CHEMISTRY I
 ORGANIC PREPARATIONS I
 PHYSICAL CHEMISTRY I
 PHYSICAL CHEMISTRY LABORATORY I
 PHYSICAL CHEMISTRY II
 PHYSICAL CHEMISTRY LABORATORY II
 Electives (*four or five subjects*)



CHEMISTRY

Professor Arthur C. Cope

There are approximately one hundred chemical elements and several hundred thousand known chemical compounds. The elements vary in properties from the light gases, hydrogen and helium, through the metals such as iron and nickel and non-metals such as chlorine and sulfur to the currently important uranium and transuranic elements. The compounds have infinite variety—from the familiar table salt and sugar to recently discovered things that have reshaped our lives and economy within the past few years. Included in the products of recent research are the life-saving antibiotic “wonder drugs” such as penicillin, streptomycin, terramycin, aureomycin and tetracycline; the sulfa drugs; new textile fibers, plastics, dyes, fuels, explosives—things unknown a decade ago, commonplace today, and to be superseded by still greater discoveries of the chemical research of tomorrow.

Chemistry deals with the properties and reactions of these elements and compounds—the study of those which are known, and the search for others remaining to be discovered. The chemistry curriculum at M.I.T. begins with an introduction to the subject in first-year general chemistry, followed by work in the four major branches of the science: organic chemistry, which concerns the limitless number of compounds of carbon; inorganic chemistry, concerned primarily with all of the elements except carbon; physical chemistry, dealing quantitatively with the principles governing the behavior of chemical substances; and analytical chemistry, based on inorganic, organic, and physical chemistry and including modern instrumental methods of analysis.

The undergraduate chemistry curriculum at M.I.T. provides a general education based on science, both 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 studies of inorganic, organic, analytical, and physical chemistry are supplemented by work in mathematics and physics and in the humanities and languages, including English, history, German, French, and other nonprofessional subjects. The Course is

a carefully planned sequence of required subjects with an opportunity for a choice of restricted electives in three fields of advanced chemistry, additional free elective time, and a liberal policy of substitution.

Elective time allows each student to extend his knowledge in fields of special interest. Students intending to take graduate work, for example, may elect subjects which will increase their ability to utilize the opportunities in graduate study. Students intending to enter industry may take subjects which offer the fundamentals in a selected field of science or engineering. Elective time may also be used for additional subjects in the humanities.

Some students completing degrees in chemistry take positions in chemical research in the constantly growing chemical industry; others continue in universities, or go to research foundations or government laboratories. The job of the chemist in such employment is that of the original investigator or inventor, as distinguished from the chemical engineer who works with the chemist and then takes over in process design, pilot-plant, and eventual production of useful products.

Chemists not primarily interested in research usually find employment in the production, business, or sales activities of the chemical industries, in which a demand for competent chemists at all levels will exceed the supply for years to come.

Chemistry (Course V)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL REQUIREMENTS

ORGANIC CHEMISTRY I
 ORGANIC PREPARATIONS I
 ORGANIC CHEMISTRY II
 ORGANIC PREPARATIONS II
 PRINCIPLES OF INORGANIC CHEMISTRY I
 QUALITATIVE ORGANIC ANALYSIS
 PHYSICAL CHEMISTRY I
 PHYSICAL CHEMISTRY LABORATORY I
 ANALYTICAL CHEMISTRY I
 ANALYTICAL CHEMISTRY LABORATORY I
 PHYSICAL CHEMISTRY II
 PHYSICAL CHEMISTRY LABORATORY II
 ANALYTICAL CHEMISTRY II
 ANALYTICAL CHEMISTRY LABORATORY II
 Language (Elementary or Intermediate German)

Electives:

At least one subject from

PRINCIPLES OF INORGANIC CHEMISTRY II
 RADIOCHEMISTRY

At least one subject from

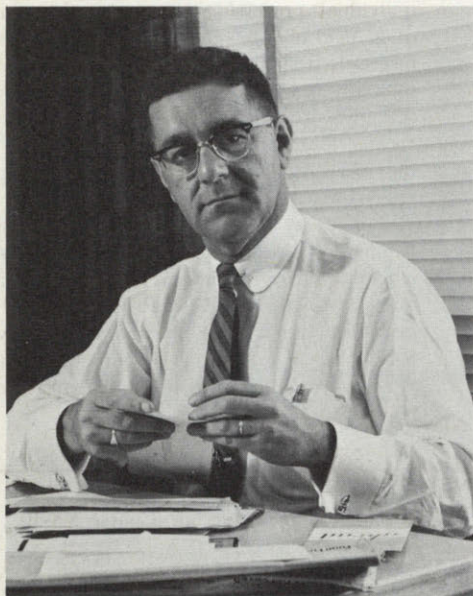
ORGANIC CHEMISTRY III
 ORGANIC CHEMISTRY IV
 ADVANCED ORGANIC CHEMISTRY: SYNTHESIS
 PHYSICAL ORGANIC CHEMISTRY
 ORGANIC CHEMISTRY: NATURAL PRODUCTS

At least one subject from

INTRODUCTION TO ATOMIC AND MOLECULAR STRUCTURE

KINETICS OF CHEMICAL REACTIONS
 INTRODUCTION TO STATISTICAL THERMODYNAMICS
 CHEMICAL THERMODYNAMICS I
 INTRODUCTION TO QUANTUM THEORY

Two or three other elective subjects



FOOD TECHNOLOGY

Professor Samuel A. Goldblith

The food industry is at present the largest single industry in the United States, accounting for over 26 per cent of our national income. Its present magnitude may be attributed in part to our increase in population and our increasing longevity. Most important, however, is the general increase in our living standards, resulting in increased expenditures for foods and particularly in the popularity of "convenience foods." Food processing today demands greatly increased numbers of young men scientifically trained in food technology to undertake research, quality control, production, and management in the food industries.

In fact, there are but few foods now on the market that need no processing to improve

their quality, preserve their value, or expedite their distribution. Refrigeration, canning, packaging, drying, and freezing are every-day processes which affect most of what we eat. They are basic processes of the vast food industry, which is only now coming to apply scientific knowledge to its many different problems and procedures.

Bringing science to food—chemical science to find the reactions and mechanisms that make better flavor, color, and nutrition; biological science to discover spoilage mechanisms; biochemical science to improve the nutritional values of food; engineering to improve food machinery, packaging, and handling; psychology to analyze public preferences for flavors and colors, business to administer the vast food industry . . . all these are part of food technology.

Our undergraduate studies in food technology at M.I.T. are planned to lay a sound foundation in the many sciences upon which food technologists rely for basic concepts. The specific information on applying these concepts to food problems is presented in the second, third, and fourth years, in such subjects as Bacteriology, Microbiology, Food Engineering, Chemistry and Technology of Food Supplies, Technology of Food Products, and Chemical Engineering Food Applications. Studies in nutrition show the elements that human beings require in their foods, how foods may be analyzed to show their content of these elements, and how food processes may preserve and enrich these essentials. Pioneering studies on new ways of preserving foods by ionizing radiations suggest a potentially important use of atomic energy. New electronic techniques are being applied to evaluating the physical properties of foods.

The student who follows this basic Course in Food Technology can look forward to an interesting and satisfying career in an industry concerned with vital human needs and on which rests marked social responsibility. Positions of executive as well as technical responsibility are waiting.

The course in Biochemical Engineering, XX-B, is basically the undergraduate curriculum in chemical engineering, modified to include studies of biology, bacteriology, microbiology, and biochemistry, particularly as they relate to

the beneficial uses of microorganisms for producing antibiotics and other important chemicals. The result is an unusual program for those interested in industries based on the antibiotics and vitamins, where microscopic plants and animals are made to do so much for us.

The undergraduate curriculum is under constant revision, reflecting man's ever-growing knowledge of food technology and his responses to this increased understanding. A new curriculum in Food Science is now in development; it will provide increased emphasis on the basic sciences and their role in understanding and improving the nutrition of man.

The food industry is the largest manufacturing enterprise in the United States, with more

individual processing companies than in any other field of industrial activity. It gathers raw materials from farms throughout the world and by processing converts these to thousands of products. The total value of these products is greater than for any other industry, and so is the increase in their dollar value during the processing.

For every four hungry Americans sitting down to a meal this year there will be a fifth citizen to satisfy twenty years hence. The nutritional standards of vast areas of the world suggest that the science of food technology has barely begun to meet even our current needs. Who can doubt the opportunities ahead in this new science?

Food Technology (Course XX)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

CHEMISTRY AND TECHNOLOGY OF FOOD SUPPLIES I
 CHEMISTRY AND TECHNOLOGY OF FOOD SUPPLIES II
 TECHNOLOGY OF FOOD PRODUCTS (*two terms*)
 CHEMICAL ENGINEERING FOOD APPLICATIONS (*two terms*)
 CHEMISTRY OF NUTRITION
 BACTERIOLOGY I
 BACTERIOLOGY II
 FOOD ENGINEERING (*two terms*)
 ANALYTICAL CHEMISTRY I
 ANALYTICAL CHEMISTRY LABORATORY I
 ORGANIC CHEMISTRY I
 ORGANIC PREPARATIONS I
 PHYSICAL CHEMISTRY I
 PHYSICAL CHEMISTRY II
 GENERAL BIOLOGY I
 GENERAL BIOCHEMISTRY AND PHYSIOLOGY I
 Electives (*three to five subjects*)

Biochemical Engineering (Course XX-B)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electricity and Magnetism)
 PHYSICS (Optics and Atomic Physics)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

CHEMICAL ENGINEERING FOOD APPLICATIONS (*two terms*)
 CHEMISTRY OF NUTRITION
 BACTERIOLOGY I
 INDUSTRIAL MICROBIOLOGY
 BACTERIOLOGY II
 BIOCHEMICAL ENGINEERING (*two terms*)
 FOOD ENGINEERING
 ANALYTICAL CHEMISTRY I
 ANALYTICAL CHEMISTRY LABORATORY I
 ANALYTICAL CHEMISTRY II
 ANALYTICAL CHEMISTRY LABORATORY II
 ORGANIC CHEMISTRY I
 ORGANIC PREPARATIONS I
 ORGANIC CHEMISTRY II
 PHYSICAL CHEMISTRY I
 PHYSICAL CHEMISTRY II
 GENERAL BIOLOGY I
 GENERAL BIOCHEMISTRY AND PHYSIOLOGY I
 CHEMICAL ENGINEERING THERMODYNAMICS
 Electives (*two or three subjects*)



GEOLOGY AND GEOPHYSICS

Professor Robert R. Shrock

The origin, age, and composition of the earth, the physical state of the earth's interior, and the origin of the oceans and atmosphere are among the most challenging and perplexing problems of science. They all lie within the domain of

the earth scientists—geologists, geochemists, geophysicists, meteorologists, and oceanographers—but they can be successfully attacked only by using the latest contributions from the physical and engineering sciences.

Graduates from M.I.T.'s Course in Geology and Geophysics are in great demand because their specialized training in geology rests on a broad foundation of the basic sciences, and they have many opportunities to tackle difficult geological problems involving the use of these basic sciences.

Geology is concerned mainly with the study of minerals, rocks, and earth structures as they are found in the field; geologists spend much of their time determining the geologic history of the earth as a basis for locating all kinds of raw materials for industry—petroleum and natural gas, metals, nuclear fuels, and building and construction materials. Laboratory geologists investigate the physical and chemical properties of earth materials by many techniques, using the most modern equipment and instruments that can be obtained.

Geophysicists are interested in the physical characteristics of the earth—magnetism, gravity, electrical conductivity, elasticity, and radioactivity—and in measuring these in the field and in the laboratory. Anyone interested in applied mathematics, physics, or electrical engineering will find geophysics a challenging profession, but it is only for the well-trained scientist who wants to tackle difficult problems. So our curriculum at M.I.T. is heavily weighted in mathematics and physics in order to give interested students the fundamentals they will need for professional practice. Most geophysicists have traveled widely over the earth by the time they have reached middle age, and they have had to solve a wide variety of problems involving mathematics, physics, electrical engineering, and geology.

Our four-year undergraduate program in Geology and Geophysics is built around a substantial core of prescribed professional subjects, work in prescribed fields within which free selection of individual subjects may be made, and a generous allocation of free electives. A student is thus able to set his own goals and progress toward them at his own pace.

In the second year at M.I.T., students in the earth sciences study Physical Geology, Mineralogy, and Historical Geology in order to obtain a fundamental understanding of geological processes and materials. Following these, the third- and fourth-year programs should be built according to the following essential pattern:

1. Professional earth science subjects should be taken in an orderly sequence which goes from subjects of broad applicability to those covering more restricted topics in considerable depth.
2. Prescribed subjects in mathematics, physics, chemistry, or electrical engineering should be selected so as to support the particular earth science program being followed.

Modern earth scientists need to be able to work in the field as well as in the laboratory. M.I.T. requires, after the sophomore year, a summer's work in the well-equipped field camp which we share with the Nova Scotian universities near Antigonish, Nova Scotia. Here students learn surveying, mapping, and geological field methods during a ten-week period.

An optional cooperative program of geophysical field training has been arranged with Geophysical Service, Inc., of Dallas, Texas, for the summer following the third year. During this summer, students who participate in the program are employed by the company; and after a week of orientation lectures in Dallas, they join field parties engaged in seismic exploration in a part of the continent where active petroleum search is going on. Other juniors may find summer work with petroleum and mining companies and may go to areas as distant as Mexico, California, British Columbia, New Brunswick, and Newfoundland.

The undergraduate thesis, usually written in the second term of the senior year, gives each student an opportunity to explore one earth science problem in a professional manner. This study is often based on field work done during the previous summer.

The nation's expanding industrial economy is making heavy demands on the petroleum and mineral industries and on the companies that find and develop the raw materials for these industries. Reserves of petroleum and

natural gas, of metallic ores, and of many non-metallic substances—even water supplies—are increasingly difficult to maintain; likewise, reserves of nuclear fuels are now being sought everywhere. The easy discoveries have been made, the low-cost deposits have been exhausted, and we now are dependent on improvements and new developments in geological, geochemical, and geophysical methods.

Geological science is young; it dates from about 1800, but its growth to national prominence is much more recent. A current survey shows that 70 per cent of those in the profession are between 25 and 45 years of age. The number of trained geologists almost doubled between 1940 and 1950; we expect it to double again by 1970. This young profession has plenty of room for promising graduates.

Geology and Geophysics (Course XII)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)

PHYSICS (Mechanics)

PHYSICS (Mechanics: Heat and Kinetic Theory)

PHYSICS (Electricity and Magnetism)

PHYSICS (Optics and Atomic Physics)

CALCULUS (*three terms*)

DIFFERENTIAL EQUATIONS

Humanities (*four core subjects and four upper-class elective subjects*)

First-year electives (*two subjects*)

THESIS

DEPARTMENTAL PROGRAM

Electives:

Four or five basic Science or Engineering subjects; two or three Earth Science subjects in at least two of these fields: Geosciences, Meteorology, or Oceanography; eight or nine additional Earth Sciences subjects; and three to five other subjects



MATHEMATICS

Professor William T. Martin

One of the postulates underlying scientific research is the assumption of the existence of "laws of nature." We assume that effect follows cause, that nature is not capricious and chaotic but possesses an inherent harmony and beauty. Mathematics has played a significant role in the discovery of physical laws, and it has provided a simple language for expressing them. But beyond this, mathematics provides what is probably the most economical tool for exploring the consequences of these laws and for predicting the outcome of experiments. For example, the planet Pluto was discovered after mathematical calculations showed that there was a discrepancy between the observed position of Neptune and the position predicted for it on the basis of the laws of gravitation. Similarly, one of the crucial tests of Einstein's theory of relativity (the bending of light rays under gravitational attraction) was first worked out mathematically, then verified experimentally. More dramatic, of course, has been the development of atomic energy, first predicted by mathematical calculations applied to basic physical laws expressed in mathematical language.

The study of mathematics as a professional major may have as its goal some or all of the following objectives:

1. The creation of new mathematics;
2. The application of mathematics in engineering, science, or industry;
3. Preparation for teaching mathematics.

One of the noticeable trends during the past decade has been the increasing demand from industry and from governmental research organizations for persons trained in mathematics. These jobs range over such fields as communications, aeronautics and astronautics, atomic energy, oil exploration, missile control and instrumentation, and design and operation of high-speed computers. No longer is it true (if indeed it ever was) that the only careers to which a mathematics major can look forward are in statistics or in teaching, though these fields are also expanding and are calling for more qualified people.

Some people are surprised to learn that mathematics is a living, growing science in its

own right and not just a collection of formulas discovered long ago and passed on from generation to generation. To the student who finds that mathematics has its own fascination, quite apart from its function as "handmaiden of the sciences," we especially offer a word of encouragement. If you can see beauty in, and feel a glow of satisfaction from understanding, a mathematical theorem—or if you have been lucky enough to discover some interesting mathematical facts for yourself—you may be one of those destined to become a mathematician in the true sense of the word—namely, a creative scientist who discovers or invents new mathematics. There is no guarantee of success, for there can never be such a guarantee in acts of discovery or invention, but you will surely derive a great deal of pleasure from the process of trying.

Only a brief word about the M.I.T. Course in Mathematics need be added: as you can see, it provides in the junior and senior years a very wide choice of subjects. This means that the Course can fulfill the needs of all who are interested in mathematics; we work with each student to develop his program to meet his special requirements.

In most cases, the Course is preparatory to further professional training at the graduate level. For this purpose we encourage each student to obtain a substantial grounding in each of the fundamental branches of mathematics and also to explore certain fields of application, in order to establish a basis for the selection of an appropriate field of graduate specialization.

Mathematics (Course XVIII)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)

PHYSICS (Mechanics)

PHYSICS (Mechanics: Heat and Kinetic Theory)

PHYSICS (Electromagnetism)

PHYSICS (Electromagnetism and Electromagnetic Theory of Light)

CALCULUS (*three terms*)

DIFFERENTIAL EQUATIONS

Humanities (*four core subjects and four upper-class elective subjects*)

First year electives (*two subjects*)

DEPARTMENTAL PROGRAM

LINEAR ALGEBRA

or

MODERN ALGEBRA

ELEMENTARY DIFFERENTIAL GEOMETRY

or

RIEMANNIAN GEOMETRY

Language (*two terms*)

Electives: *Two or three advanced Mathematics subjects; three to five advanced subjects in Mathematics, Science, or Engineering; one senior Mathematics Seminar or Thesis; and five to seven other subjects*



PHYSICS

Professor Nathaniel H. Frank

Understanding of the quantitative description of our physical environment—for example, of the laws of dynamics or of the structure of matter—is essential for proper education in pure or applied physical science. The rapidly evolving nature of standard engineering practice and especially its application to unusual and novel situations can be grasped more effectively by the man capable of relating it to a basic picture of the physical world. In its undergraduate curriculum the Physics Department attempts to develop the necessary insight through rigorous subjects encompassing not only the fields of classical physics but also the many ideas of modern physics. This physical picture relates such diverse things as individual atoms to chemistry or metallurgy and the nucleus of the atom to the intense energy radiated by stars.

The physics subjects in the first two years at M.I.T. provide thorough grounding in Newtonian mechanics and its range of applicability; then in electromagnetism, not only for its application to electrical circuits but also for its interaction with matter and the radiation of electromagnetic waves. Such wave motions give useful insight into optics and acoustics. They also lead into the modern conceptions of the wave nature of matter. An important role of these physics subjects is to supply a sound scientific foundation on which each student can build his own professional career.

In the last two years of the physics undergraduate curriculum, students are able to satisfy their individual interests by choosing from a great number of more advanced and more specialized subjects. The curriculum normally includes an orderly sequence of laboratory subjects culminating in Experimental Physics and Thesis which assures each student experimental competence adequate for future professional growth. A corresponding sequence of lecture subjects includes Mechanics I and Electromagnetic Radiation to provide a solid organization of classical theoretical physics to serve as a springboard for continuing education.

The curriculum is flexible. There is opportunity to delve into one subject deeply, and the possible choices are many. The Department

provides opportunities to see how physics research is really done, and, indeed, to participate in it in one of many active laboratories.

Both prospective physicists and those who will use their knowledge of physics for application in other fields benefit from the Physics Department's two closely interrelated objectives—good teaching and good research. The research program guarantees contact with current problems of physics and with the growth of the science. Here research groups in solid state, low temperature, nuclear, high energy, and theoretical physics; optics; spectroscopy; electronics; and many other fields of physics attack the current problems. Furthermore, physics at M.I.T. is not isolated. The members of the Department share problems which extend into other fields and other departments of M.I.T. Often these are shared unofficially, but there are so many cross-connections that several interdepartmental laboratories are in active operation. The challenge of diverse problems and intimacy with current work illuminates teaching.

The Physics Department does not expect that all its graduates will work in the field of physics. There are opportunities for the trained physicist in many places. Advanced work is often done by our graduates in allied fields. They may become metallurgists or physical chemists, to give some examples. In recent years industry has hired an increasing number of physicists to do development work—work which might previously have been assigned to engineers. Applied physics work has increased industrially and also has played a great role in the development of the defensive strength of our country. Some physicists even go farther afield and join the biologists in attacking the fundamental problems of life. At the moment a serious shortage of science teachers exists in secondary schools throughout the country. The opportunities for applying or working in physics seem to be almost limitless.

Physics (Course VIII)

GENERAL INSTITUTE REQUIREMENTS

CHEMISTRY (General) (*two terms*)
 PHYSICS (Mechanics)
 PHYSICS (Mechanics: Heat and Kinetic Theory)
 PHYSICS (Electromagnetism)
 PHYSICS (Electromagnetism and Electromagnetic Theory of Light)
 CALCULUS (*three terms*)
 DIFFERENTIAL EQUATIONS
 Humanities (*four core subjects and four upper-class elective subjects*)
 First-year electives (*two subjects*)
 THESIS

DEPARTMENTAL PROGRAM

ELECTRONIC NETWORKS AND DEVICES
 ADVANCED CALCULUS FOR ENGINEERS
 PHYSICS OF ATOMS AND MOLECULES I
 ELECTRONICS
 EXPERIMENTAL ATOMIC PHYSICS I
 PHYSICS OF ATOMS AND MOLECULES II
 EXPERIMENTAL ATOMIC PHYSICS II
 MECHANICS I
 EXPERIMENTAL PHYSICS AND THESIS
 ELECTROMAGNETIC RADIATION
 STATISTICAL MECHANICS AND THERMODYNAMICS
 Electives (*one additional subject in Mathematics and one in Chemistry, five to seven other subjects*)

Shell



$$F = F_{\text{shell}} + F_{\text{sphere}}$$

$$T = 2\pi \sqrt{\frac{R^3}{GM}}$$

Pl



$$k = \left(\frac{GM_2 M}{R^3} \right) k$$



5

The First-Year Subjects

The following descriptions are of the subjects ordinarily recommended for and taken by first-year students. Before coming to M.I.T. you may wish to consider which of these you will include in your first-year schedule; this should of course be done in accordance with the sample "recommended" curriculum of the Course which you now expect to follow at M.I.T. as given in the previous chapter. And when you arrive at M.I.T., you will want to discuss your choices with your adviser and perhaps modify them in accordance with his suggestions.

It is not usually necessary to restrict the number of students admitted to a subject. However, if applications for an elective subject are unexpectedly large, enrollment for the term may be limited.

HOURS AND CREDITS

With the descriptions on the following pages you will see the credit hours given for each first-year subject. These are presented so as to show the *total* work which a subject requires. Thus, in the case of the first subject shown:

2.00 INTRODUCTION TO ENGINEERING ANALYSIS 2—4

the credits mean that 2 hours per week are required in class and laboratory and 4 hours per week are required by an average student for outside preparation, for a total of 6 hours. On this basis the normal undergraduate schedule is approximately 45 hours per week total time, including classrooms, laboratories, and preparation. A student taking this much work in one semester is said to be registered for 45 units of credit for that semester.

As you will see, the subjects are numbered according to the department under which they are given. For example, subject 5.01 is given in the Chemistry Department, though it appears in the schedules of many Courses as well as Chemistry.

LANGUAGES

In addition to the subjects which are described on the following pages, freshmen may register for any subject in a modern language for which they are qualified. M.I.T. offers language and literature subjects in Russian, French, and German; special subjects in spoken French and spoken German for students who have had three years of either language in high school; and five subjects in linguistics. Most of these subjects have credits of 3-5, according to the system just described.

- 2.00 INTRODUCTION TO ENGINEERING ANALYSIS 2—4
Lectures and demonstrations on selected engineering concepts. Principles of dimensional analysis and of dimensional similitude with applications to the design of engineering structures, the planning of experiments, and the generalized plotting of engineering data; and properties and applications of engineering materials with particular emphasis upon new developments. The principles are applied to the solution of selected problems in many fields.
- 2.721 GRAPHICAL CONCEPTUALIZATION AND ANALYSIS 4—2
Graphic design subject based on creative projects exploiting graphical methods of conceptualization and analysis. Typical projects include the design of small mechanisms, switching circuits, optical systems, and others, varying from term to term. Freehand sketching and precision drawing as the instruments of creation and analysis; a variety of topics within this graphical framework including modern geometry, periodic functions, symbolic logic, graphical calculus, and information flow diagrams.
- 2.722 DESCRIPTIVE GEOMETRY 4—2
Analysis of three-dimensional space relations on a two-dimensional surface; analysis of problems involving points, lines, planes, and surfaces into fundamental components and development of methods of attack; and development of capacity to think in space terms.
- 2.723 ELEMENTARY NOMOGRAPHY 2—4
Introduction to graphical solution of equations through alignment diagrams based on plane geometry, including graphical use of central projections and duality of point and line; treatment of empirical data. Emphasis on the practical design of charts.
- 3.09 STRUCTURE OF MATERIALS 3—3
Lectures and demonstrations on selected topics of atomic, molecular, and crystal structure. Correlation of some physical and chemical properties with structure using common engineering materials as examples.

- 4.00 STRUCTURE OF THE CITY** 3-3
Lectures, field trips, and reading to familiarize students with the visual form and functioning of their physical environment; to suggest a responsibility and some of the means for its improvement; and to sharpen the powers of observation and the sense of design. Greater Boston studied as an example of urban structure—its historical development and current physical problems and the future possibilities of its industry, commerce, living areas, public institutions, and related services.
- 4.011 GRAPHICS LABORATORY I** 3-2
Freehand drawing exercises to develop accurate observation and skill in graphic representation. Linear, light and shadow, detail, and perspective renderings of varied subject matter. Control of line, value, color, texture, and form, using pencil, pen, and brush.
- 4.012 GRAPHICS LABORATORY II** 3-2
Continuation of practice in representational techniques. Exercises employing graphic devices useful in all types of free-hand drawing. Use of charcoal pencil, pen and ink, and water color as effective means to create the graphic equivalent of what is observed or visualized.
- 5.01 GENERAL CHEMISTRY** 6-5
Fundamental principles of chemistry: gas laws; mass and energy relationships in chemical changes; writing and the use of chemical equations for quantitative calculations; factors affecting the rate and equilibrium of a chemical reaction; correlation of equilibrium conditions through the mass-action law and the electromotive force of voltaic cells; atomic structure, chemical reactivity of elements, and the Periodic Table; chemistry of certain elements in groups 1, 2, and 3 of the Periodic Table. The laboratory work largely quantitative in nature and closely integrated with lectures and recitations.
- 5.02 GENERAL CHEMISTRY** 6-5
Application of chemical principles to the correlation of the chemical behavior of the common elements; stability of the various oxidation states; chemistry of the ionic species; quantitative application of the principles of rate and equilibrium to chemical reactions; structural chemistry of crystals and of molecules; acid-base systems; introduction to the chemistry of carbon; nuclear reactions. In the laboratory emphasis on the important chemical facts of the elements. Use of facts and principles to develop a scheme for the qualitative separation of the elements, with stress on the analysis of unknown mixtures.
- 6.41 INTRODUCTION TO AUTOMATIC COMPUTATION** 2-4
Principles of describing computation processes and programming digital computers to do them. Emphasis on concepts of computation processes and their realization by machine rather than on proficiency in the art of programming. Stored program computers; binary, octal, and decimal number systems; practice in writing programs in machine language and in Fortran and running them on I.B.M. 704; important kinds of programming languages; elementary treatment of Turing machines. Suitable elementary numerical problems in mathematics and physics; some non-numerical uses of computers.

- 7.00 PERSPECTIVES IN LIFE SCIENCE** 3-3
Lectures and demonstrations present the place of man in the world of living organisms; factors important in man's successful adaptation to his external environment, animate and inanimate; and the processes which make possible the various functions of man's body in health and disease, including major concepts of genetics, growth, development, and physiology. Concluding lectures on the growing importance of biophysics and biochemistry in the shaping of modern biological concepts (biology at the molecular level) and the outlook for theoretical biology.
- 8.01 PHYSICS (MECHANICS)** 5-6
The fundamental laws of mechanics of particles and rigid bodies; principles of conservation of mass, energy, momentum, and angular momentum. Oscillations, planetary motion, inertial forces. Free use of elementary calculus during the second half of the subject.
- 8.02 PHYSICS (MECHANICS: HEAT AND KINETIC THEORY, WAVES)** 5-6
Principles of rigid body motion. Properties of matter including elementary thermodynamics, kinetic theory of gases, solids, and liquids. Waves in matter.
- 12.00 EARTH SCIENCE (GEOLOGY, GEOPHYSICS, GEOCHEMISTRY)** 2-4
Lectures and demonstrations on the more important aspects of the origin, history, physical behavior, and chemical constitution of the earth and the methods of reasoning and investigation by which the major concepts, laws, and hypotheses of earth science were formulated. The general topics discussed: earth origin and methods of determining the sequence of events in geologic history; development of continents, oceans, and mountains; evolution of plants and animals through geologic time; formation, distribution, and methods for discovering minerals, rocks, ores, coal, petroleum, and natural gas; reshaping of the earth's surface features by water, ice, and wind; activities associated with earthquakes, volcanoes, and hot springs; and discussion of the kinds of work carried on by earth scientists as geologists, geophysicists, and geochemists. Local field trips.
- 12.001 ASTRONOMY** 3-3
Survey of the history of astronomy and its contributions in philosophy and science to our modern civilization. Emphasis on present theories of the age, origin, and evolution of the Universe. Lectures on the basic physical and chemical principles and the instruments used in modern astrophysics, followed by a study of the planets and their relation to the Universe. Discussion of concepts of stellar magnitudes, spectral classification, stellar energy production, galactic dynamics, Universe expansion, and element origin. Orientation of the Earth to the Universe. Field trips to local observatories.
- 18.00 ELEMENTARY NUMBER THEORY** 2-4
The elementary theory of whole numbers includes such topics as divisibility, prime and composite numbers, greatest common divisors, solutions of equations in integers, the congruence notation and its application, and sums of squares.

- 18.01 **CALCULUS** 3-6
The fundamental ideas of differential and integral calculus: differentiation and graphical representation of algebraic functions and of the sine and cosine; integration of simple algebraic and trigonometric functions; applications to problems in geometry and mechanics: maxima and minima, velocity and acceleration, plane areas, volumes, arc length, areas of surfaces of revolution, center of gravity, and moment of inertia; analytic geometry of the straight line.
- 18.02 **CALCULUS** 3-6
Analytic geometry of the conic sections; further study of differentiation and integration: trigonometric, inverse trigonometric, exponential, logarithmic, and hyperbolic functions; polar coordinates and parametric representation; complex numbers; elementary vector analysis.
- 18.08 **TOPICS IN DISCRETE MATHEMATICS** 2-4
Elementary topics in: propositional logic; algebra of sets; permutations and combinations; probability; vectors and matrices; mathematical models and axiomatic method.
- 19.003 **ELEMENTARY METEOROLOGY I** 2-4
An introduction to meteorological science through examples from all scales of atmospheric motions; radiation balance and the global circulation; air masses and fronts; cyclones and weather forecasting; hurricanes; sea breeze; thunderstorms; micrometeorology; cloud physics; climatology. Laboratory exercises with weather maps.
- 20.00 **MAN'S FOOD** 3-3
A survey of the natural and cultivated sources of food for mankind from the viewpoint of production, transportation, processing, packaging, and consumption. General discussions covering: history of the foods of mankind through the ages; natural food resources; nutritional requirements of man; effects of geography on dietary patterns; food habits and fads; environment, soils and agriculture; plant and animal breeding; harvest, storage, and distribution of food; international movement of food; food economics; agricultural economics; federal regulation of agriculture; food industry of the U.S.; food laws and regulations; science and engineering in food technology; population and the world food problem.
- 21.001 **PHILOSOPHY AND SCIENTIFIC METHODOLOGY** 2-4
Examination of the methods of science and of the philosophical problems raised by attempts to understand and justify these methods. Mathematical inference, observation, hypothesis, and confirmation. Problems of *a priori* knowledge, induction, the status of theoretical entities, and the relation between mind and matter. Implications of science for religion and ethics.
- 21.002 **ENGLISH COMPOSITION** 2-4
A study of the principles of effective written communication. Particular attention to logical organization of papers and to precise and coherent expression of facts and opinions. Numerous papers required.

- 21.01, 21.02 **INTRODUCTION TO THE HUMANITIES** 3-5, 3-5
Introduction to history, literature, and philosophy through intensive reading and discussion of important works from classical, medieval, and early modern periods; emphasis on method and structure as well as content. Training in writing through essays based on assigned readings.
- AS11 **EVOLUTION OF WARFARE** 4-5
Survey of the historical development of the principles of war and military policy based on technological advances, and study of the political, economic, psychosocial, and military factors of national power. The evolution of the United States Department of Defense and the definitive approach to current concepts of warfare. (*Restricted to students selected for A.F.R.O.T.C.*)
- AS12 **FOUNDATIONS OF AIR POWER** 4-6
Survey of the historical development of air power, with emphasis on its employment in the past, present, and future, as influenced by changing military policy and specialized needs created by technological developments and world political situations. (*Restricted to students selected for A.F.R.O.T.C.*)
- L21, L22 **SPOKEN GERMAN** 3-3, 3-3
Two-term sequence for students with three years of high school German or the equivalent but with little or no experience in using the spoken language. Recently developed techniques used to convert reading knowledge into ability to comprehend the spoken language. Full use of mechanical devices for improving intonation and pronunciation. Emphasis on development of basic vocabulary of words and phrases used in everyday conversation.
- L61 **INTRODUCTION TO SPOKEN FRENCH** 3-3
For students with three years of high school French or the equivalent but with little or no experience in using the spoken language. Practice in speaking French. Phonetic method for correction of accent. Mechanical devices used for improving intonation and pronunciation.
- L62 **CONVERSATIONAL FRENCH** 3-3
Development of the basic vocabulary of words and phrases used in everyday conversation. Attention to individual pronunciation problems. For students with three years of high school French or the equivalent but with little or no experience in using the spoken language.
- MS11, MS12 **MILITARY SCIENCE** 3-0, 3-0
Basic training in the school of the soldier, exercise of command, military organization, American military history, individual weapons and marksmanship, and the United States in world affairs.
- NS11, NS12 **ORIENTATION AND SEA POWER** 4-5, 4-5
Fundamentals of naval knowledge. Concepts of the use of sea power from geographical, geopolitical, and national strategic considerations. Historical influence of sea power in shaping world affairs socially, politically, and economically. (*Restricted to students selected for N.R.O.T.C.*)

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¹ Address correspondence to the Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

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² Terms expire on June 30 of the year indicated.

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