West Point
UNITED STATES MILITARY ACADEMY
1975-1976 CATALOG

One Hundred Seventy-Fourth Year
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IV. Academic Program

A young man entering the United States Military Academy can expect to expand his store of knowledge, to develop more fully the intellectual skills he needs to assume responsibility as a junior officer, and to build a strong foundation for assuming senior officer responsibilities. He can also expect to acquire a sound basis for postgraduate specialization in one of a variety of academic disciplines.

THE EDUCATIONAL PHILOSOPHY

The Military Academy, as the only college specifically charged with preparing young men for service as officers in the United States Army, has a unique educational philosophy. Graduates must be enlightened military leaders of strong moral courage whose minds are creative, critical, and resourceful.

The total curriculum helps develop those qualities an officer needs whether he leads a platoon or works at the highest level of government. Together, the academic curriculum and military training emphasize logical analysis, clear and concise expression, independent thought and action, and readiness to carry out legal orders.

Standard academic courses provide an essential core of knowledge in the arts and sciences. Emphasis is placed on using this knowledge to solve problems. Advanced and elective courses allow the individual cadet to realize his full potential, to concentrate in an area of interest, and to make forays into subjects about which he is simply curious.

Academic exploration blends with physical development, gained through physical education, intramural sports, and intercollegiate athletics. In addition, military education, training, and experience provide basic military principles and techniques and opportunities to test them in real leadership situations. Finally, while the Academy continually adapts itself to the pace of professional, national, and international change, it remains true to the sense of duty, honor, and service to country which has traditionally distinguished its graduates.

The observations of Charles Dickens are as accurate now as they were when he visited West Point in 1842. "The course of education is severe, but well devised, and manly."

THE ACADEMIC CURRICULUM

The curriculum reflects 173 years of evolutionary change both in the military profession and in higher education. Today's balanced offering of courses in the arts and sciences leads to a Bachelor of Science degree and builds a foundation for continuing education and professional development.

The two complementary parts of the curriculum are a broad, general core program which is prescribed, and an elective program which is individually tailored. The general curriculum provides a sound educational foundation across the academic spectrum—math, science, engineering, English, history, social sciences, national security, and psychology. The elective program is an extension of the core program, which allows a cadet to achieve a reasonable degree of subject concentration by choosing electives from one of four broad areas: Basic Science, Applied
Science and Engineering, Humanities, and National Security and Public Affairs.

Many graduates who remain in the Army go on to civilian graduate schools. One of the aims of the curriculum at West Point, then, is to give cadets a basis for postgraduate work within one of the above four areas.

**Methods of Instruction**

Here you will be far more than a mere face in the crowd. Small classes—usually of 12 to 16 cadets—assure discussion and individual attention. Grouping by ability, with periodic adjustments, allows concentration on the fundamentals if that is what you need, or an accelerated pace if you already have a firm grasp of the basics. You will be encouraged to participate daily and you will be evaluated frequently. If you are unsure of the material taught on any given day, or wish to move beyond it, extra one-on-one instruction is available. You always know where you stand in each course: grades go to a computer each week, and you can find out how you are doing by consulting remote terminals in your company area or in an academic building.

**Lecture Series**

Academic departments and other groups sponsor a comprehensive lecture series which complements the Academy’s course of instruction. Guest lecturers include recognized authorities in various academic disciplines, noted authors, playwrights, religious and civic leaders, businessmen, and military leaders. Among recent lecturers have been Ayn Rand, author; Walter Kerr, New York Times drama critic; James Farmer, founder of the Congress of Racial Equality; General Andrew J. Goodpaster, former Supreme Allied Commander in Europe; Dr. B.M.W. Knox, eminent classical scholar; Dr. Kay Lathrop of Los Alamos Laboratories in New Mexico; Russell F. Weigley, distinguished military historian; General Maxwell D. Taylor, USA Retired, former Chairman of the Joint Chiefs of Staff and U.S. Ambassador; and United States Senators and Representatives.

**THE CORE ACADEMIC PROGRAM**

The 42 courses of the Core Academic Program provide a nucleus of knowledge in mathematics, science, engineering, the social sciences, and the humanities—slightly weighted toward the sciences. Each course must be successfully completed. The accompanying table shows the core courses and the sequence in which they are normally taken. Variations may result from the selection of certain areas of concentration, performance in previous college-level courses, and enrollment in advanced or accelerated programs. Electives are listed to show where they are normally scheduled during the four-year program.

**Course Designation**

First-year courses are numbered in the 100's, second-year in the 200's, third in the 300's, and fourth in the 400's. The second digit indicates the level of the course: 0 = standard, 4 or 5 = advanced, 7 or 8 = elective.

For core courses the third digit indicates the term in which the course is offered: odd digit = first term, even = second term. Electives may be offered in either or both terms as indicated in the course description. A credit hour represents one hour of classroom instruction and associated preparation each week for eighteen weeks (one term).

**Validation and Advanced Placement**

You may be excused from (validate) certain core courses if you have sufficient knowledge of a subject to meet the appropriate department’s standards. Credit earned in other colleges, scores on Advanced Placement Examinations, and tests administered at the Academy are considered in validation decisions. Validation of a core course does not lighten your academic load; rather, it allows you an additional elective in place of the validated course. If you show unusual ability, or have prior knowledge of a

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CORE CURRICULUM

Fourth Class (Freshman) Year

*Mathematics
*English
*Foreign Language
*Environment
*Engineering Fundamentals

Third Class (Sophomore) Year

*Mathematics
Physics (one sequence to be selected)

*Chemistry
**Foreign Language
English
*Psychology
History (one sequence to be selected)

Second Class (Junior) Year

Electrical Engineering
*Mechanics
*Mechanics
Physics

Law
*Social Sciences

First Class (Senior) Year

Engineering (one sequence to be selected)

Leadership

English
*Social Sciences
*History

*See Chapter VI, "Courses of Instruction," for course descriptions, including required courses in military science and physical education.

*Each term of Fourth Class mathematics is equivalent to two courses.

*Advanced versions of these courses are offered to qualified individuals by the department concerned.

**Cadets concentrating their electives in the Humanities and National Security and Public Affairs areas may substitute an elective for this course.

†The Department of Foreign Languages offers programs in Chinese, French, German, Portuguese, Russian, and Spanish.

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subject but cannot validate it, you may be enrolled in an advanced or accelerated program.

**Honors Courses and Advanced Individual Study**

If you are an exceptional student, you may enroll in an honors course or advanced individual study in any of the disciplines taught at the Academy. These programs emphasize independent or tutorial work and are excellent preparation for graduate study.

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**THE ELECTIVE PROGRAM**

Each cadet takes a minimum of six electives. This number may be increased depending on area of elective concentration, number of core courses validated, and enrollment in advanced or accelerated programs. With approval of the Dean, upperclassmen may take overload electives. Careful choice of electives can weight an individual’s program toward the humanities or social sciences, or reinforce his scientific orientation. The following table lists all elective courses offered. For a course description of a particular elective, refer to Chapter VI, “Courses of Instruction.”
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<td>Social Sciences</td>
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<tr>
<td>ME 483</td>
<td>Space Mechanics</td>
<td>Mechanics</td>
<td>SS 473</td>
<td>Issues in American Foreign Policy</td>
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<td>ME 485</td>
<td>Continuum Mechanics</td>
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<td>SS 475</td>
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<td>ME 486</td>
<td>Mechanical Vibrations</td>
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<td>SS 476</td>
<td>International Affairs: Theory and Applications</td>
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<td>ME 488</td>
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<td>SS 482</td>
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<td>ME 489</td>
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<td>SS 483</td>
<td>National Security Seminar</td>
<td>Social Sciences</td>
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<td>OE 385</td>
<td>Management Engineering</td>
<td>Engineering</td>
<td>SS 485</td>
<td>Problems of Developing Nations</td>
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<td>OE 481</td>
<td>Automotive Engineering</td>
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<td>SS 486</td>
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<td>Helicopter Engineering</td>
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<td>SS 487</td>
<td>Public Policy Decision Making and Debate</td>
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<td>Operations Research</td>
<td>Engineering</td>
<td>SS 489</td>
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<td>PL 472</td>
<td>Topics in Sociology</td>
<td>Office of Military Leadership</td>
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<td>Managerial Psychology</td>
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<td>Social Psychology</td>
<td>Office of Military Leadership</td>
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<td>PL 487</td>
<td>Psychology II</td>
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</table>
The General Elective Program

A cadet following this program can choose electives from the entire list of electives, satisfying his intellectual curiosity in several disciplines while developing a sound basis for future graduate study.

Areas of Elective Concentration and Associated Elective Fields

Some cadets wish to go into greater depth in an area of special interest or aptitude. To help these cadets design their individual academic programs, electives have been grouped into 24 fields under four areas of concentration and an interdisciplinary field, Management.

Applied Science and Engineering:
Civil Engineering
Electrical Engineering
Engineering Mechanics
Nuclear Engineering
Weapon Systems Engineering

Basic Science:
Chemistry
Computer Science
Mathematics
Physics

Humanities:
American Studies
Foreign Languages:
Chinese
French
German
Portuguese
Russian
Spanish
Literature

National Security and Public Affairs:
Economics
Geography
History
International Affairs
Military Studies
Political Science

Interdisciplinary Field:
Management
ELECTIVES WITHIN AREAS OF CONCENTRATION

The requirements for each area of elective concentration and its associated fields will be found on this and succeeding pages. Although the Military Academy does not offer a majors program, a cadet, by carefully designing his elective program, can achieve the equivalent of a minor and in some cases approach the course requirements for a major as defined by other academic institutions.

APPLIED SCIENCE AND ENGINEERING AREA

Cadets concentrating in the Applied Science and Engineering Area must satisfy the following requirements:

a. Complete a core program engineering sequence other than General Engineering.

b. Complete six elective courses as follows:
   1. Five selected from the Applied Science and Engineering Area list or completion of the requirements of the Civil Engineering, Electrical Engineering, Engineering Mechanics, Nuclear Engineering or Weapon Systems Engineering fields, and
   2. One selected from among the entire elective course offerings.


CIVIL ENGINEERING FIELD

Requirement: Complete four principal electives to include ME 384 and at least one additional course chosen from the combined lists of principal and associated electives. The engineering sequence CE 401-402 or CE 451-452 must be chosen.

Principal Electives: CE 381, CE 382, CE 481, CE 482, CE 489, EF 384, GE 383, ME 384, OE 385.

Associated Electives: EF 382, EF 489A, EV 385, EV 386, GE 381, MA 471, MA 473, MA 481, MA 484, MA 486, ME 476, ME 477, ME 478, ME 485, ME 486, OE 383.

ELECTRICAL ENGINEERING FIELD

Requirement: Complete all principal electives and at least two associated electives. Electrical Engineering, EE 401-402, must be taken as the required engineering sequence.

Principal Electives: EE 382, EE 383, EE 484.

Associated Electives: EE 482, EE 483, EE 485, EE 486, EE 489, EF 382, EF 489, MA 471, MA 484, MA 485, ME 472, ME 486, OE 383, PH 483, PH 484.

ENGINEERING MECHANICS FIELD

Requirement: Complete four principal electives and at least one course chosen from the combined lists of principal and associated electives.

Principal Electives: ME 384, ME 387, ME 388, ME 472, ME 474, ME 475, ME 476, ME 477, ME 478, ME 482, ME 483, ME 485, ME 486, ME 488, ME 489.


NUCLEAR ENGINEERING FIELD

Requirement: Complete four principal electives to include PH 487 and at least one course selected from the combined lists of principal and associated electives. CE 453-454 must be taken as the required engineering sequence.

Principal Electives: EF 382, GE 383, MA 484, ME 384, ME 482, OE 383, PH 484, PH 487, PH 488.

Associated Electives: CE 382, CE 489, EE 401, EE 402, EE 488, MA 473, MA 485, MA 486, PH 383, PH 384, PH 483, PH 486, PH 489.
WEAPON SYSTEMS ENGINEERING FIELD

Requirement: Complete three principal electives and at least two courses from the combined lists of principal and associated electives. OE 401-402 or OE 451-452 must be taken as the required engineering course sequence.


Associated Electives: EE 402, EF 382, GE 381, MA 473, MA 481, MA 485, MA 486, ME 387, ME 474, ME 475, ME 482, ME 486, OE 487.

BASIC SCIENCE AREA

Cadets concentrating in the Basic Science Area must satisfy the following requirements:

a. Complete a core program engineering sequence other than General Engineering.

b. Complete six elective courses as follows:

1. Five selected from the Basic Science Area List or fulfillment of the requirements of the Chemistry, Computer Science, Physics, or Mathematics fields, and

2. One selected from among the entire elective course offerings. Basic Science Area Elective Course List: CH 383, CH 384, CH 481, CH 482, CH 485, CH 486, CH 489, EF 382, EF 383, EF 488, EF 489A, EF 489B, EV 383, EV 386, EV 489, MA 471, MA 473, MA 481, MA 482, MA 484, MA 485, MA 486, MA 487, MA 489, PH 383, PH 384, PH 385, PH 483, PH 484, PH 486, PH 488, PH 489.

CHEMISTRY FIELD

Requirement: Complete four principal electives and one course chosen from the combined lists of principal and associated electives.

Principal Electives: CH 383, CH 384, CH 481, CH 482, CH 485, CH 486, CH 489.

Associated Electives: EF 382, EV 385, MA 473, MA 484, MA 486, PH 483, PH 484, PH 486.

COMPUTER SCIENCE FIELD

Requirement: Complete three principal electives, to include EF 362, and EE 463 or EE 465 and two additional courses chosen from the combined lists of principal and associated electives.


MATHEMATICS FIELD

Requirement: Complete four principal electives and one course chosen from the combined lists of principal and associated electives.

Principal Electives: MA 471, MA 473, MA 481, MA 482, MA 484, MA 485, MA 486, MA 487, MA 489.


PHYSICS FIELD

Requirement: Complete four principal electives and one course from the combined lists of principal and associated electives.

Principal Electives: MA 484, PH 383, PH 384, PH 385, PH 483, PH 484, PH 466, PH 467, PH 468, PH 469.

DEPARTMENT OF MATHEMATICS

Professor and Head of Department
Jack M. Pollin, COL; B.S., USMA; M.S., Penn.; M.S., R.P.I.; M.A., George Washington; Ph.D., Arizona.

The general requirement in mathematics for graduation from the Military Academy is satisfied by successful completion of the Standard Program at the end of the second year of study or completion of one of the Advanced Programs. Advanced Programs are designed for cadets who, by virtue of outstanding performance demonstrated during the early months of first year mathematics, exceptional aptitude, or above standard preparation before entering West Point, are able to satisfy the Standard Program requirements in less than two years. Cadets meeting the foregoing selection criteria are permitted to volunteer for assignment to an Advanced Program. Correspondingly, if the pace proves too rapid, opportunity for transfer to a slower program without prejudice is provided. Successful completion of either Advanced Program II or III, in addition to providing coverage of enrichment topics, offers opportunity for additional elective courses. The courses constituting the Standard and Advanced Programs are summarized below. Electives chosen by cadets in Advanced Programs during their second year need not be in mathematics, but if mathematics courses are chosen the recommended courses are those listed.

STANDARD PROGRAM: MA 101-102; MA 201-207
ADVANCED PROGRAM I: MA 101-153; MA 201-207
ADVANCED PROGRAM II: MA 153-154; MA 207, one elective [MA 484 recommended]
ADVANCED PROGRAM III: MA 155-156; two electives [MA 484 and MA 485 recommended]

STANDARD PROGRAM COURSES

MA 101-102 Calculus
Prerequisite: None
An introduction to set theory and inequalities is followed by a rigorous treatment of differential and integral calculus of single variable algebraic functions coordinated with plane analytic geometry and applications. Included is the study of calculus of transcendental functions, polar coordinates, plane vectors, infinite series and an introduction to matrix algebra covering algebraic operations and systems of equations.
12 Credit Hours

MA 201 Multivariable Calculus
Prerequisite: MA 102 or MA 152
This course covers solid analytic geometry, vector calculus and the calculus of functions of several variables. Topics included are partial differentiation, multiple integration, vector differentiation, line integrals and Green's Theorem.
3.5 Credit Hours

MA 207 Differential Equations and Probability
Theory & Statistical Inference
Prerequisite: MA 154 or MA 201
Methods of solution of ordinary differential equations are studied including series solutions, differential operators, and Laplace transforms. Probability fundamentals are followed by the study and applications of distributions, estimation theory, confidence intervals, and hypothesis testing.
3.5 Credit Hours

ADVANCED PROGRAM I COURSE

MA 152 Calculus and Introduction to Linear Algebra
Prerequisites: MA 101 and selection by Head of Department
For cadets doing superior work in MA 101, this course covers the same material as MA 102 and includes an enriched introduction to matrix algebra including vector spaces and eigenvalues.
6 Credit Hours
ADVANCED PROGRAM II COURSES

MA 153-154 Advanced Placement Calculus, Multivariable Calculus, and Introduction to Linear Algebra
Prerequisite: Selection by Head of Department
An accelerated course covering the material in MA 101-152 and MA 201. Successful completion provides for one additional elective.
12 Credit Hours

ADVANCED PROGRAM III COURSES

MA 155-156 Advanced Placement Calculus, Multivariable Calculus, Introduction to Linear Algebra, Differential Equations, and Probability Theory and Statistical Inference
Prerequisite: Selection by Head of Department
An accelerated course covering the material in MA 101-152 and MA 201-207. Successful completion provides for two additional electives.
12 Credit Hours

ELECTIVE COURSES

MA 471 Linear Algebra
Second Term—Prerequisite: Completion of the Mathematics Core Curriculum
An extension of the linear algebra studied in the core curriculum, to include matrix operations, vector spaces, and characteristic values and vectors. Emphasis is on applications in science, engineering, management and economics.
2.5 Credit Hours

MA 473 Intermediate Probability and Statistical Applications
Second Term—Prerequisite: Completion of the Mathematics Core Curriculum
An introduction to modeling and stochastic processes wherein Markov chains, reliability and life testing are discussed. The theory of statistical inference is developed in detail and applied to statistical experiments.
2.5 Credit Hours

MA 481 Linear Programming
Either Term—Prerequisite: Completion of the Mathematics Core Curriculum
A study of optimal solutions of linear systems using the original and revised simplex methods. Special topics such as the transportation problem, game theory and integer programming are also introduced.
2.5 Credit Hours

MA 482 Abstract Algebra
First Term—Prerequisite: Completion of the Mathematics Core Curriculum and permission of Head of Department
An introductory modern algebra course for cadets planning graduate work in mathematics or theoretical work in science or engineering. Groups, rings, integral domains and fields are studied.
2.5 Credit Hours

MA 484 Differential Equations [Intermediate]
Either Term—Prerequisite: Completion of the Mathematics Core Curriculum
A broad spectrum of subjects is studied, to include

Courses of Instruction 75
existence and uniqueness of solutions, linear theory, systems of differential equations, non-linear equations, numerical methods, Fourier and partial differential equations.

2.5 Credit Hours

MA 485 Complex Analysis
Either Term—Prerequisite: Completion of the Mathematics Core Curriculum
Development of the classical theory provides a basis for a study of applications including residue theory, contour integrals, conformal mapping and the solution of the Dirichlet and Neumann problems.

2.5 Credit Hours

MA 486 Numerical Analysis with Digital Computation
Second Term—Prerequisite: Completion of the Mathematics Core Curriculum
Investigation of the methods of approximating the solutions of mathematical problems using the digital computer. Analysis of the significance and control of error is studied. Applicative problems are emphasized.

2.5 Credit Hours

MA 487 Real Variable Theory
Second Term—Prerequisite: Completion of the Mathematics Core Curriculum and Complex Analysis. Permission of Head of Department.
A rigorous approach to the foundations of analysis. Concepts of topology provide a basis for a formal discussion of differentiability, integrability, uniform convergence, bounded variation, monotone functions and Stieltjes integration.

2.5 Credit Hours

MA 489 Advanced Individual Study in Mathematics
Either Term—Prerequisite: Permission of Head of Department
An intensive tutorial course offered to a limited number of highly qualified cadets who have completed available mathematics elective courses. Course work is tailored to meet individual desires.

2.5 Credit Hours
1975 W. Point

Core

42 courses

Hours = 18 x credits/3
(18 week sem)

\[ 125 \cdot c = 2250 \text{ hrs} \]

Elect

6 courses minimum
\times 2.5 credits (math courses)

= 15 cr.

= 15 \times 18 = 270 \text{ hrs.}

Total Hrs

2250

270

334 Phys Ed

1274 M.I

2980 hrs.

Phys Ed

Every student does
intercolleg or intramural

Phys Ed is additional

7 credits, using
1965 ratio, we estimate

334 hrs, intercol or
intra is ignored.

Mil Sci

Mil Sci Tel 1 or hr

102 1

202 1.5

301 1

401 1.5

\[ \text{Total} = 126 \text{ hrs} \]
1975 Math

Electives 270 hrs

12 cr + \frac{1}{2} cr
\underline{7 cr} + 2 cr
\underline{19 cr}

19 \times 18 = 342 hrs.

Total (max) Math = 342 + 270 = 612