BREVARD ENGINEERING COLLEGE ANNOUNCEMENT

VOLUME VI

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BREVARD ENGINEERING COLLEGE
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“The purpose of the Brevard Engineering College shall be to provide scientific and engineering educational curricula related to the field of Space Technology ... leading to undergraduate and graduate degrees; to provide specialized courses, services and seminars fundamental to the field of Space Technology; to engage in basic and applied research in science and engineering and other areas related to the field of Space Technology.”

By Resolution of the Board of Trustees
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FOREWORD

HISTORY AND AIMS

The Brevard Engineering College was founded in 1958, by engineers and scientists working in the nation's space industry at Cape Canaveral. The campus is located in Melbourne, Florida, a few miles south of Patrick Air Force Base, the center of engineering and scientific activities for the Atlantic Missile Range.

It is the objective of the college to provide opportunities for higher education in engineering, science, and the new field of space technology. Although the college has been primarily an evening school for those working at the Cape Canaveral Complex, full daytime classes were established in 1962 to fit the needs of others seeking quality education at the college.

Many of those associated with the college are regularly employed in the missile test industry as scientists, engineers, or technical managers. Each is expert in his own particular field and it is this expertise that is brought into the classrooms. There are few colleges that can boast of such depth of technical experience in their teaching staff.

In spite of skyrocketing educational expenses, Brevard Engineering College demonstrates that a private school... voluntarily supported by the community and by industry... can become a successful, growing organization. At present, 800 students are enrolled, a third of them in the graduate school. Like the faculty, most of the students are employed in the aerospace industry at Cape Canaveral.

Undoubtedly the most important achievement of the college is the contribution now being made to America's growth in space technology. Education in space technology for scientists and engineers can best be secured where problems occur and where they are being solved at the nation's major missile development center.

Brevard Engineering College was planned and organized with foresight to meet a present need and to match its growth with the challenge of the future.

CAMPUS

The Brevard Engineering College campus is situated on approximately 32 acres of partially wooded land in the City of Melbourne, Brevard County, Florida. The present college buildings are located along Country Club Road upon which the campus fronts. A stream, abounding with a natural growth of palm trees, circles around the campus forming a tropical "backdrop" to the campus proper. An administration building with two modern, completely air-conditioned classroom wings was completed in 1961.

An additional structure containing five class rooms and two offices was completed in 1962 and a science building for chemistry, physics and engineering laboratories was opened in the fall of 1963.

A separate air conditioned library building, complete with offices, and other facilities is located adjacent to one of the classroom wings.

ACCREDITATION

The Brevard Engineering College is a relatively new institution and, therefore, not yet regionally accredited. The college is nevertheless dedicated to following the principles and standards of The Southern Association of Colleges and Schools. Also, it is the policy and practice of the college to carry out engineering curricula in conformity to criteria established by the Engineers' Council for Professional Development. Regional Accreditation is not a requirement for transferring credits, and other engineering schools and universities will accept credits from the Brevard Engineering College for courses paralleling their own.

All of the missile contracting corporations at the Air Force Missile Test Center have approved the college for their employees' educational benefits. In fact the college was singled out by a number of these corporations to be the only non-regionally accredited college for which such approval had ever been granted. This recognition by industry attests to the academic standards of the college.

The Brevard Engineering College is an academic member of The Society for Industrial and Applied Mathematics and in 1962 was elected to associate membership in the Florida Association of Colleges and Universities.
OPERATION AND CONTROL

The Brevard Engineering College is incorporated as a non-profit educational institution and chartered to confer undergraduate and graduate degrees. Under the provisions of the corporate charter, control of the college is vested in a self-perpetuating Board of Trustees. The Trustees, elected to the Board, are outstanding civic and industrial leaders in the community and serve without pay. The charter provides that the college operate as a co-educational, non-sectarian, private institution of higher learning.

FINANCIAL SUPPORT

The college is primarily supported by the tuition and fees of students. As a private school it is not supported by taxation and receives no financial appropriations from any governmental unit. Careful attention to sound business policies, help from dedicated friends of the college and insistence on a balanced budget has placed the institution on a sound financial basis.

The U. S. Bureau of Internal Revenue has declared the Brevard Engineering College to be tax-exempt thereby allowing donations to the college to be tax deductible.

A $250,000.00 building fund drive is currently underway and local financial institutions, industry and friends have pledged their financial support to the college. One industry, Radiation Inc., has in addition, pledged a part of their corporate earnings as an endowment fund. Grants are received from time to time from individuals and corporations. The Radio Corporation of America has each year supported the college with unrestricted grants. The Melbourne Kiwanis Club has given the college a grant of $1200 in honor of the late Max Rodes.

LIBRARY

The Brevard Engineering College Library is planned as the focal point of academic activity for both students and faculty on the campus and the Cape Canaveral Complex. Its development is aimed at providing the intellectual resources of books, periodicals and reports to support and enrich the academic curricula and graduate research programs.

The college library currently contains more than 11,000 volumes and subscribes to approximately 100 technical journals and periodicals. In addition to the technical books, a great many volumes are devoted to the humanities and the fine arts. Two collections which are especially noteworthy are the Lindemann History Collection and the Howe Collection of Classical Literature.

A professionally trained librarian is in charge of the library. Student assistants form an important part of its staff and receive practical experience in library service. The full time staff is assisted by volunteers called "Friends of the Library."

The library is currently housed in two separate air-conditioned buildings on the campus. In addition to the stacks and reading area, it contains the librarian's office, a book store, storage room and other auxiliary facilities. Further plans for the growth of the college include the construction of a separate and larger library building to house the ever increasing book collection and to meet the accelerating demands for library service.

Since the library is unique in the area, it is open to the general public. In 1963 the college library was designated a Federal Depository for government documents to serve the 11th Congressional District.

The library is an institutional member of the American Library Association.

FOOD SERVICE

No food service is currently provided by the college, although a Coffee Shop is being planned for the Student Center.
Housing
Dormitories are not provided for students at present but are planned for completion for fall 1964. The college maintains a list of approved off-campus housing in the community, within easy walking distance. All housing accommodations for full-time undergraduate students not living at home must be approved by the Dean.

Transportation
Students must provide their own transportation. Downtown Melbourne is within easy bicycling distance of the campus.

Student Center
A student center is scheduled for completion in 1964. It will contain a new and enlarged book store, a coffee shop, student government offices, a student lounge, and a large meeting hall suitable for student dance activities.

Bookstore
A bookstore is maintained for the accommodation of the students and is presently located in the library. New and used books and other accessories required in the college courses are sold at reasonable prices.

Medical Service
No medical facilities are presently provided by the college. However, a new modern hospital fully staffed and equipped is a three minute drive from the campus. The student’s parents will be notified in the event of injury or illness.

Counseling Services
The guidance services of the college are designed to assist the students with educational, vocational, financial, social and personal problems as they arise, and to help them take full advantage of the academic and social opportunities offered to them by the college.

Student Government
All full time day students of Brevard Engineering College automatically become members of student government when they register. They elect officers who serve as a direct liaison between the administration and students.

Student Regulations
All regulations pertaining to student behavior, dress, smoking, drinking of intoxicating beverages, and operation of automobiles on the campus are covered fully in the Students’ Handbook.

Placement Service
The Placement Bureau will assist students in obtaining part-time and summer employment as well as permanent employment toward a career.
ACADEMIC REGULATIONS

CREDIT HOURS

The credit hours of each course are normally represented by the number of class meeting hours per week for one term. Since there may be exceptions to this general rule, particularly for laboratory periods, the Course Description should be consulted for the credit hours of specific courses.

THE GRADING SYSTEM

The system of grading is as follows:

- A (excellent) — 90 - 100 4 credit points
- B (good) — 80 - 89 3 credit points
- C (average) — 70 - 79 2 credit points
- D (poor) — 60 - 69 1 credit point
- F (failed) — 0 - 59 0 credit points
- I (incomplete) 0 credit points
- N (no grade)
- WP (withdrawal—passing)
- WF (withdrawal—failing)

INCOMPLETE WORK

A grade of “I” is given for incomplete work and indicates that the work of the student in the course is qualitatively satisfactory and that there is reasonable expectancy that completion of the remaining work may result in a passing grade. The instructor shall furnish the Chairman of the Department or the Dean with a statement of the work required to be completed. The student must complete the work, and the instructor must report the final grade at the earliest possible time, but not later than six weeks following the quarter in which the “I” was received except with special permission of the Dean. If there is no possibility of the student’s receiving a passing grade, even if he should complete the remaining work, the grade entered shall automatically be an “F”. As soon as the incomplete work has been made up, the instructor, or in the case of his absence from the college, the Department Chairman or Dean, shall file the proper mark in the Registrar’s Office. Until such time as the final mark is recorded, the credit hours in the uncompleted course shall not be counted or considered for any purpose.

AUDIT

A student may audit a course with the permission of the Dean and payment of the regular tuition and fees for the course. An auditor does not receive a grade, but an “N” is entered in the grade space of the final grade report. This shall indicate that the auditor has in general maintained a satisfactory course attendance.

No changes in registration from credit to audit will be permitted after the first week of classes.

WITHDRAWAL

In order to withdraw officially from any registered course, the student shall make written application to the Dean for permission to withdraw. Application shall be made on a form provided for this purpose by the Office of the Registrar.

Students who withdraw with permission from a course at any time prior to the first day of the sixth week of classes will have a “W” entered on their grade card.

Students who drop out of a course without permission of the Dean will be automatically credited with a failure.

The policy on tuition refund is described under the section, Financial Information.

Students who are granted permission to withdraw on or following the first day of the sixth week of classes, and whose work to date has been “passing”, will have “WP” (Withdrawal—Passing) entered on their grade card.

The college will not entertain requests for withdrawal after the start of the ninth week of classes.

POINT HOUR RATIO

A student’s academic standing for a term is expressed by his point hour ratio. This is determined by dividing the total number of points earned by the total number of credit hours scheduled or undertaken. The number of points is obtained by multiplying the
number of credit points by the number of credit hours for each course. The following is an example:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Hours</th>
<th>Grade</th>
<th>Credit Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>A</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>C</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>(3)</td>
<td>I</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>B</td>
<td>9</td>
</tr>
</tbody>
</table>

Point hour ratio 3.18

When the final grade on Course No. 3 is recorded, the points and hours will be included in computing the student's point hour ratio. When a student has a record for two or more terms, he will have a cumulative grade point average determined by dividing the total points earned by the total hours undertaken. The point hour ratio of transfer students will be computed only on the work done at Brevard Engineering College.

WARNING AND DISMISSAL

“1.5 Rule.” If a student’s cumulative point-hour ratio is below 1.5 at the end of the third, or any subsequent term of residence, he shall be dropped from the degree candidacy.

“Special Action.” The Dean may dismiss a student if at any time his preparation, progress or success in his assigned work is deemed unsatisfactory.

“Transfer Students.” Students who have transferred credit from another college or university will have two Quarters at Brevard Engineering College before the above dismissal rules apply. The point-hour ratio of such a student will be computed on the work done at Brevard Engineering College.

REMOVAL OF FAILURE IN REQUIRED COURSE

The student is responsible for repeating in class, at his first opportunity, a required course in which he has failed.

NOTIFICATION OF GRADES

At the close of each term, the Registrar notifies each student by mail of the grades earned during the term. These grades become a part of the official record of the student and are not subject to change except upon official authorization of the Chairman of the Department and the Dean.

The College Office is not authorized to release grades prior to the mailing of the grade card to the student.

HONORS

Honor students at the college receive recognition in various ways. At the end of each term, a Dean's List is published, listing the names of students who carry two or more subjects and attain a grade point average of 3.5 or better. Frequently, cash awards and prizes are made available to outstanding students.

ATTENDANCE

The intensive nature of the courses imposes heavy demands upon the student's time and effort. Regular class attendance and punctuality is therefore essential and is expected of every student. Students are expected to make up all work missed through absence. No student may receive credit for a course in which he has missed as much as 25% of the class hours.
FINANCIAL INFORMATION

TUITION AND FEES

Tuition for full time students (15 hours or more) is charged at the rate of $540 a year or $180 a term. Tuition for part time students for lecture courses is charged at the rate of $12 per credit hour for 100 and 200 series courses; $14 per credit hour for 300 and 400 series courses; and $16 per credit hour for 500 and 600 series courses.

Tuition for laboratory courses is charged as follows: P103, P203 at $42 per course; P303, EE304, EE407 at $48 per course.

Effective with the Fall 1964 Term tuition for full time students will be $630 a year or $210 a term. Tuition for part time students for lecture courses will be charged at the rate of $14 per credit hour for undergraduate courses; and $16 per credit hour for graduate courses. Tuition for laboratory courses will be charged at the rate of $48.00 per course, except chemistry laboratory which will be charged at the rate of $28.00.

An entrance fee of $5 is charged. This fee is not refundable.

A fee of $5 is charged for special examinations.

A fee of $1 is charged for transcripts after the first copy.

Graduation fees are charged as follows: Associate Certificate, $10; Bachelors degrees, $15; and Graduate degrees, $20.

Financial payment plans are available.

Full time students should budget approximately $100 a year for books and supplies.

TUITION REFUND POLICY

Since the college bases its budget for the term upon the full collection of tuition from all students who are accepted, tuition refunds can be made only in accordance with the following schedule and upon written application:

- First week of classes: 100%
- Second week of classes: 70%
- Third week of classes: 40%
- Fourth week of classes: 10%

No tuition refund will be made after the end of the fourth week of classes.

Refunds to veterans enrolled for PL550 and 889 are strictly in accordance with the requirements of the Veterans Administration.

SCHOLARSHIPS AND LOANS

Various scholarships are available to the students. The Indian- lantic Rotary Club has established a Student Loan Fund.

The Technical Library contains more than 11,000 volumes.
THE BACCALAUREATE DEGREE PROGRAMS

DEGREES

Bachelor of Science degrees are offered in Electrical Engineering, Physics, Mathematics, and Space Technology.

THE COLLEGE YEAR

The college operates on the quarter or term basis. Each of these terms comprises approximately 11 weeks. They are designated the summer term, fall term, winter term, and spring term. Students may enter at the beginning of any term. A calendar of events will be found on the last page of the catalogue.

ARRANGEMENT OF CLASSES

Students may pursue courses of study on either a part time or full time basis. The baccalaureate degrees may be earned on either basis or on a combination depending on the students' needs.

The day time classes parallel the evening classes so that employed students may attend throughout the year in either class with no conflict with their regular employment schedule.

Undergraduate evening classes meet on Monday, Wednesday, and Friday evenings, from 7:00 to 10:00 P.M. Recitation sessions are divided into two periods of 80 minutes each, giving a total of six periods per week. Each subject occupies two periods per week, on different evenings, allowing for a maximum load of three subjects per term.

Undergraduate day time classes are scheduled throughout the day from Monday through Saturday.

REQUIREMENTS FOR ADMISSION

To be admitted to the College, an applicant must be at least 17 years of age and a graduate of an accredited high school, or must have been granted a high school equivalency diploma. The applicant must have attained a scholastic average which indicates a reasonable probability of success in college.

APPLICATION FOR ADMISSION

All correspondence concerning admission to Brevard Engineering College should be addressed to the Registrar, Brevard Engineering College, Melbourne, Florida. An application blank should be requested, filled out, and returned to the Office of the Registrar. The applicant should also request his High School to send his transcript to the college.

APTITUDE TESTING

An aptitude examination (ACE) is given to all entering undergraduate students. The object of the examination is to guide the faculty in assisting individual students.

ADVANCED STANDING

Credit for work successfully completed at another institution may be granted, if an official transcript is presented, and if it is determined that the work is equivalent to that given at the Brevard Engineering College in course content and hours. In doubtful cases, credit may be granted by written examination. A minimum of 45 quarter hours, however, must be taken at the Brevard Engineering College in the appropriate program to satisfy any of the undergraduate degree requirements.

SPLIT SCHEDULE

Students may split their work among different years of the curriculum as best fits their entrance qualifications, subject to conflict in classroom hours.

SPECIAL STUDENTS

Students who are not candidates for a degree may take any of the courses they desire, provided they are able to satisfy the course prerequisites. Such students are classified as Special Students.

SPECIAL COURSES

Nearly every term, the college offers one or more special courses which are outside the regular degree programs. These courses are offered on demand and some carry college credits.
CLASS SCHEDULES
A specific class schedule is available approximately one month before the beginning of each term. The class schedule states the courses to be offered, the days of the week, and the hours of the day. Copies will be mailed upon request.

CORRESPONDENCE WORK
The college offers no correspondence courses.

RESIDENCE
No less than forty-five quarter hours of work must be completed at Brevard Engineering College. The final fifteen (15) quarter hours before graduation must be earned in residence. The college reserves the right to change requirements for graduation when it is decided that such changes are necessary. A student is generally graduated according to degree requirements at the time of admission unless attendance has not been continuous. In case of re-admission, degree requirements at the time of re-admission must be met.

BACHELOR OF SCIENCE DEGREE
Brevard Engineering College confers the degree of Bachelor of Science upon students of high moral character who meet the requirements for the degree. Baccalaureate degrees are awarded in Space Technology, Electrical Engineering, Mathematics, and Physics.

ASSOCIATE PROGRAM
The Associate Certificate is awarded to part time students who successfully complete a planned program of 102 quarter hours in the basic courses with a minimum grade point average of 2.0. The Associate program forms the foundations for all curricula at Brevard Engineering College and is identical in content in the curricula in Space Technology, Electrical Engineering and Physics. The Associate program at Brevard Engineering College is not intended to be a terminal program, but rather a milestone of academic achievements in a baccalaureate pursuit.

ACADEMIC REQUIREMENTS FOR THE BACHELOR OF SCIENCE DEGREE
Candidates for the Bachelor of Science degree are required to complete a minimum of two hundred and five (205) quarter hours of college work with a minimum grade point average of 2.0. Recommended programs of study are outlined below. Deviation from the program may be made only with the approval of the Dean. Each baccalaureate program must include at least 39 quarter hours devoted to the humanities.

SPACE TECHNOLOGY
This curriculum leads to the degree of Bachelor of Science in Space Technology. In the upper division, the student receives training in courses unique to the profession of aerospace engineering. The program is designed to yield a broad training in both aerospace engineering and humanities, with an emphasis on the scientific aspects of space technology. The curriculum is geared to meet the needs of the aerospace industry for scientifically trained personnel and of the individual to enter the exciting profession devoted to the conquest of space.
ELECTRICAL ENGINEERING

The electrical engineering curriculum is primarily devoted to the principles which underline modern electronic engineering. In the early years emphasis is placed on mathematical and physical principles. The later years emphasize the basic analysis techniques of the engineer... the ways in which the engineer views physical situations and utilizes mathematical techniques in order to design a useful system or product. Finally, emphasis is placed on design of physical systems including electronic communications systems such as radar and telemetry. Communications, one of man's impelling desires, is the basic theme of the curriculum. Radar, radio, and wire telephony, measurement, electronic, computation are the fields of study designed to prepare the student for a career in engineering profession in the age of space.

MATHEMATICS

The curriculum in mathematics embraces required and elective courses in mathematics, allied scientific and technical areas, and the humanities, all of which provide the proper background for a career as a professional mathematician.

PHYSICS

The curriculum in physics is designed to train the student in both experimental and theoretical physics. Emphasis has been placed upon a curriculum that will provide a broad scientific basis for the development of the student in aerospace research. Before the student is granted a B.S. degree in physics he must demonstrate his ability to perform independent research in the aerospace field. By performing research under the direction of members of the staff of the physics department the student develops capabilities so that he is prepared for a successful career of research or to continue on in a graduate program. A central core of physics is required with a minor in mathematics. The curriculum is also designed to provide the student with an adequate background in Engineering, English, Foreign Language, Social Science, and other Humanities.

### FULL TIME PROGRAM

#### All Curricula

<table>
<thead>
<tr>
<th>FRESHMAN</th>
<th>1st Term</th>
<th>2nd Term</th>
<th>3rd Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>E 101 3</td>
<td>E 102 3</td>
<td>E 103 3</td>
</tr>
<tr>
<td>History</td>
<td>H 111 3</td>
<td>H 112 3</td>
<td>H 113 3</td>
</tr>
<tr>
<td>Chemistry</td>
<td>C 101 3</td>
<td>C 102 3</td>
<td>C 103 3</td>
</tr>
<tr>
<td>Mathematics</td>
<td>M 151 5</td>
<td>M 152 5</td>
<td>M 153 5</td>
</tr>
<tr>
<td>Graphics*</td>
<td>D 101 3</td>
<td>D 102 3</td>
<td>D 103 3</td>
</tr>
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* *(Mathematics Majors may substitute electives for D 101, 102, 103)*

<table>
<thead>
<tr>
<th>SOPHOMORE</th>
<th>1st Term</th>
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<th>3rd Term</th>
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<tbody>
<tr>
<td>English</td>
<td>E 202 3</td>
<td>E 203 3</td>
<td>E 204 3</td>
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<td>Elective*</td>
<td>3 3</td>
<td>3 3</td>
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<tr>
<td>Physics</td>
<td>P 251 6</td>
<td>P 252 6</td>
<td>P 253 6</td>
</tr>
<tr>
<td>Physics Laboratory</td>
<td>P 103 2</td>
<td>P 203 2</td>
<td>P 303 2</td>
</tr>
<tr>
<td>Mathematics</td>
<td>M 251 5</td>
<td>M 252 5</td>
<td>M 253 5</td>
</tr>
</tbody>
</table>

* *(It is recommended that all students take ST 300, Introduction to Space Technology in the first term and begin Mechanics M 201 and M 202 in the second and third terms).*

Full time students in the Junior and Senior years should consult with the Dean to arrange their schedules.
## Evening Program

### All Curricula

#### First Year

**Summer Term**
- (M 101) Algebra*

**Fall Term**
- (M 102) Algebra*
- C 101 Chemistry
- C 111 Chemistry Laboratory
- D 101 Graphic Science

**Winter Term**
- (M 103) Algebra*
- C 102 Chemistry
- C 112 Chemistry Laboratory
- D 102 Graphic Science

**Spring Term**
- (M 104) Trigonometry*
- C 103 Chemistry
- C 113 Chemistry Laboratory
- D 103 Graphic Science

**Summer Term**
- M 105 Calculus
- EC 101 Economics
- E 101 English

* (Credit for M 101, M 102, M 103, M 104 may be obtained by passing comprehensive examinations at time of admission to the College).

#### Second Year

**Fall Term**
- M 106 Calculus
- P 101 Physics
- E 102 English

**Winter Term**
- M 107 Calculus
- P 102 Physics
- P 103 Physics Laboratory

**Spring Term**
- M 201 Differential Equations
- P 201 Physics
- E 103 Technical Report Writing

**Summer Term**
- M 201 Differential Equations
- P 202 Physics
- P 203 Physics Laboratory

#### Third Year

**Fall Term**
- M 202 Differential Equations
- EE 201 A.C. Circuit Theory
- H 101 American History

**Winter Term**
- EE 202 A.C. Circuit Theory
- P 301 Physics

**Spring Term**
- P 302 Physics
- EE 203 A.C. Circuit Theory
- P 303 Physics Laboratory

Note: Mathematics majors may substitute electives for D 101, D 102, D 103 and EE 201, EE 202, EE 203.

Charles Grosick (center), laboratory assistant, illustrates a point in a laboratory class in Electrical Engineering.
### Evening Program

**Bachelor of Science Degree Curriculum in Space Technology**

#### Fourth Year

<table>
<thead>
<tr>
<th>Term</th>
<th>Course Codes</th>
<th>Course Titles</th>
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<tbody>
<tr>
<td><strong>Summer Term</strong></td>
<td>P 330</td>
<td>Physical Electronics</td>
</tr>
<tr>
<td></td>
<td>ME 201</td>
<td>Applied Mechanics</td>
</tr>
<tr>
<td></td>
<td>EE 204</td>
<td>Advanced AC Circuit Theory</td>
</tr>
<tr>
<td><strong>Fall Term</strong></td>
<td>ST 300</td>
<td>Introduction to Space Technology</td>
</tr>
<tr>
<td></td>
<td>ME 202</td>
<td>Applied Mechanics</td>
</tr>
<tr>
<td></td>
<td>P 403</td>
<td>Thermodynamics</td>
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<tr>
<td></td>
<td>ST 351</td>
<td>Space Technology Seminar</td>
</tr>
<tr>
<td><strong>Winter Term</strong></td>
<td>P 404</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td></td>
<td>ME 203</td>
<td>Applied Mechanics</td>
</tr>
<tr>
<td></td>
<td>EE 301</td>
<td>Circuit Theory of Electron Devices</td>
</tr>
<tr>
<td></td>
<td>ST 352</td>
<td>Space Technology Seminar</td>
</tr>
<tr>
<td><strong>Spring Term</strong></td>
<td>P 341</td>
<td>Electrical Measurements</td>
</tr>
<tr>
<td></td>
<td>M 301</td>
<td>Engineering Analysis</td>
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<tr>
<td></td>
<td>EE 302</td>
<td>Circuit Theory of Electron Devices</td>
</tr>
<tr>
<td></td>
<td>ST 353</td>
<td>Space Technology Seminar</td>
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#### Fifth Year

<table>
<thead>
<tr>
<th>Term</th>
<th>Course Codes</th>
<th>Course Titles</th>
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<tbody>
<tr>
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<td>P 342</td>
<td>Electrical Measurements</td>
</tr>
<tr>
<td></td>
<td>ST 311</td>
<td>Mechanics of Flight I</td>
</tr>
<tr>
<td></td>
<td>EE 303</td>
<td>Circuit Theory Electron Devices</td>
</tr>
<tr>
<td><strong>Fall Term</strong></td>
<td>P 401</td>
<td>Electromagnetic Theory</td>
</tr>
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<td>EE 311</td>
<td>Electromechanics</td>
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<tr>
<td></td>
<td>ST 312</td>
<td>Mechanics of Flight II</td>
</tr>
<tr>
<td><strong>Winter Term</strong></td>
<td>ST 411</td>
<td>Propulsion I</td>
</tr>
<tr>
<td></td>
<td>EE 312</td>
<td>Electromechanics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Humanity Elective</td>
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<tr>
<td><strong>Spring Term</strong></td>
<td>ST 412</td>
<td>Propulsion II</td>
</tr>
<tr>
<td></td>
<td>M 455</td>
<td>Vector Analysis</td>
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<tr>
<td></td>
<td>EE 331</td>
<td>Information Transmission, Modulation and Noise</td>
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#### Sixth Year

<table>
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<tr>
<th>Term</th>
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<tbody>
<tr>
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<td>ST 421</td>
<td>Structure Design</td>
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<td>H 201</td>
<td>History of Science</td>
</tr>
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<td>ME 301</td>
<td>Strength of Materials</td>
</tr>
<tr>
<td></td>
<td>ST 451</td>
<td>Advanced Space Technology Seminar</td>
</tr>
<tr>
<td><strong>Fall Term</strong></td>
<td>ST 431</td>
<td>Astrodynamics</td>
</tr>
<tr>
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<td>P 360</td>
<td>X-ray and Crystal Physics</td>
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<tr>
<td></td>
<td>ME 302</td>
<td>Machine Design</td>
</tr>
<tr>
<td></td>
<td>ST 452</td>
<td>Advanced Space Technology Seminar</td>
</tr>
<tr>
<td><strong>Winter Term</strong></td>
<td>ST 441</td>
<td>Principles of Guidance and Control</td>
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<tr>
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<td>EE 431</td>
<td>Servomechanisms</td>
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<tr>
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<td>ST 453</td>
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<tr>
<td><strong>Spring Term</strong></td>
<td>H 102</td>
<td>American History</td>
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<td>ME 402</td>
<td>Fluid Mechanics</td>
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<tr>
<td></td>
<td>EE 432</td>
<td>Servomechanisms</td>
</tr>
<tr>
<td></td>
<td>or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EE 461</td>
<td>Electronic Computers</td>
</tr>
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</table>
### Evening Program

**Bachelor of Science Degree Curriculum in Electrical Engineering**

#### Fourth Year

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summer</strong></td>
<td>EE 211</td>
<td>Electron Devices</td>
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<tr>
<td></td>
<td>EE 204</td>
<td>Advanced A.C. Circuit Theory</td>
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<tr>
<td></td>
<td>ME 201</td>
<td>Applied Mechanics</td>
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<td><strong>Fall</strong></td>
<td>EE 212</td>
<td>Electron Devices</td>
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<td>EE 311</td>
<td>Electromechanics</td>
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<tr>
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<td>ME 202</td>
<td>Applied Mechanics</td>
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<td><strong>Winter</strong></td>
<td>EE 301</td>
<td>Circuit Theory of Electron Devices</td>
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<tr>
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<td>EE 312</td>
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<td>Circuit Theory of Electron Devices</td>
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<td>H 102</td>
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<td></td>
<td>M 455</td>
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#### Fifth Year

<table>
<thead>
<tr>
<th>Term</th>
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<th>Title</th>
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<tbody>
<tr>
<td><strong>Summer</strong></td>
<td>EE 303</td>
<td>Circuit Theory of Electron Devices</td>
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<tr>
<td></td>
<td>H 201</td>
<td>History of Science</td>
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<tr>
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<td>ME 301</td>
<td>Strength of Materials</td>
</tr>
<tr>
<td><strong>Fall</strong></td>
<td>E 203</td>
<td>English Literature</td>
</tr>
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<td>P 401</td>
<td>Electromagnetic Theory</td>
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<td>EE 304</td>
<td>Electron Devices Laboratory</td>
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<td><strong>Winter</strong></td>
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<td>Pulse Techniques</td>
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<tr>
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<td>ME 403</td>
<td>Engineering Thermodynamics</td>
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<td>Humanity Elective</td>
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<tr>
<td><strong>Spring</strong></td>
<td>EE 322</td>
<td>Pulse Techniques</td>
</tr>
<tr>
<td></td>
<td>EE 323</td>
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#### Sixth Year

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<tr>
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### Evening Program
#### Bachelor of Science Degree Curriculum in Mathematics

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<tr>
<td>E 201 Public Speaking</td>
<td>M 302 Mathematical Analysis</td>
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<td>M 303 Mathematical Analysis</td>
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<td>M 405 Digital Computers</td>
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<td>M 405 Digital Computers</td>
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<td>M 407 Advanced Programming</td>
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### Evening Program
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<td>P 330 Physical Electronics</td>
<td>P 350 Optics</td>
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<tr>
<td>ME 201 Applied Mechanics</td>
<td>ME 202 Applied Mechanics</td>
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<td>EE 204 Advanced AC Circuit Theory</td>
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<tr>
<td>P 401 Electromagnetic Theory</td>
<td>P 402 Atomic Physics Lab</td>
<td>P 413 Atomic and Nuclear Physics</td>
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<tr>
<td>P 360 X-ray and Crystal Physics</td>
<td>P 422 Atomic Physics Lab</td>
<td>P 423 Experimental Atomic Physics Lab</td>
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<tr>
<td>ST 300 Intro. to Space Technology</td>
<td>Physics Elective</td>
<td>M 455 Vector Analysis</td>
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<td><strong>Winter Term</strong></td>
<td><strong>Spring Term</strong></td>
<td><strong>Summer Term</strong></td>
</tr>
<tr>
<td>P 412 Atomic and Nuclear Physics</td>
<td>P 431 Electrical Measurements</td>
<td>H 201 History of Science</td>
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<tr>
<td>P 422 Atomic Physics Lab</td>
<td>Human Elective</td>
<td>P 435 Nuclear Physics</td>
</tr>
<tr>
<td>Spring Term</td>
<td>P 491 Experimental Research</td>
<td>P 450 Physics of the Atmosphere and Space</td>
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<tr>
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<td><strong>Winter Term</strong></td>
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<td>P 492 Experimental Research</td>
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<tr>
<td>Physics Elective</td>
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<td>P 491 Experimental Research</td>
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#### Bachelor of Science Degree Curriculum in Physics

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THE GRADUATE SCHOOL

PURPOSE AND OBJECTIVES

It is the purpose of the Graduate School degree program, within the framework of the general objectives of the College, to achieve in the student mastery of an area of technical learning and the development of independent scholarship. Graduate degrees are awarded only to individuals who have demonstrated a breadth of knowledge and a maturity of scholarship. They are not awarded for routine completion of course requirements.

DEGREES OFFERED

Four Master of Science programs are offered in the Graduate School. Degrees may be earned in the fields of Electrical Engineering, Applied Mathematics, Physics, and Space Technology.

CLASS SCHEDULE

Graduate classes normally meet on Tuesday and Thursday evenings. However, the College reserves the right to schedule classes on other evenings when necessary. Each class period is normally of 1½ hours duration.

COURSE ANNOUNCEMENTS

Courses offered during a given term are listed in the quarterly Graduate School Bulletin.

CLASSIFICATION OF STUDENTS

REGULAR STUDENTS are those who intend to meet requirements for a degree and who have been unconditionally approved to work toward a graduate degree by the Chairman of the Department in which the student expects to major and by the Dean of the Graduate School. Such approval does not imply acceptance of the student as a candidate for a degree. Approval of candidacy is subject to the considerations indicated in the Requirements for the Master of Science Degree. A program of study will be outlined for a Regular Student. The program must be approved by the Dean of the Graduate School and may be modified from time to time as circumstances may require.

PROVISIONAL STUDENTS are those admitted to graduate study who intend to meet requirements for a degree but

(a) Who are deficient in previous academic grade average or
(b) who are deficient in course or subject prerequisites or
(c) whose applications, transcripts or other required information are received after application deadlines.

Upon removal of all deficiencies a Provisional Student may be reclassified as a Regular Student.

SPECIAL STUDENTS are those holding baccalaureate degrees who have been admitted to study in the Graduate School and who wish to have such study become a matter of record, but who do not seek a graduate degree. Such students must comply with all regular requirements for admission to the course or courses desired, but waivers of admission requirements may in certain cases be granted by the Dean of the Graduate School. Should a Special Student subsequently desire to become a Regular Student, credit earned is subject to evaluation by the department in which he expects to specialize and
may or may not be accepted to apply toward minimum degree requirements in the College.

DEGREE STUDENTS are those students who have fulfilled all requirements for the grade of Regular Student and have in addition fulfilled the requirements for admission to candidacy (see Requirements for Master of Science Degree).

AUDITORS are those students holding baccalaureate degrees who have been admitted to study in the Graduate School but who do not wish to have such study become a matter of record. Admission as an auditor must be approved by the instructor and by the Dean of the Graduate School. Auditors will be permitted, but are not required, to take course examinations. They will not receive a grade in the course. They must pay the full tuition and fee requirements. No changes in registration from credit to audit will be permitted after the close of registration at the end of the first week of classes.

ADMISSION REQUIREMENTS

The following general requirements must be met by all applicants for admission to the Graduate School:

(1) The applicant must have been granted a Bachelor's Degree in a field of science, mathematics or engineering from an institution of standard collegiate rank recognized by an appropriate accrediting agency. An applicant who is a graduate of a non-accredited institution is evaluated on an individual basis to determine his eligibility for admission. A graduate of a non-accredited institution may be required to raise his standing by taking additional courses at the undergraduate level in Brevard Engineering College as required by the Dean of the Graduate School.

(2) The applicant must have had a B average in undergraduate work and specifically a B average in the field in which the applicant expects to major in the Graduate School.

(3) The applicant must submit to the Dean of the Graduate School one copy of an official transcript of his undergraduate record. This transcript must be sent directly from the applicant's college or university to the Brevard Engineering College.

(4) His application must be approved by the Dean of the Graduate School.

ADMISSION PROCEDURE

Application for admission to the Graduate school shall be made by new students on a form that may be obtained from the College Office. Upon completion of the application form the applicant shall present himself at the Office of the Dean of the Graduate School for assignment to an adviser who will then check the applicant's qualifications for admission and, if satisfactory, work out with the applicant an acceptable course of study based on the applicant's objectives and qualifications. The adviser will then approve the application for admission and the agreed upon course of study.

Students previously enrolled in the college who wish to take new, but previously approved, courses or who wish to take the second or third term of a previously approved course just completed with a passing grade shall make application on a form provided by the Office of the Registrar.

Requirements for Master of Science Degree

ADMISSION TO CANDIDACY — Admission to the Graduate School does not imply that the work taken by the student will be credited toward a degree. No commitment in this matter has been made until the student is admitted to candidacy for a degree. The following are the requirements for admission to candidacy:

(1) Completion of a minimum of two terms in residence and the completion of a minimum of nine term hours of study.

(2) Certification by the Chairman of the Department that the Graduate Record Examination has been taken and all other requisite preliminary examinations have been passed.

(3) Foreign language requirements, if specified, have been met.

(4) A general course average of no lower than B with no individual course grade lower than C. A student may have a "D" in a course which is not counted for credit towards the degree.

(5) The presentation of an outline of the student's program of study, and a plan of work proposed as a basis for his thesis, if re-
required, which have the approval of the Chairman of the Department and the Dean of the Graduate School.

Application for admission to candidacy for a Master's Degree must be made by the student on a form to be obtained from the Office of the Dean of the Graduate School and must be filed with the Dean of the Graduate School upon completion.

LANGUAGE REQUIREMENTS — At the option of the Department a reading knowledge of one foreign language must be demonstrated prior to admission to candidacy. This requirement may be met by one of the following methods: (1) by examination, or (2) presentation of two years of college credit (at least 12 semester hours or 18 quarter hours) in one of the following foreign languages: French, German, Russian. The examination will consist of 1 ½ hours in which to write an acceptable translation of a technical document, with the aid of a dictionary. No student will be permitted a re-examination in a foreign language during the same quarter in which he failed the examination. Permission for re-examination in subsequent terms can be granted only upon evidence of sufficient work done to justify re-examination.

GRADUATE RECORD EXAMINATION — This examination is required for all students seeking the Master of Science Degree unless waived by the Dean of the Graduate School. It should be taken not later than the student's second quarter of residence, but must be taken before admission to candidacy can be approved. Information as to the dates on which the examination may be taken may be obtained from the Office of the Registrar.

PROGRAM OF STUDY — A program of study, and thesis plan if required, must be submitted on the proper forms for approval by the student's Department Chairman, and the Dean of the Graduate School. This should be completed not later than the student's second quarter of residence and must be done before the student is admitted to candidacy. These approved programs must be on file in the Office of the Registrar.

Two courses per term are considered a full load for evening students in the Master of Science programs. Thus the study program may be expected to require at least two calendar years. In general, however, it is anticipated that a longer time will be required. Additional departmental requirements are given in the section on Graduate Degree Programs.
Office of the Dean of the Graduate School not later than two weeks from the date of mailing of the original grade.

EXAMINATIONS — In addition to all examinations required for admission to candidacy and all examinations on the courses taken, the candidate must pass a comprehensive written examination covering his field of specialization, and at the option of the Department, an additional oral examination. An oral examination shall be conducted by a committee appointed by the Department Chairman, but will be open to any member of the faculty who may desire to attend.

RESIDENCE—The minimum residence requirement for a Master's Degree is six (6) quarters. All work credited toward a Master's Degree must be completed within six (6) years.

TRANSFER OF CREDITS — Transfer of credits for graduate courses is never automatic. In a program of study for a graduate degree the courses taken must constitute a logical whole. In cases in which a course taken at another recognized institution does constitute a logical part of the student’s program, transfer of credit may be allowed if recognized by the Chairman of the Department and approved by the Dean of the Graduate School. Such transfer of credit cannot exceed 9 quarter hours. Work done at extension or by correspondence will not be credited toward the Master's Degree.

THESIS — At the option of the student's major department, a thesis may be required for the Master of Science Degree. It must show that the student has used independence of judgment in developing a problem from primary source materials. A thesis adviser will be appointed by the Chairman of the student's major department. The Master's thesis must be approved by the adviser and placed on file with the Dean of the Graduate School for a reading committee at least six (6) weeks before the date of graduation. Three file copies must be deposited with the College Library before the degree is granted. These copies must contain the written approval of the adviser, Chairman of the final reading committee, and the Dean of the Graduate School.

**GRADUATE DEGREE PROGRAMS**

**GENERAL** — The degree of Master of Science may be conferred upon satisfactory completion of the requirements for Master of Science degree as described in the previous sections and in addition the departmental requirements described in this section.

**DEPARTMENT OF PHYSICS** — The Physics option for the Master of Science degree requires a minimum of 48 hours. The following courses are required:

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>M-505</td>
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<tr>
<td>M-507</td>
<td>Advanced Calculus</td>
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<tr>
<td>P-515</td>
<td>Advanced Dynamics</td>
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<tr>
<td>P-516</td>
<td>Wave Equation and Relativity</td>
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<td>P-517</td>
<td>Advanced Electromagnetic Theory</td>
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<td>P-530</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>P-535</td>
<td>Solid State Physics</td>
<td>3</td>
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<td>P-540</td>
<td>Nuclear Physics I</td>
<td>3</td>
</tr>
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<td>P-550</td>
<td>Physical Optics</td>
<td>3</td>
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<tr>
<td>P-580</td>
<td>Statistical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>P-605</td>
<td>Thesis</td>
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The balance of 12 hours may be electives from the following list:

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<th>Course</th>
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<td>P-510</td>
<td>Electrical Discharges in Gases</td>
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<tr>
<td>P-520</td>
<td>Astrophysics</td>
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<td>P-531</td>
<td>Quantum Mechanics II</td>
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<td>P-537</td>
<td>Molecular Vibrations</td>
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<td>P-541</td>
<td>Nuclear Physics II</td>
<td>3</td>
</tr>
<tr>
<td>P-558</td>
<td>Quantum Electronics</td>
<td>3</td>
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<tr>
<td>P-560</td>
<td>Magnetohydrodynamics</td>
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<tr>
<td>P-570</td>
<td>Selected Topics in Physics</td>
<td>3</td>
</tr>
<tr>
<td>EE557</td>
<td>Transistor Theory</td>
<td>3</td>
</tr>
<tr>
<td>ST540</td>
<td>Astrodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>ST541</td>
<td>Astrodynamics II</td>
<td>3</td>
</tr>
</tbody>
</table>

A final comprehensive written examination covering the entire range of the candidate's program of study must be taken along with a final oral examination.
DEPARTMENT OF SPACE TECHNOLOGY — The Space Technology option for the degree of Master of Science requires a minimum of 51 hours. The following courses are required:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>M-505</td>
<td>Advanced Calculus</td>
<td>3</td>
</tr>
<tr>
<td>M-507</td>
<td>Advanced Calculus</td>
<td>3</td>
</tr>
<tr>
<td>P-515</td>
<td>Advanced Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ST-530</td>
<td>Inertial Guidance I</td>
<td>3</td>
</tr>
<tr>
<td>ST-510</td>
<td>Rocket Propulsion I</td>
<td>3</td>
</tr>
<tr>
<td>ST-540</td>
<td>Astrodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>ST-541</td>
<td>Astrodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>ST-542</td>
<td>Geodesy I</td>
<td>3</td>
</tr>
<tr>
<td>ST-550</td>
<td>Range Instrumentation I—Optical</td>
<td>3</td>
</tr>
<tr>
<td>ST-552</td>
<td>Range Instrumentation II—Telemetry</td>
<td>3</td>
</tr>
<tr>
<td>ST-553</td>
<td>Range Instrumentation III—Pulse Radar</td>
<td>3</td>
</tr>
<tr>
<td>ST-554</td>
<td>Range Instrumentation IV—C. W. Radar</td>
<td>3</td>
</tr>
</tbody>
</table>

12 hours must be elected from one of the groups A, B, or C:

**GROUP A**
- ST-531 Inertial Guidance II 3 hours
- M-545 Probability Theory 3 hours
- EE-515 Advanced Theory of Servomechanisms 3 hours
- EE-531 Random Processes 3 hours

**GROUP B**
- ST-511 Rocket Propulsion II 3 hours
- ST-512 Rocket Propulsion III 3 hours
- ST-513 Advanced Rocket Propulsion 3 hours
- ST-514 Nuclear Reactor Principles 3 hours

**GROUP C**
- M-545 Probability Theory 3 hours
- M-546 Mathematical Statistics 3 hours
- M-535 Theory of Determinants and Matrices 3 hours
- M-547 Error Analysis 3 hours

The balance of 3 hours may be selected from the following group:

**GROUP D**
- EE-545 Logical Design of Digital Computers I 3 hours
- ST-543 Geodesy II—Theoretical Geodesy 3 hours
- ST-511 Rocket Propulsion II 3 hours
- ST-512 Rocket Propulsion III 3 hours
- ST-513 Advanced Nuclear Propulsion 3 hours
- ST-514 Nuclear Reactor Principles 3 hours
- ST-531 Inertial Guidance II 3 hours
- ST-570 Communications and Tracking Networks 3 hours
- ST-580 Space Medicine 3 hours
- ST-585 Analysis of a Manned Space Craft 3 hours
- ST-590 Man-Machine Processes 3 hours
- M-545 Probability Theory 3 hours
- EE-515 Advanced Theory of Servomechanisms 3 hours
- EE-531 Random Processes 3 hours
- P-516 Wave Equation and Relativity 3 hours
- P-517 Advanced Electromagnetic Theory 3 hours

Modifications to the above requirements in individual cases require the written approval of the Department Chairman and the Dean of the Graduate School.

A final comprehensive written examination, covering the entire range of the candidate’s program of study, must be taken. A final oral examination may also be required.
DEPARTMENT OF MATHEMATICS — The Graduate Department of Mathematics offers a Master of Science degree program in Applied Mathematics. The minimum hour requirement for the degree is 51 quarter hours. A Master's thesis is optional under this program and a maximum of 9 hours may be elected for thesis preparation. If the thesis option is not selected, a 3 hour course of directed individual study is required.

In order to enter the Graduate Department of Mathematics, the equivalent of an undergraduate degree in Mathematics is required. Such a program would have included calculus, differential equations and vector analysis.

A. MATHEMATICS OPTION

The following courses are required:

- M-505 Advanced Calculus 3 hours
- M-507 Advanced Calculus 3 hours
- M-525 Complex Variables I 3 hours
- M-526 Complex Variables II 3 hours
- M-527 Real Variables 3 hours
- M-535 Matrix Theory I 3 hours
- M-538 Matrix Theory II 3 hours
- M-545 Probability 3 hours
- M-546 Mathematical Statistics 3 hours

Total: 27 hours

At least nine hours must be taken from the following list:

- P-515 Advanced Dynamics 3 hours
- P-516 Wave Equation and Relativity 3 hours
- P-517 Advanced Electromagnetic Theory 3 hours
- P-520 Astrophysics 3 hours
- P-530 Quantum Mechanics I 3 hours
- P-531 Quantum Mechanics II 3 hours
- ST-540 Astrodynamics I 3 hours
- ST-541 Astrodynamics II 3 hours
- EE-531 Random Processes 3 hours
- EE-532 Communication Theory 3 hours
- EE-545 Logical Design of Digital Computers I 3 hours
- EE-546 Logical Design of Digital Computers II 3 hours

One or more of the following courses shall be taken if the thesis option is selected:

- M-605 Thesis 3 hours
- M-606 Thesis 3 hours
- M-607 Thesis 3 hours

The following course is required if the thesis option is not selected:

- M-599 Directed Individual Study 3 hours

The balance of hours may be elected from any of the following:

- M-508 Operational Calculus
- M-511 Advanced Differential Equations
- M-536 Modern Algebra I
- M-537 Modern Algebra II
- M-547 Error Analysis
- M-548 Reliability Theory & Application I
- M-549 Reliability Theory & Application II
- M-551 Experimental Design
- M-557 Optimization Techniques
- M-561 Number Theory
- M-575 Numerical Analysis I
- M-576 Numerical Analysis II
- M-581 Advanced Analytical Geometry
- EE-533 Communication Systems

B. RELIABILITY OPTION

In view of the increasing emphasis toward higher reliability standards in the aerospace and related industries, it is apparent that the demand for people trained in the technical aspects of reliability engineering will increase sharply. To fill this need a series of courses is offered leading to a Master of Science degree in Applied Mathematics with an option in Reliability.

The curriculum is of a purely technical nature and courses in both theory and applications are offered. This program is administered through the Graduate Department of Mathematics and either the thesis or non-thesis option of the Department may be elected.

The following courses are required for the degree:

- M-505 Advanced Calculus
M-507 Advanced Calculus
M-535 Matrix Theory I
M-545 Probability
M-546 Mathematical Statistics
M-547 Error Analysis
M-548 Reliability Theory & Applications I
M-549 Reliability Theory & Applications II
M-551 Experimental Design
M-557 Optimization Techniques
M-592 Special Topics in Reliability
EE-545 Logical Design of Digital Computers

The remaining courses (exclusive of thesis or directed individual study) are to be taken from one of the other graduate departments depending upon the interest of the student and with the approval of the Chairman, Graduate Department of Mathematics.

A comprehensive written examination must be passed covering the general field of applied mathematics and an oral examination in defense of the thesis if elected. The thesis must be a comprehensive and searching piece of work in applied mathematics suitable for publishing and guided by a member of the faculty, appointed by the Chairman of the Department for this purpose.

DEPARTMENT OF ELECTRICAL ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING—The Electrical Engineering option for the degree of Master of Science requires a minimum of 48 hours of course work.

REQUIRED COURSES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>M-505</td>
<td>Advanced Calculus</td>
<td>3</td>
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<tr>
<td>M-507</td>
<td>Advanced Calculus</td>
<td>3</td>
</tr>
<tr>
<td>M-545</td>
<td>Probability</td>
<td>3</td>
</tr>
<tr>
<td>M-547</td>
<td>Reliability Theory &amp; Applications I</td>
<td>3</td>
</tr>
<tr>
<td>EE-515</td>
<td>Advanced Theory of Servomechanisms</td>
<td>3</td>
</tr>
<tr>
<td>EE-525</td>
<td>Synthesis of Passive Networks I</td>
<td>3</td>
</tr>
<tr>
<td>EE-526</td>
<td>Synthesis of Passive Networks II</td>
<td>3</td>
</tr>
</tbody>
</table>

Three hours must be taken from the following list:

EE-501 Transient Analysis
EE-517 Analysis of Non-Linear Control Systems I
EE-518 Analysis of Non-Linear Control Systems II
EE-527 Synthesis of Passive Networks III
EE-531 Random Processes
EE-532 Communication Theory
EE-533 Communication Systems

Nine hours must be taken from the following list:

EE-528 Electromagnetics
EE-535 Radar Systems
EE-545 Logical Design of Digital Computers I
EE-546 Logical Design of Digital Computers II
EE-550 Introduction to Analog Computers
EE-551 Advanced Analog Computers
EE-557 Transistor Theory
EE-558 Properties of Electronic Materials I
EE-559 Properties of Electronic Materials II
M-525 Complex Variables I
M-526 Complex Variables II
M-535 Theory of Determinants & Matrices I
M-538 Theory of Determinants & Matrices II
P-515 Advanced Dynamics
P-516 Wave Equation and Relativity

The remaining 18 hours may be chosen from the above list and the list given below:

EE-528 Electromagnetics
EE-535 Radar Systems
EE-545 Logical Design of Digital Computers I
EE-546 Logical Design of Digital Computers II
EE-550 Introduction to Analog Computers
EE-551 Advanced Analog Computers
EE-557 Transistor Theory
EE-558 Properties of Electronic Materials I
EE-559 Properties of Electronic Materials II
M-525 Complex Variables I
M-526 Complex Variables II
M-535 Theory of Determinants & Matrices I
M-538 Theory of Determinants & Matrices II
P-515 Advanced Dynamics
P-516 Wave Equation and Relativity
A final comprehensive written examination covering the entire range of the candidate's program of study must be taken. A final oral examination may also be required.

Students who hold the B.S. or A.B. degree in a field other than electrical engineering must complete certain preparatory course work before starting the program leading to the M.S. degree in electrical engineering. In general, these students should complete the following studies or their equivalents:

**MATHEMATICS**

**MECHANICS**
Statics, kinematics, fluid mechanics, thermodynamics (ME-201, -202, -203, -402, -403, -404).

**PHYSICS**
Mechanics, heat, sound, electric and magnetic fields, electromagnetic waves, light, atomic physics (P-101, -102, -103, -201, -202, -203, -301, -302, -303, -401).

**ELECTRICAL ENGINEERING**

The exact preparatory program required will depend upon the student's previous training and experience. Each student is expected to work out a suitable program in conference with the Chairman of the graduate Electrical Engineering Department.
C 301 GEOLOGY Cr. 3
A survey of structural and historical geology including principal geological formations, rocks and minerals and a history of the earth's crust.

C 404, C 405 ORGANIC CHEMISTRY Cr. 3, 3
An elementary course in the chemistry of carbon compounds. Emphasis on bio-chemical compounds.

C 450 PHYSICAL CHEMISTRY Cr. 3
Properties of solutions, chemical equilibrium, pH, the colloidal state; particular emphasis on biochemical applications.

ECONOMICS
EC 101 ECONOMICS Cr. 3
Basic course dealing with the problems of production and distribution of wealth, pricing, business organization, money, credit, public finance, and the economic organization of society.

EC 201, 202 ECONOMICS CR. 3, 3
(Prerequisite EC 101)
A further study and extension of the principles of economics including cost of production, elements of money and banking and applications of economics to public policy in a democratic society.

EC 210 LABOR RELATIONS Cr. 3
A critical appraisal of the labor problems including the history, organization and operation of American trade unionism, collective bargaining and public control of labor relations. Three hours.

EC 302 COMPARATIVE ECONOMIC SYSTEMS
A study of the world's major economic systems with special emphasis on capitalism and communism.

ELECTRICAL ENGINEERING
EE-201, 202, 203 A-C CIRCUIT THEORY Cr. 3, 3, 3
(Prerequisite M 107; Concurrent P 201)
Concepts of resistance, inductance, and capacitance as electric circuit elements, series and parallel circuits; resonance phenomena; real and apparent power; Kirchoff's voltage and current laws; network equations on loop and node basis. Bridge circuits; network theorems; coupled circuits; impedance transformation and matching; tuned coupled circuits.

EE 204 ADVANCED A-C CIRCUIT THEORY Cr. 3
(Prerequisites EE 203, M 202, M 203)
Network Equations; Laplace Transformation; Time Domain, Frequency Domain; Impedance and Admittance Functions; Network Functions; Network Functions in terms of Poles and Zeros.

EE 211, 212 ELECTRON DEVICES Cr. 3, 3
(Prerequisites P 302, M 203)
Particles and Waves; Bound Particles; Fermi Energy; Electron Emission; Charged Particle Dynamics; Classical Vacuum Devices; Continuity Equation; Boltzman and Einstein Relations; Gaseous Processes; Band Theory of Solids; Semiconductors; Semiconductor Devices; Physics of Electron Beams; Modern Amplifiers.

EE 301, 302, 303 CIRCUIT THEORY OF ELECTRON DEVICES Cr. 3, 3, 3
(Prerequisite: EE-203)
Power Supplies; Filters; Four-Terminal Networks; Vacuum-tube Amplifier Circuits; Noise Sources; Transistor Amplifier Circuits; Small-Signal Amplifiers; Feedback; Audio-Frequency Amplifiers; R-F Amplifiers; Oscillators; Modulation; Demodulation; Power Rectification; Gaseous Control Tubes and Circuits. Vacuum-tube and transistor applications are presented concurrently.

EE 304 ELECTRON DEVICES LABORATORY Cr. 2
(Prerequisite EE-303)
Laboratory experiments to illustrate the principles of EE-301, 302, 303.

EE 311, 312 ELECTROMECHANICS Cr. 3, 3
(Prerequisite: EE-204)
Ampere's Law; The Magnetic Field; Electromotive Force; Rotating Generators; D-C Motors; A-C Motors; Synchronous Machines; Transformers; Electrical and Mechanical Relations; Transfer Functions; Laplace Transfer Functions; Induction De-
vices; Electromechanical Systems; Magnetohydrodynamics; Ion Propulsion.

EE 321, 322 PULSE TECHNIQUES (Prerequisite: EE-303) Cr. 3, 3
Linear Wave Shaping; Linear Pulse Amplifiers; Non-linear Wave Shaping; Bistable Multivibrator; Monostable and Astable Multivibrators; Voltage Time-Base Generators; Current Time-Base Generators; Pulse Transformers and Blocking Oscillators; Electromagnetic Delay Lines; Counters; Digital Computer Circuits; Transmission Gates; Pulse and Digital Systems. Vacuum-tube and transistor applications are presented concurrently.

EE 323 PULSE TECHNIQUES LABORATORY Cr. 2 (Concurrent with EE-322)
Laboratory experiments to illustrate principles presented in EE-321, 322.

EE 331, 332 INFORMATION TRANSMISSION, MODULATION AND NOISE (Prerequisites: EE-303, M-202, M-203) Cr. 3, 3
Information and System Capacity; Transmission through Electric Networks; Modulation and Modulation Systems; AM; FM; SSB generators; Periodic Sampling and Pulse Modulation; Thermal Noise; Shot Noise; Signal-to-Noise and Noise Figure; Noise in transistors; Transistor Noise Figure; Noise in vacuum tubes; Signal and Noise Power Spectra; Signal-to-Noise ratios in FM, AM, and PPM; Quantization noise and S/N in PCM.

EE 411 TRANSMISSION LINES (Prerequisite: EE-203, P-401, M-202) Cr. 3
Voltage and Current Relations; Traveling and Standing Waves; Propagation, Phase, and Attenuation Constants; Incident and Reflected Waves; Reflection Coefficient; Wavelength and Phase Velocity; Characteristic Impedance; Standing-wave Ratio; the Smith and z-O Charts; Transmission Line Measurements; Impedance Matching; Directional Couplers; Wave Guides; Cavity Resonators.

EE 421 ANTENNAS (Prerequisite: EE-411) Cr. 3
Point Sources; Radiation Patterns; Directivity; Antenna Gain; Field and Phase Patterns; Antenna Aperture; Antenna Arrays; Dipole, Loop, Helical, Biconical, Slot, Horn and Reflector-type Antennas; Self and Mutual Impedances; Antenna Measurements; Noise Temperature of Antennas.

EE 431, 432 SERVOMECHANISMS (Prerequisites: EE-303, 331, 312, M-202.) Cr. 3, 3
General background of servomechanisms. Laplace transformation; Equations of Physical Systems; Transient Analysis; transfer Functions; Design; gain adjustment; Comprehension. Nyquist Diagram, Bode plots, Root Locus.

EE 441 R-F PROPAGATION (Prerequisite: EE-421) Cr. 3
Propagation of Electromagnetic Waves in the Troposphere, Ionosphere and Outer Space; Ducting; Refraction; Atmospheric, Precipitation and Plasma Absorption; Modes of propagation; Ground Waves; Sky Waves; Space or Tropospheric Waves; Propagation in a Plasma; Cosmic, Solar and Man-made Noise; Noise Temperature.

EE 461 ELECTRONIC COMPUTERS (Prerequisite: EE-322, M-203) Cr. 3
Theory of digital and analog electronic computers and Basic Computer Programming for the electronics engineer.

EE 471 ELECTRONIC SYSTEMS (Prerequisite: EE-308, 312, 322, 332, 411, 421, 431, 441) Cr. 3
The application of basic principles to major electronic systems are studied. The course serves to integrate knowledge gained in previous electronic courses into the "systems" concept. Transmitters, receivers, pulse and C-W radar, telemetry, television, communications, data transmission and control systems are examined.

EE-491 ADVANCED EE LABORATORY (Prerequisite EE 411) Cr. 2
Laboratory associated with EE 421.

EE 492 ADVANCED EE LABORATORY (Prerequisite EE 411) Cr. 2
Laboratory associated with EE 431.
EE 493 ADVANCED EE LABORATORY  Cr. 2
(Prerequisite EE 411)
Laboratory associated with EE 471.

EE 501 TRANSIENT ANALYSIS  Cr. 3
This course covers the basic operational methods of linear systems analysis. The fundamental results of Fourier series, Fourier Transforms and Laplace Transforms are discussed. Methods of analyzing systems of differential equations, circuits and other linear systems are treated in terms of the frequency domain. The notion of frequency spectrum, impulse responses, convolution, etc. are treated.

EE 501 ADVANCED THEORY OF SERVOMECHANISMS  Cr. 3
(Prerequisite EE 431, 432 or equivalent)
Phase plan analysis of non-linear systems; application of Z-transforms to sampled systems; statistical approach to systems analysis by way of Fourier transforms, autocorrelation and cross correlation techniques.

EE 517 ANALYSIS OF NON-LINEAR CONTROL SYSTEMS I  Cr. 3
(Prerequisite EE-515)
General theory of "quasi-linear" systems (for the description of periodic and random input behavior) and topological phase space techniques (for the description of transient behavior); Analysis of non-linear systems by describing functions, phase plane, Liapounoff's method, Lagrange's method, and extensions of these techniques.

This term covers description and classification on non-linearities; general techniques for solving non-linear control problems, introduction to quasi-linearization and the describing function technique; describing functions of simple non-linearities, frequency invariant non-linearities and frequency variant non-linearities; quasi-linear closed loop systems.

EE 518 ANALYSIS OF NON-LINEAR CONTROL SYSTEMS II  Cr. 3
(Prerequisite EE-517)
A continuation of EE-517. This term covers random input

EE 525 SYNTHESIS OF PASSIVE NETWORKS I  Cr. 3
The first of a three term series concerned with the study of the techniques for the synthesis of passive networks. As most of the practicing engineer's problems are those of designing rather than analyzing circuits, this course is designed to provide the basic tools necessary to perform this task. This term covers the basic introduction to the required mathematics. The basic energy relations that must exist for a network to be realizable are developed and techniques for determining the existence of these conditions established.

EE 526 SYNTHESIS OF PASSIVE NETWORK II  Cr. 3
(Prerequisite EE-525)
The techniques for deriving functions that satisfy the basic conditions for a physically realizable network are established. Methods for deriving two element parameter networks (RL, RC, and LC) based on input impedance parameters are developed and many examples considered.

EE 527 SYNTHESIS OF PASSIVE NETWORKS III  Cr. 3
(Prerequisite EE-526)
Three element (RLC) input network synthesis is developed. Techniques for the development of transfer impedance synthesis are derived and example illustrating the most powerful schemes are presented.

EE 528 ELECTROMAGNETICS  Cr. 3
(Prerequisites P-401, EE 411, EE-421 or equivalent)
Plane waves in dielectric and conducting media, transmission lines, wave guides, antennas, and boundary value problems.

EE 531 RANDOM PROCESSES  Cr. 3
(Prerequisite M-545)
A basic course in the methods of random processes. The topics to be covered are average, sampling, spectral analysis, noise, gaussian processes, linear and non-linear systems. The course is intended to give the engineer the capability of analyzing the effects of statistical inputs to communication systems.
EE 532 COMMUNICATION THEORY Cr. 3
(Prerequisite M-545, EE-531 recommended)
A basic course in the methods of analyzing and optimizing statistical communication systems. The topics to be discussed are: information theory, detection theory, parameter estimation, and signal-to-noise ratios. The course is intended to review the basic methods used to analyze and compare various communication systems. Notes will be distributed which summarize and reference the fundamental papers in these fields.

EE 533 COMMUNICATION SYSTEMS Cr. 3
(Prerequisite EE-532)
A course in the application of the methods of communication theory to telemetry, radar systems, communication systems, modulation techniques, etc. Modern methods in system design will be discussed, covering such topics as frequency modulation, pulse code modulation, etc., pulse compression radars, coherent radars, moving target radars, etc., noise-like communication systems, phased array antenna systems, etc. The course is intended to provide a fundamental understanding of the methods applied in modern systems.

EE 535 RADAR SYSTEMS Cr. 3
Fundamental principles of radar systems; analysis of the engineering principles and the design of circuitry unique to these systems.

EE 545 LOGICAL DESIGN OF DIGITAL COMPUTERS I Cr. 3
Basic principles and circuits in logical design of digital systems. Covers Boolean algebra, computer arithmetic, minimization of combinational logic, basic circuits, design of simple sequential circuits.

EE 546 LOGICAL DESIGN OF DIGITAL COMPUTERS II Cr. 3
(Prerequisite EE-545)
Continuation of EE-545. Simplification of sequential logic by Huffman-Mealy technique. Design of arithmetic units including multipliers. Includes memory and input-output techniques, and design of a small digital computer.

EE 550 INTRODUCTION TO ANALOG COMPUTERS Cr. 3
(Prerequisite: Differential Equations)
This course presents the fundamentals necessary for the programming and solving of numerous types of problems on the electronic analog computer. Included are methods of determining scale factors, time scales, non-linear phenomena, multiplying, dividing, coordinate transformation and function generation. Also covered are the repetitive operation and digital differential analyzers.

EE 551 ADVANCED ANALOG COMPUTERS Cr. 3
(Prerequisite EE-550)
A continuation of EE-550 with particular emphasis on real time computers and hybrid systems.

EE 557 TRANSISTOR THEORY Cr. 3
Physical concepts or transistors and other related semiconductor devices; P-N Junction theory; characteristics and parameters of transistors; equivalent circuits; basic amplifier circuits, miscellaneous solid state devices.

EE 558 PROPERTIES OF ELECTRONIC MATERIALS I Cr. 3
Theory of basic physical, electrical, mechanical and chemical properties of metallic, ceramic and plastic materials. Review of atomic structure, quantum mechanics and crystallography. Introduction to the theory of phases in materials, multiphase materials and phase diagrams; plasticity of materials; oxidation and corrosion; reaction rates; and diffusion. Methods of physically studying and analyzing materials.

EE 559 PROPERTIES OF ELECTRONIC MATERIAL II Cr. 3
(Prerequisite EE-558)
A continuation of EE-558.

ENGLISH

E 101, 102 ENGLISH Cr. 3, 3
The basic mechanics of written communications; sentence and paragraph structure; vocabulary; punctuation; clarity of expression.

E 103 TECHNICAL REPORT WRITING Cr. 3
(Prerequisite E 102)
The evaluation of data, their sources and uses in preparing reports; practice in the organization of material and preparation
of concise and accurate reports; training in practical writing for industry, business and research, with emphasis on the special requirements and techniques of the professional report.

E 201 PUBLIC SPEAKING Cr. 3
(Prerequisite E 102)
The course is designed specifically to develop the student's ability to deal effectively with speaking situations arising in his job. It covers the presentation of concepts and ideas to technical and non-technical audiences; instruction and practice in platform speaking, group or conference participation, use of visual aids, preparation, planning and presentation.

E 202 LITERATURE Cr. 3
Reading and discussion of selected plays and essays.

E 203, 204 SURVEY OF ENGLISH LITERATURE Cr. 3, 3
A study and evaluation of English Literature from Beowulf to modern times. Reading and discussion of selected English classics.

E 232 CREATIVE WRITING Cr. 3
Methods of involving the reader audience in fiction and non-fiction writing. Review of modern approaches to magazine, radio, TV writing and the novel.

GRAPHICS
D 101, 102, 103 GRAPHIC SCIENCE Cr. 3, 3, 3
Engineering Drawing. Instruments and their use; applied geometry; lettering; theory and practice of projection drawing; auxiliary and oblique views; sections and conventions; pictorial views; drawings and the shop; dimensions, notes, limits and precision; working drawings. Descriptive Geometry and Graphical Solutions. Point, edge and normal views; points and straight lines and planes; curved lines; curved and warped surfaces; intersections, developments; vector geometry; charts, graphs and diagrams; functional scales, nomography.
MANAGEMENT

G 361 PRINCIPLES OF MANAGEMENT Cr. 3
A survey course to examine the principles of management and the problems incident to their application. The course deals with decision making, organizing, planning and controlling of business organizations.

G 362 MANAGEMENT PROCESSES I Cr. 3
An intermediate management course designed to present a view of the management processes as they operate in the job situation. Emphasis will be placed on the specific management functions of organizing and planning.

G 363 MANAGEMENT PROCESSES II Cr. 3
(Prerequisite G 362)
A further study and extension of the management processes to include control and leadership.

G 364 PRINCIPLES OF INDUSTRIAL MANAGEMENT Cr. 3
A continuation of the Principles of Management to include such areas as Production Control, Quality Control, Finance, Industrial Relations, etc.

G 371 MANAGERIAL STATISTICS Cr. 3
A study of statistical methods and analysis to include basic principles, sampling techniques, the concept of error, statistical presentations, use of averages, and the practical applications utilizing the above.

G 372 MANAGERIAL ACCOUNTING Cr. 3
A study of the principles underlying the basic concepts of accounting and the measurement of income, expenses and the valuations of assets. The analysis and interpretation of financial reports from the viewpoint of management.

MATHEMATICS

M 101, 102, 103 ALGEBRA Cr. 3, 3, 3
The fundamental operations of algebra. Factoring and fractions; exponents and radicals; functions and their graphs; equations and their solutions; systems or linear equations; quadratic equations; ratio, proportion, and variation. Progressions; mathematical induction; binomial theorem; inequalities, complex numbers; theory of equations, logarithms; permutations, combinations, and probability; determinants; partial fractions.

M 104 TRIGONOMETRY Cr. 3
(Prerequisite M 101)
Ordinary topics of trigonometry. Trigonometric functions; functions of acute angle; related angles, identities; radian measure; graphs; functions of two angles, trigonometric equations, logarithms; solving right and oblique triangles; inverse trigonometric functions.

M 105, 106, 107 CALCULUS Cr. 3, 3, 3
(Prerequisite M 103, 104 or M 103, 104 concurrently)
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 of problems in geometry and mechanics; maxima and minima; velocity and acceleration; plane areas; volumes; arc length; area of surfaces of revolution center of gravity; movement of inertia; analytic geometry; analytic geometry of the conic sections. Trigonometric, inverse trigonometric, exponential, logarithmic and hyperbolic functions. Polar coordinates and parametric representation. Elementary vector analysis in the plane.

M 151, 152, 153 ENGINEERING MATHEMATICS Cr. 5, 5, 5
A thorough treatment of fundamental mathematics. Studies include algebra, trigonometry, and fundamentals of analytic geometry and calculus.
(Equivalent to M 101 - M 105)
M 201, 202 DIFFERENTIAL EQUATIONS  Cr. 3, 3
(Prerequisite M 107)
Infinite series, and complex number, solutions of ordinary
differential equations, including first order equations, linear dif­
ferential equations with constant coefficients, simultaneous sys­
tems, methods of numerical solution, series solutions and appli­
cation to physics and engineering problems.

M 203 INTERMEDIATE CALCULUS  Cr. 3
(Prerequisite M 107)
Brief review of elementary calculus. Further topics in­
clude vector velocity and acceleration in plane curvilinear mo­
tion; three dimensional analytic geometry; partial differentiation,
multiple integration; Laplace Transformations.

M 251, 252, 253 CALCULUS & DIFFERENTIAL  Cr. 5, 5, 5
EQUATIONS
(Prerequisite M 105 or M 153)
A thorough treatment of calculus, differential equations
and intermediate calculus. (Equivalent to M 106—M 203)

M 301 ENGINEERING ANALYSIS  Cr. 3
(Prerequisite M 202, 203, EE 203, ME 301)
Introduction to the mathematical treatment of advanced
problems arising in various branches of engineering and science.
Emphasis is placed on the application of calculus, differential
equations, matrices, Fourier methods, vector analysis, etc., to
engineering problems.

M 302, 303, 304 MATHEMATICAL ANALYSIS  Cr. 3, 3, 3
(Prerequisite M 203, M 303)
A systematic discussion of the fundamental properties of
real numbers and a careful development of the concepts of func­
tions, limits, continuity, derivatives, integrals series etc. A
general study of integration line and surface integrals theo­
rems of Gauss Stokes and Green; selected topics in the theory
of functions of a real variable.

M 401, 402, 403 INTRODUCTION TO MODERN  Cr. 3, 3, 3
MATHEMATICS
(Prerequisite M 304)
Supplements the usual elementary courses. Emphasizes
recently developed mathematical ideas and proofs which underlie
mechanical and manipulative techniques. Without the former,
the student is liable to commit fundamental errors in his appli­
cation of mathematics. Topics discussed include: sets, relation,
measure and probability, metric and vector spaces, linear function­
als, modern generalization of the concept of function.

Introduces numerical methods. Finite differentiation and
integration, interpolation methods, polynomial approximations,
Chebychev polynomials, smoothing techniques.

M 405 DIGITAL COMPUTERS  Cr. 3
(Prerequisite M 103, M 104)
An introduction to the operation of general purpose elec­
tronic digital computers. Number systems, arithmetic operations
in digital machines; coding, digital computer programming.

M 406 DIGITAL COMPUTERS  Cr. 3
(Prerequisite M 106 & M 405)
A continuation of M 405. Numerical techniques. Actual
practice on medium size digital computer.

M 407 ADVANCED PROGRAMMING  Cr. 3
(Prerequisite M 406)
Advanced programming of digital computers.

M 411 INTRODUCTION TO STATISTICAL METHODS  Cr. 3
(Prerequisite M 107)
A first course in statistics. Probability, normal distribu­
tion, chi-square distribution, Student's t distribution, F-dis­
tribution, hypothesis testing.

M 412 INTRODUCTION TO STATISTICAL METHODS  Cr. 3
(Prerequisite M 404)
Hypothesis testing, analysis of variance, curve fitting, re­
gression and correlation.

M 455 VECTOR ANALYSIS  Cr. 3
(Prerequisite M 202, M 203)
A study of the algebra and geometry of vectors and linear
vector spaces and matrices. The following topics will be in­
cluded: vector algebra; dot, cross and continued products; equa­
tions of lines, planes and surfaces; application to mechanics and
dynamics; vector calculus; vector motion; scalar and vector
fields; gradient; divergence and curl.
M 456 VECTOR ANALYSIS II
(Prerequisite M 455) Cr. 3
This term will constitute a study of spaces of higher dimensions. Divergence Theorem and Stokes Theorem. Frenet's formulas. Green's Theorem. Orthogonal transformations. Application of vector analysis theory to problems in physics, mechanics and thermodynamics.

M 505 ADVANCED CALCULUS Cr. 3
Properties and uses of infinite series; convergence and divergence of infinite series; tests for convergence; conditional and absolute convergence; power series; uniform convergence; differentiation and integration of power series; Taylor's series; power series solutions of differential equation; Legendre polynomials; Bessel functions; infinite series with complex terms; Fourier series and Fourier type series or orthogonal functions; definition and uses of the Laplace Transform.

M 507 ADVANCED CALCULUS Cr. 3
A. Functions of Several Variables. Review of basic techniques; change of variables; Jacobians; directional derivatives; maxima and minima; Lagrange Multipliers; Taylor's formula; differentiation under the integral sign; Leibniz's formula; calculus and variations.

B. Partial Differential Equations. The vibrating string. Derivation of differential equation; initial conditions; characteristics; boundary conditions; damped oscillations; forced oscillations and resonance; solution by series; separation of variables; the Dirichlet problem; Legendre and Bessel functions; solutions by integrals; Fourier transform; convolution theorem; elliptic, parabolic and hyperbolic equations.

M 508 OPERATIONAL CALCULUS
(Prerequisite M 507) Cr. 3

M 511 ADVANCED DIFFERENTIAL EQUATIONS Cr. 3
Method of successive approximations, including Lipschitz condition; systems of ordinary equations, including the equation of the M-th order; systems of equations of higher order and total differential equations; interpolation and numerical integration; symbolic methods; the numerical solution of differential equations; linear equations, including reduction of the order of the equation and the Euler equation; certain classical equations, including solutions in series; regular singular points; the hypergeometric differential equation; the Legendre differential equation; Bessel's differential equation.

M 525 COMPLEX VARIABLES I
(Prerequisite M 507) Cr. 3
Complex numbers, analytic functions, continuity. Cauchy-Riemann conditions, harmonic functions, exponential function, logarithmic function, geometry of elementary functions, mapping; the point at infinity, the linear fractional transformation, successive transformations; line integrals, Cauchy-Goursat theorem, multiply connected regions; derivatives of analytic functions, Morera's theorem; the fundamental theorem of algebra.

M 526 COMPLEX VARIABLES II
(Prerequisite M 525) Cr. 3
Power series, Taylor's series, Laurent's series, uniform convergence, uniqueness of representations by power series; residues and poles, the residue theorem, computation of residues at poles, evaluation of real infinite integrals, integration around a branch point; conformal mapping, the Schwarz-Christoffel transformation, analytic continuation, Riemann surfaces.

M 527 REAL VARIABLES
(Prerequisite M 526) Cr. 3
Set theory, real number system, measure theory, sequence of functions, implicit functions and integration theory.

M 535 THEORY OF DETERMINANTS AND MATRICES I
(Prerequisite M 202) Cr. 3
Algebra of matrices; submatrices; transposition; elementary transformation; determinants; special matrices; rational equivalence of rectangular matrices; multiplication of matrices; the associative law; elementary transformation matrices; determinant of a product; non-singular matrices; inverse of a matrix; equivalence of rectangular matrices; multiplication of matrices; of square matrices; skew matrices and skew bilinear forms;
symmetric matrices and quadratic forms; non-modular fields; addition of matrices; real quadratic forms, linear spaces; linear sub-spaces; linear independence, linear mappings and linear transformations.

M 538 THEORY OF DETERMINANTS AND MATRICES II  
(Prerequisite M 535)  
Matrices with polynomial elements; elementary divisors; matrix polynomials; the characteristic matrix, function and equation; eigen-values; invariant factors; characteristic matrices with prescribed invariant factors; reduction to canonical forms; applications of matrices.

M 536 MODERN ALGEBRA I  
Cr. 3  
The general plan of work in this course consists of the following: an introduction to abstract algebra and an account of most of the important algebraic concepts. The course goes beyond the foundations and basic properties of algebraic systems and presents comprehensive accounts of selected topics. Included in the first term are semi-groups and groups including transformation groups and the fundamental theorem of homomorphisms for groups; rings; integral domains and fields.

M 537 MODERN ALGEBRA II  
(Prerequisite M 536)  
A continuation of M 536. Includes extension rings and fields; groups with operators, including Schreier's theorem and the Jordan-Holder theorem.

M 545 MATHEMATICAL STATISTICS I  
Cr. 3  
An introduction to mathematical statistics to include probability concepts, theoretical and empirical frequency distributions, linear correlation and regression and introduction into the theory and applications of least squares and statistical inference.

M 546 MATHEMATICAL STATISTICS II  
(Prerequisite M 545)  
Methods of statistical estimation and hypothesis testing. Sampling distributions. Introduction to multivariate analysis, design of experiments and distribution free methods.

M 547 ERROR ANALYSIS  
(Prerequisites M 546, M 538)  
Basic principles of error analysis; error models; statistical treatment of errors; generalized least squares; error propagation; geometric dilution of precision; application to complex systems.

M 548 RELIABILITY THEORY AND APPLICATION I  
Cr. 3  
(Prerequisite Probability Theory or Consent of Instructor)  

M 549 RELIABILITY THEORY AND APPLICATION II  
Cr. 3  
Additional study of the “burn-in” problem, step stress techniques, redundancy techniques including redundant information, redundant hardware, majority voting, adaptive voting, stochastic repair models, statistical circuit design and discrete failure distributions.

M 551 EXPERIMENTAL DESIGN  
(Prerequisite M 546)  
Cr. 3  
Basic concept of the statistical design of experiments, complete and incomplete block designs, confounding, factorial experiments.

M 557 OPTIMIZATION TECHNIQUES  
Cr. 3  
An introduction to linear and non-linear programming; simulation methods; Theory of Games.

M 561 NUMBER THEORY  
Cr. 3  
M 575 NUMERICAL ANALYSIS I  
Cr. 3
Numerical solutions of equations including Gauss, Crout and matrix inversion methods, Gauss-Seidel and other iterative methods. Other methods applicable to automated calculation procedures and error analysis will be discussed. The general area of least squares polynomial approximation will be covered and include the principle of least squares, various approximate forms (orthogonal, Hermite, Legendre, etc.) curve fitting and smoothing.

M 576 NUMERICAL ANALYSIS II  
Cr. 3
Special emphasis will be on solution of problems with the aid of digital computers. Subjects covered include interpolation methods such as Newton's divided differences, Lagrangian and finite differences. Also studies will be operations with finite differences and the numerical solution of differential equations. Various schemes in current use for computer solution of sets of differential equations will be discussed.

M 581 ADVANCED ANALYTIC GEOMETERY  
Cr. 3
A thorough review of the analytic geometry of Euclidean space, beginning with elementary propositions on real vectors; coordinates; planes and lines; transformation of coordinates; types of surfaces and some properties of quadric surfaces; including study of invariants under rotations and translations and of conformal quadrics; tetrahedral coordinates and quality in such coordinates, quadric surfaces in tetrahedral coordinates; linear systems of quadrics; hyperbolic coordinates; pencils of quadrics; bundle of quadrics; apolarity; transformations of space; curves and surfaces.

M 592 SPECIAL PROBLEMS IN RELIABILITY  
Cr. 3
Detailed study of current advanced techniques in reliability with special emphasis on problems which need additional research. The use of probabilistic models for reliability.

M 599 DIRECTED INDIVIDUAL STUDY  
Cr. 3
A comprehensive review of the literature of a specialized topic of mathematics.

M 605, 606, 607 THESIS IN MATHEMATICS  
Cr. 3, 3, 3
Individual work under the direction of a member or members of the graduate faculty on a selected topic in the field of mathematics.

SP 7 MATHEMATICS REVIEW  
Non-Credit
Brief review of important concepts of algebra and trigonometry; basic concepts of differential equations; definitions of derivatives and integrals; applications of derivatives and integrals; properties of limits; mean value theorem; L'Hospital's Rule; natural logarithms; determinants; hyperbolic functions; polar coordinates; vectors and parametric equations; partial differentiation; multiple integrals; infinite series; complex numbers and functions; first and second order differential equations, homogeneous, linear and exact, higher order equations.

This course is specially designed for those students who completed their undergraduate calculus and differential equations a number of years ago and who require renewed experience in working problems in these fields or who may wish to pursue a graduate program but who may not have achieved a sufficiently high standing in undergraduate mathematics to allow them to enroll immediately in courses in calculus and differential equations at the graduate level.

MECHANICS

ME 201 THE STUDY OF STATICS  
(Prerequisite P 101, M 107)  
Cr. 3
Resultants of Force Systems, equilibrium of force systems, internal forces in members of structures and machines, friction, virtual work, minimum potential energy, stability of equilibrium.

ME 202 THE STUDY OF KINEMATICS AND KINETICS  
(Prerequisite P 101, M 107)  
Cr. 3
Motion of a particle, curvilinear motion, motion of rigid bodies, force, mass and acceleration, impulse and momentum, work and energy.

ME 203 KINEMATICS AND SPECIAL TOPICS  
(Prerequisite ME 202)  
Cr. 3
Flexible cables, introduction to vector analysis, coriolis, vibrations, first moments and centroids, movements of inertia.

ME 301 STRENGTH OF MATERIALS  
(Prerequisite ME 201)  
Cr. 3
ME 302 MACHINE DESIGN                  Cr. 3  
(Prerequisite ME 301, ME 203)  
Applications of the principles of applied mechanics strength of materials and kinematics to the design of machine parts. Creative design problems involving fits, endurance limits, fastenings, shafting, gears, springs, couplings, brakes, clutches, flexible connectors, etc.

ME 401 ENGINEERING MATERIALS          Cr. 3  
(Prerequisite ME 301)  
Solid State physics presented from the point of view of engineers. Thermal, electrical and physical properties of common engineering materials.

ME 402 FLUID MECHANICS                Cr. 3  
(Prerequisite ME 203, M 202)  
A study of the properties of fluids, gas laws, viscosity, static pressure, buoyant force and equilibrium of floating and immersed bodies, dynamics of fluids, Bernoulli's theorem, flow in pipes, Reynolds number.

ME 403, 404 ENGINEERING THERMODYNAMICS Cr. 3, 3  
(Prerequisite M 202, P 102)  
Fundamental laws governing flow of gases, vapors. Basic concepts of thermodynamics of chemical reactions and combustion. Emphasis is placed on applications to internal combustion engines, turbines, compressors and refrigeration.

PHYSICS

P 101, 102 PHYSICS                   Cr. 3, 3  
(Prerequisite M 105 or M 105 concurrently)  

P 103 PHYSICS LABORATORY          Cr. 2  
Physics laboratory to accompany P 101, 102.
P 330 PHYSICAL ELECTRONICS  Cr. 3  
(Prerequisite P 302)  
Electron Ballistics, mass spectroscopy, introduction to accelerators, space charge theory, Fermi-Dirac statistics, thermionic emission. Schottky effect, high field and secondary emission.

P 350 OPTICS  Cr. 3  
(Prerequisite P 302)  
Fundamental principles of geometrical and physical optics. Refraction at spherical surfaces, thick lenses, limitation of rays by apertures, diffraction, interference polarization, radiation.

P 360 X-RAYS AND CRYSTAL PHYSICS  Cr. 3  
(Prerequisite P 302)  
Production of X-rays, absorption, scattering, X-ray spectra, refraction. Theory and application of the diffraction of X-rays in matter to the determination of the structure of crystals. Introduction of crystallography.

P 401 ELECTROMAGNETIC THEORY  Cr. 3  
(Prerequisite M 202, M 455)  
A study of Maxwell's equations; plane waves; radiation; theory of antennas and wave guides.

P 402 HYDRODYNAMICS  Cr. 3  
(Prerequisite P 302)  
Theory of ideal, incompressible flow. Basic flow equations for two and three dimensional flow, stream function, velocity potential, conformal mapping, one and two dimensional compressible flow theory.

P 403, 404 THERMODYNAMICS  Cr. 3  
(Prerequisite P 302)  
Relationships for P-V-T data on pure substances. Examination of the Thermodynamic energy relationships for pure substances. First and Second Laws. Phase and chemical equilibria.

P 412 ATOMIC AND NUCLEAR PHYSICS  Cr. 3  
(Prerequisite P 401)  
Experimental foundation of quantum physics. Limitations of classical physics, photons, de Broghe waves. Internal structure of atoms and quantization.

P 413 ATOMIC AND NUCLEAR PHYSICS  Cr. 3  
(Prerequisite P 412)  
The vector model of the atom, Pauli exclusion principle and the periodic table of the elements.

P 422 EXPERIMENTAL ATOMIC PHYSICS  Cr. 2  
(Prerequisite or concurrent P-412)  
Laboratory experiments in modern physics. Millikan oil drop method, charge to mass ratio of electrons, Rutherford scattering.

P 423 EXPERIMENTAL ATOMIC PHYSICS  Cr. 2  
(Prerequisite P 422)  
Continuation of P 422. Discreteness of atomic and molecular structure, and wave-corpuscle dualism. Experiments on absorption spectra, X-ray emission spectra, photoelectric effect, Zeeman effect, Faraday effect.

P 434 INTRODUCTION TO SOLID STATE PHYSICS  Cr. 3  
(Prerequisite P 413)  
Free electron theory of metals and semiconductors. The band approximation; zone structure; the Hall effect and properties of semiconducting materials.

P 435 INTRODUCTION TO NUCLEAR PHYSICS  Cr. 3  
(Prerequisite P 413)  
An introduction to the study of the nucleus. Correlation of experimental evidence with theory; alpha and beta decay; gamma radiation; meson theory and the fundamental particles. Cosmic rays.

P 450 PHYSICS OF THE ATMOSPHERE AND SPACE  Cr. 3  
(Prerequisite M 301 and P 302)  
Study of the model of the atmosphere, and space, from the ground level to Intergolates Space. Atmosphere of the sun, planets and moons will be investigated and the effect of solar storms on their behavior.

P 491 EXPERIMENTAL RESEARCH—THESIS  Cr. 3  
(Prerequisite—Permission of the instructor)  
Introduction to experimental research techniques by participation in active research program. Familiarization with research laboratory equipment and techniques. Selection of thesis re-
search project and presentation by each student to the group. Designed to bridge the gap between elementary laboratory and research in modern physics.

P 492 EXPERIMENTAL RESEARCH—THESIS Cr. 3
Continuation of P 491.

P 510 ELECTRICAL DISCHARGES IN GASES Cr. 3
(Prerequisite P 302)
Fundamental processes of electron emission from cathodes and interaction with gas. High frequency discharges. Townsend discharge, Geiger Mueller tubes, cathode fall, plasma, glow discharges and arcs.

P 515 ADVANCED DYNAMICS Cr. 3
Dynamics, Newton's laws, inertial and non-inertial reference frames; displacement and motion of a particle and of a rigid body; potential function, equation; central forces, Newton's law of universal gravitation, Kepler's laws; dynamics of a system of particles and of rigid bodies; Euler's equation and equations of motion of a free rigid body; generalized coordinates and the method of Lagrange, Hamilton's principle and least action, canonical equations of Hamilton.

P 516 WAVE EQUATION AND RELATIVITY Cr. 3
Waves and vibrations, wave equation and related characteristics, eigenvalues, vibrating string, membrane and sphere; Theory of Relativity, basic postulates, generalization of the Galileo transformations, Lorentz transformations, determination of distances and synchronization of clocks, time sequence of events.

P 517 ADVANCED ELECTROMAGNETIC THEORY Cr. 3
Electrostatics, conductors and dielectrics, electrostatic boundary value problems, magnetostatics, double dipole layers, potentials; electromagnetism, Ampere's theorem, circuitual theorem, vector and scalar potentials, Maxwell's equations; electromagnetic radiation, Poynting Vector, electromagnetic wave propagation, refraction and reflection; Coulomb field, atomic structure.

P 520 ASTROPHYSICS Cr. 3
Analysis of light, solar spectrum, the sun's light and energy; properties and structure of interstellar and interplanetary space; diameters of the stars; constitution and evolution of the stars; physics of the nebulae and galaxies; relativity and cosmology.

P 530 QUANTUM MECHANICS I Cr. 3
(Prerequisite P 515)
The new concepts necessary to explain the experimental observations of modern physics lead to quantum mechanics which will be treated primarily using the Schroedinger equation; energy levels and wave functions, wave packets, motion of a free particle, electron spin, spin-orbit forces, spectroscopic term classification, radiation and radiative transitions, the Pauli principle, atomic shell structure and quantum statistics.

P 531 QUANTUM MECHANICS II Cr. 3
(Prerequisite P 530)
This term is concerned with the application of quantum mechanics to the solution of practical engineering and scientific problems.

P 535 SOLID STATE PHYSICS Cr. 3
(Prerequisite P 530)
Classification of solids and crystal structures; Lattice Energy of Ionic Crystals; Elastic Constants of Crystals; Lattice Vibrations; Thermal Properties of Solids; Dielectric Properties; Ferroelectric Crystals; Diamagnetism, Paramagnetism, Superconductivity; Free Electron Theory of Metals; Band Theory of Metals; Semiconductors.

P 537 MOLECULAR VIBRATION Cr. 3
(Prerequisite P 530)
Vibration of Molecules; Wave Mechanics and Molecular Vibration; More Advanced Methods of Studying Vibrations; Symmetry Considerations; Application of Group Theory to the Analysis of Molecular Vibration; Vibration Selection Rules and Intensities; Potential Functions; Methods of Solving the Secular Determinant.

P 540 NUCLEAR PHYSICS I Cr. 3
(Prerequisite P 435)
Experiments and theoretical principles underlying our understanding of the fundamental properties of nuclei; nuclear masses and binding energies; alpha, beta and gamma ray spectra; Nuclear models.
P 541 NUCLEAR PHYSICS II  
(Prerequisite P 540)  
Elementary particles; scattering of protons and neutrons; nuclear reactions; energy release; cross section; resonance effects; nuclear levels; fusion and fission; origin of the elements.

P 550 PHYSICAL OPTICS  
(Prerequisite P 350)  
Study of Wave Motion; reflection and refraction on Huygen's Principle; Lenses, Dispersion; Spectrum; Interference; Diffraction; Fraunhofer Diffraction; Double Refraction; Plane Polarized Light; Rotary Polarization, Electromagnetic Theory of Light.

P 558 QUANTUM ELECTRONICS  
(Prerequisite P 530)  
Molecular Beam Masers; Atomic Beam Oscillator; Parallel Plate Resonators; Atomic Frequency Standards and Clocks; Optical Pumping; Parametric Amplifiers.

P 560 MAGNETOHYDRODYNAMICS  
(Prerequisite P 517)  
Study of the interaction of moving and conducting fluids with magnetic fields and their application to energy device development; plasma acceleration studies; application to space propulsion; magnetogasdynamic shock layer flow; space-charge waves and plasma diagnostics; microwave reflection and absorption by a non-uniform plasma sheath; thermonuclear power.

P 570 SPECIAL TOPIC IN PHYSICS  
The student may sign up for a special topic if he has the sponsorship of an instructor, and has the consent of the Chairman. Four (4) copies of a report on the topic must be made, one each for the school library, Chairman, sponsoring instructor, and a personal copy.

P 580 STATISTICAL MECHANICS  
(Prerequisite P 404)  
Classical statistical mechanics; system phase space; representative ensembles; the ergodic surmise; Liouville theorem; point-mass perfect gas; molecular distribution; the most probable distribution; temperature; entropy; Boltzmann's distribution; equipartition of energy; second law of thermodynamics; entropy and probability; relativity and statistical theory.

P 605 THESIS  
Individual work under the direction of a member or members of the graduate faculty on a selected topic in the field of physics.

PHILOSOPHY

PH 131 INTRODUCTION TO PHILOSOPHY  
Cr. 3  
A survey of classical philosophy with selected reading and discussion of the works of the great philosophers of history.

PH 331,332 LOGIC  
Cr. 3, 3  
A study of the principles of reasoning involved in normal human thought processes. The inter-relationship of logic, philosophy, and mathematics.

PSYCHOLOGY

PS 141,142 GENERAL PSYCHOLOGY  
Cr. 3, 3  
Study of the principles of psychology of normal behavior. Prerequisite to all courses.

PS 241 INDUSTRIAL PSYCHOLOGY  
Cr. 3  
A survey of the uses of psychology in industry. Topics include: selection, placement and training of workers; familiarization with tests commonly used in industry; significance of individual differences; factors influencing attitude and morale; causes of job dissatisfaction; analysis of individual problems.

SOCIOLOGY

S 261 PRINCIPLES OF SOCIOLOGY  
Cr. 3  
A systematic explanation of man's social nature, types of groups and institutions, social processes and social change.

S 262 PRINCIPLES OF SOCIOLOGY  
Cr. 3  
An analysis and suggestions for dealing with contemporary problems in modern society: i.e., crime, poverty, alcoholism, juvenile delinquency and social welfare.
S 263 PRINCIPLES OF SOCIOLOGY Cr. 3
A social psychological analysis of social controls such as folkways, customs, fashions, attitudes, etc.

SPACE TECHNOLOGY

ST 300 INTRODUCTION TO SPACE TECHNOLOGY Cr. 3
Introductory study of space vehicle systems; rocket propulsion; guidance; telemetry; controls, instrumentation and tracking networks; communications; celestial mechanics and cosmology; geophysics and astrophysics; space medicine and geodesy.

ST 311 MECHANICS OF FLIGHT I Cr. 3
Fundamental principles of aerodynamics, air foil theory, lift and drag, control surfaces and stability.

ST 312 MECHANICS OF FLIGHT II Cr. 3
(Prerequisite ST 311)
Analysis of forces acting on aircraft and spacecraft. Determination of vehicle performance and trajectories.

ST 351, 352, 353 SPACE TECHNOLOGY SEMINAR Cr. 1, 1, 1

ST 411 PROPULSION I Cr. 3
(Prerequisite Thermodynamics)
Fundamental principles of operation and performance of ramjet, turbojet, turboprop and turbofan, reciprocating engine, and chemical rocket propulsion systems.

ST 412 PROPULSION II Cr. 3
(Prerequisite ST 411)
Fundamental principles of operation and performance of nuclear, electrical, plasma and solar sail propulsion systems.

ST 421 STRUCTURE DESIGN Cr. 3
(Prerequisite ST 412)
Fundamental principles of operation and design of structures and components of launch vehicles and satellites.

ST 431 ASTRODYNAMICS Cr. 3

ST 451, 452, 453 ADVANCED SPACE TECHNOLOGY SEMINAR Cr. 1, 1, 1

ST 460 PRINCIPLES OF GUIDANCE AND CONTROL I Cr. 3
Basic principles of navigation, electromagnetic and gravity fields, radio, inertial and radio-inertial guidance systems.

ST 510 ROCKET PROPULSION I Cr. 3
(Prerequisite P 403 or ME 403)
Thrust equation and performance parameters; development of the differential equations for fictionless, one-dimensional fluid flow with heat addition and area change; application of the differential equations to rocket propulsion; rocket nozzle design; application of propulsion principles to chemical, nuclear, and electrical propulsion systems.

ST 511 ROCKET PROPULSION II Cr. 3
(Prerequisite ST 510)
Liquid propellant Rocket power plants; injection systems design and test; combustion chambers, heat transfer, feed systems, controls and instrumentation; properties, storage and handling of liquid propellants; design of a typical liquid propellant rocket power plant.

ST 512 ROCKET PROPULSION III Cr. 3
(Prerequisite ST 511)
Solid Propellant Rocket Power Plant; configuration and composition of various solid propellant grains; performance parameters; controls and instrumentation, properties, storage and handling of solid propellants; design of a typical solid propellant rocket power plant. Types of exotic propulsion systems and comparison with chemical propulsion systems.

ST 513 ADVANCED ROCKET PROPULSION Cr. 3
(Prerequisite ST 512)
Properties, storage, and handling of cryogenic propellants;
performance of cryogenics; types of nuclear rocket reactors, performance of nuclear rocket systems; principles of plasma dynamics and electrostatics; ion, plasma, and photo propulsion system fundamentals.

ST 514 NUCLEAR REACTOR PRINCIPLES Cr. 3
Introduction to nuclear reactor principles, steady state and transient behavior, materials, heat transfer fluid flow, reactor and nuclear rocket testing and safety considerations.

ST 530 INERTIAL GUIDANCE I Cr. 3
(Prerequisite EE 406)
Theory of inertial navigation; rocket vehicle guidance; error analysis; performance optimization, performance analysis; application to space missions.

ST 531 INERTIAL GUIDANCE II Cr. 3
(Prerequisite ST 530)
Theory of inertial sensing devices; testing of inertial components; stable platforms; initial conditions and platform alignment; steering dynamics and control system integration.

ST 540 ASTRODYNAMICS I Cr. 3
(Prerequisite M 202)
Basic principles of applied mechanics applied to the calculation of orbits of planets and satellites. The Solar system; the central force field, orbit determination; perturbation analysis; introduction to celestial navigation.

ST 541 ASTRODYNAMICS II Cr. 3
(Prerequisite ST 540)
Three body problem; special and general perturbation; ballistic missile trajectory; ascent into the perturbation of satellite orbit; orbit transfer; liberation points in earth-moon system.

ST 542 GEODESY I Cr. 3
Techniques of measurement of large portions of the earth's surface; form and dimensions of the earth; ellipticity; utilization of observations of the stars; use of ballistic cameras in geodesy.

ST 543 GEODESY II—THEORETICAL GEODESY Cr. 3

ST 550 RANGE INSTRUMENTATION I—OPTICAL Cr. 3
(Prerequisite P 301)
types of optical instrumentation used in tracing launch vehicles and satellites; design principles and operation of these instruments; computation of trajectory from data; capabilities and limitations.

ST 552 RANGE INSTRUMENTATION II—TELEMETRY Cr. 3
Introduction and historical background methods of radio telemetry; signal processing; typical ground borne systems; ancillary considerations.

ST 553 RANGE INSTRUMENTATION III— PULSE RADAR Cr. 3
Pulse radar principles and basic operating equations; range and angle measurements; precision radar techniques; performance evaluation: acquisition; tracking of missiles and space vehicles.

ST 554 RANGE INSTRUMENTATION IV—C. W. RADAR Cr. 3
C. W. radar principles; tracking systems and systems equations.

ST 570 COMMUNICATIONS AND TRACKING NETWORKS Cr. 3
Earth to earth links; earth to space vehicle links; earth to artificial satellite to space vehicle links; communication equipment design including transmitters, receivers, antennas, frequency, optics, control and relay stations.

ST 580 SPACE MEDICINE Cr. 3
Role of man in the space program; review of the physiology of the cardio-pulmonary and nervous systems; dynamic forces, acceleration, deceleration and weightlessness; life support sys-
tems, oxygen-respiration requirements, waste disposal, closed ecological systems, CO₂ disposal, nutritional requirements, pressure suits; medical monitoring and data acquisition systems; radiation; psychological aspects of isolation and confinement, perception-reaction, stress factors and stress relieving systems, day-night cycle, work-adaptation to environment.

ST 585 ANALYSIS OF A MANNED SPACE CRAFT Cr. 3
The problems associated with designing, establishing and maintaining a manned earth-orbiting space craft will be considered, including the following: space craft configuration; artificial gravity versus gravity-free environment; structural problems; space power requirements; human factors and safety; vehicle and orbital stabilization and control problems; booster requirements for placing the craft in orbit; rendezvous and resupply operations.

ST 590 MAN-MACHINE PROCESSES
Optimum operation and maintenance of large complex systems where man plays a leading role. Psychophysiological operator response, environmental problems.

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B.S. in Electrical Engineering 1963)
Thomas M. Farr, Associate in Engineering (1961)
James L. Fay, Associate in Engineering (1962)
Alexander A. Fischback, III, Associate in Engineering (1962)
Gary Carl Gast, M.S., Space Technology (1963)
Johnny W. Gillis, Associate in Engineering (1963)
Raymond Henry Gompf, M.S. Space Technology (1962)
Paul J. Greenawalt, Associate in Engineering (1961)
Charles Donald Grosick, Associate in Engineering (1961); B.S. in Electrical Engineering (1963)
Walter C. Hardesty, Associate in Engineering (1961)
Carl E. Harris, Associate in Engineering (1962)
Dale Eugene Hull, Associate in Engineering (1963)
James Nelson Irwin, Associate in Engineering (1962)

Edward T. Johnson, Associate in Engineering (1961)
Richard B. Jones, M.S., Space Technology (1961)
John H. Jory, M.S. Space Technology (1962)
Herman N. Kasser, Associate in Science (1962)
Elmer L. Keesler, Associate in Engineering (1962)
John W. Korpal, M.S., Space Technology (1963)
John George Krampert, Associate in Engineering (1963)
Bert K. Kreinbring, Associate in Engineering (1962)
Robert G. Kunze, Associate in Engineering (1962)
Cecil J. Leaney, Associate in Engineering (1962)
Frederick Littleton LeMosy, Associate in Engineering (1963)
Ernest Major Lindley, Associate in Science (1963)
David William Lindsay, Associate in Engineering (1963)
Donald Wells Mangold, Associate in Engineering (1963)
Joseph L. McCracken, Associate in Engineering (1961)
Troy L. McDavid, Associate in Engineering (1962)
John F. McGehee, M.S., Applied Mathematics (1961)
Robert L. Mears, Associate in Engineering (1962)
Theodore P. Meier, Associate in Engineering (1962)
Franklin M. Miller, M.S., Applied Mathematics (1961)
Robert Miller, Associate in Engineering (1961)
Terence H. Murdock, B.S., Mathematics (1962)
Donald Arthur Neal, M.S., Space Technology (1963)
Raymond J. Phillips, Associate in Engineering (1962)
Richard J. Pulley, Associate in Engineering (1962)
Peter C. Ray, M.S., Applied Mathematics (1961)
Chester V. Reator, M.S., Space Technology (1962)
David Alexander Ritchley, Associate in Engineering (1963)
Daniel Epling Rorrer, M.S., Space Technology (1963)
William A. Rowley, Associate in Engineering (1962)
Thomas G. Rutherford, B.S., Electrical Engineering; M.S., Space Technology (1962)
George N. Sirbola, M.S., Space Technology (1962)
F. Courtney Stone, Associate in Science (1961)
Robert L. Stubbins, M.S., Space Technology (1963)
Phillis Surwillo, M.S., Space Technology (1962)
J. Nolley Trapp, Associate in Engineering (1962)
Harry Leon Turner, Associate in Science (1961); B.S. in Mathematics (1963)
John A. Vallee, Associate in Engineering (1961)
Paul I. Waite, Associate in Engineering (1962)
James Ludwig Wall, Jr., M.S., Space Technology (1963)
Cyrus Ely Warden, Jr., Associate in Science (1962)
Walter B. Wheeler, Associate in Engineering (1962)
Sanford Adrian White, M.S., Space Technology (1963)
Thomas Charles Wirth, Associate in Engineering (1962)
Jack H. Williams, M.S., Space Technology (1963)
Ray A. Work, Jr., M.S., Space Technology (1961)
John R. Wright, M.S., Applied Mathematics (1961)
Russell V. Zimmerman, Associate in Engineering (1962)

BUILDING DEDICATION

A complete classroom building was built and donated to the college by financial institutions and industries in the community. Honored names on this classroom building are:

ABCO Concrete Company, Inc.
Burnup & Sims, Inc.
First Federal Savings & Loan Association of Brevard County
First National Bank of Eau Gallie
First National Bank of Melbourne
Florida Power and Light Company
Southern Bell Telephone and Telegraph Company

A science and engineering laboratory was built, furnished, and donated to the college by aerospace firms in the Cape Canaveral area. Honored names on the laboratory building are:

AC Spark Plug Division of General Motors
Aerospace Corporation
Chrysler Corporation
Lockheed Aircraft Corporation
Martin Company, Canaveral Division
Radiation, Inc.
Radio Corporation of America
The Boeing Company
TRW Space Technology Laboratories

FRIENDS OF THE LIBRARY

Dedicated persons in the community who donate their time and talent in serving the college library are called Friends of The College Library. The members are:

Mrs. Mary Germond
Mrs. Mary McElhaney
Mrs. Madge Stoms
Mrs. Janice Way
Mrs. Sue Ann Field
Mrs. Betty Douglass
## RECIPIENTS OF HONORARY DEGREES

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<th>NAME</th>
<th>DEGREE</th>
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<td>1962</td>
<td>Astronaut Virgil &quot;Gus&quot; Grissom</td>
<td>Doctor, Space Science</td>
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<td>1962</td>
<td>The Honorable Tom Adams</td>
<td>Doctor, Space Education</td>
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<tr>
<td>1963</td>
<td>Major General (Ret.) John B. Medaris</td>
<td>Doctor, Space Science</td>
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<tr>
<td>1963</td>
<td>President Hugh F. McKean (Rollins College)</td>
<td>Doctor, Space Education</td>
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# HONORARY ALUMNI ASSOCIATION

The Brevard Engineering College has not yet reached the age when it may look to its alumni for substantial financial support. Therefore, an Honorary Alumni Association has been created to provide this life giving service to the College. Its membership is made up of citizens of the community who, as individuals, willingly and generously support the college in its formative years. They will long be remembered for their constant faith in the college.

### Life Members
- Mr. V. C. Brownlie
- Mr. Homer Denius
- Mr. James C. Ray
- Mr. Fred S. Roberts
- Mr. George Shaw
- Mrs. George H. Wood

### Regular Members

1964
- Mr. Philander Betts
- Mr. Lawrence Connel
- Dr. Charis S. Cummings, II
- Dr. Dan Dahle
- Mr. F. George duPont
- Mr. William S. Fenner
- Mr. William L. Graham
- Mr. Percy Hedgecock
- Mr. Elton Hall
- Mr. Fielding Hills
- Mr. Neill Johnson
- Mrs. Archie Kerr
- Mr. W. F. Kennedy
- Dr. Jerome P. Keuper
- Mr. Richard Lawrence
- Mr. Alex Lindsay
- Dr. Robert Lindemann
- Mr. Norman S. Lund
- Mr. Kenneth M. McLaren
- Mr. Clifford E. Mattox
- Mr. Donald Merritt
- Mrs. Elliot C. Newell
- Mrs. Jean Risher
- Mrs. Josephine A. Schaefer
- Mr. Jeff W. Speck
- Mr. O. E. Tibbs
- Mr. Ray A. Work
BREVARD ENGINEERING COLLEGE

CALENDAR OF EVENTS

WINTER 1964
Jan. 2, Thurs. Classes begin
Jan. 8, Wed. Last day for registration and full tuition refund
Jan. 16, Thurs. Faculty meeting—(No evening classes)
Feb. 5, Wed. Last day for withdrawal
Feb. 21, Fri. Holiday (Washington's Birthday)
Mar. 13, Fri. Last day of classes
Mar. 14-19 Final exams
Mar. 20-25 SPRING VACATION

SPRING 1964
Mar. 26, Thurs. Classes begin
Apr. 1, Wed. Last day for registration and full tuition refund
Apr. 29, Wed. Last day for withdrawal
May 7, Thurs. Faculty meeting (No evening classes)
May 29, Fri. Holiday (Memorial Day)
June 5, Fri. Last day of classes
June 6-11 Final exams
June 12-July 5 SUMMER VACATION

SUMMER 1964
July 6, Mon. Classes begin
July 11, Sat. Last day for registration and full tuition refund
July 16, Thurs. Faculty meeting (No evening classes)
Aug. 8, Sat. Last day for withdrawal
Sept. 7, Mon. Holiday (Labor Day)
Sept. 15, Tues. Last day of classes
Sept. 15-21 Final Exams
Sept. 22-28 FALL VACATION

FALL 1964
Sept. 28, Mon. Psychological test for all new undergraduates
Sept. 29, Tues. Classes begin
Oct. 5, Mon. Last day for registration and full tuition refund
Oct. 6, Tues. Faculty meeting (No evening classes)
Nov. 2, Mon. Last day for withdrawal
Nov. 11, Wed. Holiday (Veterans' Day)
Nov. 26-29 Thanksgiving Recess
Dec. 12, Sat. Last day of classes
Dec. 14-17, 19 Final Exams
Dec. 20-Jan. 3 CHRISTMAS VACATION

WINTER 1965
Jan. 4, Mon. Classes begin

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