STUDENT GUIDE:

ENGINEERING PREPARATION AT THE UNIVERSITY OF OREGON
INCLUDING THE 3/2 PROGRAM WITH OREGON STATE UNIVERSITY
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<table>
<thead>
<tr>
<th>CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contacts for Engineering Preparation Information</td>
</tr>
<tr>
<td>Cover</td>
</tr>
<tr>
<td>1. General Information</td>
</tr>
<tr>
<td>2. Engineering Preparation Options</td>
</tr>
<tr>
<td>3. High School Preparation</td>
</tr>
<tr>
<td>4. Engineering Preparation Requirements</td>
</tr>
<tr>
<td>5. A Word of Caution</td>
</tr>
<tr>
<td>6. The Cooperative UO-Lane Engineering Preparation Program</td>
</tr>
<tr>
<td>7. Process for Enrolling in Lane Courses Under Joint Program</td>
</tr>
<tr>
<td>8. Sample Transfer Program</td>
</tr>
<tr>
<td>9. The Physics/Engineering 3/2 Program</td>
</tr>
<tr>
<td>10. Admission to the 3/2 Program</td>
</tr>
<tr>
<td>11. Institutional Requirements</td>
</tr>
<tr>
<td>12. Transferring to OSU College of Engineering</td>
</tr>
<tr>
<td>13. Descriptions of UO and Lane Engineering Preparation Course Offerings</td>
</tr>
<tr>
<td>Notes</td>
</tr>
</tbody>
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ENGINEERING PREPARATION AT THE UNIVERSITY OF OREGON

1. GENERAL INFORMATION

Graduates with baccalaureate degrees in engineering are needed in our technological society to solve practical problems by the application of physical science principles and mathematics. While it is sometimes difficult to define the difference in outlook between a career in one of the physical sciences, and a career in engineering, engineering solutions to problems are usually much more influenced by practical and economic considerations.

A student with a major in a field of engineering has a number of career opportunities. He or she may choose to work for private industry or for government. An engineer may work in research and development, design, production, operations, or sales. Engineers with sufficient experience and background may advance to management or consulting positions. Another option is to continue studies in graduate school leading to careers in university teaching and advanced research.

At OSU there are two academic phases in earning a baccalaureate degree in an engineering field: (1) engineering preparation, consisting of at least two years of course work, before admission to a professional engineering program; (2) professional engineering, consisting of at least two years of course work at a school of engineering, leading to a Bachelor of Arts or a Bachelor of Science degree in engineering. Engineering graduates may become licensed professional engineers after four years of employment in their field of specialization and successful completion of state license examinations. At other institutions who award engineering degrees, the overall pattern of courses will be similar; however, the two-phase structure may not necessarily be used.

**UO does not offer a degree in engineering**, but does provide students opportunities to complete the first phase of the engineering degree. Options for students include an engineering transfer program and the 3/2 program. Students in the engineering transfer program transfer to OSU or another institution after completing the courses that correspond to the first two years of engineering school. Typically these courses are **calculus, physics with calculus and general chemistry**. Students in the 3/2 program complete additional courses in physics at the UO and earn a physics degree from UO and an engineering degree from OSU. Some students choose to first earn a physics degree and then pursue a graduate degree in engineering or a related field.

2. ENGINEERING PREPARATION OPTIONS

The selection of the best path to an engineering degree depends on many factors. The options offered by the University of Oregon are best for students that want a broader science and liberal arts background than would normally be offered in conjunction with an engineering degree. UO offers courses in physics, chemistry and mathematics that are basic to the academic preparation of either a scientist or an engineer. Students who pursue engineering preparation at UO should be aware that the broader course background involves more credit hours than would be the case at OSU or in an engineering transfer program at a community college. The UO program may also be of interest to students who are unsure of their career direction and wish to begin their preparation at the UO where a variety of academic options are readily available. Since the engineering preparation programs in specialized engineering schools are crowded and competitive; some students will benefit from a less directed beginning to their university studies, allowing them to experiment with career choices.
Students interested in obtaining an engineering degree in the shortest possible time should consider an engineering transfer program at a community college such as Lane Community College (Lane), or by directly enrolling at an engineering school such as OSU. These programs are highly structured and allow the students to complete their requirements in a minimum amount of time. In those instances where a student is very close to completing an Associate of Arts Oregon Transfer Degree (AAOT) or a UO Bachelor’s degree in a subject other than physics, the quickest path to completing a degree at OSU may be to finish the AAOT or Bachelor’s degree before entering OSU.

3. HIGH SCHOOL PREPARATION

High school students interested in an engineering career are urged to complete as much mathematics and science as possible in high school. Students with insufficient mathematics preparation encounter serious delays in college. Four years of high school mathematics (including advanced algebra, trigonometry, and elementary functions) should be completed in order to begin calculus and physics the freshman year at the University. If possible, AP or IB calculus and chemistry courses should be taken in high school.

The UO Mathematics department administers a placement test to all students without prior college calculus or AP calculus credit and adheres to the results of the test rigorously. High school science courses in physics and chemistry are recommended. Reading, writing and speaking skills are highly valued in engineering and a foreign language is always recommended.

4. ENGINEERING PREPARATION REQUIREMENTS

The requirements below are designed for students planning to transfer to the Oregon State University (OSU) College of Engineering. While engineering preparation requirements at other engineering schools are similar, students should obtain an advising guide from the schools of interest.

Engineering preparation students should be aware that candidates at OSU must earn 180 credits or more for a baccalaureate degree in engineering. In practice, students in the transfer program must complete considerably more credits because almost all UO courses are four credits while the equivalent OSU course are often only three credits. To complete the transfer program, five or more years are often required.

The Department of Physics also offers a three-plus-two program which will allow a student to earn a baccalaureate degree in physics from the University of Oregon and a baccalaureate degree in engineering from OSU by completing three years of study here and two in the OSU College of Engineering. This program is described in section 10.
5. A WORD OF CAUTION

Completion of suggested curricula listed in this advising manual does not guarantee admission to the professional engineering program at OSU or any other school. Students completing the courses listed below before admission may still need to take several introductory engineering courses at OSU before they can be admitted to the professional program. Once admitted to the professional engineering program, there may be additional prerequisites, which are taught at neither UO nor LANE, that prevent students from taking the upper level engineering courses in the optimal order. The various engineering departments at OSU also reserve the right to deny admission to students below a minimum grade point average. Students wishing to know the exact grade point requirement, which varies from one department to another and from year to year, should consult the Head Engineering Advisor at OSU. **In general, your GPA in the UO pre-engineering program should be at least 3.0 if you are to successfully transfer.**

6. THE COOPERATIVE UO-Lane ENGINEERING PREPARATION PROGRAM

Lane began their engineering preparation program in 1979 and UO began theirs in 1983. Both Lane and UO offer programs which can lead a student to successful admission at any engineering college in the U.S. including OSU. But there are some gaps in the detailed offerings at both institutions. The cooperative program allows students at one institution to take courses at the other.

Lane provides Statics, Dynamics and Strength of materials sequence ENGR 211-13, Engineering Orientation GE 101, Engineering Graphics GE 115 and Electrical Fundamentals, ENGR 221. UO makes available courses such as Foundations of Physics I (PHYS 251, 252, 253) and Foundations of Physics II (PHYS 351). Students who are full-time pre-engineering students at one institution are currently permitted to register in any of the approved courses (see list below) at the other institution with no additional fee. Note that these course offerings do not include certain prerequisites for upper level engineering courses normally taken in the engineering preparation stage at OSU. For example, upper level courses in Mechanical Engineering require OSU ENG 248 (Solid Works), upper level courses in Electrical Computer Engineering require ECE 272 (Digital Design Lab), ENG 202,203 (Electrical Fundamentals, 2nd and 3rd term) and upper level courses in Bioengineering require BIOE 211 and BIOE 212.

**Approved Courses**

<table>
<thead>
<tr>
<th>Lane</th>
<th>UO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Graphics ENG 115</td>
<td>Foundations of Physics I, PHYS 251,252,253</td>
</tr>
<tr>
<td>Engineering Orientation ENG 101</td>
<td>Foundations of Physics II, PHYS 351</td>
</tr>
<tr>
<td>Statics, Dynamics &amp; Strength of Materials</td>
<td>Introductory Physics Laboratory PHYS 290</td>
</tr>
<tr>
<td>ENGR 211, 212, 213</td>
<td>Differential Equations, MATH 256</td>
</tr>
<tr>
<td>Electrical Fundamentals ENGR 221</td>
<td>Calculus III, MATH 253</td>
</tr>
<tr>
<td>General Physics with Calculus</td>
<td>Linear Algebra, Math 341, 342</td>
</tr>
</tbody>
</table>
PHYS 211, 212, 213 Vector Calculus, MATH 281, 282
7. PROCESS FOR ENROLLING IN LANE COMMUNITY COLLEGE COURSES
UNDER JOINT UO-LANE PREENGINEERING PROGRAM

1. Discuss course work plans with the engineering preparation advisor, UO Physics
   Department.

2. Enroll for at least 12 Credit hours at the UO.

3. Obtain the Lane Community College/University of Oregon Pre-Engineering Program
   Certification of Registration Eligibility form and have it signed by the UO Registrar.
   (Contact UO Office of the Registrar, second floor Oregon Hall and ask for Linda
   Kizer-Paquette, 346-3184.)

4. Look for courses in the Lane class schedule (http://www.lanecc.edu). Apply for
   admission to Lane and register using ExpressLane for the Lane engineering class. If
   you use a UO course for a Lane prerequisite, it may be necessary to contact the
   department concerned to have the UO prerequisite approved.

5. After the registration, submit the completed eligibility form (described in #3 above)
   to Enrollment Services, Building 1 (Lane) or mail it to PO Box 7100, Eugene, Or,
   97401-0025.

6. Attend first day of Lane class whether or not you have completed the LANE CC
   registration (Lane classes may start as much as a week earlier than the UO). See time
   schedule for the first day of classes. (Lane books are at the Lane Bookstore, Center
   Building.)

7. The tuition for the Lane course will be waived, but this will not happen until after the
   refund drop period has ended. Students are responsible for all fees i.e., student
   activity fee, transportation fee, technology fee. Students can access their account
   summary and pay their fees using ExpressLane before the term ends.
8. SAMPLE TRANSFER PROGRAM

The following sample program is for students prepared to begin calculus in their freshman year. Courses marked with an asterisk (*) are required by most the engineering departments. Make sure you study this list and plan a program before talking to an advisor about this. Be prepared.

**Freshman Year**  
51 credits

- *Foundations of Physics I (PHYS 251, 252, 253) 12
- *Introductory Physics Laboratory (PHYS 290) 3
- *Calculus (MATH 251, 252, 253) 12
- *Concepts of Computing: Algorithms and Programming (CIS 122) 4
- *General Chemistry\(^1\) (CH 221,222) 8
- *General Chemistry Lab (CH 227,228) 4
- College Composition I (WR 121) 4
- Arts & Letters or Social Sciences 4

**Sophomore Year**  
48 credits

- Foundations of Physics II (PHYS 351,352,353) 12
- *Introduction Differential Equations (MATH 256) 4
- *Several-Variable Calculus\(^2\) (MATH 281,282) 8
- *Elementary Linear Algebra\(^3\) (MATH 341,342) 8
- *Statics, Dynamics (ENGR 211,212) 8
- *Strength of Materials or Electrical Fundamentals\(^4\) (ENG 221 or 213) 4
- Arts & Letters or Social Sciences 4

\(1\) (Three terms of Chemistry are required for some OSU programs.)

\(2\) (UO Vector Calculus 281, 282 is equivalent to OSU 254, 255.)

\(3\) (UO MATH 253 and 341 will substitute for OSU MATH 306, MATH 342 is recommended, but not required.)

\(4\) (Depends on engineering department, some require both.)

Note that all required engineering preparation courses must be completed with a grade of C or better for admission to the OSU College of Engineering Professional Program (contact OSU for details concerning repeated courses). There is considerable variation in engineering preparation requirements between engineering departments. Students should consult the flowcharts given at [http://www.engr.orst.edu/students/charts/](http://www.engr.orst.edu/students/charts/) for details. In addition to the requirements for admission to the professional program, there may be additional prerequisites for taking courses in the professional program. For example, in Mechanical Engineering, a graphics course that involves the program “Solid Works” is required. Unfortunately, such a course is not presently available at either Lane or UO. For Electrical and Computer Engineering, Discrete Math (UO Math 231) is required as are three terms of Electrical Fundamentals (ENGR 201-203). Only one term of Electrical Fundamentals (Lane ENGR 221) is available at LANE.

Other UO courses which satisfy OSU engineering requirements include a technical writing course such as UO WR 320, a biological science course which includes a laboratory such as UO BI 120 (Reproduction and Development) or UO BI 121 (Human Physiology), and a statistics course such as UO MATH 425. All of these courses should be selected in consultation with an
adviser. Different fields of engineering require specific courses to fulfill these requirements: see Section 13.
9. THE PHYSICS/ENGINEERING 3/2 PROGRAM

The Physics/Engineering 3/2 Program is designed to give the student a thorough knowledge of the physics and mathematics fundamental to all fields of engineering as well as an in depth knowledge of a particular field of engineering. Ideally, the first three years of the program are spent at the University of Oregon, and the last two years are spent at Oregon State University*. In practice more time may be needed to fulfill all of the requirements.

Two degrees are awarded upon completion of study -- a B.S. or B.A. in Physics from the University of Oregon and a B.S. in Engineering from Oregon State University. A student may specialize in any of the following engineering disciplines:

- Bioengineering
- Chemical Engineering
- Civil Engineering
- Construction Engineering Management
- Ecological Engineering
- Electrical and Computer Engineering
- Environmental Engineering
- Health Physics
- Industrial Engineering
- Manufacturing Engineering
- Mechanical Engineering
- Nuclear Engineering

*Students who complete the 3/2 program are waived from the UO residence requirement of 45 of the last 60 hours on the UO campus. The students, however, must complete a minimum of 90 credits at the UO.

The strong physics and mathematics background that students obtain in the 3/2 program can help them to adapt to future technological developments. It also gives these students the advantages of a liberal arts education in a major research university with a professional education from a major engineering school.

Physics requires completion of the following required lower-division courses or their equivalents: Foundation of Physics I (PHYS 251, 252, 253), Introductory Physics Laboratory (PHYS 290), Calculus I, II, III (MATH 251, 252, 253), General Chemistry (CH 221, 222), Introduction to Differential Equations (MATH 256), Several-Variable Calculus, I, II, (MATH 281, 282). The intermediate physics laboratory requirement can be waived for 3/2 students.

A grade point of C (2.00) or better must be earned in all required physics courses. At least 20 of the upper-division credits must be completed in residence at the University of Oregon. Exception to these requirements must be approved by the physics advising coordinator. Additionally, each 3/2 student must meet the specific OSU requirements for admission into the respective programs.
### SAMPLE 3/2 PROGRAMS

<table>
<thead>
<tr>
<th>First Year</th>
<th>Hours</th>
<th>Required by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus</td>
<td>12</td>
<td>Both</td>
</tr>
<tr>
<td>Physics</td>
<td>12</td>
<td>Both</td>
</tr>
<tr>
<td>Introductory Physics Laboratory</td>
<td>3</td>
<td>Both</td>
</tr>
<tr>
<td>Chemistry</td>
<td>8</td>
<td>Both</td>
</tr>
<tr>
<td>Chemistry Lab</td>
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<td>OSU</td>
</tr>
<tr>
<td>College Composition</td>
<td>8</td>
<td>UO</td>
</tr>
<tr>
<td>Arts &amp; Letters or Social Science¹</td>
<td>4</td>
<td>UO</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>51</strong></td>
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<tr>
<th>Second Year</th>
<th>Hours</th>
<th>Required</th>
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<tbody>
<tr>
<td>Foundations of Physics II</td>
<td>12</td>
<td>UO</td>
</tr>
<tr>
<td>Intermediate Physics Laboratory</td>
<td>4</td>
<td>UO</td>
</tr>
<tr>
<td>Statics²</td>
<td>4</td>
<td>OSU</td>
</tr>
<tr>
<td>Linear Algebra</td>
<td>8</td>
<td>OSU</td>
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<tr>
<td>Programming</td>
<td>4</td>
<td>OSU</td>
</tr>
<tr>
<td>Arts &amp; Letters or Social Science¹</td>
<td>8</td>
<td>UO</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<table>
<thead>
<tr>
<th>Third Year – Physics Emphasis</th>
<th>Hours</th>
<th>Required</th>
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</thead>
<tbody>
<tr>
<td>Mechanics, Electricity &amp; Magnetism</td>
<td>12</td>
<td>UO</td>
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<tr>
<td>Electromagnetism</td>
<td>4</td>
<td>UO</td>
</tr>
<tr>
<td>Quantum Physics</td>
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<tr>
<td>Electrical Fundamentals</td>
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<tr>
<td>Arts &amp; Letters or Social Science¹</td>
<td>20</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>52</strong></td>
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<table>
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<tr>
<th>Third Year – Applied Physics Emphasis</th>
<th>Hours</th>
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<tbody>
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<td>Introduction to Quantum Mechanics</td>
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<td>UO</td>
</tr>
<tr>
<td>Mechanics, Electricity &amp; Magnetism</td>
<td>12</td>
<td>UO</td>
</tr>
<tr>
<td>Electromagnetism</td>
<td>4</td>
<td>UO</td>
</tr>
<tr>
<td>Electronics³</td>
<td>8</td>
<td>Both</td>
</tr>
<tr>
<td>Arts &amp; Letters or Social Science¹</td>
<td>20</td>
<td>UO</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
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¹Some students may wish to defer some of the Arts & Letters and Social Sciences group requirements to the two years at OSU.
²Presently available on UO/LANE CC Cooperative program. OSU will accept PHYS 411 in lieu of ENGR 212.
³In some circumstances PHYS 431 and 432 may be used to substituted for Electrical Fundamentals. Check with OSU advising for details.

Note that the sample program listed above satisfies most UO physics requirements for the B.S. Degree and some OSU engineering requirements. The remaining UO physics requirements can be satisfied with engineering courses taken at OSU. Students who require four years to complete these requirements are encouraged to complete their UO physics degree before enrolling at OSU. The UO and OSU requirements are often revised and are subject to change. Please see information in Section 8 concerning prerequisites for upper level OSU engineering.
courses; these vary by discipline and may be difficult to fulfill at UO. Students are cautioned that there are additional requirements for UO and OSU degrees that must be satisfied while attending OSU.

10. ADMISSION TO THE 3/2 PROGRAM

Before formal admission into the 3/2 program, candidates admitted to UO must obtain the permission of the engineering preparation adviser. Students must be aware that completion of the UO part of this program does not guarantee admission to the professional engineering program at OSU.

11. INSTITUTIONAL REQUIREMENTS

Students at UO entering the engineering preparation program are advised to take their general requirements outside physics, chemistry and mathematics from the UO group requirements. UO and OSU requirements at the lower division level do not vary substantially. Students transferring to OSU on the 3/2 program will generally be presumed to have satisfied UO’s degree requirements by the time of graduation; students that are awarded their UO degree before graduating from OSU will be exempt from the OSU Baccalaureate Core.

Students with specific problems in choosing courses should seek the advice of an advisor. Many curricular changes are in the offing throughout the state.

In the somewhat unlikely event that students wish to graduate with a Bachelor of Arts degree, they must complete two years (or the equivalent) of a foreign language and 36 credits in the Language and Literature fields.

The components of the Oregon State University Baccalaureate Core can be found on the OSU web pages:

http://oregonstate.edu/dept/clasked/bac-core.html

Students in the transfer program can find out if a given course taken at UO will satisfy an OSU requirement by consulting the articulation table at

http://oregonstate.edu/dept/admin/db/OregonTransferCredit-OregonCollegesandUniversities/scr1160_003223.htm

Note that in many cases 3/2 students will only have to satisfy the UO group and multicultural requirements.
12. TRANSFERRING TO OSU COLLEGE OF ENGINEERING

The student should apply for admission to OSU during fall term of their last year at UO, and then to the appropriate Professional Engineering Program in the College of Engineering, OSU, during winter term. A visit to the Head Advisor in the OSU College of Engineering is strongly advised sometime during the application process in order to gain first hand information on the student’s individual situation.

13. DESCRIPTIONS OF UO AND LANE COURSE OFFERINGS

UO PHYSICS COURSES

PHYS 251, 252, 253  Foundations of Physics I (4,4,4)
(First year sequence for physics majors. Mechanics and special relativity are covered in 251; electricity and magnetism are covered in 252; quantum phenomena are covered in 253. Lectures and associated laboratory. Coreq: MATH 251, 252, 253 or equivalent. Prereq: Physics major status or instructor’s permission.

PHYS 290 Introductory Physics Laboratory (1R)
Introduction to laboratory measurements, reports, instrumentation, and experimental techniques. Coreq: PHYS 251, 252, 253. Repeatable twice for a maximum of 3 credits.

PHYS 351, 352, 353  Foundations of Physics II (4,4,4)
Second year sequence for physics majors. The study of wave motion in diverse branches of physics, including mechanical, electrical, optical, and quantum systems. Equations of state, laws of thermodynamics, phase changes, entropy, kinetic theory, collisions, transport, statistical physics. Coreq: MATH 256, 281, 282. Prereq: Physics major status or instructor’s permission.

UO MATHEMATICS COURSES

MATH 111 College Algebra (4)
Algebra needed for calculus including graph sketching, algebra of functions, polynomial functions, rational functions, exponential and logarithmic functions, linear and nonlinear functions. Prereq: MATH 95 or satisfactory placement test score.

MATH 112 Elementary Functions (4)
Exponential, logarithmic, and trigonometric functions; mathematical induction. Intended as preparation for MATH 251. Prereq: MATH 111 or satisfactory placement test score.

MATH 251 Calculus I (4)
Differential calculus and applications. First term of the standard sequence for students of physical, biological, and social sciences, and of mathematics. Students cannot receive credit for both MATH 241 and MATH 251. Prereq: MATH 112 or satisfactory placement test score.
MATH 252 Calculus II (4)
Integral calculus. Second term of the standard sequence for students of physical, biological, and social sciences, and of mathematics. Students cannot receive credit for both MATH 242 and MATH 252. Prereq: MATH 251 or satisfactory placement test score.

MATH 253 Calculus III (4)
Introduction to improper integrals, infinite sequences and series, Taylor series and differential equations. Third term of the standard sequence for students of physical, biological, and social sciences, and of mathematics. Prereq: MATH 252 or satisfactory placement test score.

MATH 256 Introduction to Differential Equations (4)
Introduction to differential equations and applications. Linear algebra is introduced as needed. Prereq: MATH 253 or instructor’s consent.

MATH 281, 282 Several-Variable Calculus I,II (4,4)
Introduction to calculus of functions of several variables including partial differentiation; gradient, divergence, and curl; line and surface integrals; Green’s and Stokes’s theorems. Linear algebra introduced as needed. Prereq for MATH 281 is MATH 256 or instructor’s consent.

MATH 341,342 Elementary Linear Algebra (4,4)
Vector and matrix algebra; n-dimensional vector spaces; systems of linear equations; linear independence and dimension; linear transformations; rank and nullity; determinants; eigenvalues; inner product spaces; theory of a single linear transformation. Prereq: MATH 252. MATH 253 is recommended.
UO CHEMISTRY COURSES

CH 221, 222, 223 General Chemistry (4,4,4)
First-year university chemistry: atomic and molecular structure, thermodynamics, equilibrium, physical properties, and the chemical reactions of the elements. Lectures. Prereq: high school chemistry; coreq: MATH 111, 112 or equivalents.

CH 227, 228, 229 General Chemistry Laboratory (2,2,2)
Teaches laboratory skills through chemical reactions and writing equations, phase diagrams, equilibrium constants, acid-base titrations, volumetric analyses, voltaic cells, exercises in kinetics and inorganic chemistry. Lecture, laboratory. Pre- or coreq: CH 211, 212, 213 or CH 221, 222, 223 or instructor’s consent.

LANE ENGINEERING PREPARATION COURSES

ENGR 101 Engineering Orientation (3)
Coreq: MTH 251 An introduction to engineering, its evolution, ethics, and methods. An overview of various engineering disciplines and curriculum requirements, an introduction to a variety of modeling and analysis methods, written and oral communication activities, discussion of professional ethics and social implications of engineering work. The course includes visits by guest speakers, possible field trips, introductory activities on measurement methods, data collection, use of electronic spreadsheets and the internet, possible group projects and/or oral and written reports.

ENGR 103 Engineering Graphics (3)
Coreq: MTH 112. An introduction to graphic communication, including visualization, multiview and pictorial projections, sections auxiliary views, and ASME dimensioning and tolerancing standards. Graphic concepts are applied using freehand sketching and CAD.

ENGR 211 Statics (4)
Fall term (4 lecture hrs/wk). Prereq: MATH 252; Coreq: MATH 253; General Physics with Calculus PHYS 211 (UO PHYS 251) recommended or consent of instructor. Principles of statics of particles and rigid bodies are studied with a vectorial approach. Particular attention will be given to the composition, resolution, and equilibrium of coplanar and non-coplanar force systems; two dimensional trusses and frames; centroids, and moments of inertia of plane areas; coulombic friction; and the distribution of shear and bending moments in simple beams.

ENGR 212 Dynamics (4)
Spring term (4 lecture hrs/wk). Prereq: Statics ENGR 211 (LANE CC); MATH 254 (UO MATH 281); General physics with Calculus PHYS 211 (UO PHYS 251) recommended. Fundamental dynamics course of particles and rigid bodies. Topics include kinematics and kinetics of particles and kinematics of rigid bodies; Newton’s second law of motion; rectilinear and curvilinear motion; linear and angular momentum; principles of work and energy; impulse and momentum and D’Alembert’s Principle.
ENGR 213 Strength of Materials (4)
Winter term (4 lecture hrs/wk). Prereq: Statics ENGR 211, MATH 253. General physics with Calculus PHYS 211 (UO PHYS 251). Theory of stress and strain, shear, bending, torsion, and combined stresses; temperature induced stresses, and elements of intermediate analysis. Additional topics include axially loaded members, thin walled pressure vessels, torsional and flexural loading, failure theory and column buckling.

ENGR 221 Electrical Fundamentals 1 (4)
Winter term (3 lecture, 3 lab hrs/wk) Prereq: General Physics with Calculus PHYS 212 (UO PHYS 252). This is an electrical foundation course and is part of the Second Year of the engineering program. It will familiarize the student with principles of circuit analysis, circuit components, phasors, and steady state responses, and the use of electrical measuring equipment.

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