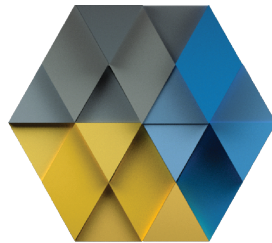




UC SANTA BARBARA  
**engineering**



UC SANTA BARBARA  
**MATERIALS**



UC SANTA BARBARA  
**Chemistry and  
Biochemistry**

**FIVE-YEAR COMBINED  
BS-ENGINEERING + MS-MATERIALS PROGRAM  
BS-CHEMISTRY + MS-MATERIALS PROGRAM**

**Brochure for the Class incoming on Fall 2023**

(UPDATED MAY 2023)

## TABLE OF CONTENTS

<b>CONTACT INFORMATION</b> .....	<b>3</b>
<b>ABOUT THE PROGRAM</b> .....	<b>4</b>
WHY IS KNOWLEDGE OF MATERIALS IMPORTANT TO ENGINEERS? .....	4
IS THIS PROGRAM FOR YOU? .....	4
<b>ADMISSION PROCESS</b> .....	<b>4</b>
BS/MS INFORMATION SESSION .....	4
BS/MS PROGRAM ADVISORS .....	5
WHO IS ELIGIBLE TO APPLY? .....	5
DEPARTMENTAL INTERNAL APPLICATION .....	5
<b>IMPLEMENTATION OF THE PROGRAM</b> .....	<b>6</b>
SENIOR YEAR .....	6
FIFTH YEAR.....	7
<b>MS DEGREE IN MATERIALS – PLAN 2</b> .....	<b>8</b>
<b>ADVANCING TO GRADUATE STATUS</b> .....	<b>8</b>
<b>TABLE I. TIMELINE FOR THE BS-ENGINEERING/MS-MATERIALS PROGRAM</b> .....	<b>9</b>
<b>APPENDIX A: APPROVED COURSES</b> .....	<b>10</b>
<b>TABLE II. APPROVED UNDERGRADUATE COURSES</b> .....	<b>11</b>
<b>TABLE III-A. ELECTRONIC/PHOTONIC MATERIALS</b> .....	<b>12</b>
<b>TABLE III-B. INORGANIC MATERIALS</b> .....	<b>13</b>
<b>TABLE III-C. MACROMOLECULAR/BIOMOLECULAR MATERIALS</b> .....	<b>14</b>
<b>TABLE III-D. STRUCTURAL MATERIALS</b> .....	<b>15</b>
<b>APPENDIX B SAMPLE SCHEDULES BY UNDERGRADUATE MAJOR</b> .....	<b>16</b>
<b>BS-CHEMICAL ENGINEERING/MS-MATERIALS</b> .....	<b>17</b>
<b>BS-ELECTRICAL ENGINEERING/MS-MATERIALS</b> .....	<b>18</b>
<b>BS-MECHANICAL ENGINEERING/MS-MATERIALS</b> .....	<b>19</b>
<b>BS-CHEMISTRY/MS-MATERIALS</b> .....	<b>20</b>
<b>MATERIALS DEPARTMENT MS PLAN 2 FOR BS/MS PROGRAM</b> .....	<b>21</b>
<b>ACKNOWLEDGMENT OF HAVING READ BS/MS STUDENT MANUAL</b> .....	<b>22</b>

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**Important:** There will be an informational session for all interested students during the Spring Quarter of their sophomore year. Please notify your departmental undergraduate staff advisor of your interest in attending this session. If afterward you are still interested in joining the program you must (i) notify your Undergraduate Department Advisor and the Materials Department Graduate Office of your interest before the end of the Spring Quarter of your Sophomore Year, (ii) enroll in Matrl 100A for the Fall quarter of your Junior year, and (iii) arrange a meeting with the BS/MS Program Advisor for your Engineering Major (from list above) during your Junior year to start planning your academic program. Students who do not comply with these requirements will find it difficult to join the program later on.

## ABOUT THE PROGRAM

### *Why is knowledge of Materials important to Engineers and Chemists?*

- Materials are the substances of which things are made and, hence, their properties are critical to the performance of the components and systems constituted by them.
- From a practical perspective, *materials allow the embodiment of ideas to solve societal problems and to enhance our lives*. Indeed, almost every aspect of modern life is touched by a technology made possible by advances in materials. For example, it is difficult to envision the revolution in high-speed computing and telecommunications without semiconductors and optical fibers, or the modern jet engine without high temperature superalloys, or advanced CAT scanners without superconducting magnets and ceramic scintillators, etc.
- Materials are often the enabling element of technological progress in all major industries in which engineers and scientists find employment, e.g. electronics, communications and information, biotechnology, aerospace, energy, transportation, environmental control, food processing, etc. As such, knowledge of materials has always been an asset for the practicing engineer or scientist and is likely to become even more important for professional success as the pace of technological change increases.
- The study of materials is predicated on the relationship between the *properties* of a material, which determine its *performance* in service, and its *internal structure*, i.e., the way in which the material is assembled at all relevant length scales, from the atoms up to the application. In turn, the structure may be modified by changes in the chemical composition and the processing conditions, allowing the engineer/scientist to tailor the material for specific performance goals. Materials is a dynamic and eminently interdisciplinary field, with strong elements of both Science and Engineering, which provides understanding of why materials behave the way they do and thus enables engineers/scientists to better harness their potential in developing new technologies.

### *Is this program for you?*

- This program is designed for students who wish to enhance their undergraduate education in one of the classical engineering disciplines or in chemistry by adding a strong knowledge base in the understanding of materials behavior, of their synthesis and processing, and of their applications in modern technology.
- The program allows outstanding students to concurrently pursue a Bachelor of Science degree in Chemical, Electrical, or Mechanical Engineering, or in Chemistry, and a Master of Science degree in Materials, and to complete graduation requirements for both degrees within 5 years. (See appendix for timelines and worksheets for each discipline.)
- The graduates of this program retain the breadth and flexibility inherent in their mainstream disciplines while their specialized knowledge of engineering materials will give them a competitive edge in the high technology industry.
- The program capitalizes on the reputation of UCSB as an internationally renowned institution in Materials research and education. The students involved will interact with faculty working at the cutting edge of technology in a broad range of modern materials, benefiting from their advice and expertise in areas critical to future industrial development.

## ADMISSION PROCESS

### *BS/MS Information Session*

An informational meeting is typically held during the Spring Quarter for all sophomore students who may be interested in applying to the BS/MS program. After that meeting students interested in the program must inform their Undergraduate Department Advisor and the Materials Graduate Office of their intention to pursue the Materials BS/MS program. Students must consult with these offices about admission procedures and the structure of the program.

## ***BS/MS Program Advisors***

Prior to the start of their third year (or in the quarter when the student achieves Junior status), candidates should arrange for a meeting with one of the Materials Department's BS/MS advisors (below) to discuss their interests, academic goals, and program requirements:

Chemistry students<sup>1</sup>..... Professor Ram Seshadri  
Chemical Engineering students..... Professor Rachel Segalman  
Electrical Engineering students..... Professor Chris Palmstrøm  
Mechanical Engineering students..... Professor Irene J. Beyerlein

The BS/MS advisors help students plan their Junior and Senior year studies, in coordination with the student's own departmental undergraduate program advisor, and also assist them during the application process for the program. In preparing their academic plan, all students interested in this program must plan on taking MATRL 100ABC during the Junior year (no exceptions).

### ***Who is eligible to apply?***

Applicants must meet the following requirements in order to qualify for admission:

- Eligible applicants are in their third year and have completed the pre-requisites to enroll in 100A. Please note that Physics 4 is no longer required for 100A.
- A minimum overall GPA of 3.2 at the end of the third year, with a 3.5 minimum GPA in Engineering courses.
- Receive a B minimum in each of the undergraduate Materials core courses (MATRL 100A, MATRL 100B and MATRL 100C)<sup>2</sup>. Grades in Physics, Chemistry and Math are particularly important, as are grades in core courses within the discipline.
- A GRE score with a minimum of 85% in the Quantitative portion and performance in the verbal and writing sections comparable to the Materials Department entry class in the previous academic year. This requirement was relaxed in 2020 as a consequence of the Covid 19 pandemic and remains suspended for Fall 2023 but may be reinstated later.

While some exceptions might be made for special circumstances, students must realize that they will be taking courses with Ph.D. oriented students from a very competitive pool in the graduate part of the program, so they must be able to perform academically well in that environment.

### ***Departmental Internal Application***

The student must submit a complete application for admission to the MS program in Materials under Plan 2, **no later than the last working day of July** (after the end of Spring quarter of their third year). The application must

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<sup>1</sup> The BS/MS program with the DCB students is limited to students in the Chemistry major, not available for students in the biochemistry major.

<sup>2</sup> Chem E and Mech E students who are not participating in the BS/MS program are **required** to complete MATRL 101, typically in their junior year, in order to graduate with a BS. Students in the BS/MS **must** take MATRL 100ABC sequence in lieu of MATRL 101 as part of their upper division major requirements. Because the 100ABC sequence counts for 9 units and 101 covers material that is covered in more depth in 100B and 100C, **students may not get credit for 101 by just taking 100B** (for which MATRL 100A is a pre-requisite). Chem E and Mech E students may use 3 of the units from the **completed** 100ABC series to satisfy the required credit for 101, and use the other 6 units to satisfy departmental electives in their undergraduate major. ECE majors may count 100A, B, and C toward their departmental elective requirements. Chemistry majors may count 100A (but not 100b and C) toward their departmental elective requirements. All BS/MS students must get prior approval from their undergraduate departmental advisor to ensure they get the proper credit for these 100ABC courses, regardless of whether they will continue with the MS portion of the program.

be submitted electronically to the Materials Graduate Program Coordinator ([academic@engineering.ucsb.edu](mailto:academic@engineering.ucsb.edu)), and must include:

- A Statement of Purpose, a Statement of Personal Achievements, and a Resume or CV.
- An official copy of transcripts from UCSB and all other post-secondary institutions attended.
- Three letters of recommendation from people able to judge the potential of the student for graduate studies. These people should ideally be faculty at UCSB or other higher education institutions who are familiar with the student's academic performance. Because this BS/MS program does not have a research or thesis requirement it is strongly recommended that letter writers can assess the potential of the applicant to **do well academically in a graduate program**, rather than on their performance in undergraduate internships. Letters of recommendation **must be mailed** by post or electronic means directly by the recommender to the Materials Graduate Program Coordinator by the application deadline. Letters submitted directly by the students will not be accepted. It is recommended that students provide their referees with all the information needed for them to send the letters and ranking forms directly to the Materials Department. These will be forwarded to the Graduate Division application process once the students finish their fourth year.
- Official GRE scores by the application deadline (last working day in July) if and when the GRE requirement is reinstated. Request that the official scores be sent to UCSB—Institution code 4835. GRE scores must be submitted by the application deadline (the last working day of July) to allow the admissions committee enough time to evaluate the application. It is strongly recommended that students prepare for the GRE and take it early, in case they need to retake it to improve their scores.
- A preliminary BS/MS study plan. The appropriate Undergraduate Department Advisor must approve the BS portion. The BS portion of the plan **must** include the required 6 units of approved departmental elective courses with materials content. MATRL 100A, B, and C **do not** count toward those 6 units (See Table II).<sup>3</sup> The MS study plan must include your proposed emphasis (Electronic/Photonic, Functional Inorganic and Quantum, Macro-/Bio-molecular or Structural Materials) and the faculty of interest to serve as your advisor for the graduate portion of your program. (These would be typically different from the designated faculty advisor for your undergraduate department listed on page 3).

Details on the application requirements can be found in the departmental application packet. You may download the departmental application from the Materials Department [website](#). Direct any questions about the application process to Mrs. Johnson at [academic@engineering.ucsb.edu](mailto:academic@engineering.ucsb.edu).

## IMPLEMENTATION OF THE PROGRAM

### *Senior Year*

- Notification of an admissions decision before the start of the Fall quarter of the Senior year.
- You must confirm the **emphasis** (Electronic/Photonic, Functional Inorganic and Quantum, Macro-/Bio-molecular or Structural Materials) listed in your application and select an MS advisor within the Materials Department (usually different from the BS/MS advisors listed on page 3) and cognizable with that emphasis area. The MS advisor will help the student revise his/her preliminary MS study plan and plan for their independent studies (MATRL 596) units and engineering report required for graduation under Plan 2 (see below).
- Submit a formal proposed MS study plan before the end of the Fall quarter. You must submit this plan together

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<sup>3</sup> However, those students who decide not to continue with the MS part of the program can still use the 100ABC series as departmental electives, as noted earlier.

with your approved undergraduate departmental elective form<sup>4</sup> or the study plan you intend to use for graduation from your BS major (as appropriate to your department) to the Materials Graduate Office. (This plan may be revised but any changes must be reapproved as noted below).

- The MS study plan must include an individualized major course sequence consisting of 3 graduate courses and approximately 7-8 graduate elective courses. The form is attached to his brochure. The MS study plan must be endorsed by your proposed graduate advisor and approved by the Materials Department Graduate Advisor in consultation with the Materials Department Academic Affairs Committee.
- Take at least **one** Materials graduate course per quarter to count towards the MS degree from the list of graduate elective courses in Table III A-D. You are allowed to take some courses outside your chosen area of emphasis with prior approval of your MS advisor and the departmental Materials Graduate Advisor. However, courses in your major sequence must be taken within the Materials Department. For cross-listed courses the student must register with the MATRL course number.
- You are **required** to take a minimum of 6 units of approved undergraduate elective courses with Materials content, to be counted as technical/departmental electives toward your BS degree. The courses will be selected from Table II.<sup>5</sup>
- A final MS study plan must be submitted before the end of Spring quarter. These approvals are required before a BS/MS student is eligible to advance to graduate status (see below) by the start of Fall quarter of the Graduate (5<sup>th</sup>) year.

### ***Fifth Year***

- Take remaining undergraduate courses for your BS degree, if any.
- Take remaining Materials graduate electives. Up to 6 units of approved undergraduate courses from Table II, not applied already toward the BS degree, may be taken as preparation or complement to graduate courses in the MS program (Optional).
- Take one (and only one) unit of MATRL 290 (Research Group Studies) per quarter, for a total of 3 units during the MS year. Students must register for MATRL 290 under their individual MS advisor's code, in order to receive credit for these units. Students must check with their MS advisor the appropriate requirements for earning the credit in MATRL 290, which could involve attending research group meetings and/or area seminars (e.g. the Structural Materials Seminar for students in this emphasis).
- Take a minimum of 3 up to a maximum of 6 units of MATRL 596 (Direct Reading and Research). Students must register for these units under their MS advisor's code, as soon as they start working on preparation for their Engineering Report, but not before. Students may have to present evidence of progress to receive a satisfactory grade in the quarter(s) in which these units are taken if their Engineering Report is not submitted by the end of the quarter in which the units are completed.
- Submit an Engineering Report based on the MATRL 596 work by the end of Spring quarter.

Students in this program are neither required nor eligible to be teaching assistants, and thus are not eligible to receive credit for teaching assistant practicum (MATRL 501). Because of the anticipated course load at the graduate level, students in this program are also neither required nor eligible to be Graduate Research Assistants

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<sup>4</sup> Students can include on their undergraduate elective forms, MATRL 100 A, B, and C (students may only count either 101 or 3 units from the 100 ABC toward their major) as well as the required 6 units of undergraduate electives with Materials content selected from the list in Table II, in order to satisfy the requirements of their individual BS major, to be taken during the senior year. Students are not required to take any undergraduate units toward their MS, but they are given the opportunity to count up to 6 units of courses that may be preparatory for some courses in the Materials MS.

<sup>5</sup> These courses may be revised annually depending on changes in the academic schedule. As new electives may emerge, a student may petition to have that new course approved as an elective for his/hers study plan on an ad-hoc basis, subject to it having substantial materials content and the unit limit.

during their MS year. They could, however, do a research internship under their MS advisor during the summer between the 4<sup>th</sup> and 5<sup>th</sup> year and, if appropriate, use the results of that experience as a foundation for their engineering report. They would not need to register for 596 during the summer but can register in a subsequent quarter.

## MS DEGREE IN MATERIALS – PLAN 2

All students in the BS/MS program **must follow Plan 2** (no thesis) for the M.S. degree.

Students in this plan are required to:

- 1) Complete 42 units of coursework including:
  - a) a minimum of **27-33** units from approved 200 level courses (200-289),
  - b) at most 6 units (optional) of approved advanced undergraduate courses (Table II) not used already for credit toward a previous degree
  - c) no fewer than 3 and no more than 6 units of MATRL 596 (Directed Reading and Research),
  - d) 3 units of MATRL 290 (Research Group Studies), and
- 2) Submit an acceptable Engineering Report based on the MATRL 596 work. A committee of two faculty members, including the student's individual MS advisor, must approve the report. At least one member of the committee must have a majority appointment in Materials.

## ADVANCING TO GRADUATE STATUS

This change in status must happen prior to the beginning of the Fall quarter of the fifth year in order to satisfy the minimum residency requirements for the MS degree (3 quarters) set by the Graduate Division. BS/MS students are therefore advised to change from undergraduate to graduate status as soon as they complete the required undergraduate coursework and units (180+ depending on the major). Once a BS/MS student reaches graduate status, he/she can begin to take the rest of the graduate unit requirements. Students should be aware that the change in status would prompt the registrar to charge Graduate fees for courses taken during this time.

In order to advance to MS (Graduate) status, students must:

- Have final MS study plan approved by their MS advisor and the Materials Department Graduate Advisor. The approved study plan must be submitted to the College of Engineering Undergraduate Office by May 1<sup>st</sup> and student must sign the Advancement Request Memo.
- Submit the UCSB Graduate Online application by May 15<sup>th</sup>. The student will receive an email from the Graduate Division with instructions for completing and submitting the application: [www.graddiv.ucsb.edu/eapp](http://www.graddiv.ucsb.edu/eapp). The letters of recommendation received with the original application will be forwarded by the Materials Department to the Graduate division.
- Officially accept your offer of admission by submitting a Statement to Intent to Register (SIR) through the application by June 15<sup>th</sup>

Note: In addition to fulfilling the requirements of the BS/MS program discussed above, students must ensure that they follow all the requirements of their individual undergraduate curricula for the Bachelor of Science in Chemistry or Chemical, Electrical or Mechanical Engineering. Tables are provided in the Appendix to help students in each curriculum understand how they can plan their BS/MS program to satisfy both the BS and the MS requirements within five years. At the end of a BS/MS student's senior year he/she has the option of filling out a BS graduation form and leaving the program with a BS degree, assuming all requirements for the BS have been met.



**TABLE I. TIMELINE FOR THE BS-ENGINEERING/MS-MATERIALS PROGRAM**

<b>Year:</b>	<b>Summary of Events:</b>
<b>Second</b>	<ul style="list-style-type: none"> <li>▪ Spring quarter: Attend BS/MS information session</li> <li>▪ Notification to the Undergraduate Department Office of student's interest in BS/MS program</li> <li>▪ Meeting with the Materials Department Graduate Program Coordinator (Ms. Johnson) to ensure all initial steps have been followed properly.</li> </ul>
<b>Third</b>	<ul style="list-style-type: none"> <li>▪ Meeting with the appropriate faculty BS/MS advisor corresponding to the student's BS department (page 3).</li> <li>▪ Take Matrl 100A (Fall); Matrl 100B (Winter); Matrl 100C (Spring).</li> <li>▪ Winter: Prepare for, and take the GRE (if reinstated as a requirement).</li> <li>▪ Spring: Submission of application by the last working day of July, to the Materials Graduate Program Coordinator for admission to the BS/MS Program.</li> <li>▪ Summer: Departmental admission decision by last working day in August.</li> </ul>
<b>Fourth</b>	<ul style="list-style-type: none"> <li>▪ Submit proposed MS study plan by the end of Fall quarter -must include individualized major course sequence.</li> <li>▪ 6 units of approved undergraduate electives with Materials content, to be counted toward the BS degree (Table II).</li> <li>▪ Take one Graduate course each quarter. It is recommended that two of these courses are part of the proposed major course sequence.</li> <li>▪ Select an advisor no later than the end of the Fall quarter and notify the Materials Department. He/she must help you prepare and endorse your final MS study plan.</li> <li>▪ Have final MS study plan approved by their MS advisor and the Department Graduate Advisor. The approved study plan must be submitted to the College of Engineering Undergraduate Office by May 1<sup>st</sup> and student must sign the Advancement Request Memo.</li> <li>▪ Submit the Graduate Division electronic application by May 15<sup>th</sup></li> <li>▪ Advance to graduate status at the end of Spring quarter</li> </ul>
<b>Fifth</b>	<ul style="list-style-type: none"> <li>▪ Remaining Undergraduate Courses, if any.</li> <li>▪ Remaining Graduate Electives</li> <li>▪ Up to 6 units of additional undergraduate courses not applied already toward the BS degree may be taken in fourth or fifth year as preparation or complement to graduate courses in the MS program. These courses must be included in the approved MS study plan.</li> <li>▪ Research Group Studies, MATRL 290 (3 units, one unit per quarter)</li> <li>▪ Directed Reading and Research, MATRL 596 (3-6 units)</li> <li>▪ Deliver Engineering Report based on Directed Reading and Research studies by the end of the Spring quarter. Project must be approved by their committee in time for student to file for graduation during the Spring quarter. The report should be delivered to the Materials Department Graduate office (Mrs. Johnson) no later than the last day of classes of the Spring quarter prior to filing for graduation.</li> </ul>

**APPENDIX A:  
APPROVED COURSES**

**TABLE II. APPROVED UNDERGRADUATE COURSES**

Fall	U	Winter	U	Spring	U
<b>Undergraduate Core</b>					
<b>MATRL 100A Structure &amp; Properties I</b>	3	<b>MATRL 100B Structure &amp; Properties II</b>	3	<b>MATRL 100C Structural Evolution</b>	3
<b>Undergraduate Electives</b>					
CHEM 115A Fundamentals of Quantum Chemistry	3			CHEM 145 Computational Biochemistry	3
CH E 102 or CH E 121 Biomaterials and Biosurfs or Colloids and Biosurfs	3	MATRL/PHYS 135 Biophysics and Biomolecular Materials	3	CHEM 186/286 Structure, Bonding, and Applications	3
		MATRL/CH E 160 Introduction to Polymer Science	3	CH E 126 Non-Newtonian Fluids, Soft Materials and Chem Prods	3
ECE/MATRL 162A* Quantum Description of Electronic Materials	4	ECE/MATRL 162B Fundamentals of the Solid State	4	ECE 162C Optoelectronic Materials and Devices	4
ME 167 Structural Analysis	3	ME/ECE 141B: MEMS Semiconductor Processing and Device Characterization	4	ME 180 Crystalline defects	3
MATRL/ME 185 Materials in Engineering		MATRL/ME 186A Manufacturing and Materials	3	MATRL/ME 186B Introduction to Additive Manufacturing	3

Any of the “Undergraduate Elective” courses listed above may be taken by BS/MS candidates in any department to satisfy their undergraduate technical/departmental elective requirements with prior approval of the departmental undergraduate advisor.

Please check with individual departments as course scheduling may change from year to year and some courses may not be offered every year.

Courses **must** have materials science or materials engineering content. Check for offerings that may not be in this table. You may petition as long as the course is clearly related to Materials. Your petition must be endorsed by your graduate and undergraduate advisors and approved by the academic affairs committee in Materials.

\*Note: this course is typically a background course for the Electronic/Photonic Materials graduate sequence (see Table IIIA).

**TABLE III-A. ELECTRONIC/PHOTONIC MATERIALS  
SUGGESTED COURSES FOR THE MS STUDY PLAN**

*Please note course offerings may change from year to year.*

<b>Course Number</b>	<b>Course Title</b>	<b>Units</b>
<b>Suggested Major Sequence Courses:</b>		
206A-B	Fundamentals of Electronic Solids I, II	4
209A	Crystallography and Diffraction Fundamentals	3
211A	Engineering Quantum Mechanics	4
215A-B-C	Semiconductor Device Processing (215A is <i>required for authorization to work independently in clean room.</i> )	4
<b>General Courses:</b>		
209B	X-Ray Diffraction	3
209C	Electron Microscopy	3
219	Phase Transformations	3
228	Computational Materials	3
279	First-Principles Calculations for Materials	3
281	Technical Communication and Presentation Design	3
<b>Specialized Courses:</b>		
204	Introduction to Magnetism and Magnetic Materials	3
211B	Engineering Quantum Mechanics II	4
216	Defects in Semiconductors	3
217	Molecular Beam Epitaxy & Band Gap Engineering	3
226	Symmetry and Tensor Properties of Materials	3
227	Metal Organic Chemical Vapor Deposition	3
263	Thin Films and Multilayers	3
268A-B	Semiconductor Lasers I, II	4
288AA-ZZ	Special Topics in Electronic Materials	3
<b>Background Courses</b>		
162A	Quantum Description of Electronic Materials	4
162B	Fundamentals of Solid State	4
ECE 162C	Optoelectrical Materials and Devices	4

**TABLE III-B. FUNCTIONAL INORGANIC AND QUANTUM MATERIALS  
SUGGESTED COURSES FOR THE MS STUDY PLAN**

*Please note course offerings may change from year to year.*

<b>Course Number</b>	<b>Course Title</b>	<b>Units</b>
<b>Suggested Major Sequence Courses:</b>		
209A	Crystallography and Diffraction Fundamentals	3
218	Introduction to Inorganic Materials	3
274	Solid State Inorganic Materials	3
<b>General Courses:</b>		
209B	X-Ray Diffraction	3
209C	Electron Microscopy	3
211A	Engineering Quantum Mechanics	4
219	Phase Transformations	3
222A	Colloids & Interfaces	3
228	Computational Materials	3
241	Structural Inorganic Chemistry	3
281	Technical Communication and Presentation Design	3
<b>Specialized Courses:</b>		
204	Introduction to Magnetism and Magnetic Materials	3
226	Symmetry and Tensor Properties of Materials	3
251	Processing of Inorganic Materials	3
286AA-ZZ	Special Topics in Inorganic Materials	3
<b>Background Courses</b>		
Chem 175	Physical Inorganic Chemistry	3

**TABLE III-C. MACROMOLECULAR/BIOMOLECULAR MATERIALS  
SUGGESTED COURSES FOR THE MS STUDY PLAN**

*Please note course offerings may change from year to year.*

<b>Course Number</b>	<b>Course Title</b>	<b>Units</b>
<b>Suggested Major Sequence Courses:</b>		
270	Biomaterials and Biosurfaces	
271A	Synthesis of Macromolecules	3
271B	Structure and Characterization of Complex Fluids	3
271C	Properties of Macromolecules	3
<b>General Courses:</b>		
214	Advanced Topics in Equilibrium Statistical Mechanics	3
228	Computational Materials	3
253	Liquid Crystal Materials	4
273	Experimental Techniques in Macromolecular Materials	3
281	Technical Communication and Presentation Design	3
<b>Specialized Courses:</b>		
276A	Biomolecular Materials I: Structure & Function	3
276B	Biomolecular Materials II: Applications	3
278	Interactions in Biomolecular Complexes	3
280A	Synthesis and Electronic Structures of Conjugated Polymers	3
280B	Organic Electronic Devices	3
287AA-ZZ	Special Topics in Macromolecular Materials	3
<b>Background Courses</b>		
135	Biophysics and Biomolecular Materials	3
160	Introduction to Polymer Science	3

**TABLE III-D. STRUCTURAL MATERIALS  
SUGGESTED COURSES FOR THE MS STUDY PLAN**

*Please note course offerings may change from year to year.*

Course Number	Course Title	Units
<b>Suggested Major Sequence Courses:</b>		
207	Mechanics of Materials	3
220	Mechanical Behavior of Materials	3
234	Fracture Mechanics	3
<b>General Courses:</b>		
209A	Crystallography and Diffraction Fundamentals	3
209B	X-Ray Diffraction	3
209C	Electron Microscopy	3
219	Phase Transformations	3
228	Computational Materials	3
251	Processing of Inorganic Materials	3
281	Technical Communication and Presentation Design	3
<b>Specialized Courses:</b>		
230	Elasticity and Plasticity	3
232	Plasticity	3
240	Finite Element Structural Analysis	3
261	Composite Materials	3
263	Thin Films and Multilayers	3
280	Crystalline Defects	3
289AA-ZZ	Special Topics in Structural Materials	3

Notes:

- Some introductory graduate courses will not be available for credit to students who have taken undergraduate courses covering similar topics, e.g., students cannot get credit toward the MS for ME 166 or ME 162 if they are taking MATRL 207 or vice versa.

**APPENDIX B:  
SAMPLE SCHEDULES  
BY UNDERGRADUATE MAJOR**



## BS-CHEMICAL ENGINEERING/MS-MATERIALS

<b>Junior Year (50 units)</b>					
FALL	Units	WINTER	Units	SPRING	Units
CH E 120A	4	CH E 120B	3	CH E 118	1
CH E 128	3	CH E 132C	3	CH E 120C	3
CH E 132B	3	CHEM 113B	4	CH E 140A	3
G.E. Elective	4	Tech Elective	3	CH E 180A	3
Matrl 100A <sup>†</sup>	3	Matrl 100B	3	CHEM 113C	4
				Matrl 100C <sup>†</sup>	3
<b>Total:</b>	<b>17</b>		<b>16</b>		<b>17</b>
<b>Senior Year (50 units)</b>					
FALL	Units	WINTER	Units	SPRING	Units
CH E 140B	3	CH E 180B	3	CH E 184B	3
CH E 152A	4	CH E 184A	3	Tech Elective	3
G.E. Elective	4	Tech Elective	3	GE Elective	8
Tech Elective	3	GE Elective	4		
Matrl Grad. Elec.	3	Matrl Grad. Elec.	3	Matrl Grad. Elec.	3
<b>Total:</b>	<b>17</b>		<b>16</b>		<b>17</b>
<b>Graduate Year (33 units)</b>					
FALL	Units	WINTER	Units	SPRING	Units
Matrl Grad. Elec.	4	Matrl 596 or Matrl Grad. Elec.	3*	Matrl 596 or Matrl Grad. Elec.	3*
Matrl Grad. Elec.	6-8	Matrl Grad. Elec.	6-7	Matrl Grad. Elec.	6-7
MATRL 290	1	MATRL 290	1	MATRL 290	1
<b>Total:</b>	<b>11-13</b>		<b>10-11</b>		<b>10-11</b>

\* Students must take at least 3, but no more than 6 units of Matrl 596.

† Matrl 100A and 100C count toward the undergraduate technical elective requirements.

**Note:** 6 additional units of undergraduate technical electives must have Materials content.

## BS-ELECTRICAL ENGINEERING/MS-MATERIALS

<b>Junior Year (58 units)</b>					
<b>FALL</b>	<b>Units</b>	<b>WINTER</b>	<b>Units</b>	<b>SPRING</b>	<b>Units</b>
ECE 130A	4	ECE 130B	4	ECE 137B	4
ECE 132	4	ECE 137A	4	ECE 139	4
ECE 134	4	ECE Elective	4	ECE 152A	5
GE / Free UG Elec.	4	GE / Free UG Elec.	4	GE / Free UG Elec.	4
Matrl 100A <sup>†</sup>	3	Matrl 100B <sup>†</sup>	3	Matrl 100C <sup>†</sup>	3
<b>Total:</b>	<b>19</b>		<b>19</b>		<b>20</b>
<b>Senior Year (58 units)</b>					
<b>FALL</b>	<b>Units</b>	<b>WINTER</b>	<b>Units</b>	<b>SPRING</b>	<b>Units</b>
ECE 188A	4	ECE 188B	4	ECE Elec.	8
ECE Electives	8	ECE Electives	8	Free UG Elec.	4
Matrl Grad Elec.	3	Matrl Grad Elec.	3	Matrl Grad Elec	3
GE / Free UG Elec.	4	GE / Free UG Elec.	4		
		ENGR 101**	3		
<b>Total</b>	<b>19</b>		<b>22</b>		<b>15</b>
<b>Graduate Year (33 units)</b>					
<b>FALL</b>	<b>Units</b>	<b>WINTER</b>	<b>Units</b>	<b>SPRING</b>	<b>Units</b>
Matrl Grad. Elec.	4	MATRL 596 or Matrl Grad. Elec.	3*	MATRL 596 or Matrl Grad. Elec.	3*
Matrl Grad. Elec.	6-8	Matrl Grad. Elec.	6-7	Matrl Grad. Elec.	6-7
Matrl 290	1	Matrl 290	1	Matrl 290	1
<b>Total</b>	<b>11-13</b>		<b>10-11</b>		<b>10-11</b>

\*Students must take at least 3, but no more than 6 units of Matrl 596.

\*\*ENGR 101 is offered FWS.

† Matrl 100A, 100B and 100C count toward the undergraduate departmental elective requirements.

**Note:** 6 additional units of undergraduate technical electives must have Materials content.

## BS-MECHANICAL ENGINEERING/MS-MATERIALS

<b>Junior Year (42 units)</b>					
<b>FALL</b>	<b>Units</b>	<b>WINTER</b>	<b>Units</b>	<b>SPRING</b>	<b>Units</b>
ME 103	4	MATRL 101	3	ME 104	4
ME 107	3	ME 108	3	ME 153	3
ME 151A	4	ME 151B	4	Specialization Course	3
ME 152A	4	Specialization Course	3	GE/ Free UG Elec.	4
Matrl 100A <sup>†</sup>	3	Matrl 100B <sup>†</sup>	3	Matrl 100C <sup>†</sup>	3
<b>Total:</b>	<b>18</b>		<b>16</b>		<b>17</b>
<b>Senior Year (43 units)</b>					
<b>FALL</b>	<b>Units</b>	<b>WINTER</b>	<b>Units</b>	<b>SPRING</b>	<b>Units</b>
ME 105	4	ME 156B	3	ME 189C	3
ME 154, 157 or 167	3	ME 189B	3	Engr. Elec.	3
ME 156A	3	Engr. Elective	3	GE / Free UG Elec.	4
ME 189A	3	GE / Free UG Elec.	4	GE / Free UG Elec.	4
Engr. Elective	3	Matrl Grad Elective	3	Matrl Grad Elective	3
Matrl Grad Elec.	3				
<b>Total</b>	<b>19</b>		<b>16</b>		<b>17</b>
<b>Graduate Year (33 units)</b>					
<b>FALL</b>	<b>Units</b>	<b>WINTER</b>	<b>Units</b>	<b>SPRING</b>	<b>Units</b>
Matrl Grad. Elec.	4	Matrl 596 or Matrl Grad. Elec.	3*	Matrl 596 or Matrl Grad. Elec.	3*
Matrl Grad. Elec.	6-8	Matrl Grad. Elec.	6-7	Matrl Grad. Elec.	6-7
Matrl 290	1	Matrl 290	1	Matrl 290	1
<b>Total</b>	<b>11-13</b>		<b>10-11</b>		<b>10-11</b>

\*Students must take at least 3, but no more than 6 units of Matrl 596.

† Matrl 100A, 100B, and 100C count toward the undergraduate departmental elective requirements.

**Note:** 6 additional units of undergraduate technical electives must have Materials content.

## BS-CHEMISTRY/MS-MATERIALS

Fall		Winter		Spring	
Course	Units	Course	Units	Course	Units
<b>Year 1</b>					
Chem 1A/3A	(3)	Chem 1B/3B	(3)	Chem 1C/3C	(3)
Chem 1AL	(2)	Chem 1BL	(2)	Chem 1CL	(2)
Math 2A/3A	(4-5)	Math 2B/3B	(4-5)	Math 4A	(4)
		Phys 7A	(4)	Phys 7B	(4)
<b>Year 2</b>					
Chem 109A/130A	(4)	Chem 109B/130B	(4)	Chem 109C/130C	(4)
Phys 7C	(3)	Chem 6AL	(3)	Chem 6BL	(3)
Phys 7L	(1)	Math 6A	(3)	Math 6B	(3)
Math 4B	(4)				
<b>Year 3</b>					
Chem 113A	(4)	Chem 113B	(4)	Chem 113C	(4)
Chem 142A*	(3)	Chem 116AL	(3)	Chem 116BL	(3)
Chem 150 <sup>6</sup> *	(3)	Matrl 100B	(3)	Matrl 100C	(3)
Chem 6CL <sup>7</sup> *	(3)				
Matrl 100A <sup>8</sup> *	(3)				
<b>Year 4</b>					
Chem 173A	(3)	Chem 173B	(3)		
Chem 116CL	(3)	Matrl 218	(3)		
Matrl 209A or 241	(3)				
<b>Year 5</b>					
Matrl 200A	(4)	Matrl 290	(1)	Matrl 290	(1)
Matrl 290	(1)	Matrl 596		Matrl 596	
Matrl 596		(2-3 Matrl courses)		(2-3 Matrl courses)	
(2-3 Matrl courses)					

Denotes Materials elective course, to be chosen from Table III of approved courses.  
Some optional UG electives (Table II): Matrl/ChE 160, Matrl/Phys 135

**Note** that 209A, 218, and 241 are nominally electives and are only recommended courses for the senior year if the student decides to follow the Inorganic emphasis within the MS in Materials.

<sup>6</sup> Chem 150 may be taken in Fall quarter of year 2 if the general chemistry series has been completed.

<sup>7</sup> Chem 6CL may be taken Spring quarter of year 4 to help alleviate course workload in Fall quarter of year 3.

<sup>8</sup> Student may petition to have Matrl 100A count toward BS in Chemistry. Please email [ugrads@chem.ucsb.edu](mailto:ugrads@chem.ucsb.edu) for further information. Matrl 100B and 100C are required prerequisites for the MS program, but they cannot be used to fulfill either BS or MS unit requirements.

**MATERIALS DEPARTMENT  
MS PLAN 2 FOR BS/MS PROGRAM**

Name: \_\_\_\_\_ Perm Number: \_\_\_\_\_  
 Entrance Year: \_\_\_\_\_ UG Department: \_\_\_\_\_  
 Materials Research Track: \_\_\_\_\_  
 Faculty MS Advisor: \_\_\_\_\_  
 Faculty MS Advisor Signature: \_\_\_\_\_  
 Dept. Grad Advisor Signature: \_\_\_\_\_

*Students must complete 42 units of coursework*

**Major course sequence (9-12 units):**

*Include units for each course*

	<b>Matrl 290:</b>	_____ 3 _____
	<b>Matrl 596 (3-6 units):</b>	_____
	<b>Undergrad* (3-6 units):</b>	_____
<b>Elective courses (21-24 units):</b>	<b>Total Graduate Units:</b>	_____

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***Report Committee (2 faculty members):***

\_\_\_\_\_  
Chair (MS advisor)

\_\_\_\_\_  
Member

NOTE: This is a proposed study plan that must be submitted by the end of fall quarter of your fourth year. A final MS study plan must be submitted later for advancement to graduate status.

\*THIS IS OPTIONAL: These undergrad units are different from the minimum of 6 undergrad electives with Materials content required toward the BS, to be taken during the senior year.

**ACKNOWLEDGMENT OF HAVING READ  
BS/MS STUDENT MANUAL**

(Print this page, sign it after reading the manual, and turn it in to the Materials Graduate Program Coordinator by the end of the first week of classes in the first quarter after admission to the Program.)

I, \_\_\_\_\_ acknowledge that I have carefully read and understood the contents of the BS/MS Student Manual for the Materials Department (Edition Fall 2023). I understand my first point of contact for any questions regarding the BS/MS Manual or the BS/MS Materials Program is the Graduate Program Coordinator\* in the Materials Department, who may refer me to the Graduate Advisor\*\* in the Materials Department.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\* The current Graduate Program Coordinator is Mrs. AJ Johnson

\*\* The current Graduate Advisor is Prof. Daniel Gianola