

# **Undergraduate Guide to the Mechanical Engineering Department**

Effective Fall 2016

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## Recent Changes

Our curriculum, university requirements and procedures, and this guide itself change from time to time. A summary of the major changes is included here for people who have been using older versions of the guide.

Major changes in this edition:

- ▶ Change from DEC to Stony Brook Curriculum for General Education Requirements
- ▶ AMS 210 or MAT 211 – added to degree requirement (Spring 2016 admits)
- ▶ The Modern Physics Requirement (PHY 251/252 or ESG 281) changed to a 3-credit Basic Science Elective for Spring 2016 admits. Prior admits can replace Modern Physics with 4 credits of Basic Science with permission of the Undergraduate Program Director
- ▶ Course changes (see **Mechanical Engineering Course Descriptions** on page 19):
  - MEC 101 – changed to 3 credits
  - MEC 220 – changed to 3 credits
  - MEC 301 – prerequisite CHE 131 added
  - MEC 316 – prerequisite PHY 134 added
  - MEC 450 – prerequisite MEC 411 added

## How to Use This Guide

### For new students and transfer students

This guide provides an overview of our program, the degree requirements, and official department policy on nearly all aspects of the program. You are strongly encouraged to go through the guide in its entirety as soon as possible following admission to the program.

### For students already in the program

Please see the *Recent Changes* section for a quick summary of Course and Curriculum changes.

### Additional Resources

An electronic copy of this document can be found on the Department's website

<http://me.eng.sunysb.edu>

## About Mechanical Engineering

Mechanical engineering is one of the core disciplines of engineering. It encompasses a large number of subdisciplines that are at the heart of both traditional and leading edge technologies. Mechanical engineers can be found in leadership roles in almost any sector of industry, ranging from electronics and aerospace to civil transportation and consumer household products. The undergraduate mechanical engineering program at Stony Brook recognizes that students have a variety of career path objectives within the wide variety of industrial environments available to mechanical engineers. While the majority of our graduates directly pursue careers in industry, a significant percentage of them join graduate schools. Most of the students entering graduate schools continue their mechanical engineering studies. However, many of them have gone to law, business and medical schools. The undergraduate curriculum in mechanical engineering is designed to provide students with the detailed mechanical engineering education and training required for immediate entry into the job market. At the same time, the curriculum maintains enough flexibility to enable students to fully prepare themselves for graduate studies and research careers.

## **Curriculum Overview**

The undergraduate mechanical engineering curriculum includes the Stony Brook Curriculum (SBC) required by the university, as well as a core curriculum designed for the mechanical engineering major. The core curriculum provides students with a solid education in mathematics and the physical sciences along with a broad sequence of courses covering thermal processes and fluid mechanics, mechanical design, solid mechanics, and the dynamic behavior and control of mechanical systems. Students also take courses that introduce them to the use of advanced computational methods for engineering design and analysis as well as data processing and analysis. A series of laboratory courses introduces them to sensors and electronics, modern instrumentation and experimental techniques used in engineering for tasks ranging from product design, evaluation and testing to research. In addition, students can select electives to provide either higher level academic training in preparation for graduate school or a broader exposure to subjects related to engineering practice to enhance their preparation for a job after graduation.

## **ABET Accreditation**

The Mechanical Engineering degree program is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>).

### **Program Educational Objectives:**

The objective of our Bachelors of Engineering Program in Mechanical Engineering is to train and educate highly competent professionals to serve the rapidly evolving technological needs of our society.

1. Graduates will meet the expectations of employers of mechanical engineers.
2. Qualified graduates will pursue advanced studies if they so desire.
3. Graduates will pursue leadership positions in their profession and/or communities.

### **Student Outcomes:**

The students will demonstrate the following:

- (a) an ability to apply knowledge of mathematics, science, and engineering.
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data.
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- (d) an ability to function on multidisciplinary teams.
- (e) an ability to identify, formulate, and solve engineering problems.
- (f) an understanding of professional and ethical responsibility.
- (g) an ability to communicate effectively.
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- (i) a recognition of the need for, and an ability to engage in life-long learning.
- (j) a knowledge of contemporary issues.
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## Introduction

This guide is provided to incoming or transferring Mechanical Engineering undergraduate students to assist them in selecting the sequence of courses needed to obtain a Bachelor of Engineering degree in Mechanical Engineering. It is extremely important that students carefully study the information given in this guide, know the recommended sequence of courses and be familiar with the prerequisites for these courses. They should consult their advisors before deviating from the recommended course scheduling sequence. As part of a continuing effort to improve our educational program, the degree requirements for the Bachelor of Engineering in Mechanical Engineering may change. This guide describes the degree requirements that apply to all students who enter the major during or after the Fall 2016–Spring 2017 academic year.

## Acceptance Requirements for the Mechanical Engineering Major

Freshman and transfer applicants who have specified their interest in the Mechanical Engineering major may be accepted directly into the major upon admission to the University. Students not accepted directly may apply for acceptance after completing their first semester at the University. Acceptance is based upon a student's achievement in 10 or more credits of mathematics, physics, and engineering courses that are taken at Stony Brook and satisfy the Major's requirements. In these courses, a student must achieve a grade point average (G.P.A.) of at least 3.0 with no more than one grade of a C or lower. Students who do not meet these requirements after two semesters of working towards the Major are disqualified and should not apply. The first semester of working towards the Major will be determined by a student's first MEC course that applies towards Major degree requirements. All transfers courses used to meet requirements of the major must be completed prior to admission. Students interested in applying for admission are encouraged to talk to the Undergraduate Program Director (listed in the front matter of this document).

## Information for Transfer Students

Students who are interested in transferring or have transferred into the department of mechanical engineering from community colleges or other universities should consult the Undergraduate Transfer Office (<http://ws.cc.stonybrook.edu/ugadmissions/transfer/>) regarding transfer admission, transfer credit evaluations as well as other university and CEAS policies regarding transfer credits. Advising by the Undergraduate Transfer Office for new transfers is available on a walk-in basis, Monday through Friday 10:00am - 4:00pm, by e-mail, and by telephone at (631) 632-7028. The office is located in Room E-2360 of the Melville Library.

The Undergraduate Transfer Office maintains and publishes a list of courses from other institutions that are deemed equivalent to Stony Brook courses. Transfer students must fill out the appropriate forms at the Undergraduate Transfer Office in order for their transfer credits to appear in the Solar system. For courses that are not on the list, students should fill out a transfer credit evaluation form in CEAS Undergraduate Student Office. The form will be sent out for transfer credit evaluation to the department where a potentially equivalent course is offered.

The policy with regard to transfer credits is uniform throughout the College of Engineering and Applied Sciences. Faculty members in the appropriate department evaluate all transfer credits, e.g., mathematics courses are evaluated by the Department of Mathematics, etc. No Credits is granted for grades less than C. Credits earned at unaccredited institutions or in a technical (2-year/Associates Degree program) curriculum are generally not accepted for transfer or technical elective Credits.

For advice about registering courses required for mechanical engineering major, transfer students should consult their faculty advisor or Undergraduate Program Director of the Mechanical Engineering Department.

Occasionally, students wish to take a course at another institution during their matriculation at Stony Brook. This happens, for example, if students (especially transfer students) find themselves out of sequence. Credits for a summer course at another institution might ease their subsequent scheduling problems. In these cases, students may request advanced written permission from the Undergraduate Program Director of the Department to certify that such courses taken off campus are transferable.

## **Bachelor of Engineering Degree Requirement for the Mechanical Engineering Major**

Students following a program of study leading to a B.E. degree must satisfy the general education requirements of the university, as well as the requirements of the major, which comprises a core of mandated courses and a set of three approved technical electives. The total number of credits required for a B.E. degree in mechanical engineering is 128.

### **General Education Requirements:**

**For students starting Fall 2014**, the new general education requirements are described in the Undergraduate Bulletin. **EST 392 (or ECO 108) is a required course to satisfy category SBS.** You can also view them at <http://www.stonybrook.edu/commcms/gened/requirements.html>.

**For students prior to Fall 2014**, you can view the DEC requirements at: [http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/degree\\_requirements/diversified.php](http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/degree_requirements/diversified.php). **EST 392 (or ECO 108) is a required DEC course for Mechanical Engineering majors and satisfies letter category F.**

Students are encouraged to visit the CEAS (College of Engineering and Applied Sciences) Undergraduate Student Office for a formal review of their general education requirements at least two semesters prior to their expected date of graduation.

## Requirements for the Major in Mechanical Engineering (MEC)

The major in mechanical engineering leads to the Bachelor of Engineering degree. Completion of the degree requirements for the major requires approximately 107 credits. **Students are strongly encouraged to visit the Office of Mechanical Engineering Undergraduate Program Director for a formal review of their MEC major requirements at least one semester prior to their expected date of graduation. A sample graduate clearance form is shown in Table 3.**

### 1. Mathematics

- a. AMS 151, 161 Calculus I, II
- b. AMS 261 Applied Calculus III *or* MAT 203 Calculus III with Applications
- c. AMS 361 Applied Calculus IV: Differential Equations  
*or* MAT 303 Calculus IV with Applications

Notes:

- MAT 125 *and* 126 *or* MAT 131 *or* MAT 141 may be substituted for AMS 151
- MAT 126 *and* 127 *or* MAT 132 *or* MAT 142 may be substituted for AMS 161
- MAT 125, 126 *and* 127 may be substituted for AMS 151 *and* 161

### 2. Natural Sciences

- a. PHY 131, 132, 133 and 134 Classical Physics I and II and Classical Physics Labs I and II
- b. CHE 131 General Chemistry *or* CHE 141 Honors Chemistry *or* CHE 152 *or* ESG 198
- c. Basic Science Elective:
  - i. For students admitted prior to Spring 2016: PHY 251 *and* PHY 252 *or* ESG 281. Important: The 3 credit version of ESG 281 offered from Spring 2016 does not apply to this requirement. Note: Other 4 credit options are available with permission from the Undergraduate Program Director.
  - ii. For students admitted Spring 2016 or later: PHY 251 *and* 252 *or* ESG 281 *or* PHY 300 *or* CHE 132 *or* BIO 202 *or* BIO 203 *or* GEO 310 *or* GEO 312 *or* AST 203 *or* AST 205 *or* ATM 205.

Notes:

- PHY 125 *and* 126 *or* PHY 141 may be substituted for PHY 131
- PHY 126 *and* 127 *or* PHY 142 may be substituted for PHY 132
- PHY 125, 126 *and* 127 may be substituted for PHY 131 and 132

### 2. Laboratories

- MEC 316 Mechanical Engineering Laboratory I
- MEC 317 Mechanical Engineering Laboratory II

### 3. Mechanical Engineering

- MEC 101 Freshman Design Innovation
- MEC 102 Engineering Computing and Problem Solving
- MEC 203 Engineering Drawing and CAD
- MEC 214 Probability and Statistical Analysis for Experiments
- MEC 220 Practical Electronics for Mechanical Engineers
- MEC 225 Fundamentals of Machining Laboratory
- MEC 260 Engineering Statics
- MEC 262 Engineering Dynamics
- MEC 301 Thermodynamics
- MEC 305 Heat and Mass Transfer
- MEC 325 Manufacturing Processes and Machining
- MEC 363 Mechanics of Solids
- MEC 364 Introduction to Fluid Mechanics

4. **Materials Science**
  - ESG 332 Materials Science I: Structure and Properties of Materials
5. **Engineering Design**
  - MEC 310 Introduction to Machine Design
  - MEC 320 Numerical Methods in Engineering Design and Analysis
  - MEC 410 Design and Analysis of Machine Elements
  - MEC 411 System Dynamics and Control
  - MEC 422 Thermal Systems Design
  - MEC 440 Mechanical Engineering Design I
  - MEC 441 Mechanical Engineering Design II
6. **Engineering Economics**
  - EST 392 Engineering and Managerial Economics  
or ECO 108 Introduction to Economics
7. **Writing and Oral Communication Requirement**
  - MEC 300 Technical Communication in Mechanical Engineering
8. **Three Approved Technical Electives** (see below)

### Technical Electives

Three technical elective courses are required. At least two must be mechanical engineering (MEC) and the other may be selected from courses offered by any department of the College of Engineering and Applied Sciences, including MEC. The following is a list of approved technical elective courses:

Mechanical Engineering

**MEC:** 393, 398, 402, 423, 442, 450, 455, 456, 457, 460, 464, 465, 470, 491, 492, 499 (requires GPA of 3.0 or better). See note below on used of 500-level graduate courses as Technical Electives

Applied Math and Statistics:

**AMS:** 310, 311, 315, 341, 342, 351

Biomedical Engineering:

**BME:** 353, 481

Civil Engineering:

**CIV:** 310, 422

Chemical Engineering:

**CME:** 369

Computer Science:

**CSE:** 308, 327, 328, 352

Electrical Engineering:

**ESE:** 305, 306, 311, 330, 347, 350, 352, 380, 381

Material Science and Engineering

**ESG:** 333, 339

**ESM:** 335, 336, 353, 369, 486

Technology and Society

**EST:** 326, 327, 364, 391, 393

Other electives for the major require the approval of the undergraduate program director. Unless otherwise noted, all 500 level graduate MEC courses (excluding tutorials, MEC 599 and 699) will count as a technical elective. MEC 596 requires a GPA of 3.0 or better. You will need to complete a permission form in order to register for a graduate course.

For departments other than Mechanical Engineering, check with that department for the semester in which these courses are offered and their frequencies. Note that many of these courses have several prerequisites and/or co-requisites that must be satisfied in order to take the course.

### Staying On-track for On-time Graduation

The Recommended Course Sequence in the next Section (see Tables 2) is an important guide for staying on-track to graduate. **If you should fall off track**, use the Table 1 below to determine the **latest term that you must take and pass each course** in order to graduate on time. This table is based on the chain of prerequisites and historical course offering at Stony Brook. Courses indicated by "\*" require a grade of C or better to proceed through the program (P grades cannot be used to proceed). All others course require a passing grade of D or better (P grade can be use to proceed, but must to retaken for a grade in order to graduate). Table 1 does unless include aggregate requirements such as minimum overall and major Grade Point Averages.

**Table 1: Latest term that a requirement must be completed to graduate on time**

Dead Line	Must have Completed
End of Summer after your Freshman year	MAT 131* or equiv, approximately 32 total degree credits
End of Fall Sophomore year	MEC 101*, PHY 131* or equiv, MAT 132 or equiv, (approximately 50 total degree credits)
End of Spring Sophomore year	MEC 102, MEC 260*, PHY 133*, AMS 261 or equiv, approximately 66 total degree credits
End of Summer after your Sophomore year	MEC 262*, MEC 363*, PHY 134, PHY 132 or equiv, AMS 361 or equiv, CHE 131 or equiv approximately 66 total degree credits
End of Fall Junior year	MEC 214, MEC 203, MEC 220, MEC 301, MEC 310, MEC 316, MEC 364, WRT 102*, AMS 210 <sup>†</sup> or equiv, approximately 82 total degree credits
End of Spring Junior year	MEC 225, MEC 300, MEC 305, MEC 317, MEC 320, MEC 325, MEC 410, approximately 97 total degree credits
End of Fall Senior year	MEC 440*, MEC 411, MEC 422, ESG 332 approximately 113 total degree credits
End of Spring Senior year	MEC 441*, 3 Tech Elective Courses, EST 392 or equiv, Basic Science Elective (or PHY 251/252), General Education Requirements <sup>‡</sup> , at least 128 total degree credits

\* requires a grade of C or better to proceed through the program

<sup>†</sup> applies to student admitted Spring 2016 or later

<sup>‡</sup>SBC (HUM, USA, STAS, GLO, ARTS) or DEC (B, G, H, I, K)

### Recommended Course Sequence

Table 2 shows a recommended course sequence. Due to strict pre- and co-requisite requirements, students are **strongly** advised to follow this course sequence. Any deviation from this course sequence should be discussed with the faculty advisor.

**Table 2a: Recommended course sequence (effective for students admitted prior to Fall 2016)**

		<b>Fall</b>			<b>Spring</b>
<b>Freshman</b>	1	ITS 101		1	ITS 102
	4	MAT 131		4	MAT 132 ( <i>QPS</i> )
	4	PHY 131+133		4	PHY 132+134 ( <i>SNW</i> )
	3	WRT 101		3	WRT 102 ( <i>WRT</i> )
	2	MEC 101		2	MEC 102 <sup>#</sup>
	3	<i>DEC (B)/HUM</i>		3	<i>DEC (G) /USA</i>
<b>Total</b>	<b>17</b>			<b>17</b>	
<b>Sophomore</b>					
	4	MAT 203/AMS 261		4	MAT 303/AMS 361
	4	<i>PHY 251+252/ESG 281</i>		4	CHE 131/ESG 198
	3	<b>MEC 203</b>		3	MEC 262 <sup>‡</sup>
	2	MEC 220/ESE 271 (4cr)		3	MEC 363 <sup>‡</sup>
	3	<b>MEC 260<sup>†</sup></b>		3	<i>EST 392/ECO 108</i> <i>(DEC F / <u>SBS</u>)</i>
<b>Total</b>	<b>16</b>			<b>17</b>	
<b>Junior</b>					
	4	ESG 332		1	MEC 300
	1	MEC 214		3	MEC 305
	1	<b>MEC 225*</b>		2	MEC 317 ( <i>TECH</i> )
	3	MEC 301		3	MEC 320
	3	MEC 310		3	MEC 325
	2	MEC 316 ( <i>TECH</i> )		3	MEC 410
	3	MEC 364			
<b>Total</b>	<b>17</b>			<b>15</b>	
<b>Senior</b>					
	4	MEC 411		3	MEC 441 <sup>†</sup>
	3	MEC 422		3	Tech Elec #2
	3	MEC 440		3	Tech Elec #3
	3	Tech Elec #1		3	<i>DEC (I)/ <u>GLO</u></i>
	3	<i>DEC (H)/ <u>STAS</u></i>		3	<i>DEC (J)/ <u>ARTS</u></i>
<b>Total</b>	<b>16</b>			<b>15</b>	
		<b>TOTAL = 130</b>			

\* May be taken in any semester prior to or including MEC 325.

† A minimum grade of “C” or higher is required in order to graduate.

‡ A minimum of “C” or higher is required in MEC 260 to take this course.

# A minimum grade of “C” or higher is required in MEC 101 in order to take MEC 102

(bold) MEC 203, 225, and 260, are typically offered both fall and spring; all other courses offered only in their respective semesters. MEC 262 and MEC 363 are also often offered during the summer.

(italicized) SB Curriculum courses, PHY 251/252 or ESG 281, EST 392/ECO 108 are not prerequisites for future courses and can be taken any semester

Note: For students entering Fall 2014, they follow the new Stony Brook Curriculum instead of DEC. Those courses are underlined.

**Table 2b: Recommended course sequence (effective for students admitted Fall 2016 or later)**

		<b>Fall</b>		<b>Spring</b>
<b>Freshman</b>	1	ITS 101	1	ITS 102
	3	WRT 102 ( <u>SBC-WRT</u> )	3	AMS 161 OR MAT 132 ( <u>SBC-QPS</u> )
	3	AMS 151 or MAT 131 ( <u>SBC-QPS</u> )	3	MAT 211 OR AMS 210
	4	PHY 131 & 133 ( <u>SBC-SNW</u> )	4	PHY 132 & 134 ( <u>SBC-QPS</u> )
	3	MEC 101	2	MEC 102#
	3	<u>SBC (HUM)</u>	3	<u>SBC (USA)</u>
<b>Total</b>	<b>17</b>		<b>16</b>	
<b>Sophomore</b>				
	4	AMS 261 or MAT 203	3	<i>EST 392 or ECO 108</i>
	4	CHE 131	3	<i>Basic Science Elective</i>
	3	<b>MEC 203</b>	4	AMS 361 or MAT 303
	3	MEC 220	3	MEC 262 †‡
	3	<b>MEC 260 †</b>	3	MEC 363 ‡
<b>Total</b>	<b>17</b>		<b>16</b>	
<b>Junior</b>				
	3	ESG 332	1	MEC 300
	1	MEC 214	3	MEC 305
	1	<b>MEC 225*</b>	2	MEC 317 ( <u>SBC-TECH</u> )
	3	MEC 301	3	MEC 320
	3	MEC 310	3	MEC 325
	2	MEC 316 ( <u>SBC-TECH</u> )	3	MEC 410
	3	MEC 364		
<b>Total</b>	<b>16</b>		<b>15</b>	
<b>Senior</b>				
	3	MEC 440 ( <u>SBC-Cat. 3 &amp; 4</u> )	3	MEC 441 †
	4	MEC 411	3	Tech Elec #2
	3	MEC 422	3	Tech Elec #3
	3	Tech Elec #1	3	<u>SBC (GLO)</u>
	3	<u>SBC (STAS)</u>	3	<u>SBC (ARTS)</u>
<b>Total</b>	<b>16</b>		<b>15</b>	
		<b>TOTAL = 128</b>		

\* May be taken in any semester prior to or including MEC 325

† A minimum grade of "C" or higher is required in order to graduate.

‡ A minimum of "C" or higher is required in MEC 260 to take this course.

# A minimum grade of "C" or higher is required in MEC 101 in order to take MEC 102 (**bold**) MEC 203, 225, and 260, are typically offered both fall and spring; all other courses offered only in their respective semesters. MEC 262 and MEC 363 are also often offered during the summer.

(italicized) SB Curriculum courses, PHY 251/252 or ESG 281, EST 392/ECO 108 are not prerequisites for future courses and can be taken any semester

Note: For students entering Fall 2014, they follow the new Stony Brook Curriculum instead of DEC. Those courses are underlined.

**Basic Science Elective Options:**

PHY 251/252: Modern Physics	4
ESG 281: Engrg Intro Solid State	3
PHY 300: Waves and Optics	4
CHE 132: General Chem II	4
BIO 202: Molecular & Cellular Bio	3
BIO 203: Cellular and Organ Phys	3
GEO 310: Intro to Geophysics	3
GEO 312: Structure & Prop of Materials	3
AST 203: Astronomy	4
AST 205: Intro to Planetary Science	3
ATM 205: Intro to Atmosph Science	3

**Table 3a: Graduation clearance form.**

(for students entering the program from Fall 2012 through Fall 2015)

NAME: BLANK, STUDENT (MAT LVL 5) ID: 100000005					DEGREE STATUS: INCOMPLETE
REQUIREMENT	GRADE	T/Wvr	GPA	NOTES	
* EST 392 or ECO 108 (3)					
* CHE 131, 141 or ESG 198 (4)					
* MAT 131 or AMS 151 (4)					
* MAT 132 or AMS 161 (4)					
* MAT 203 or AMS 261 (4)					
* MAT 303 or AMS 361 (4)					
* PHY 131/133 (4)					
* PHY 132/134 (4)					
* PHY 251/252 or ESG 281 (4)					
* ESG 332 (3)					
* MEC 101 (2)					
* MEC 102 (2)					
* MEC 203 (3)					
* MEC 214 (1)					
* MEC 220 or ESE 271 (2)					
* MEC 225 (1)					
* MEC 260 (3)					
* MEC 262 (3)					
* MEC 300 (1)					
* MEC 301 (3)					
* MEC 305 (3)					
* MEC 310 (3)					
* MEC 316 (2)					
* MEC 317 (2)					
* MEC 320 (3)					
* MEC 325 (3)					
* MEC 363 (3)					
* MEC 364 (3)					
* MEC 410 (3)					
* MEC 411 (4)					
* MEC 422 (3)					
* MEC 440 (3)					
* MEC 441 (3)					
* TE 1 (3)					
* TE 2 (3)					
* TE 3 (3)					
✓ Major GPA	...		...		
✓ UG GPA	...		...		
* SBC Courses (verify with CEAS; not accurate for Honors College plan)					Need: WRT,WRT,HUM,QPS,SNW,TECH,SBS,USA,STAS,G...

### Table 3b: Graduation clearance form.

(for students entering the program from Spring 2016 to present)

<b>NAME:</b> BLANK, STUDENT (MAT LVL 5)		<b>DEGREE STATUS:</b> INCOMPLETE		
<b>ID:</b> 100000005				
REQUIREMENT	GRADE	T/Wvr	GPA	NOTES
* EST 392 or ECO 108 (3)				
* MAT 131 or AMS 151 (3)				
* MAT 132 or AMS 161 (3)				
* MAT 211 or AMS 210 (3)				
* MAT 203 or AMS 261 (4)				
* MAT 303 or AMS 361 (4)				
* PHY 131/133 (4)				
* PHY 132/134 (4)				
* CHE 131 (4)				
* Basic Science Elective (3)				
* ESG 332 (3)				
* MEC 101 (3)				
* MEC 102 (2)				
* MEC 203 (3)				
* MEC 214 (1)				
* MEC 220 or ESE 271 (3)				
* MEC 225 (1)				
* MEC 260 (3)				
* MEC 262 (3)				
* MEC 300 (1)				
* MEC 301 (3)				
* MEC 305 (3)				
* MEC 310 (3)				
* MEC 316 (2)				
* MEC 317 (2)				
* MEC 320 (3)				
* MEC 325 (3)				
* MEC 363 (3)				
* MEC 364 (3)				
* MEC 410 (3)				
* MEC 411 (4)				
* MEC 422 (3)				
* MEC 440 (3)				
* MEC 441 (3)				
* TE 1 (3)				
* TE 2 (3)				
* TE 3 (3)				
✓ Major GPA	...		...	
✓ UG GPA	...		...	
* SBC Courses (verify with CEAS; not accurate for Honors College plan)				Need: WRT,HUM,QPS,SNW,TECH,SBS,USA,STAS,GLO,ARTS

### **Advising for Course Registration**

Every mechanical engineering student will be assigned an academic advisor who is a member of the mechanical engineering faculty. The Department will schedule two Advising Weeks before the pre-registration period of each semester. Students are required to obtain the advisor's approval before registering for mechanical engineering courses for the following semester.

### **Grading**

All courses taken to satisfy requirements 1 through 9 above must be taken for a letter grade. No courses fulfilling the major requirements for the B.E. in Mechanical Engineering may be taken on a Pass/No Credits basis.

In addition, the grade point average for all MEC courses and all technical electives must be at least 2.0. When a course is repeated, the higher grade will be used in calculating this average. A minimum grade of "C" in MEC 260, MEC 262, and MEC 441 is required for the BE degree. Note: In order to satisfy prerequisites for certain required courses, grades of "C" or higher are needed in the following courses: PHY 131 or PHY 125, MAT 131 or MAT 125, and MEC 101.

### **Minimum Grades**

Starting in Fall 2010, the following minimum grades will be required in the following courses before being allowed to move onward:

- A grade of *C* or higher must be obtained in MEC 101 in order to take MEC 102.
- A grade of *C* or higher must be obtained in MEC 260 and MEC 262 in order to graduate.
- A grade of *C* or higher must be obtained in MEC 260 in order to take MEC 262 and MEC 363.

Starting in Fall 2014, the following additional minimum grades will be required:

- grade of *C* or higher must be obtained in MEC 441 in order to graduate
- A grade of *C* or higher must be obtained in MEC 262 in order to take MEC 310
- A grade of *C* or higher must be obtained in MEC 363 in order to take MEC 316

Note also that the Physics and Mathematics departments have minimum grade requirements for their courses, including those required for Mechanical Engineering. Grades of "C" or higher are needed in the following courses: PHY 131 or PHY 125, MAT 131 or MAT 125. Please check with these departments for details.

### **Undergraduate Research**

Students with a superior academic record (a G.P.A of 3.0 or better) may use MEC 499 (3 credits) for an independent research study under the guidance of a Mechanical Engineering faculty member. Additional details may be found in the course description. The department has several research laboratories; a description of these laboratories can be found in the Graduate Bulletin. This course must be taken at Stony Brook.

### **Graduate Courses**

Graduate level courses may be taken by undergraduate students with a superior academic record and may be counted as technical electives. Approval must be obtained from the Department of Mechanical Engineering Undergraduate Program Director, the course instructor, and the Graduate School.

### **College Residence Requirement**

In addition to course requirements for a B.E. degree in mechanical engineering, students must meet the Residence Requirement of the College of Engineering and Applied Science (CEAS) as follows.

At least seven engineering courses (those with the designator BME, MEC, ESE, ESG, or ESM) and/or approved technical elective courses must be completed in CEAS at Stony Brook. At least five of the seven courses must be taken in the Department of Mechanical Engineering. In addition, the following courses may not be used to meet the above requirement: MEC 300; MEC 316, 317; MEC 440, and 441. Similar courses (laboratories and senior design) in other departments of CEAS also may not be used to meet the requirement.

### **College Time Limits for the B.E. Degree**

All requirements for the Bachelor of Engineering degree must be met in eleven semesters by those students with full-time status. Full-time transfer students must meet all degree requirements in the number of semester remaining after the number of transferred degree-related credits are divided by 12 (the semester equivalency) and the result is subtracted from 11 (semesters). In addition, students who withdraw from the University and return at a later date to complete degree requirements are required to have formally re-evaluated all courses more than six years old that were taken at Stony Brook or elsewhere to fulfill major requirements.

### **University Graduation Requirements**

In addition to the above requirements a student should check that he or she has met all additional requirements set forth by the University, and the CEAS.

### **Allowed Calculators**

Effective spring, 2010 only the following calculators will be permitted on all midterm and final exams in the Department of Mechanical Engineering. There will be no exceptions! This list of calculators is identical to that allowed for the *National Council for Examiners for Engineering and Surveying* (NCEES) Fundamentals of Engineering (FE) exam that many of you will take in your senior year, as well as the Professional Engineering (PE) exam that you may take several years from now. The sooner you become comfortable on one of these calculators, the better.

#### NCEES Allowed calculators as of spring, 2010:

- ▶ Casio: All **fx-115** models. Any Casio calculator must contain fx-115 in its model name.
- ▶ Hewlett Packard: The **HP 33s** and **HP 35s** models, but no others.
- ▶ Texas Instruments: All **TI-30X** and **TI-36X** models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

The NCEES policy on calculators can be found here: <http://ncees.org/exams/calculator-policy/> .

## **Other College-Wide Information**

### **CEAS Undergraduate Student Office (Room 127, Engineering, (631) 632-8381)**

The Undergraduate Student Office of College of Engineering and Applied Sciences provides a variety of services to undergraduate students within the College, including general academic advising, appropriate referrals for advising within a specific major, D.E.C. (Diversified Education Curriculum) or Stony Brook Curriculum requirement advising, and assistance with processing transfer credits. The Undergraduate Student Office also receives and processes student petitions to the CEAS Committee on Academic Standing and Appeals (CASA). Student organizations, including profes-

sional and honor societies, maintain mailboxes within the Undergraduate Student Office, and scholarships and internships for CEAS students are also coordinated through this office (see below). The Undergraduate Student Office is open Monday to Friday, 9:00 a.m. to 5:00 p.m.

### **Internship Program**

The College of Engineering and Applied Sciences manages an extensive internship program for students in engineering and applied science disciplines. Students interested in obtaining an internship with an outside organization should contact the Undergraduate Student Office (Room 127, Engineering) for information on position postings and application procedures. Internships obtained through CEAS are paid and may or may not include academic credits.

### **Scholarships**

CEAS students may apply for a variety of scholarships available to sophomores, juniors, and seniors. Applications can be obtained from the Undergraduate Student Office (Room 127, Engineering) beginning in early December for the following academic year.

## **The Accelerated BE/MS Program in Mechanical Engineering**

The accelerated BE/MS program in mechanical engineering allows students to use up to 9 graduate credits taken as an undergraduate towards both BE and MS degree requirements, thus reducing the normal time required to complete the MS degree. The program is designed for upper-division mechanical engineering students with superior academic records (GPA > 3.1). For detailed program requirements including admission requirements, please contact the Graduate Program Director.

## **Minor in Mechanical Engineering**

The minor in mechanical engineering is offered for students who want the record of their University studies to show a significant amount of upper-division work in the discipline. Entry into this minor presupposes a background in mathematics and physics, represented by the prerequisite requirements for the courses listed below.

### **Requirements for the Minor in Mechanical Engineering (MEC)**

Completion of the minor requires 18-20 credits, of which 12-13 are from required courses and 6-7 from electives. A student who wishes to pursue this minor should consult with the undergraduate program director in the Department of Mechanical Engineering before registering for the elective courses. All courses must be taken for a letter grade and a G.P.A. of 2.0 or higher is required for the six courses that constitute the minor.

#### **1. Four required courses:**

- MEC 260 Engineering Statics
- MEC 262 Engineering Dynamics
- MEC 301 Thermodynamics  
*or* ESG 302 Thermodynamics of Materials
- MEC 363 Mechanics of Solids

#### **2. Two elective courses chosen from the following:**

- MEC 305 Heat and Mass Transfer
- MEC 310 Introduction to Machine Design
- MEC 320 Numerical Methods in Engineering Design and Analysis
- MEC 325 Manufacturing Processes and Machining (requires MEC 225 also)

- MEC 364 Introduction to Fluid Mechanics
- MEC 393 Engineering Fluid Mechanics
- MEC 398 Thermodynamics II
- MEC 402 Mechanical Vibrations
- MEC 411 System Dynamics and Control
- MEC 491, 492 Topics in Mechanical Engineering
- MEC 455: Applied Stress Analysis

Note that *all* pre- and co-requisites for a course must be met in order to be eligible to register for it. Other electives require approval of the undergraduate program director.

## Minor in Engineering Composites

The Department of Mechanical Engineering offers the minor in Engineering Composites to Mechanical Engineering students and non-Mechanical Engineering students who seek a strong education in the mechanical behavior of composite materials. This major is intended for students with a strong background in engineering or physical science. Engineering composites are used widely in many industries including aerospace, civil, naval, medical, and automotive; examples can be seen in aircraft, yachts, motor vehicles, dental fillings and a wide range of military equipment. Engineering composites can be designed with high stiffness, high strength and light weight, making them efficient as structural load bearing components. They constitute an extremely broad and versatile class of materials that encompass a wide range of constituents, length scales and configurations. Examples include fiber reinforced polymer composites, metal matrix composites, particle reinforced composites, nano-reinforced composites. Composites are inherently more complex than monolithic engineering materials that students are used to (e.g. metals and ceramics). They are heterogeneous, anisotropic and predicting their mechanical behavior and failure is far more challenging than that of conventional structural materials. In comparison to conventional materials, designing with composites admits tremendous possibility, but requires specialized analysis methods. This minor will provide the students with the background as well as the analysis and design methods to provide a foundation for using engineering composites effectively. To fulfill this outcome, three main topics will be addressed: 1) Theoretical background, analysis and design; 2) Fabrication; and 3) Characterization. Students will learn how to fabricate composites, experimentally measure their relevant mechanical properties, and incorporate them into engineering designs. Students will gain invaluable insight into engineering composites, give them a competitive edge in an engineering market that is becoming increasingly dependent on engineering composites.

### Requirements for the Minor in Engineering Composites

Completion of the minor requires 18-21 credits from the following 3 required and 3 elective courses. Please note that all prerequisites must be satisfied in order to take these courses. A student who wishes to pursue this minor should consult with the undergraduate program director in the Department of Mechanical Engineering before registering for the elective courses. All courses must be taken for a letter grade and a G.P.A. of 2.0 or higher is required for the six-seven courses that constitute the minor.

1. Three Required Courses (9 credits)
  - MEC 363: Mechanics of Solids
  - MEC 456: Intro to Engineering Mechanics of Composites
  - MEC 457: Engineering Composites Fabrication and Characterization

2. Three Elective Courses from the following list (9 to 12 credits):
- MEC 455: Applied Stress Analysis
  - MEC 442: Introduction to Experimental Stress Analysis
  - ESG 302: Thermodynamics of Materials
  - ESG 332: Materials Science I (Cannot be used by MEC, ESG, and CIV majors)
  - ESM 335: Strength of Materials
  - ESM 369: Polymer Engineering
  - BME 353 or ESM 353: Biomaterials : Manuf, Prop, and Appl

## Mechanical Engineering Course Descriptions

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**MEC 101: Freshman Design Innovation, Prerequisite: Pre- or co-requisites: AMS 151 or MAT 125 or MAT 131 or MAT 141 or MPE level 4 or greater and PHY 125 or PHY 131 or PHY 141, Fall, Credits 3.** Presents an overview of mechanical engineering profession, engineering ethics, basics of computation via correct usage of dimensions, units, and significant digits, and engineering documentation. Furthermore, this course introduces the students to the process of engineering design and provides a project-based design experience wherein the students design, build, and program a microcontroller driven autonomous mechatronic device. In doing so, they are provided an early exposure to the systematic approach to engineering problem solving that brings together fundamentals concepts of forces, motions, energy, materials, manufacturing processes, and machines and mechanisms from Mechanical Engineering and basic electronics, sensing, actuation, and Computer Programming.

**MEC 102: Engineering Computing and Problem Solving, Prerequisite: a grade of “C” or better in MEC 101, Spring, Credits 2.** Introduction to programming with MATLAB. Topics include base systems, finite machine arithmetic, variables and storage, control structures, iteration, arrays and matrix operations, functions, reading and writing data files, interfacing MATLAB with other languages. Emphasis is on developing good programming skills, debugging, documenting code, and optimization.

**MEC 203: Engineering Graphics and CAD, Fall, Spring and Summer, Credits 3.** Introduces engineering graphics and its role in design process. Includes the principles of engineering drawing and sketching for mechanical design, the use of computer graphics and solid modeling in design representation of 3D objects, assembly and simulation as well as ASME standards on geometric dimensioning and tolerances. Includes hands-on experience in the use of CAD software packages for engineering design. Engineering ethics.

**MEC 213: Studies in Nanotechnology, Prerequisites: PHY 131 or PHY 125; CHE 131 or ESG 198, Spring, Credits 2.** The emerging field of nanotechnology develops solutions to engineering problems by taking advantage of the unique physical and chemical properties of nanoscale materials. This interdisciplinary, co-taught course introduces materials and nano-fabrication methods with applications to electronics, biomedical, mechanical and environmental engineering. Guest speakers and a semester project involve ethics, toxicology, economic and business implications of nanotechnology. Basic concepts in research and design methodology and characterization techniques will be demonstrated. Course is cross-listed as BME 213, MEC 213, and EST 213 and is required for the Minor in Nanotechnology Studies (NTS).

**MEC 214: Probability and Statistics for Mechanical Engineers, Prerequisites: MAT 126 or 131 or 141 or AMS 151. Co-requisites: MAT 127 or 132 or 142 or 171 or AMS 161, Fall, Credits 1.** Foundations of probability and statistics as applied to mechanical measurements and experimentation. Basic statistical analysis of data and assessing likelihood of future events based on past history. Concept of random sampling. Uncertainty analysis and error propagation, using both analytical and graphical tools. Assessing dominant sources of error in measurements.

**MEC 220: Practical Electronics for Mechanical Engineers, Prerequisites: PHY127, PHY132, or PHY142; Fall, Credits 3.** This is a lecture and laboratory two-credit course that will overview basic electronics from a practical level (versus a theoretical approach) to provide mechanical engineering students with the fundamentals to do basic electronics work needed for laboratories, subsequent courses and their professional careers.

**MEC 225: Fundamentals of Machining Practices, Pre- or Co-requisite: MEC 203; Prerequisite: MEC major or permission of instructor, *Spring and Fall*, Credits 1.** Hands-on experience in the fundamentals of machining including metrology tools and devices, saw, sheet metal working, drilling, reaming, tapping, turning, boring, milling, and welding.

**MEC 260: Engineering Statics, Prerequisites: PHY 131 or 141 or 125, Co-requisite: MAT 203 or AMS 261. *Fall and Spring*, Credits 3.** A review of vector algebra. Concept of force. Equilibrium of particles. Moments about points and lines, couples and equivalent force systems. Equilibrium of rigid bodies. Analysis of simple structures such as trusses, frames, and beams. Centroids, centers of gravity, and moments of inertia. Dry friction with applications to wedges, screws, and belts. Method of virtual work, potential energy, and stability.

**MEC 262: Engineering Dynamics, Prerequisites: MEC260 with a grade of “C” or higher, *Spring and Summer*, Credits 3.** Vectorial kinematics of particles in space, orthogonal coordinate systems. Relative and constrained motions of particles. Dynamics of particles and the systems of particles, equations of motion, energy and momentum methods. Collisions. Two- and three-dimensional kinematics and dynamics of rigid bodies. Moving frames and relative motion. Free, forced, and damped vibrations of particles and rigid bodies.

**MEC 300: Technical Communication in Mechanical Engineering, Prerequisite: WRT 102; Co-requisite MEC 317; MEC major; U3 or U4;. *Spring, S/U Grading*. Credits 1.** Aims to ensure proficiency in the types of communication necessary for success in the engineering profession. Provides students with the ability to apply their knowledge of correct written and spoken English to the diverse modes of communication encountered and used by engineers in the professional workplace.

**MEC 301: Thermodynamics, Prerequisites: AMS 261 or MAT 203; PHY 131 or 141 or 125, CHE 131, MEC Major. *Fall*, Credits 3.** Variables that describe the thermodynamic state of a system or control volume, including absolute temperature, internal energy, enthalpy, and entropy are introduced, and basic principles governing the transformations of energy, especially heat and work, are developed. Underlying principles are used to analyze and solve problems related to thermodynamic systems and to determine the changes in properties of the systems and surroundings implied by changes in inputs, configuration or constraints.

**MEC 305: Heat and Mass Transfer, Prerequisites: MEC 301 and 364; MEC 102 or MEC 111 or MEC 112 or ESG 111 or ESE 124 CSE 114 or CSE 130 or BME 120. *Spring*, Credits 3.** The fundamental laws of momentum, heat and mass transfer, and the corresponding transport coefficients. Principles of steady-state and transient heat conduction in solids are investigated. Laminar and turbulent boundary layer flows are treated, as well as thermal radiation, and radiation heat transfer between surfaces. Applications to heat transfer equipment are covered throughout the course.

**MEC 310: Introduction to Machine Design, Prerequisites: MEC 102 or MEC 111 or MEC 112, or ESG 111, or ESE 124, or CSE 114 or 130, or BME 120; minimum grade of “C” or better in MEC 262 (or BME 260 for BME majors); Pre- or co-requisites: MEC 203 (ESG 316 for ESG Majors). *Fall*, Credits 3.** Application of graphical and analytical methods to the analysis and synthesis of mechanism. Covers concepts of degrees of freedom, graphical and analytical linkage synthesis, position, velocity, acceleration, and force analysis of linkage mechanisms. Introduces principles behind the operation of various machine elements such as gears and gear trains, cams, and flywheels, and their design and analysis techniques.

**MEC 316: Mechanical Engineering Lab I: *Sensors and Instrumentation*, Prerequisites: MAT 303 or AMS 361, PHY 134 and MEC major; Co-requisites: MEC 220 or ESE 271, MEC 214, MEC 301 and MEC 364; and minimum grade of “C” or better in MEC 363. *Fall*, Credits 2.** The spatial and temporal resolution of modern instrumentation and sensors that are particular to mechanical engineering. Concepts of Fourier analysis and frequency responses are discussed together with the statistical analysis of data. Includes basic circuit components. Laboratory safety. Students learn to operate instruments for measuring temperature, pressure, flow velocity, displacement, angle, acceleration, and strain. Design project. Laboratory fee required.

**MEC 317: Mechanical Engineering Laboratory II, Prerequisites: MEC 316 and MEC 364, Co-requisites: MEC 300, 305. *Spring*, Credits 2.** Hands-on experience in solid and fluid mechanics and heat transfer. Emphasis is on the understanding of fundamental principles as well as familiarity with modern experimentation. Lectures at the beginning of the course provide background information and theories of experimentation. Student groups perform four experiments each in solid mechanics and in fluid mechanics and heat transfer. Report writing is an integral part of the course, with emphasis on design of experiment, interpretation and presentation of data, error analysis, and conclusions. Laboratory fee required.

**MEC 320: Numerical Methods in Engineering Design and Analysis, Prerequisites: MEC 102 or MEC 111 or MEC 112, or ESG 111, or ESE 124, or CSE 114 or CSE, or BME 120, AMS 261 or MAT 203; AMS 361 or MAT 303 *Spring*, Credits 3.** This course emphasizes the implementation of numerical methods for computer-aided solutions to problems that arise in engineering design and analysis. Methods include interpolation, extrapolation, curve fitting, and integration and techniques for solving non-linear equations, systems of linear equations, and differential equations. Optimization in engineering design is covered from the formulation of design specifications and criteria, to analyzable models, through to numerical implementation.

**MEC 325: Manufacturing Processes and Machining, Pre-or Co-Requisite: MEC 125 or MEC 225. *Spring*, Credits 3.** The relationship between product design and manufacturing. Materials properties and influence. Introduces traditional and nontraditional manufacturing processes and their capabilities and limitations. Measurement inspection, reliability, and quality engineering. Economic impact of modern process engineering.

**MEC 363: Mechanics of Solids, Prerequisite: MEC 260 or BME 260 with a grade of “C” or higher, *Spring and Summer*, Credits 3.** Stress and deformation of engineering structures and the influence of the mechanical behavior of materials. Concepts of stress and strain, constitutive relations, analysis of statically indeterminate systems, study of simple bars and beams, and stability conditions. Emphasis on force equilibrium, elastic response of materials, geometric compatibility, Mohr’s circle, stresses and deflections in beams, and torsion and buckling of rods. Design for bending, shear and combined states of stress.

**MEC 364: Introduction to Fluid Mechanics, Prerequisite: MEC 262 (or BME 260 for BME majors), Prerequisite: PHY 126 or PHY 131, MEC or CIV major, *Fall*, Credits 3.** Fundamental properties of fluids and their conservation laws with applications to the design and evaluation of flows of engineering interest. Topics include hydrostatics, surface tension, dimensional analysis and dynamic similitude, Euler’s equation, rotating coordinate systems, boundary layers, lubrication, drag on immersed bodies, open channel and pipe flows, and turbomachinery.

**MEC 391: Introduction to Automotive Engineering I, Prerequisites: MEC 262, MEC 363, MEC Major, Credits 1.** First part of a year-long course. Review of Society of Automotive Engineers (SAE) Collegiate Design competitions of past years and the rules of specific competitions and other competition-related issues. Selected engineering topics and mathematical/software tools are introduced including their application to solving engineering problems and to achieving design objectives.

**MEC 392 Introduction to Automotive Engineering II, Prerequisite: MEC 391; MEC Major. Credits 2.** A continuation of MEC 391. Students who enroll in MEC 391 must complete MEC 392 in the subsequent semester and receive only one grade upon completion of the sequence.

**MEC 393: Engineering Fluid Mechanics, Prerequisite: MEC 364, Credits 3.** The application of the principles of fluid mechanics to important areas of engineering practice such as turbomachinery, hydraulics, and wave propagation. Prepares students for advanced coursework in fluid dynamics. Extends the study of viscous effects, compressibility, and inertial begun in MEC 364.

**MEC 398: Thermodynamics II, Prerequisite: MEC 301 and MEC 364, Credits 3.** Psychrometrics and psychrometric charts. Thermodynamic considerations for the design and performance of cooling towers, humidifiers, and dehumidifiers. Reacting mixtures, combustion, and chemical equilibrium. Thermodynamics of fluid flow, simple compression and expansion processes. Analysis and design of gas and vapor power cycles. Cycles with reheat, intercooling, and cogeneration plants. Refrigeration cycles.

**MEC 402: Mechanical Vibrations, Prerequisites: MEC 262 and MEC 363, Credits 3.** Modeling, analysis and design for mechanical vibrations. Fundamentals of free vibration, harmonically excited vibration and vibration under general forcing conditions are considered for one degree, two degree and multidegree of freedom systems; continuous systems; vibration design strategies including isolation and absorbers.

**MEC 406: Energy Management in Commercial Buildings, Prerequisites: MEC 398, Credits 3.** Basic heating, ventilating, and air-conditioning (HVAC) system design and selection for commercial buildings. Includes both low-rise and high-rise structures. Selection of central plant components and equipment, calculation of space heating and cooling load, computer techniques for estimating annual energy consumption. ASHRAE codes. Building controls. BACnet.

**MEC 410: Design of Machine Elements, Prerequisites: MEC 310 and MEC 363, Spring, Credits 3.** Application of analytical methods, material science, and mechanics to problems in design and analysis of machine components. Includes the design of mechanical components such as bearings, gears, shafting, springs, fasteners, belts, clutches, and brakes, and takes into consideration factors such as manufacturability and reliability. Design projects with open-ended and interactive problems are assigned to integrate several machine elements in a system.

**MEC 411: Control System Design and Analysis, Prerequisites: MEC 262, MEC 316, and AMS 361 or MAT 303, Fall, Credits 4.** Analysis and design of feedback control systems. Topics include system modeling; transfer function, block diagram and signal-flow graph; sensors, actuators, and control circuit design; control system characteristics and performance; stability analysis; root locus method; Bode diagram; PID and lead-lag compensator design.

**MEC 422: Thermal System Design, Prerequisite: MEC 305, Fall, Credits 3.** Device design and system design. Quantitative data for system design including operating characteristics of compressors, turbines, heat exchangers, piping systems, internal combustion engines, and other component equipment. Component matching and system simulation. Optimization including thermo-economic evaluation and energy analysis. Case studies: refrigeration and air conditioning systems; combined cycles; steam-injected gas turbines.

**MEC 423: Internal Combustion Engines, Prerequisites: MEC 305, Varies, Credits 3.** Introduction to internal combustion engines and their operation. Analytical approach to the engineering problem and performance analysis of internal combustion engines. Topics include thermodynamics fundamentals; fuel-air cycle analysis; engine combustion; emission formation and control strategies. Includes both the relevant fundamental concepts and the extensive practical knowledge base on which engine research, development, and design depend. Not for credit in addition to MEC 523.

**MEC 440: Mechanical Engineering Design I, Prerequisites: MEC 125 or MEC 225, and MEC 310, 320, 325, and MEC major: U4 standing, Co-requisite: MEC 300, MEC 317, MEC 410 and 411, Fall, Credits 3.** Part I of the two-semester capstone design project sequence. Senior students select a project incorporating multiple realistic constraints and engineering standards, develop the necessary technical background, and write a proposal, progress reports, and a preliminary design report. Includes an oral presentation on the development and progress of the project. Not counted as a technical elective. Laboratory fee required. The final grade will be assigned at the end of the two course sequence MEC 440-441.

**MEC 441: Mechanical Engineering Design II, Prerequisite: MEC 440, Spring, Credits 3.** Part II of the two-semester capstone design project sequence. Students complete the project design incorporating multiple realistic constraints and engineering standards, building and test a prototype, write a mid-term report and a final design report as well as giving an oral presentation. Not counted as a technical elective. Laboratory fee required.

**MEC 442: Introduction to Experimental Stress Analysis, Prerequisites: MEC 363, Varies, Credits 3.** The concepts of three-dimensional stress and strain, their transformation laws, and their mutual relationships are discussed in detail. Results from theory of elasticity as pertinent to experimental stress analysis are also presented. Experimental techniques studied include two-dimensional photoelasticity, resistance strain gauge, moire method, brittle coating, and analog methods. The application of different techniques to the measurement of stress and strain in models as well as actual structures is demonstrated. Students form small groups and each group is assigned different laboratory projects to gain experience in various experimental stress analysis methods.

**MEC 450 Mechatronics, Prerequisites: MEC 310, 316, 411; Spring, Credits 3.** An introduction to the design, modeling, analysis and control of mechatronic systems (smart systems comprising mechanical, electrical, and software components). Fundamentals of the basic components needed for the design and control of mechatronic systems, including sensors, actuators, data acquisition systems, microprocessors, programmable logic controllers, and I/O systems, are covered. Hands-on experience in designing and building practical mechatronic systems is provided through integrated lab activities.

**MEC 455: Applied Stress Analysis, Prerequisite: MEC 363, Spring, Credits 3.** A study of linear elastic solids with emphasis on internal stress analysis. Simple boundary value problems at plane structures are analyzed with various solution techniques. Major topics are stress and strain tensors, linear elasticity, principle of virtual work, torsion, stress functions, stress concentration, elementary fracture, and plasticity.

**MEC 456: Introduction to Engineering Mechanics of Composites, Prerequisite: MEC 363, Credits 3.** Introduction to the engineering mechanics of fiber reinforced composites. Brief history of the development of fiber composites, their properties, advantages, limitations and applications. Overview of the different types of composites but with focus on long fiber reinforced composites; particularly, lamina and laminate concepts characteristics and configurations. Topics covered include: elastic properties of unidirectional lamina, strength of unidirectional lamina, elastic behavior of multidirectional laminates and stress and failure of multidirectional laminates. Design methodologies and considerations for structural composite materials.

**MEC 457: Engineering Composites Fabrication and Characterization, Prerequisite: MEC 363, Credits 3.** Overview of fiber reinforced composites, applications and mechanical properties. Introduction to fiber composites fabrication methods as well as experimental characterization methods used in acquiring their relevant mechanical properties. Fabrication topics include: Impregnation of fibers; Prepregs; Stacking; Curing; Vacuum bagging; Autoclave technology; Out-of-autoclave manufacturing processes; Molding; Processing; Cutting and Joining. Topics in mechanical characterization include: Experimental methods; Characterization of the elastic properties and failure strengths of unidirectional lamina; Characterization of the elastic properties and failure strengths of multidirectional laminates. Course is divided into in-class lectures and laboratory sessions.

**MEC 460 Introduction to Robotics, Prerequisites: MEC 262; U4 standing, Varies, Credits 3.** Theory and Applications Robot components and mechatronic aspects of robotics (sensors, actuators, end effectors, system integration). Rotation, translation, rigid-body transform. Robotics foundations in kinematics and inverse kinematics, dynamics, serial and parallel manipulators and their duality. Introduction to mobile robots and LEGO Robotics, control theories, motion planning, trajectory generation, grasping and manipulation, robotic programming language, industrial robotics, manufacturing automation, and societal impacts. Hands-on projects. *Note:* Not for Credits in addition to CSE 378.

**MEC 464 Fundamentals of Aerodynamics, Prerequisites: MEC 305, 310, and 364, Varies, Credits 3.** Kinematics and dynamics of incompressible irrotational flow; stream function and the potential function; Euler and Bernoulli equations. Thin-foil theory; lift and moment for symmetric and cambered airfoils. Finite-wing theory; induced drag. Compressible flow, small disturbance theory; thin wing at subsonic and supersonic speeds.

**MEC 465 Aerospace Propulsion, Prerequisites: MEC 305, 310, 364, Varies, Credits 3.** Fundamentals of propulsion; performance parameters, thermodynamic cycles. Introduction to combustion and combustors. Performance and cycle analysis of various flight propulsion systems: turbojets, turbofans, turboprops, ramjets, scramjets, rockets, propellers. Design of supersonic inlet nozzles, component matching and map.

**MEC 470 Introduction to Engineering Tribology, Prerequisites: MEC 363 and 364; Spring, Credits 3.** Focus is on the fundamentals of tribology, the science of surfaces in relative motion, with an introduction to friction, lubrication, and wear. The basics of tribology science: engineering surfaces, contact mechanics, lubrication theory, wear processes and modeling, wear properties of materials, and tribology test methods will be covered. Analysis of tribological aspects of machine components and bearings. Industrial case studies will be presented to place the topics in context to industry and society.

**MEC 475: Undergraduate Teaching Practicum, Prerequisites: U4 standing; a minimum GPA of 3.00 in all Stony Brook courses and the grade of B or better in the course in which the student is to assist; permission of department, Credits 3.** Students assist the faculty in teaching by conducting recitation or laboratory sections that supplement a lecture course. The student receives regularly scheduled supervision from the faculty instructor. May be used as an open elective only and repeated once.

**MEC 488: Mechanical Engineering Internship, Prerequisite: Permission of undergraduate program director, Credits 3 to 9. S/U Grading.** Participation in off-campus engineering practice. Students are required to submit to the department a proposal at the time of registration and two term reports before the end of the semester. May be repeated up to a limit of 12 credits. **Note:** MEC 488 may *not* be used for to satisfy degree requirements in any way, and is not a technical elective.

**MEC 495: Professional Engineering Seminar, Prerequisites: CEAS major; U4 standing, Credits 1. S/U Grading.** Prepares the student to enter the workplace as a practicing engineer. Topics include professional ethics, professional activities, professional engineering licensing, patents, seeking entry-level employment, and exposure to the engineering work environment. Aids in preparation for the EIT/FE exam. Includes speakers from a variety of disciplines, within the College and from industry.

**MEC 499: Research in Mechanical Engineering, Prerequisite: Permission of department, Credits 0–4.** An independent research project under the supervision of a mechanical engineering faculty member. Permission to register requires the agreement of the faculty member to supervise the research and submission of a one-page research proposal. May be repeated but only six credits of research electives may be counted as technical electives.

### **TECH (DEC E) Category Course offered from Mechanical Engineering**

**MEC 104: Practical Science of Things, Prerequisite: Level 2+ on the mathematics placement exam or satisfactory completion of D.E.C. C or QPS, Credits 3.** A practical introduction to the science and engineering of objects and phenomena in everyday life. The basic principles that underlie the operation common to modern devices such as rollercoasters, balloons, vacuum cleaners, airplanes, bicycles, thermostats, air conditioners, automobiles, and GPS systems are developed by investigating how they work. Issues of design, safety, and environmental impact are also discussed.

### **SNW (DEC E) Category Courses offered from Mechanical Engineering**

**MEC 104: Practical Science of Things, Prerequisite: Satisfaction of entry skill in mathematics requirement, Prerequisite: Level 2+ on the mathematics placement exam or satisfactory completion of D.E.C. C or QPS, Credits 3.** A practical introduction to the science and engineering of objects and phenomena in everyday life. The basic principles that underlie the operation common to modern devices such as rollercoasters, balloons, vacuum cleaners, airplanes, bicycles, thermostats, air conditioners, automobiles, and GPS systems are developed by investigating how they work. Issues of design, safety, and environmental impact are also discussed.

**MEC 105: Everyday Science, Prerequisite: Level 2+ on the mathematics placement exam or satisfactory completion of D.E.C. C or QPS, Credits 3.** A practical introduction to the science and engineering of objects and phenomena in everyday life. The basic principles that underlie the operation common to modern devices such as xerographic copiers, tape recorders, computers, microwaves, lasers, CDs, plastics, nuclear weapons, and magnetic resonance imaging (MRI) are developed by investigating how they work. Issues of design, safety, and environmental impact are also discussed.

### **STAS (DEC H) Category Course Offered from Mechanical Engineering**

**MEC 280: Pollution and Human Health, Prerequisite: one D.E.C. E or SNW course, Credits 3.** An examination of major environmental pollution problems such electromagnetic radiation, ozone layer depletion, and global warming, with a specific focus on the resulting effects on human health. Assessment of health risks in relation to the formulation of environmental and workplace regulations is also considered.

## Faculty – Areas of Specialization

### Department of Mechanical Engineering

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<b>CHAKRABORTY, Nilanjan</b> , Assistant Professor Ph.D., Rensselaer Polytechnic Institute <a href="mailto:Nilanjan.Chakraborty@stonybrook.edu">Nilanjan.Chakraborty@stonybrook.edu</a> Robot motion planning, multi-robot coordination, human-robot interaction, mechanism design, multi-body dynamics, distributed intelligent systems for energy automation, sensor networks, distributed algorithms, combinatorial optimization.	HE 212 632-9327
<b>CHANG, Qing (Cindy)</b> , Assistant Professor Ph.D., University of Michigan <a href="mailto:Qing.Chang@stonybrook.edu">Qing.Chang@stonybrook.edu</a> Real-time production control, manufacturing system modeling, simulation and intelligent maintenance, real-time energy management of manufacturing system.	LE 163 632-8329
<b>CHEN, Shikui</b> , Assistant Professor Ph.D., Northwestern University Ph.D., Chinese University of Hong Kong, <a href="mailto:Shikui.Chen@stonybrook.edu">Shikui.Chen@stonybrook.edu</a> Predictive science based design optimization	LE 165 632-2309
<b>CHIANG, Fu-pen</b> , Distinguished Professor Ph.D., University of Florida <a href="mailto:Fu-pen.Chiang@stonybrook.edu">Fu-pen.Chiang@stonybrook.edu</a> Experimental solid mechanics; optical-nondestructive evaluation	LE 105 632-8311
<b>COLOSQUI, Carlos</b> , Assistant Professor Ph.D., Boston University <a href="mailto:Carlos.Colosqui@stonybrook.edu">Carlos.Colosqui@stonybrook.edu</a> Numerical analysis of fluid and thermal systems, energy, and high-performance computer simulations.	LE 155 632-4758
<b>CUBAUD, Thomas</b> , Associate Professor Ph.D., Paris-Sud University/ESPCI <a href="mailto:Thomas.Cubaud@sstonybrook.edu">Thomas.Cubaud@sstonybrook.edu</a> Microfluidics, multiphase flows, interfacial fluid dynamics, complex fluids, nanotechnologies.	LE 107 632-1110

<p><b>GE, Q. Jeffrey</b>, Professor &amp; Chair  Ph.D., University of California  <a href="mailto:Qiaode.Ge@stonybrook.edu">Qiaode.Ge@stonybrook.edu</a>  Design automation; robotics; CAD/CAM, mechanical systems  analysis and simulation</p>	<p>LE 113  632-8305</p>
<p><b>HUANG, Hsengji (Sam)</b>, Assistant Professor  Ph.D. University of Michigan  <a href="mailto:Hsengji.Huang@stonybrook.edu">Hsengji.Huang@stonybrook.edu</a>  Solid Mechanics</p>	<p>LE 133  632-8309</p>
<p><b>HWANG, David J.</b>, Associate Professor  Ph.D. University of California, Berkeley  <a href="mailto:David.Hwang@stonybrook.edu">David.Hwang@stonybrook.edu</a>  Laser materials processing, solar energy, energy technology,  near-field optical diagnostics</p>	<p>HE 222  632-8346</p>
<p><b>KAO, Imin</b>, Professor  Ph.D., Stanford University  <a href="mailto:Imin.Kao@stonybrook.edu">Imin.Kao@stonybrook.edu</a>  Robotics; stiffness control; wiresaw  manufacturing process; manufacturing  automation; Taguchi methods</p>	<p>LE 167/OE 127  632-8308</p>
<p><b>KINCAID, John</b>, Professor Emeritus  Ph.D., The Rockefeller University  <a href="mailto:John.Kincaid@stonybrook.edu">John.Kincaid@stonybrook.edu</a>  Statistical mechanics and thermodynamics</p>	
<p><b>KUTKA, Robert V.</b>, Associate Professor &amp; Associate Dean  Ph.D., Brown University  <a href="mailto:Robert.Kukta@stonybrook.edu">Robert.Kukta@stonybrook.edu</a>  Solid mechanics, thin films crystal growth, micro-  mechanics of defects in crystals</p>	<p>OE 127  632-8384</p>
<p><b>LADEINDE, Foluso</b>, Associate Professor  Ph.D., Cornell University  <a href="mailto:Foluso.Ladeinde@stonybrook.edu">Foluso.Ladeinde@stonybrook.edu</a>  Turbulence; highspeed flows; theoretical and  computational fluid dynamics; materials processing</p>	<p>HE 224  632-9293</p>
<p><b>LAWLER, Benjamin</b>, Assistant Professor  Ph.D., University of Michigan  <a href="mailto:Benjamin.Lawler@stonybrook.edu">Benjamin.Lawler@stonybrook.edu</a>  Internal combustion engines</p>	<p>LE 131  632-8022</p>

<p><b>LONGTIN, Jon P.</b>, Professor  Ph.D., University of California , Berkeley  <a href="mailto:Jon.Longtin@stonybrook.edu">Jon.Longtin@stonybrook.edu</a>  Short-pulse laser-material interactions,  precision laser measurement techniques,  microscale heat transfer</p>	<p>LE 159  632-9436</p>
<p><b>MACHTAY, Noah</b>, Research Assistant Professor  Ph.D., Stony Brook University  <a href="mailto:Noah.Machtay@stonybrook.edu">Noah.Machtay@stonybrook.edu</a></p>	<p>HE 146  632-9014</p>
<p><b>MAMALIS, Sotirios</b>, Assistant Professor  Ph.D., University of Michigan  <a href="mailto:Sotirios.Mamalis@stonybrook.edu">Sotirios.Mamalis@stonybrook.edu</a>  Internal combustion engines</p>	<p>LE 151  632-8077</p>
<p><b>NAKAMURA, Toshio</b>, Professor  Ph.D., Brown University  <a href="mailto:Toshio.Nakamura@stonybrook.edu">Toshio.Nakamura@stonybrook.edu</a>  Solid mechanics; computational fracture mechanics</p>	<p>LE 137  632-8312</p>
<p><b>O'BRIEN, Edward E.</b>, Professor Emeritus  Ph.D., Johns Hopkins University  <a href="mailto:Edward.Obrien@stonybrook.edu">Edward.Obrien@stonybrook.edu</a>  Fluid mechanics; theoretical studies of turbulence  transport, and chemical reactions</p>	
<p><b>PURWAR, Anurag</b>, Research Associate Professor and SPIR Coordinator  Ph.D., State University of New York at Stony Brook  <a href="mailto:Anurag.Purwar@stonybrook.edu">Anurag.Purwar@stonybrook.edu</a>  Computer modeling; theory, practical application</p>	<p>LE 169  632-8542</p>
<p><b>RASTEGAR, Jahangir</b>, Associate Professor  Ph.D., Stanford University  <a href="mailto:Jahangir.Rastegar@stonybrook.edu">Jahangir.Rastegar@stonybrook.edu</a>  Kinematics, dynamics and control of high  performance machinery, optimal design of  mechanical systems</p>	<p>HE 108  632-8314</p>
<p><b>SESAY, Juldeh</b>, Research Associate Professor  Ph.D., State University of New York at Stony Brook  <a href="mailto:Juldeh.Sessay@stonybrook.edu">Juldeh.Sessay@stonybrook.edu</a>  Turbulent flows; combustion; computational fluid dynamics  and biothermal fluid sciences.</p>	<p>HE 226  632-8493</p>

<p><b>SHARMA, Satya</b>, Research Professor and Executive Director  Center of Excellence in Wireless and Information Technology  Ph.D., University of Pennsylvania  <a href="mailto:Satya.Sharma@stonybrook.edu">Satya.Sharma@stonybrook.edu</a>  Manufacturing and Production</p>	<p>CEWIT  632-8350</p>
<p><b>TASI, James</b>, Professor Emeritus  Ph.D., Columbia University  <a href="mailto:James.Tasi@stonybrook.edu">James.Tasi@stonybrook.edu</a>  Solid mechanics; study of shock waves  in crystal lattices and granular media;  dislocation motion in crystals</p>	
<p><b>WANG, Lifeng</b>, Assistant Professor  Ph.D., Tsinghua University  <a href="mailto:Lifeng.Wang@stonybrook.edu">Lifeng.Wang@stonybrook.edu</a>  Solid mechanics, structural and composite materials,  and multifunctional smart materials.</p>	<p>LE 141  632-1182</p>
<p><b>WANG, Lin-Shu</b>, Associate Professor  Ph.D., University of California  <a href="mailto:Lin-Shu.Wang@stonybrook.edu">Lin-Shu.Wang@stonybrook.edu</a>  Energy conversion: foundation of  thermodynamics; high-efficiency combustion engines</p>	<p>HE 214  632-8324</p>
<p><b>WANG, Ya</b>, Assistant Professor  Ph.D., Virginia Tech  <a href="mailto:Ya.S.Wang@stonybrook.edu">Ya.S.Wang@stonybrook.edu</a>  adaptive and multifunctional structures with integrated  wireless sensing, energy harvesting and dynamic control  using smart materials</p>	<p>LE 153  632-8322</p>
<p><b>YADAV, Vivek</b>, Assistant Professor  Ph.D., Ohio State University  <a href="mailto:Vivek.Yadav@stonybrook.edu">Vivek.Yadav@stonybrook.edu</a>  Robotics and controls to identify the principles governing  human motor control and corresponding neural correlates</p>	<p>LE 161  632-9164</p>

## Staff

### Department of Mechanical Engineering

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BARONE, Dominique Assistant to Chair <a href="mailto:Dominique.Barone@stonybrook.edu">Dominique.Barone@stonybrook.edu</a>	LE 109 632-8300
HSU, Ta-Yung Supervisor of Mechanical Engineering Laboratories <a href="mailto:Ta-Yung.Hsu@stonybrook.edu">Ta-Yung.Hsu@stonybrook.edu</a>	LE 129 632-8307
TEJADA, Raphael Mechanical Laboratory Technician <a href="mailto:Raphael.Tejada@stonybrook.edu">Raphael.Tejada@stonybrook.edu</a>	LE 139 632-8249
MORRIS, April Department Secretary <a href="mailto:April.Morris@stonybrook.edu">April.Morris@stonybrook.edu</a>	LE 113 632-8310
BERGER, Dianna (Dee) Graduate Program Secretary <a href="mailto:Dianna.Berger@stonybrook.edu">Dianna.Berger@stonybrook.edu</a>	LE 113 632-8340

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## Lab Safety

Students working in a research laboratory can take a two-part training class, offered by Environmental Health and Safety. Students using ionizing radiation and lasers should take an additional class. The classes are offered in the fall, spring, and summer. Please contact your advising professor for details on these classes and when and where they are offered.

## Important Campus Phone Numbers

<b>STUDENT HEALTH CENTER</b>	2-6740
<b>HOUSING</b>	
Campus Residences	2-6750
Off-Campus Housing Service	2-6770
<b>MEAL PLAN</b>	
Meal Plan Office	2-6517
<b>ENVIRONMENTAL HEALTH &amp; SAFETY</b>	
Emergency	333
Non-Emergency	2-6410

## Directions to Stony Brook University

Stony Brook University is situated on an 1,100 acre site on the north shore of Long Island in southeastern New York. We are approximately 60 miles east of New York City. The GPS Coordinates of the Engineering Building are:

### By Car:

From New York City, take the Long Island Expressway (LIE, I-495) eastbound from the Queens Midtown Tunnel in Manhattan or the Throgs Neck Bridge or Whitestone Bridge in Queens to exit 62, and follow Nicolls Road (Route 97) north for 9 miles. The main entrance to the University is on the left.

### By Train:

Take the [Long Island Railroad's](#) Port Jefferson line from Penn Station in Manhattan to Stony Brook. The LIRR station is at the north end of the campus; bus service to the central campus is provided. Trains to and from Penn Station generally require a transfer at either Jamaica or Huntington. Hicksville is also a transfer point on some lines.

### By Ferry:

Car ferries cross [Long Island Sound at Bridgeport, Connecticut to Port Jefferson, Long Island](#). Take Route 25A West to Nicolls Road (about 4 miles), and turn left on Nicolls Road. The University entrances are the first three intersections that you come to. From [New London, Connecticut to Orient Point, Long Island](#) take Route 25A west to Nicolls Road and proceed as above.

### By Plane:

[Long Island's Islip-MacArthur Airport](#) is 16 miles from the campus and is serviced by direct flights by major airlines and commuter lines. [New York City Area Airports](#) (JFK, LaGuardia and Newark) are 50 miles to the west.

Driving directions to Stony Brook University from Islip-MacArthur Airport: exit the airport via Johnson Avenue. Turn right onto Veterans Memorial Highway (Route 454 West). Turn right onto Lakeland Avenue (Route 93) and right again onto Smithtown Avenue. After crossing the bridge, Smithtown Avenue becomes Ronkonkoma Avenue. Turn right onto Expressway Drive South and take the Long Island Expressway (I-495) east to Exit 62 (Route 97) and follow Nicolls Road north for 9 miles. The main entrance to the University is on the left.