



MONTCLAIR STATE
UNIVERSITY

**Office of the Provost and
Vice President for Academic Affairs**

Voice: 973-655-4382

Fax: 973-655-4647

July 16, 2020

Dr. Christopher Pierre
Provost and Vice President for Academic Affairs
Stevens Institute of Technology
Wesley J. Howe Center, 12th Floor
Castle Point on Hudson
Hoboken, NJ 07030

Dear Dr. Pierre,

I am forwarding the enclosed signed agreement regarding the 5-year dual degree program, providing a BS in Physics from Montclair State University and an ME in Mechanical Engineering from Stevens Institute of Technology.

This revised agreement extends the duration of the original agreement and incorporates recent updates to the Physics BS curriculum. Changes in our mathematics course sequence that will be implemented in the fall semester are also reflected in the updated curriculum guide and 5-year plan found in Appendices I and II.

Prof. Favata has previously sent these changes to your Sr. Vice Provost for Graduate Education, Dr. Costas Chassapis.

Sincerely,

Willard P. Gingerich, Ph.D.
Provost and Vice President for Academic Affairs

WPG:lg

Encl.

cc: Lora Billings, Dean, College of Science and Mathematics
Marc Favata, Chairperson & Associate Professor, Department of Physics &
Astronomy Joanne Cote-Bonanno, Associate Provost for Academic Programs &
Assessment

An Educational Agreement
Between
The Trustees of the Stevens Institute of Technology
And
Montclair State University
For the
Articulated
Baccalaureate in Physics – Master of Engineering in Mechanical Engineering
Degree Program
Dated as of February 10, 2020

The Trustees of the Stevens Institute of Technology (“Stevens”), One Castle Point on Hudson, Howe Center, 13th Floor, Hoboken, New Jersey 07030, and Montclair State University (“MSU”), 1 Normal Avenue, Montclair, NJ 07043, hereby formally agree as of February 10, 2020 to the establishment of an Educational Articulation Agreement in an effort to encourage the entrance of students into the engineering profession.

WHEREAS, Stevens is an educational institution serving the region and the State as a primary provider of engineering education; and

WHEREAS, MSU is dedicated to the provision of undergraduate educational programs;

WHEREAS, the College of Science and Mathematics of MSU offers the B.S. in Physics, among other degree and non-degree programs;

WHEREAS, Stevens offers the M.E. in Mechanical Engineering, among other degree and non-degree programs;

NOW, THEREFORE, MSU and Stevens hereby agree as to the terms of mutual and individual responsibilities related to the offering of an Articulated Baccalaureate BS Physics – M.E. degree program in Mechanical Engineering (as further described herein, the “Articulated Program”).

A. GENERAL GUIDELINES

A.1 MSU agrees to offer the Baccalaureate in Physics and Stevens agrees to offer the Master’s program in Mechanical Engineering, in each case in accordance with their respective policies and procedures and the general guidelines described below.

- A.2 Stevens will award the M.E. degree to students covered by this Agreement upon the recommendation of the Stevens' Department of Mechanical Engineering and obtaining all other approvals required by Stevens' policies and procedures.
- A.3 MSU will award the B.S. degree upon the recommendation of the MSU Department of Physics and Astronomy and obtaining all other approvals required by MSU's policies and procedures.
- A.4 An Advisory Committee (the "Committee") shall be formed, comprised of equal representation of faculty/staff appointed by MSU and Stevens and jointly chaired by a co-director from MSU and a co-director from Stevens. The Committee shall provide advice on the overall operation of the Articulated Program. The Committee will meet as needed with the program co-directors to review the progress of the Articulated Program. The Committee shall be advisory in nature, shall make recommendations to the parties for approval of all matters and shall have no authority to create new academic or administrative policies without further approval by the appropriate institution.
- A.5 The Committee shall be responsible for recommending criteria for admission into the Articulated Program, advertising and publicity, recruitment brochures, evaluation, interviewing, selection based on established criteria, and notification of applicants. The Committee shall establish procedures within each institution which ensure that, upon admission, all applicants are informed of the specific requirements for continued good standing and the requirements for acceptance at Stevens at the completion of the undergraduate phase. Ultimate admission to Stevens will remain the prerogative of Stevens, and the Committee will establish procedures to ensure that all prospective students are aware of this condition to admission.

- A.6 The Committee shall be responsible for advising, counseling and reviewing the progress of each student in the undergraduate phase of the Articulated Program. It is recognized that students in the Articulated Program must fulfill all the necessary curricular requirements of each of MSU and Stevens to qualify as candidates for the baccalaureate and Master's degrees. If the candidate were to drop out of the Stevens graduate program, the courses completed at Stevens would still be counted towards the undergraduate degree at MSU.
- A.7 The Committee shall be responsible for coordinating the baccalaureate requirements at the MSU undergraduate colleges/schools with the pre-requisites for admission to Stevens, and shall recommend students from the program for admission to Stevens based upon their performance in the Articulated Program. Stevens shall retain final authority to admit students to Stevens.
- A.8 Salary and non-salary support for faculty and staff associated with the Articulated Program will be provided by the institution where the faculty/staff appointment is held, as determined to be appropriate in the sole discretion of such institution.
- A.9 Faculty/staff office space will be provided by the institution where the faculty/staff appointment is held, as determined to be appropriate in the sole discretion of such institution.
- A.10 While matriculated at MSU, each student will be entitled to the same services and privileges accorded to all regularly enrolled MSU students, and while enrolled at Stevens each student will be entitled to the same services and privileges accorded to all regularly enrolled Stevens students.

B. ELIGIBILITY AND ADMISSION CRITERIA

- B.1 Qualified students who are interested in the Articulated Program will be identified in their second semester as candidates for the Articulated Program so that they may be suitably advised to take the necessary courses and stay in track. They will formally apply at the beginning of the 2nd semester of their third year (sixth semester from freshman entry) for admission into the graduate program at Stevens.
- B.2 For admission into Stevens for the Mechanical Engineering phase of the Articulated Program, applicants must have completed their general education requirements set forth in Appendix I and all the required major courses set forth in Appendix II with an overall grade point average of 3.2 and a cumulative math and science grade point average of 3.0 or better. In the event of advanced placement credit in the prerequisite sciences, applicants will still be required to take substituted upper level science courses at MSU. Performance in these sciences will be a component for the basis of evaluation for admission into the engineering phase of the Articulated Program. The Committee shall periodically review the eligibility and admission criteria and recommend modifications as appropriate.
- B.3 After preliminary evaluation of the applications by the Committee, selected applicants will be invited for interviews with members of the Committee from Stevens and MSU respectively. Following this interview, the Committee will make recommendations to their admissions office and obtain final decisions regarding the student's eligibility to be admitted to the undergraduate phase of the Articulated Degree program. Applicants will be notified of admission decisions in writing as early as possible after the interviews.

- B.4 All applicants and accepted and enrolled students in the Articulated Program must satisfy MSU and Stevens requirements, including, but not limited to, student immunization and health requirements and disciplinary disclosure.

C. ARTICULATED PROGRAM REQUIREMENTS

- C.1 Prior to matriculation at Stevens, each applicant must have successfully completed three years of undergraduate matriculation with the required overall grade point average of 3.2 and a math/science grade point average of 3.0.
- C.2 All Stevens applications must be submitted to the Stevens Graduate School by January 15th of the year during which the student applicant is beginning the 6th semester at MSU;
- C.3 No withdrawals or incomplete grades in any Articulated Program requirement course at MSU will be accepted by Stevens;
- C.4 Those applicants who meet the academic criteria noted above may be invited for an interview with Stevens Admissions Committee, however, MSU will establish procedures to ensure that those applicants who are invited are advised that the invitation does not guarantee acceptance into the Mechanical Engineering phase of the Articulated Program.
- C.5 Applicants who are not invited for interview, or are not selected for admission to Stevens, shall be notified of the decision as early as possible, and may reapply for regular admission the following year through the Stevens Graduate School. Upon completing the fourth year of the Articulated Program, these students will be eligible to graduate with a B.S. in physics from MSU despite the absence of admission to Stevens.
- C.6 During their fourth year in the Articulated Program, students who have been admitted to Stevens will enroll in the first year of Mechanical Engineering courses, which may be

applied towards fulfilling credit requirements for the undergraduate Physics degree at MSU. The MSU baccalaureate degree will be conferred at the end of four years or when a student has completed the requirements for the degree. It is the responsibility of the student to satisfy all requirements for their degree(s), including cross registration and submission of Stevens transcripts to MSU, enabling transfer of up to 15 credits.

- C.7 The MSU Co-Director of the Articulated Program will meet regularly with students in the Articulated Program and inform the Committee of any matters or recommendations concerning the Articulated Program or individual students.
- C.8 The parties acknowledge and agree that both parties are covered by the Federal Family Educational Rights and Privacy Act (“FERPA”) and neither party will share educational records of any student except in compliance with FERPA including without limitation 34 CFR§99.34. For purposes of FERPA compliance, the parties shall liaise through the Committee and their respective registrar’s offices.

D. FINANCIAL ARRANGEMENTS

- D.1 Financial aid, scholarships and fellowships shall be awarded to students in the Articulated Program by MSU and Stevens, respectively, on the same basis as awarded to other students at these institutions, and within the sole discretion of each such institution.
- D.2 MSU will bill for and collect all student fees and tuition for students enrolled in the baccalaureate phase of the Articulated Program at MSU (prior to matriculation at Stevens).
- D.3 Stevens will bill for and collect all student fees and tuition for students enrolled in the Stevens phase of the Articulated Program (subsequent to matriculation at Stevens).

D.4 The cost for administering the Articulated Program will be shared equally by MSU and Stevens.

E. GOVERNING LAW; OTHER LEGAL MATTERS

E.1 This Agreement shall be governed by the laws of the State of New Jersey, in which State this Agreement has been made.

E.2 The parties agree that all Federal and State laws against discrimination, and all rules and regulations promulgated thereunder, shall be applicable to all activities under this agreement. Each institution agrees to consider and admit students into the Articulated Program on the basis of merit without regard to race, national or ethnic origin, color, religion, age, sex, sexual orientation, gender identity or expression, marital status or disability, genetic information, veteran status, or any other basis protected by law.

E.3 MSU is an agency of the State of New Jersey. Any agreement or arrangement signed or entered into on behalf of the State of New Jersey by a State official or employee shall be subject to all of the provisions of the New Jersey Torts Claims Act, NJSA 59:1-1 et seq., the New Jersey Contractual Liability Act, NJSA 59:13-1, et seq., and the availability of appropriations. The State of New Jersey does not carry public liability insurance, but the liability of the State and the obligations of the State to be responsible for tort claims against its agencies and employees is covered under the terms and provisions of the New Jersey Tort Claims Act. The Act also creates a special self-insurance fund and provides for payment and claims against the State of New Jersey against its employees for which the State of New Jersey is obligated to indemnify against tort claims which arise out of the performance of their duties. Claims against MSU or its employees should be referred for handling to the Attorney General, Division of Law, Claims Service Section, Richard

Hughes Complex, Trenton, New Jersey 08625. Furthermore, the State of New Jersey self-funds for Workers Compensation and Disability.

- E.5 Stevens shall provide for professional and general liability coverage ensuring Stevens and its faculty, students, and employees performing activities under this Agreement providing limits of coverage of \$1,000,000/\$3,000,000 on an occurrence type basis pursuant to N.J.S.A. 59:1 – 1et seq., the State of New Jersey Tort Claims Act.

E. REPORTS

- E.1 The co-directors of the Articulated Baccalaureate/M.E. Program shall submit a written report annually to the appropriate academic officers holding jurisdiction, summarizing the activities of the Articulated Program along with academic transcripts for each student in the Program (subject to FERPA compliance).

F. OTHER CONSIDERATIONS

- F.1 This Agreement shall be for a term of five (5) years, commencing on September 1, 2020, and terminating on June 30, 2025. At least six months prior to the expiration of this Agreement, or no later than on January 31, 2025, the parties agree that they will conduct a review of the Articulated Program and determine whether to renew or terminate this Agreement. If the parties agree to extend the term of this Agreement for another five (5) years, its terms may be modified or changed only with the written consent of both parties.
- F.2 This Agreement may be terminated (a) by mutual agreement of the parties or (ii) by either party upon the occurrence and continuation of a material breach by a party of any term or condition of this Agreement, provided that written notice has been given

by the non-defaulting party and, if such default is capable of cure, the defaulting party has not cured such failure within thirty (30) days of receipt of such notice.

It is further agreed that in the event that either party terminates this Agreement, and notwithstanding any other provision of this Agreement, both parties will assume a responsibility to all students enrolled in their respective degree programs as of the date of the termination notice, to permit said students to complete such program.

F.2 Copies of this Agreement shall be filed in the offices of the University Provost at MSU and in the Office of the Provost at Stevens.

F.3 This Agreement shall not be assigned or transferred, nor shall any obligation or right be delegated, without written consent of Stevens and MSU.

F.5 This Agreement shall be binding upon the parties hereto and their successors.

F.6 In this Agreement, Stevens and MSU shall continue to be autonomous and shall be governed independently by their respective governing bodies and administration.

F.7 Any notice by either institution to the other regarding this Agreement shall be in writing and sent by registered or certified mail and addressed as follows:

1) Provost and Vice President for Academic Affairs, Stevens Institute of Technology, One Castle Point on Hudson, Hoboken, New Jersey 07030, with a copy to the General Counsel at the same address; or

2) The Provost, MSU, 1 Normal Avenue, Montclair, NJ 07043.

F.8 MISCELLANEOUS PROVISIONS.

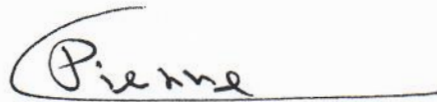
(a) Entire Agreement. This Agreement constitutes the entire agreement between the parties pertaining to the subject matter hereof, and supersedes all prior and contemporaneous agreements, understandings, negotiations and discussions of the Parties, whether oral or written.

(b) Severability. If any provision of this Agreement or portion thereof is held invalid, illegal, void or unenforceable by reason of any rule of law, administrative or judicial provision or public policy, such provision shall be ineffective only to the extent invalid, illegal, void or unenforceable, and the remainder of such provision and all other provisions of this Agreement shall nevertheless remain in full force and effect.

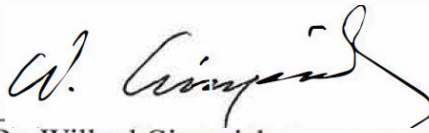
(c) Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original, but taken together shall constitute one instrument.

(d) Relationship of the Parties. Nothing contained herein shall create any agency, partnership, or joint venture between the parties. Neither party shall have any right or authority to create any obligation or responsibility, express or implied, on behalf of or in the name of the other party, or to bind the other party contractually in any manner whatsoever. Under no circumstances, as a result of this Agreement, shall any employee, agent, or representative of either party be considered an employee, agent or representative of the other party, and no employee, agent or representative of either party shall be entitled to any payment from the other party in the nature of benefits under workers' compensation or disability benefits laws, or otherwise, for any accident, illness, occurrence or event arising out of or relating to this Agreement.

IN WITNESS WHEREOF, Stevens and MSU have caused this Agreement to be executed by their duly authorized officers and their seals hereunder to be affixed as of the day and year as set forth above.

A handwritten signature in cursive script, appearing to read "Pierre", followed by a horizontal line.

Dr. Christophe Pierre
Provost and Vice President for Academic Affairs

A handwritten signature in cursive script, appearing to read "W. Gingerich", followed by a horizontal line.

Dr. Willard Gingerich
Provost

Appendix I

MSU BS in Physics Degree Requirements

BS/ME PHME -- Fall 2020



MONTCLAIR STATE
UNIVERSITY

Montclair State University
Department of Physics and Astronomy

BS Physics, ME Mechanical Engineering 5-year Program



STEVENS
INSTITUTE of TECHNOLOGY
THE INNOVATION UNIVERSITY®

I. GenEd Requirement		23 sh	PHYS 470 Solid State Physics	3
A. New Student Seminar	<i>GNED 199</i>	1	PHYS 480 Astrophysics	3
C. Communication		9	PHYS 495 Research/Indep. Study in Physics	1-4
C1. Writing				
C2. Literature				
C3. Communication				
Complete 3 sh from Categories D, F1, and F2:		3		
D. Fine and Performing Arts				
F. Humanities				
F1. Great Works and Their Influences				
F2. Philosophical and Religious Perspectives				
G. Computer Science	<i>CSIT 104</i>	(0)		
H. Mathematics	<i>MATH 122 or AMAT 120</i>	(0)		
I. Natural Science Laboratory	<i>PHYS 191</i>	(0)		
J. Physical Education		1		
K. Social Science		6		
Complete 6 credits from Categories K1, K2, K3 or				
II.B. (World Cultures)				
K1. American and European History				
K2. Global Cultural Perspectives				
K3. Social Science Perspectives				
L. Interdisciplinary Studies		3		
II. World Languages and Cultures Requirement		3 sh		
A. World Languages		3		
B. World Cultures		(0)		
(Some World Cultures courses may fulfill Gen Ed requirements.)				
III. Major Requirements		68-72 sh		
A. Physics Core		(33 sh)		
PHYS 191 University Physics I		4		
PHYS 192 University Physics II		4		
PHYS 198 Introductory Physics Seminar		1		
PHYS 210 Intermediate Mechanics		3		
PHYS 220 Oscillations, Waves, & Optics		3		
PHYS 230 Intermediate Physics Laboratory		4		
PHYS 300 Junior/Senior Physics Seminar		1		
PHYS 320 Statistical and Thermal Physics		3		
PHYS 330 Advanced Physics Laboratory		4		
PHYS 340 Electricity and Magnetism		3		
PHYS 360 Modern Physics		3		
B. Physics Electives		(6-8 sh)		
PHYS 180 Astronomy for Everyone		4		
PHYS 245 Fundamentals of Electronics		4		
PHYS 280 Astronomy for Physicists		4		
PHYS 341 Electronics and Digital Circuits		4		
PHYS 350 Modern Optics		4		
PHYS 380 Observational Astronomy		4		
PHYS 399 Special Topics in Physics		1-4		
PHYS 451 Radiation and Medical Physics		3		
PHYS 461 Special & General Relativity		3		
PHYS 462 Nuclear Physics		4		
PHYS 464 Quantum Mechanics		3		
			C. Collateral Requirements	(26-27 sh)
			CSIT 104 Computational Concepts	3
			CHEM 120 General Chemistry I	4
			CHEM 121 General Chemistry II	4
			MATH 122 Calc. I or AMAT 120 Applied Calc. A	4
			MATH 221 Calc. II or AMAT 220 Applied Calc. B	4
			MATH 222 Calculus III	4
			and choose one of the following options:	
			AMAT 350 Applied Mathematics I	3
			or PHYS 377 Mathematical Physics	3
			or MATH 325 Differential Equations	4
			D. Program Electives	(3-4 sh)
			Choose one physics, math, or applied math course from this list:	
			PHYS 310 Advanced Mechanics	3
			PHYS 325 Computational Physics	3
			PHYS 368 Fluid Mechanics	3
			PHYS 377 Mathematical Physics	3
			AMAT 240 Introduction to Linear Algebra	3
			AMAT 356 Mathematical Modeling	3
			AMAT 360 Numerical Computing	3
			AMAT 450 Applied Mathematics II	3
			MATH 225 Linear Algebra	4
			MATH 421 Partial Differential Equations	3
			MATH 460 Intro. to Applied Mathematics	3
			MATH 463 Numerical Analysis	3
			MATH 464 Operations Research I	3
			MATH 469 Mathematical Modeling	3
			AMAT 530 Scientific and Numerical Computing I	3
			AMAT 534 Data-Driven Modeling and Computation	3
			AMAT 542 Methods of Applied Mathematics	3
			AMAT 544 Applied Differential Equations	3
			IV. Transfer credits from Stevens applied to MSU	15 sh
			(Undergraduate engineering courses to prepare for graduate coursework.)	
			V. Free Electives	7 - 11 sh
			Minimum total required for graduation	120 sh
			Students apply to dual-degree program in 6th semester (Jan. 15th deadline). For admission to Stevens MS program, General Education and major courses must be completed by the end of the 6th semester, with an overall GPA of at least 3.2 and math/science GPA at least 3.0. Admission committee interview required. Enrollment at Stevens commences in year 4.	

Appendix II
Suggested Sequence for Five-Year Program
BS in Physics – M.E. in Mechanical Engineering

BS/ME PHME -- Fall 2020

Suggested Sequence for Five-Year Plan

First Year (MSU)

Fall	Total: 18cr	Spring	Total: 18cr
I. PHYS 191 University Physics I (4) H. MATH122 Calc I or AMAT120 App Calc A(4)* G. CSIT 104 Computational Concepts (3) C1. Writing (3) A. New Student Seminar (1) D, F1, or F2 Gen. Ed. Course (3)		PHYS 192 University Physics II (4) PHYS 198 Introductory Physics Seminar (1) MATH 221 Calc II or AMAT 220 App Calc B (4) C2. Literature (3) C3. Communication (3) K1, K2, K3, or World Cultures Course (3)	

Second Year (MSU)

Fall	Total: 18cr	Spring	Total: 16cr
PHYS 220 Oscillations, Waves, & Optics (3)** PHYS 230 Intermediate Physics Lab (4) MATH 222 Calculus III (4) CHEM 120 General Chemistry I (4) L. Interdisciplinary Studies (3)		PHYS 360 Modern Physics (3)** AMAT 350 or PHYS 377 (3) [or MATH 325 (4)] CHEM 121 General Chemistry II (4) K1, K2, K3, or World Cultures Course (3) Free Elective (3)	

Third Year (MSU)

Fall	Total: 18cr	Spring	Total: 17cr
PHYS 210 Intermediate Mechanics (3)** PHYS 330 Advanced Physics Lab (4) PHYS 300 Junior/Senior Physics Seminar (1) Physics Elective (4) Free Elective (3) World Language I (3)		PHYS 340 Electricity and Magnetism (3)** PHYS 320 Statistical and Thermal Physics (3)** Program Electives (3) Physics Elective (4) Free Elective (3) J. Physical Education (1)	

Fourth Year (Stevens)

Fall	Total: 15cr ("swing credits")	Spring	Total: 12cr
ME 126 Mechanics of Solids (4) ME 322 Engineering Design VI (2) ME 345 Modeling and Simulation (3) ME 361 Design of Machine Components (3) ME 354 Heat Transfer (3)		ME 483 Control Systems (3) ME 491 Manufacturing Processes & Systems (3) ME 635 Modeling & Simulation (3); required ME 641 Engineering Analysis I (3); required	

Fifth Year (Stevens)

Fall	Total: 12cr	Spring	Total: 12cr
ME Concentration Course I (3) ME Concentration Course II (3) ME Elective Course I (3) ME Elective Course II (3)		ME Concentration Course III (3) ME Concentration Course IV (3) ME Elective Course III (3) ME Elective Course IV (3)	

Note: General Education, World Languages/Cultures, and free electives can be taken in any sequence, but C1 and C2 should be completed in Year 1.

*Students who do not have a strong (4 year) background in high school mathematics, including exponential, logarithmic, and trigonometric functions are advised to take MATH 111 Applied Precalculus before Calculus I.

** The PHYS 210, 320, 340 and PHYS 220, 360 sequences are offered in alternate years and can be taken in Year 2 or Year 3. Most 200-level and higher physics courses are offered on an alternate-year schedule.

Stevens' M.E. in Mechanical Engineering Degree Requirements:

The Master of Engineering in Mechanical Engineering program offers seven areas of concentration and requires the completion of thirty credits. The program structure is as follows:

- Two required core courses
- At least four courses from any one of the seven concentrations below must be chosen
- Four elective courses must be chosen. These are explained in the “Elective Courses” section below.

Required Courses

- ME 635 Modeling and Simulation
- ME 641 Engineering Analysis I

Concentration Courses

Product Design

- ME 520 Analysis and Design of Composites
- ME 615 Thermal Systems Design
- ME 658 Advanced Mechanics of Solids
- ME 659 Advanced Structural Design
- ME 663 Finite Element Method
- ME 665 Advanced Product Development

Manufacturing

- ME 565 Introduction to Additive Manufacturing
- ME 566 Design for Manufacturability
- ME 644 Computer Integrated Design and Manufacturing
- ME 645 Design of Production Systems
- ME 652 Advanced Additive Manufacturing
- ME 653 Design for Additive Manufacturing

Thermal, Fluids, Energy

- ME 510 Power Plant Engineering
- ME 601 Engineering Thermodynamics
- ME 604 Advanced Heat Transfer
- ME 615 Thermal Systems Design
- ME 674 Fluid Dynamics
- ME 675 Computational Fluid Dynamics and Heat Transfer

Pharmaceutical Manufacturing

- ME 530 Introduction to Pharmaceutical Manufacturing

- ME 535 Good Manufacturing Practice in Pharmaceutical Facilities Design
- ME 540 Validation and Regulatory Affairs in Pharmaceutical Manufacturing
- ME 628 Manufacturing and Packaging of Pharmaceutical Oral Solid Dosage Products
- ME 629 Manufacturing of Sterile Pharmaceuticals
- ME 647 Environmental Systems (HVAC) in Healthcare Manufacturing

Medical Devices

- ME 525 Biomechanics
- ME 526 Biofluid Mechanics
- ME 580 Medical Device Design and Technology
- ME 658 Advanced Mechanics of Solids
- ME 660 Medical Devices Manufacturing
- ME 674 Fluid Dynamics

Robotics & Control

- ME 598 Introduction to Robotics
- ME 621 Introduction to Modern Control Engineering
- ME 622 Optimal Control and Estimation of Dynamical Systems
- ME 631 Mechanical Vibrations I
- ME 651 Analytic Dynamics
- ME 654 Advanced Robotics

Micro/Nano Systems

- ME 573 Introduction to MEMS
- ME 581 Introduction to BioMEMS
- ME 680 Fundamentals of Micro/Nano Fluidics
- ME 681 Applications of Advanced Micro/Nano Materials, Structures, and Devices
- NANO 525 Techniques of Surface and Nanostructure Characterization
- NANO 600 Nanoscale Science and Technology

Elective Courses

Four elective courses may be chosen. Of these four courses, a maximum of two courses may be non-ME courses, and of the non-ME courses, a maximum of one may be a non-SES course (i.e. any Stevens graduate course). A student may substitute a Project (**ME 800** Special Problems in Mechanical Engineering, 3 credits) or a Master's Thesis (**ME 900** Thesis in Mechanical Engineering, 6 credits) for the appropriate number of courses.



Stevens Undergraduate Course Summaries

ME 126 Mechanics of Solids: Fundamental concepts of particle statics, equivalent force systems, equilibrium of rigid bodies, analysis of trusses and frames, forces in beam and machine parts, stress and strain, tension, shear and bending moment, flexure, combined loading, energy methods, statically indeterminate structures. (Prerequisites: *PEP 111 Mechanics, MA 115 Calculus I, MA 122 Integral Calculus*)

ME 322 Engineering Design VI: This course is intended to teach modern systematic design techniques used in the practice of mechanical engineering. Methodology for the development of design objective(s), literature surveys, base case designs, and design alternatives are given. Economic analyses with an emphasis on capital investment and operating costs are introduced. Integrated product and process design concepts are emphasized with case studies. Students are encouraged to select their senior capstone design project near the end of the course, form teams, and commence preliminary work. A number of design projects are required of all students. (Corequisites: *ME 345 Modeling and Simulation*; Prerequisites: *E 321 Engineering Design V*)

ME 345 Modeling and Simulation: Modeling and simulation methodologies including model-block building, logical and data modeling, validation, simulation and trade-off analysis, decision-making, and optimization. Product and assembly modeling; visual simulation; process modeling; production modeling; process plans and resource modeling, entity flow modeling including conveyors, transporters, and guided vehicles; Input and output statistical analysis. Several CAD/CAE simulation software are used. (Prerequisites: *MA 221 Differential Equations* and *ME 225 Dynamics* and *ME 234 Mechanical Engineering Thermodynamics*)

ME 354 Heat Transfer: Basic modes of heat transfer, steady heat conduction, extended surface heat transfer, transient heat conduction, computational methods, forced and free convection, boiling and condensation, thermal radiation, heat exchangers. Design projects. (Prerequisites: *MA 227 Multivariable Calculus* and *ME 234 Mechanical Engineering Thermodynamics* and *ME 342 Fluid Mechanics*)

ME 361 Design of Machine Components: Application of the principles of strength of materials to the analysis and design of machine parts. Stress and deflection analysis. Curved bars, multi-support shafts, torsion, cylinders under pressure, thermal stresses, creep, and relaxation, rotating disks, fasteners, springs, bearings, gears, brakes and other machine elements are considered. Failure of structural materials under cyclic stress. (Prerequisites: *MA 221 Differential Equations* and *E 126 Mechanics of Solids*)

ME 483 Control Systems: Analysis and synthesis of feedback control systems to achieve specified stability and performance criteria, stability via root-locus techniques, Nyquist's criterion, Bode and Nichol's plots, effect of various control laws and pole-zero compensation on performance, applications to servomechanisms, hydraulic and pneumatic control systems, analysis of nonlinear systems. (Prerequisites: *MA 227 Multivariable Calculus* and *ME 225 Dynamics*)

ME 491 Manufacturing Processes and Systems: Analysis of both bulk-forming (forging, extrusion, rolling, etc.) and sheet-forming processes, metal cutting, and other related manufacturing processes; physics and stochastic nature of manufacturing processes and their effects on quality, rate, cost and flexibility; role of computer-aided manufacturing in manufacturing system automation; methodologies used to plan and control a manufacturing system, forecasting, production scheduling, facility layout, inventory control, and project planning. (Prerequisites: *ME 345 Modeling and Simulation* and *ME 361 Design of Machine Components*)

Courses taken at Stevens may transfer to MSU as electives, since the requirements for the MSU Physics Degree will have been satisfied in the first 3 years of study at MSU.