3+2 Program – Bachelor's (Physics) and Master's (Mechanical Engineering)

The 3+2 Program summarized below combines a Bachelor's degree in Physics with a Master's degree in Mechanical Engineering program, earned over a 5-year period. The undergraduate courses highlighted in light gray are taken at Montclair State University (MSU) (Terms 1-6) and Stevens Institute of Technology (SIT) (Terms 7 and 8), leading to a Bachelor's degree in Physics granted by MSU. The graduate courses highlighted in light blue are taken at SIT (Terms 8-10), leading to a Master's degree in Mechanical Engineering granted by SIT.

Term 1	
PHYS 191 University Physics I	4
MATH 122 Calculus I	4
CSIT 111 Fundamentals of Programming I	3
GNED 199 New Student Seminar	1
ENWR 105 Writing I	3
GNED General Education	3
Total	**18**

Term 2	
PHYS 192 University Physics II	4
MATH 221 Calculus II	4
ENWR 106 Writing II	3
CMST 101 Fundamentals of Speech	3
Physical Education	1
World Cultures	3
Total	**18**

Term 3	
PHYS 210 Mechanics	4
MATH 222 Calculus III	4
ARID 220 Intro to Computer Aided Solid Modeling Representation ***OR*** ARID 221: Surface Modeling Techniques ***OR*** Materials Science	3
GNED General Education	3
GNED General Education	3
Total	**17**

Term 4	
PHYS 240 Electricity & Magnetism	4
PHYS 368 Fluid Mechanics ***OR*** PHYS 430 Computer Simulations of Physical Systems ***OR*** MATH 463 Numerical Analysis	3
MATH 235 Introduction to Linear Algebra ***OR*** MATH 335 Linear Algebra	4
PHYS 320 Thermodynamics ***OR*** PHYS 460 Modern Physics	3
GNED General Education	3
Total	**17**

Term 5	
PHYS Physics Elective OR PHYS 350 Optics	3-4
PHYS 377 Mathematical Physics ***OR*** MATH 420 Ordinary Differential Equations ***OR*** MATH 460 Intro to Applied Mathematics	3-4
CHEM 120 General Chemistry I	4
General Education	3
Language	3
Free Elective	0-2
Total	**18**

Term 6	
PHYS 368 Fluid Mechanics ***OR*** PHYS 430 Computer Simulations of Physical Systems ***OR*** MATH 463 Numerical Analysis	3
CHEM 121 General Chemistry II	4
PHYS 320 Thermodynamics ***OR*** PHYS 460 Modern Physics	3
General Education	3
Language	3
Free Elective	1
Total	**17**

Term 7	
ME 126 Mechanics of Solids	4
ME 322 Engineering Design VI	2
ME 345 Modeling & Simulation	3
ME 354 Heat Transfer	3
ME 361 Design of Machine Components	3
Total	**15**

Term 8	
ME 483 Control Systems	3
ME 491 Manufacturing Processes & Systems	3
ME 635 Modeling & Simulation (Required Course)	3
ME 641 Engineering Analysis I (Required Course)	3
Total	**6+6**

Term 9	
ME Concentration Course I	3
ME Concentration Course I	3
ME Elective Course I	3
ME Elective Course II	3
Total	**12**

Term 10	
ME Concentration Course III	3
ME Concentration Course IV	3
ME Elective Course III	3
ME Elective Course IV	3
Total	**12**

Sven Esche 05/26/16

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*)