

# Focus Area in Mechanical Engineering

## Design

Revised on March 22, 2022

The Design FA offers advanced courses in engineering design and prepares students for successful careers in industries ranging from manufacturing (aerospace, automotive, biomedical, etc.) and processing of materials (metals, composites, biomaterials, etc.) to consulting and energy (power plants, wind farms, etc.). It provides an in-depth background in the computational methods commonly used in modeling, analysis, synthesis, simulation, and design optimization of mechanical, thermal, and fluid systems. Developing an understanding of how design/analysis software functions and gaining a working knowledge of commonly used software solutions form the centerpiece of this FA.

Students selecting the Design FA are required to participate in the one-year long Program for Enhanced Design Experience (PEDE) by enrolling the following two courses (in this order):

- ME:4086 (which is a required course for all ME students and not a Design FA course) during Semester 7 (Fall) and
- ME:4186 Enhanced Design Experience during Semester 8 (Spring).
- The Virtual International Project Teams (VIPT) program can substitute for this PEDE requirement.
- Students should carefully review the Policy on Participation in the PEDE or VIPT Programs on page 3.
- In the past, students graduating from this FA have been highly successful in industry.

Semester	Course	Session	SH	Pre-/Co-Requisites
4 (Spring)	ME:4111 Scientific Computing and Machine Learning	F, S	3	MATH:2560
6 (Spring)	Elective		3	
6 (Spring)	Elective		3	
7 (Fall)	Elective		3	
7 (Fall)	Elective		3	
8 (Spring)	ME:4186 Enhanced Design Experience	S	3	ME:4086
8 (Spring)	Elective		3	

Design Electives (minimum of 2 required)	Session	SH	Pre-/Co-Requisites
ME:4024 Product Design and Realization	S	3	ME:2200 or ENGR:2760, /ENGR:2750
ME:4110 Computer Aided Engineering	S	3	ENGR:2750/ME:3052
ME:4112 Engineering Design Optimization	S	3	ENGR:2110 & MATH:2550
ME:4117 Finite Element Analysis	F <sup>1</sup>	3	ENGR:2750
ME:5143 Computational Fluid and Thermal Engineering	F	3	ME:3045
ME:5170 Data-driven Analysis in Engineering Mechanics	F <sup>2</sup>	3	ENGR:2750 & ME:4111
ME:5300 Uncertainty Quantification and Design Optimization	F <sup>1</sup>	3	ENGR:2750 & STAT:2020/ME:3052
General Electives	Session	SH	Pre-/Co-Requisites
ME:4116 Manufacturing Processes, Simulation and Automation	F	3	ME:2300 or ENGR:2760
ME:4120 Advanced Linear Control Systems	S	3	ME:3600 or (MATH:2550 & MATH:2560 & ENGR:2710)
ME:4125 Biomimetic Fluid Dynamics	S <sup>2</sup>	3	ENGR:2510
ME:4140 Modern Robotics and Automation	S	3	ENGR:2710
ME:4145 Industrial Internet of Things	F	3	ME:3351
ME:4150 Artificial Intelligence in Engineering	F	3	ME:4111
ME:4153 Fundamentals of Vibrations	S <sup>2</sup>	3	ENGR:2750

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ME:4175 Computational Naval Hydrodynamics	S	3	ENGR:2510
ME:4200 Modern Engineering Materials in Mechanical Design	F	3	ME:3052
ME:5114 Nonlinear Control in Robotic Systems	S	3	Any of ME:3600, ME:4120, CBE:4105, ECE:3600
ME:5120 Vehicle System Dynamics	S <sup>1</sup>	3	ENGR:2710
ME:5145 Intermediate Heat Transfer	F	3	ME:3045
ME:5149 Propulsion Engineering	F	3	ME:3040
ME:5150 Intermediate Mechanics of Deformable Bodies	F	3	ENGR:2750
ME:5154 Intermediate Kinematics and Dynamics	F	3	ENGR:2710
ME:5159 Fracture Mechanics	S <sup>2,4</sup>	3	ENGR:2750, /ME:3052
ME:5160 Intermediate Mechanics of Fluids	F	3	ENGR:2510
ME:5167 Composite Materials	S <sup>1</sup>	3	ENGR:2750
ME:5179 Continuum Mechanics	S <sup>1</sup>	3	ENGR:2510 or ENGR:2750
Flexible Elective – At most, one general elective may be selected from: (i) engineering courses that are required in another (non-ME) program, (ii) engineering courses at an upper level (e.g. ME courses numbered 4100 and above), (iii) mathematics, physics or chemistry courses at a more advanced level than those required in the ME curriculum, except MATH:3800, (iv) independent investigation in a mechanical engineering subject area, or (v) courses that appear on a list of approved courses found at <a href="http://engineering.uiowa.edu/mechanical-engineering-undergraduate-program/focus-areas">engineering.uiowa.edu/mechanical-engineering-undergraduate-program/focus-areas</a>	Any	3	

<sup>1</sup> Offered in even years only

<sup>2</sup> Offered in odd years only

<sup>3</sup> Off-cycle students who would like to take CEE:4553 Finite Element I in the Spring shall submit the substitution form for approval

<sup>4</sup> Offered in the Spring 2020, and then Spring of odd years only beginning 2023.

### Policy on Participation in the PEDE or VIPT Programs

Students selecting the Design FA are **required to apply** for and participate in the PEDE or VIPT programs. Please consult the following links for additional information on these programs:

- PEDE: [engineering.uiowa.edu/me/senior-design-projects/pede](http://engineering.uiowa.edu/me/senior-design-projects/pede)
- VIPT: [engineering.uiowa.edu/me/senior-design-projects/vipt](http://engineering.uiowa.edu/me/senior-design-projects/vipt)

These programs offer an enhanced one-year design project experience that goes beyond the one-semester senior capstone design project course “ME:4086 Mechanical Engineering Design Project (MEDP),” which is required by all Mechanical Engineering undergraduate students.

- It is possible that a student is not accepted into the PEDE or VIPT programs after they have **applied**. The reason could be that the student was not selected by any of the companies sponsoring the program. Furthermore, for a student graduating in December, it may be difficult, if not impossible, to participate in PEDE/VIPT, as the programs begin in the Fall semester and end in the Spring semester. In these cases only, a student can still select the Design FA as his/her focus area. Instead of the required ME:4186 Enhanced Design Experience course (see the first table on page 1), the student must choose one additional course from the Design Elective or General Elective courses with the exception of Flexible Elective course on page 2. At least 21 semester hours of courses are required for all FAs.
- Substitutions are discouraged and will only be approved under exceptional circumstances requiring the approval of the advisor, FA coordinator and DEO (need to submit the substitution form).

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