

Industrial and Systems Engineering

Learn more about the Bachelor of Science in Industrial and Systems Engineering.

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The Bachelor of Science in Industrial and Systems Engineering program prepares students to become leaders in quality and productivity management. This 128-credit undergraduate program is a blend of engineering and business, preparing students to design, develop, implement and improve the integrated systems that help a wide variety of companies save money and increase operating efficiency.

Industrial and systems engineering applies to more than manufacturing—the work of industrial and systems engineers encompasses nearly every industry and sector. The versatile, interdisciplinary curriculum positions students to graduate with the tools and skills that meet a growing demand for industrial and systems engineers. Compared to other engineering disciplines, Industrial and System Engineering students take courses in business and across engineering fields of study, making learning versatile for many types of applications for companies as they continuously seek to increase productivity and efficiency and improve quality. Students will gain the knowledge base to provide these companies with innovative and creative solutions.

Goals & Objectives

The curriculum will prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, and equipment. The curriculum includes in-depth instruction to accomplish the integration of systems using appropriate analytical, computational, and experimental practices.

Summary of Requirements

University Requirements

All new students are required to complete the university's General Education (GenEd) curriculum.

All Temple students must take a minimum of two writing-intensive courses for a total of at least six credits. The writing-intensive course credits are counted as part of the major; they are not General Education (GenEd) or elective credits. The writing-intensive courses must be completed at Temple University and students may not transfer in credits to satisfy this requirement. The specific writing-intensive courses required for this major are:

Code	Title	Credit Hours
ENGR 2196 or ENGR 2996	Technical Communication Honors Technical Communication by Design	3
ENGR 4296 or ENGR 4996	Senior Design Project II Honors Senior Design Project II	3

Department Requirements

Code	Title	Credit Hours
Required Math & Basic Science Courses		
MATH 1041 or MATH 1941	Calculus I Honors Calculus I	4
MATH 1042 or MATH 1942	Calculus II Honors Calculus II	4
MATH 2043 or MATH 2943	Calculus III Honors Calculus III	4
MATH 3041 or MATH 3941	Differential Equations I Honors Differential Equations I	3
CEE 3048	Probability, Statistics & Stochastic Methods	3

Select one of the following:		3
ENGR 2011	Engineering Analysis & Applications	
MATH 2101	Linear Algebra	
PHYS 1061	Elementary Classical Physics I	4
or PHYS 1961	Honors Elementary Classical Physics I	
PHYS 1062	Elementary Classical Physics II	4
or PHYS 1962	Honors Elementary Classical Physics II	
CHEM 1035	Chemistry for Engineers	3
CHEM 1033	General Chemistry Laboratory I	1
or CHEM 1953	Honors Chemical Science Laboratory I	
Required General Education Courses		
Select one of the following:		4
ENG 0802	Analytical Reading and Writing	
ENG 0812	Analytical Reading and Writing: ESL	
ENG 0902	Honors Literature/Reading/Writing	
IH 0851	Intellectual Heritage I: The Good Life	3
or IH 0951	Honors Intellectual Heritage I: The Good Life	
IH 0852	Intellectual Heritage II: The Common Good	3
or IH 0952	Honors Intellectual Heritage II: The Common Good	
GenEd 08xx or 09xx (Human Behavior)		3
GenEd 08xx or 09xx (Race and Diversity)		3
GenEd 08xx or 09xx (Global/World Society)		3
GenEd 08xx or 09xx (U.S. Society)		3
GenEd 08xx or 09xx (Arts)		3
Required Industrial and Systems Engineering Courses		
ISE 2101	Applied Statistical Methods for Industrial and System Engineers	3
ISE 2102	Production Process Design and Laboratory	4
ISE 2103	Deterministic Models in Operations Research	3
ISE 3101	Product Quality Assurance	3
ISE 3102	Stochastic Models in Operations Research	3
ISE 3103	Systems Thinking and Modeling	3
ISE 4102	Industrial Simulation	3
ISE 4104	Production Planning and Control	3
ISE 4105	Facility Planning	3
ISE 4107	Systems Engineering Fundamentals	3
Required Engineering Courses		
ENGR 1101	Introduction to Engineering & Engineering Technology	3
or ENGR 1901	Honors Introduction to Engineering	
ENGR 1102	Introduction to Engineering Problem Solving	3
ENGR 1117	Engineering Graphics	2
ENGR 2196	Technical Communication	3
or ENGR 2996	Honors Technical Communication by Design	
ENGR 3001	Engineering Economics	3
ENGR 4169	Engineering Seminar	1
ENGR 4171	Senior Design Project I for Industrial and Systems Engineering	2
ENGR 4296	Senior Design Project II	3
or ENGR 4996	Honors Senior Design Project II	
Select one of the following:		4
CIS 1051	Introduction to Problem Solving and Programming in Python	
CIS 1057	Computer Programming in C	
ECE 1111	Engineering Computation I	
Industrial & Systems Technical Electives		
		6

Select two of the following:

CEE 3711	Environmental Engineering	
CEE 4201	Transportation Systems Management	
CEE 4221	Intelligent Transportation Systems	
ECE 3822	Engineering Computation II	
ENGR 2181	Co-Op Work Experience I	
ENGR 3181	Co-Op Work Experience II	
ENGR 3033	Entrepreneurial Engineering	
ISE 4101	Human Factors (Ergonomics)	
ISE 4103	Engineering Cost Analysis	
ISE 4106	Service Systems Engineering	

Required Business Courses

ACCT 2501	Survey of Accounting	3
MSOM 3101	Operations Management	3
SCM 3515	Principles of Supply Chain Management	3

Total Credit Hours		128
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Suggested Academic Plan

Please note that this is a **suggested** academic plan. Depending on your situation, your academic plan may look different.

Bachelor of Science in Industrial and Systems Engineering Requirements for New Students starting in the 2020-2021 Academic Year

Year 1		Credit Hours
Fall		
ENGR 1101 or 1901	Introduction to Engineering & Engineering Technology	3
ENGR 1117	Engineering Graphics	2
MATH 1041 or 1941	Calculus I	4
PHYS 1061 or 1961	Elementary Classical Physics I	4
ENGR 0802, 0812, or 0902	Analytical Reading and Writing [GW]	4
	Term Credit Hours	17
Spring		
PHYS 1062 or 1962	Elementary Classical Physics II	4
CHEM 1035	Chemistry for Engineers	3
CHEM 1033 or 1953	General Chemistry Laboratory I	1
MATH 1042 or 1942	Calculus II	4
ENGR 1102	Introduction to Engineering Problem Solving	3
	Term Credit Hours	15
Year 2		
Fall		
MATH 2043 or 2943	Calculus III	4
IH 0851 or 0951	Intellectual Heritage I: The Good Life [GY]	3
ACCT 2501	Survey of Accounting	3
ISE 2101	Applied Statistical Methods for Industrial and System Engineers	3
ISE 2102	Production Process Design and Laboratory	4
	Term Credit Hours	17
Spring		
MATH 3041 or 3941	Differential Equations I	3
IH 0852 or 0952	Intellectual Heritage II: The Common Good [GZ]	3
MSOM 3101	Operations Management	3
ISE 2103	Deterministic Models in Operations Research	3
Select one of the following:		3
ENGR 2011	Engineering Analysis & Applications	

MATH 2101	Linear Algebra	
	Term Credit Hours	15
Year 3		
Fall		
CEE 3048	Probability, Statistics & Stochastic Methods	3
ENGR 2196 or 2996	Technical Communication [WI]	3
ENGR 3001	Engineering Economics	3
SCM 3515	Principles of Supply Chain Management	3
ISE 3103	Systems Thinking and Modeling	3
GenEd Breadth Course		3
	Term Credit Hours	18
Spring		
ENGR 4169	Engineering Seminar	1
ISE 3101	Product Quality Assurance	3
ISE 3102	Stochastic Models in Operations Research	3
ISE 4104	Production Planning and Control	3
Select one of the following:		4
CIS 1051	Introduction to Problem Solving and Programming in Python	
CIS 1057	Computer Programming in C	
ECE 1111	Engineering Computation I	
	Term Credit Hours	14
Year 4		
Fall		
ENGR 4171	Senior Design Project I for Industrial and Systems Engineering	2
ISE 4102	Industrial Simulation	3
ISE 4105	Facility Planning	3
Industrial & Systems Technical Elective #1		3
GenEd Breadth Course		3
GenEd Breadth Course		3
	Term Credit Hours	17
Spring		
ENGR 4296 or 4996	Senior Design Project II [WI]	3
ISE 4107	Systems Engineering Fundamentals	3
Industrial & Systems Technical Elective #2		3
GenEd Breadth Course		3
GenEd Breadth Course		3
	Term Credit Hours	15
	Total Credit Hours:	128

Code	Title	Credit Hours
Approved Industrial & Systems Technical Electives		
CEE 3711	Environmental Engineering	3
CEE 4201	Transportation Systems Management	3
CEE 4221	Intelligent Transportation Systems	3
ECE 3822	Engineering Computation II	3
ENGR 2181	Co-Op Work Experience I	3
ENGR 3181	Co-Op Work Experience II	3
ENGR 3033	Entrepreneurial Engineering	3
ISE 4101	Human Factors (Ergonomics)	3
ISE 4103	Engineering Cost Analysis	3
ISE 4106	Service Systems Engineering	3

Courses

ISE 2101. Applied Statistical Methods for Industrial and System Engineers. 3 Credit Hours.

Statistical analysis techniques and their applications in the field of industrial and systems engineering are presented. Topics include the statistical measures describing data, frequency distributions, probability distributions, sampling parameter estimation, hypothesis testing, regression analyses, and analyses of variance. Special emphasis on their application to field of industrial and systems engineering.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

MATH 1042|Minimum Grade of C-|May be taken concurrently
OR MATH 1942|Minimum Grade of C-|May be taken concurrently
OR MATH 1951|Minimum Grade of C-|May be taken concurrently
OR MA07 Y|May not be taken concurrently
OR MATW Y|May not be taken concurrently.

ISE 2102. Production Process Design and Laboratory. 4 Credit Hours.

Introduction to the theory and practice of manufacturing processes. Study covers the fabrication of metallic, plastic, and electrical products, operation of NC and other automatic equipment, and economics of the design and production process. Topics to be covered include introduction to manufacturing processes, metal forming processes, metal cutting processes and machine tools, metal finishing processes, introduction to AutoCAD, numerical control (NC) machining, processing of plastic products and an introduction to automated manufacturing processes. Lectures will be complemented by a laboratory.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

ENGR 1117|Minimum Grade of C-|May not be taken concurrently.

ISE 2103. Deterministic Models in Operations Research. 3 Credit Hours.

The deterministic techniques of operations research. Topics include the applications of linear, nonlinear, integer, and dynamic programming methods and network flows analysis to solve industrial and systems engineering problems. Other topics include an introduction and overview of deterministic models, preliminaries of Linear Programming (LP), graphical solution of linear programming and introduction to simplex method, sensitivity analysis, marginal utility, computer applications and LP packages, transportation and assignment problems, network and graph theory introduction, spanning trees shortest route algorithm, Dijkstra's algorithm, formulation of shortest path as LP, maximum flow algorithms, nonlinear programming, classical optimization, integer programming introduction, Gomory's cutting plane, branch and bound method, complete methods, Dynamic Programming (DP), and recursive relationship of DP.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

MATH 2043|Minimum Grade of C-|May not be taken concurrently.

ISE 3101. Product Quality Assurance. 3 Credit Hours.

Methods used to achieve higher product quality, to prevent defects, to locate chronic sources of trouble, to measure process capability, and to use inspection data to regulate manufacturing processes are emphasized. Preparation of statistical control charts and selection of suitable sampling plans. Topics include review of probability distributions, control chart principles, control charts for variables (X, R charts), control charts for attributes (p, c, u charts), specifications and tolerances, fundamentals of acceptance sampling, acceptance sampling by attributes, special attribute sampling procedures, reliability, graphic methods for quality control, and TQM and ISO standards.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

ISE 2101|Minimum Grade of C-|May not be taken concurrently.

ISE 3102. Stochastic Models in Operations Research. 3 Credit Hours.

Probabilistic techniques of operations research. Topics include the applications of Markov chains, queueing and inventory control models to analyze and evaluate systems performance. Other topics include introduction to stochastic processes, review of probability, Markov chains and classification of their states, long-run Markov chains and applications, introduction to queueing theory, birth and death process, applications of queueing theory, introduction to inventory theory, components of inventory models, deterministic inventory models, stochastic inventory models, and introduction to forecasting.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

ISE 2103|Minimum Grade of C-|May not be taken concurrently.

ISE 3103. Systems Thinking and Modeling. 3 Credit Hours.

Utilizing a systems thinking approach in engineering design and development is necessary to understand the connections and dependencies that exist within the system. This course introduces the concept of systems thinking and computer modeling via system dynamics. Computer modeling can aid in understanding the complex feedback dynamics possible emergent behavior which can be found in the human, technological and organization systems. In addition, policy interventions and their effect on the behavior and structure of the system will also be addressed.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(ISE 2101|Minimum Grade of C-|May not be taken concurrently)
AND (MATH 3041|Minimum Grade of C-|May not be taken concurrently)
OR MATH 3941|Minimum Grade of C-|May not be taken concurrently)

ISE 4101. Human Factors (Ergonomics). 3 Credit Hours.

This course covers Human-machine systems analysis. The study of workplace layout, measurement of employee efficiency and productivity, criteria for tool and fixture design or selection, industrial fatigue, environmental influences on performance including the effects of illumination, noise, vibration, thermal, and other atmospheric factors. The basic ideas of industrial hygiene; the impact of OSHA; and special techniques for experimenting with human subjects, via demonstrations and supervised experiments are explored. Additional topics include human factor definitions, human factor research methodologies, human information processing, visual presentation - static and dynamic information, auditory and other displays; speech communication, motor skills, human control systems, data entry devices, physical work and manual materials handling, applied anthropometry, workplace environment; illumination and atmospheric conditions, noise, vibration and motion, human error, accidents and warnings, and usability and human-computer interaction.

Class Restrictions: Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

Repeatability: This course may not be repeated for additional credits.

ISE 4102. Industrial Simulation. 3 Credit Hours.

Introduction to the application of simulation modeling for the analysis of complex industrial and manufacturing service systems. Examples are chosen from real-life situations such as warehousing, material handling, robotics, transportation, and hospital emergency rooms. Verification/validation as well as statistical analysis of both input/output data are introduced. Topics include Verification and validation, calibration of models, face validity, validity of assumptions, Turing/Delphi test, comparison and evaluation of alternative systems, simulation examples, queueing systems, inventory systems, object oriented programming, ARENA simulation software, random number generation, Input modeling and Output analysis, confidence intervals, and variance reduction.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

ISE 2103|Minimum Grade of C-|May not be taken concurrently.

ISE 4103. Engineering Cost Analysis. 3 Credit Hours.

This course introduces the tools and techniques applicable for cost analysis and control including standard costs, variance analysis, cost volume relationships, cost estimation, and utilization of accounting data for control of operations. Topics include basics of financial/cost management; elements of financial accounting and development of income statements and balance sheets; cash flow statements, inventory valuation methods; cost-volume relationships, cost drivers; methods of measurement, application of regression analysis; product addition or deletion, target costing, pricing decision; cost allocation; activity based costing, job order cost systems and process cost systems and overhead, cost allocation, analysis and control.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

ACCT 2501|Minimum Grade of C-|May not be taken concurrently.

ISE 4104. Production Planning and Control. 3 Credit Hours.

This course introduces the study of the components and functioning of integrated production, planning, and control systems; forecasting, aggregate planning, scheduling, and recent models of production and inventory control for optimizing continuous and intermittent manufacturing operations. MRP basics and introduction to using a computer to apply scheduling models will be covered. Topics include functional modules in the control of a manufacturing organization, forecasting methods, aggregate planning and master scheduling, linear programming based methods, capacity requirements planning; machine scheduling, job sequencing and line balancing; job shop and flow shop models; material requirements planning and just-in-time production control.

Class Restrictions: Must be enrolled in one of the following Classes: Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

ISE 2103|Minimum Grade of C-|May be taken concurrently.

ISE 4105. Facility Planning. 3 Credit Hours.

This course will study strategic planning of production facilities including location, planning, design and maintenance. Emphasis on production systems, machine selection, automation, material handling, storage and warehousing, quality, retrofitting and preventative maintenance.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(ISE 2101|Minimum Grade of C-|May not be taken concurrently)

AND (ISE 2102|Minimum Grade of C-|May not be taken concurrently)

AND (ISE 2103|Minimum Grade of C-|May not be taken concurrently)

ISE 4106. Service Systems Engineering. 3 Credit Hours.

Services play a vital role in modern economies. In many economies they surpass their manufacturing counterparts in terms of contribution to the Gross Domestic Product, yet they cannot be handled in the exact same manner. The fundamentals of this sector as an engineering field will be discussed as well as the operations of service systems as a customer-centric environment. Topics will include service quality, strategies, operations, electronic services, queueing, service supply chains and managing service projects. Various projects will be handled during the course of the semester focusing on various aspects of the service industry.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(ISE 2101|Minimum Grade of C-|May not be taken concurrently)

AND (ISE 4104|Minimum Grade of C-|May not be taken concurrently)

ISE 4107. Systems Engineering Fundamentals. 3 Credit Hours.

Complex system development requires both hard and soft skills to address the challenges in modern engineering. Systems engineering includes human, organization and technical variables that all must be considered in complex system development. This course will cover the foundations of systems science and systems thinking, as well as an overview of the methodology that systems engineers use to bring these systems to fruition. Topics in the methodology that will be covered include identification of needs, requirements development, design and design integration, verification and validation as well as tools used to perform these functions such as technical management, life cycle costing and risk analysis and management. This course will show the breadth of knowledge that is required of a systems engineer to address engineering challenges.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

(ISE 2101|Minimum Grade of C-|May not be taken concurrently)

AND (ISE 3103|Minimum Grade of C-|May not be taken concurrently)