Bachelor of Science in Systems Science & Engineering

This professional degree program is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org).

Key points:
- Systems Engineering: how to integrate different components in engineering systems
- Operations Research: mathematical solutions to business problems
- Pre-Financial Engineering: the best preparation for the MS in Financial Engineering
- Applied Mathematics
- Control Engineering: how to control jet airplanes, electric power grids, and the nation's economy
- Ideal for students strong in math and physics
- Ideal for students interested in engineering and business
- Ideal for students interested in a second degree
- The most mathematical program in the School of Engineering & Applied Science
- The most flexible professional program in the School of Engineering & Applied Science

The Bachelor of Science in Systems Science & Engineering (BSSSE) program educates students in the engineering and science of systems. Graduates are expected to have mathematical competence and knowledge of systems analysis, control, design methods, numerical methods, differential equations, dynamic systems theory, automatic control theory, system stability, estimation, optimization, modeling, identification, simulation and basic computer programming. Graduates will have an engineering outlook and engineer's competence of their own and be able to interact fully with other engineers. They also will possess sufficient proficiency in computer use to design algorithms for simulation, estimation, control and optimization.

The engineering departments of high-technology industries are staffed by large numbers of engineers with this type of expertise. However, graduates are by no means restricted to careers in traditional industry or in high-technology industries. Within the outlined framework, a salient feature of the program is its flexibility and interdisciplinary nature. It is possible for students to orient study toward preparation for systems science and engineering work in large complex systems such as transportation or power or communications networks or in societal systems such as the economy, ecology, the cities or biological systems. Students may wish to prepare for work along theoretical or professional lines. There is ample room in the program structure to accommodate all these interests and to make preparation at the BS level ideally suited for a student's future plans and interests.

Educational Objectives of the BSSSE Degree Program

A. Our graduates will be engaged as practicing professionals in a broad range of careers in industry or government or will pursue advanced degrees in academic graduate education in engineering or a related field.
B. Our graduates will function effectively as members of teams demonstrating sensitivity to professional and societal contexts, integrity and versatility.

Student Outcomes

Graduates of the BSSSE program are expected to know or have:
- An ability to apply knowledge of mathematics, science and engineering
- An ability to design and conduct experiments, as well as to analyze and interpret data
- 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
- An ability to function on multidisciplinary teams
- An ability to identify, formulate and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- A recognition of the need for, and an ability to engage in, lifelong learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills and modern engineering tools necessary for engineering practice

BSSSE Degree Requirements

The course sequence designed to achieve the type of education outlined above requires at least 120 units, satisfies the residency and other applicable requirements of Washington University and the School of Engineering & Applied Science, and meets the following program requirements:

1. Common Studies program of the School of Engineering & Applied Science. This includes courses in engineering, mathematics, physics, chemistry, humanities, social sciences and technical writing. The required chemistry sequence is Chem 111A–Chem 151.
2. Engr 4501 Engineering Ethics and Sustainability (1 unit).
3. Required courses in systems science and engineering:
   ESE 105 Introduction to Electrical and Systems Engineering (3 units);
   ESE 205 Introduction to Engineering Design (3 units);
   ESE 318 Engineering Mathematics A (3 units) and
   ESE 319 Engineering Mathematics B (3 units);
   ESE 326 Probability and Statistics for Engineering (3 units);
   ESE 351 Signals and Systems (3 units);
   ESE 403 Operations Research (3 units);
   ESE 441 Control Systems (3 units);
   ESE 448 Systems Engineering Laboratory (3 units); and
   ESE 499 Systems Science and Engineering Capstone Design Project (3 units).

4. Two of the following three computer science courses:
   CSE 131 Introduction to Computer Science (3 units);
   CSE 247 Data Structures and Algorithms (3 units); and
   CSE 132 Introduction to Computer Engineering (3 units).

   Students are encouraged to take CSE 131 and CSE 247. The other possible sequence is CSE 131 and CSE 132.

5. One of the following three laboratory courses: ESE 447 Robotics Laboratory (3 units),
   ESE 449 Digital Process Control Laboratory (3 units),
   ESE 488 Signals and Communication Laboratory (3 units). ESE 449 is only recommended to students with a chemical engineering background.

6. 12 units in elective courses in systems science and engineering: ESE 400 through 428; ESE 437; ESE 440 through 449; ESE 450 through 459; SWCD 5660 Designing Sustainable Social Policies & Programs: A System Dynamics Approach. Up to 3 units of the following business courses may be part of the 12 units of SSE electives: OSCM 356 Operations Management, OSCM 458 Operations Planning and Control, OMM 576 Foundations of Supply Chain Management, OMM 577 Information Technology and Supply Chain Management.

7. 12 units in engineering concentration outside of systems science and engineering. These units must all be taken in one of the following engineering areas: Biomedical Engineering, Chemical Engineering, Computer Science & Engineering, Electrical Engineering (ESE 102; ESE 230 through 239; ESE 260 through 290; ESE 330 through 339; ESE 360 through 390; ESE 429 through 439; ESE 460 through 469; 490 through 496; ESE 498; ESE 530 through 539; ESE 560 through 589), or Mechanical Engineering & Materials Science. Of the 12 units, 9 units must be at the 200 level or higher. Sequences for concentrations in economics, mathematics, physics, pre-medicine and other fields can be arranged with special departmental approval to meet a student’s specific needs. When a non-engineering discipline is chosen as the outside concentration, the student needs to pay special attention to the engineering topics unit requirement and make sure that enough engineering content is obtained from the other courses. The use of basic required courses to fulfill the requirement for an outside concentration is not permitted.

8. The entire course sequence for the BSSSE, containing engineering topics of at least 45 units. The number of engineering topics units assigned to undergraduate courses in the School of Engineering & Applied Science vary from none (0) to the number of credits given to the course. For the precise number for each course, please refer to the table of Topics Units — Engineering Courses (http://engineering.wustl.edu/current-students/student-services/Pages/default.aspx) provided by Engineering Undergraduate Student Services.

9. Limitations. No more than 6 units of the combined units of ESE 400 Independent Study and ESE 497 Undergraduate Research (including 497A and 497B) may be applied toward the SSE elective requirement (item 6) of the BSSSE degree. Any remaining combined units are allowed as free electives to satisfy the requirement on the total number of units.

10. The courses taken to satisfy the following BSSSE degree requirements must be taken for a letter grade and not on a pass/fail basis: item 3 (required ESE courses), item 5 (elective laboratory course) and item 6 (elective ESE courses).

   The program requirements for the BS in Systems Science & Engineering allow a double major with another department. Changes in the program to accommodate such double majors may be made with departmental approval. For a sample program for the BS in Systems Science & Engineering, please refer to the following tables:
   
   • Sample Systems Science & Engineering Curriculum (http://bulletin.wustl.edu/undergrad/engineering/electrical-bs-systems/ssecurriculum)

   For more information on BS in Systems Science & Engineering curriculum (https://ese.wustl.edu/undergraduate/degreeprograms/Pages/systems-science-engineering.aspx), please visit the ESE website.