Institutional Effectiveness
2024-2025

Program: Nuclear Engineering BS
College and Department: College of Engineering, Mechanical Engineering
Contact: Dr. Mohan Rao
Mission:
The Bachelor of Science in Nuclear Engineering (BSNE) program, housed in the Department of Mechanical Engineering (ME), aims to educate and prepare individuals for careers in nuclear engineering. The BSNE curriculum is broad in scope and strongly based in the fundamentals essential for professional practice, life-long learning, and advanced study at the graduate level. It focuses on nuclear science and technologies, such as nuclear reactor design, operation, simulation, and maintenance, as well as nuclear energy production, radiation detection, and computational methods. The program also covers topics related to nuclear materials, security, and policies. Design being a unique element of the engineering profession, students' design experience is developed and integrated throughout the degree program. By graduation, students are equipped for various job opportunities in industry, national laboratories, and graduate studies. The program emphasizes the highest standards of professional and ethical conduct and prepares students to tackle the complex challenges associated with the next generation of nuclear science and engineering. The curriculum is developed to meet the criteria for the institutional generation education core, ABET accreditation, and existing articulation and transfer pathways.

Attach Curriculum Map (Educational Programs Only):
Attached Files: See Appendix 1

Student Learning Outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Assessment Methods:

1. ***Alumni Survey (AS):*** Alumni surveys are sent to graduates of the program at one year and five years post- graduation. The fifteen questions on this survey occur in three sections. Section 1 (four questions) gathers data related to the Program Goals; Section 2 (seven questions) is used to assess alumni perception of ability with respect to ABET Student Outcomes; and Section 3 (four questions) requests text feedback on program strengths, weaknesses, suggested improvements, and open comments. The electronic Alumni Survey is issued annually in late fall via Machform and employs a 0-4 point scale in Sections 1 and 2, so there is no adjustment of scale prior to combining with other measures. Data from the Alumni Survey informs the evaluation of each Student Outcome (1-7).

2. ***Co-Op Employer Survey (CES):*** For students who participate in co-op appointments sponsored through Tennessee Tech University's Center for Career Development, the co-op employers are required to complete a formal evaluation of the performance of each student at the end of each term in the co-op program. For College of Engineering students, the Tech Co-op Employer

Survey (CES) also includes program- and Student Outcome-related assessment questions. These co-op surveys are considered a valuable source of direct feedback from employers, providing insight into student performance in-process, i.e., before they graduate. The Co-Op Employer Survey employs a 5-point scale (1 to 5), which is then converted to the 0-4 point scale by subtracting 1 point. Data from the Co- op Employer Survey informs the evaluation of five of the Student Outcomes (1, 3, 4, 5, 7).

Co-op is not mandatory in the proposed Bachelor of Science in Nuclear Engineering program, but strongly encouraged as a vital part of the student experience. The proposed program recognizes the immense value of co-op in bridging academic learning with practical industry experience, thereby enhancing both the educational journey and future career prospects of students. About 50% of enrolled Mechanical Engineering students currently pursue co-ops indicating its popularity among our students.

To promote co-op participation, we have already established robust partnerships with leading industries in the engineering field, and additional industries in nuclear pertinent fields will be added over time. These partnerships not only provide diverse co-op opportunities but also serve as a platform for networking and potential career paths after graduation. We integrate these experiences into our curriculum by offering academic credit for relevant co-op placements, thus incentivizing students to engage in these practical learning opportunities. Additionally, our career services department plays a pivotal role in facilitating co-op placements, offering resources such as resume workshops, interview preparation, and career fairs to connect students with potential employers.

3. ***External Evaluation of Senior Design Projects (EESDP):*** The External Evaluation of Senior Design Projects (EESDP) is conducted by evaluators invited from the ME External Advisory Board and from industry partners. These assess the Senior Design Projects and Project Presentations. The EESDP instrument uses the 0-4 pt. level-of-attainment scale. This instrument form has undergone three significant revisions, described in a later section, as part of the program's continuous improvement process. Data from the External Evaluation of Senior Design Projects informs the evaluation of five of the Student Outcomes (2, 3, 4, 5, 7). This assessment method is currently under discussion by the ME department Goals and Assessment Committee for possible revision.

4. ***Instructional Outcomes Faculty Assessment (IOFA):*** The Instructional Outcomes Faculty Assessment (IOFA) instrument provides a direct assessment of the level-of attainment of the students in a class with regards to the Course Instructional Outcomes. The Instructional Outcomes Faculty Assessment is surveyed for selected courses in the curriculum. The assessment, completed by the course instructor at the end of each semester, consists of a detailed analysis of the extent to which the Course Instructional Outcomes are achieved, as evidenced by student performance on specific test and homework problems, and other course assignments. The IOFA tool uses the 0-4 pt. level-of-attainment scale. Data from the Instructional Outcomes Faculty Assessment informs the evaluation of each of the Student Outcomes (1-7).

5. ***Instructional Outcomes Student Survey (IOSS):*** The Instructional Outcomes Student Survey (IOSS) is administered to students in selected courses in the BSNE curriculum, same as for the IOFA above. The IOSS tool provides a pre/post self-assessment of student progress in achieving the Instructional Outcomes of the course. This is based on the difference between a student's perception of their level of knowledge for each Course Instructional Outcome upon entering a course and upon leaving the course. The IOSS survey is considered an indirect data source for assessment of Student Outcomes, as it requires a conversion through detailed mapping of a Course Instructional Outcomes to the Student Outcomes. The Instructional Outcomes Student Survey tool uses the 0-4 pt. level-of-attainment scale. Data from the IOSS informs the evaluation of each of the Student Outcomes (1-7).

6. ***Senior Exit Interview Written Survey (SEIWS):*** The Senior Exit Interview Written Survey (SEIWS) is one part of the Senior Exit Interview process. Students graduating from the BSNE program provide self-assessment of their level of attainment of the ABET Student Outcomes, self-reporting of their engineering club and pre-professional activities while at Tennessee Tech, and text feedback regarding the BSME program and the Department. The Senior Exit Written Survey uses a quantitative 1-5 pt. “satisfaction” scale which is then converted to a 0-4 pt. scale for later combination with other assessment instruments results. The quantitative data is reviewed in conjunction with the Senior Exit Interview Oral Focus Groups, and the Goals and Assessment Committee summarize the qualitative comments. The data from the Senior Exit Interview Written Survey informs the evaluation of each of the Student Outcomes (1-7).

7. ***Senior Exit Interview Oral Focus Groups (supporting source of evidence):*** The Senior Exit Interview Oral Focus Groups (SEIOFG) process consists of an open discussion forum of graduating seniors with the ME chair and associate chair. The interview serves as a valuable source of suggestions for program improvement, as well as a source of supporting feedback on student performance. After receiving the feedback from the students, continuing concerns are compiled by the Goals and Assessment Committee and brought to the ME faculty for further discussion and possible action. Full records of student commentary are stored with all other assessment records.

8. ***ME External Advisory Board Feedback (supporting source of evidence):*** Feedback from the ME External Advisory Board is an important source of evidence for program improvement, guidance, and provides supporting evidence regarding the performance of students who are graduates of the BSME program. The External Advisory Board is composed of member representatives of several key constituency groups of the program, i.e., employers, alumni, and the professional community at large. Meeting minutes are kept with the other assessment data.

Expected Level of Attainment of the Student Outcomes

The expected level of attainment of Student Outcomes is scored with a 0-4 point level-of- attainment scale where each level is defined as 4 = Excellent, 3 = Good, 2 = Satisfactory, 1 = Low, and 0 = Negligible. Data from the assessment instruments are combined according to the evaluation plan to determine the final scored value each year for each Student Outcome.

A score of 3-to-4 is the desired level-of-attainment for each Student Outcome. A score between 2-to-3 is cause for review by the ME Goals and Assessments Committee, with possible actions and/or continued monitoring recommended to the ME faculty. A score lower than 2 requires corrective action to be taken by the ME faculty after review and recommendations for change by the ME Goals and Assessments Committee.

Beginning Fall 2021 the ME department adopted a new plan for an overall change in process for assessment, evaluation, and change (AEC Plan). The two-year implementation cycle of the new AEC Plan, data collection and tracking and

reporting on outcomes is currently underway. Observational analysis from existing data collection instruments used before are being made by the members of the Goals and Assessment Committee as we consider modifications to current instruments into the new AEC Plan. The objective is to improve assessment tools and analysis procedure to collect data that are effective in the continuous improvement of the curriculum to attain student outcomes.

Schedule for Administration of Assessment Instruments and Review of Assessment Data for Accreditation and Continuous Improvement.

Assessment Instrument	**Administration Schedule** By Semester	**Review Schedule**
Alumni Survey (AS)	Fall	Spring
Co-Op Employer Survey (CES)	Fall, Spring, Summer	Yearly
External Evaluation of Senior Design Projects (EESDP)	Fall, Spring	Yearly
Grades Received in STEM, General Education, Writing, and Speech Courses	N/A	Mid-cycle review
Instructional Outcomes Student Survey (IOSS)	Fall, Spring	Yearly
Instructional Outcomes Faculty Assessment (IOFA)	Fall, Spring	Yearly
Senior Exit Interview Written Survey (SEIWS)	Fall, Spring	Yearly
Senior Exit Interview Oral Focus Groups (SEIOFG)	Fall, Spring	Yearly
External Advisory Board Feedback (EABF)	Fall, Spring	Yearly

Appendix 1: Curriculum Map

Associated ME Courses

Course	Student Outcomes I = Introduce, R = Reinforce, D = Demonstrate						
Number and Title	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ME 2330 Dynamics	I						I
ME 2910 Professionalism and Ethics			R	D	R		I
ME 3001 Mechanical Engineering Analysis	I				I	I	I
ME 3010 Materials & Processes in Manufacturing	I	I		I			
ME 3023 Measurements in Mechanical Systems	R			I	I	R	I
ME 3210 Thermodynamics I	I						
ME 3710 Fluid Dynamics	R						
ME 3720 Heat Transfer	R						

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New NE Courses (Preliminary Map)

Course	Student Outcomes						
Number and Title	**1**	**2**	**3**	**4**	**5**	**6**	**7**
NE 2110 Intro to Nuclear Engineering	x	x		x	x	x	x
NE 2120 Intro to Radiological Engr & Detection	x	x	x	x	x		x
NE 3210 Nuclear Reactor Safety & Analysis	x		x	x	x		x
NE 4110 Nuclear Engineering Lab I	x	x	x	x	x	x	x
NE 4120 Nuclear Engineering Lab II	x	x	x	x	x	x	x
NE 4210 Nuclear Reactor Theory & Analysis	x	x	x	x	x	x	x
NE 4220 Nuclear Reactor Dynamics & Control	x	x		x	x	x	x
NE 4310 Senior Design I	x	x	x	x	x	x	x
NE 4320 Senior Design II		x	x	x	x	x	x
NE 4410 Senior Seminar	x		x	x	x		x
NE 4510 Introduction to Industrial Maintenance Tech	x	x	x	x	x		x
NE 4520 Adv Reactors and Small Modular Reactors	x	x	x		x		x