New Jersey Institute of Technology
School of Applied Engineering & Technology
ENGR 430- Engineering for Quality & Reliability

COURSE NUMBER	ENGR 430
COURSE NAME	Engineering for Quality and Reliability
COURSE STRUCTURE	2-2-3 (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR/ INSTRUCTOR	Dr. S. Lieber/ Mr. M. Cherkowski
COURSE DESCRIPTION	Engineering for quality and reliability has become paramount to ensure realized products and processes are not only effective but safe. This course covers the fundamental principles and tools of quality and reliability engineering. Students will learn how to apply this background directly to engineering work in industry, government, and academic settings. Career options and industry credentialing will be reviewed and discussed.
PREREQUISITE(S)	FED 101 or MET 103;
RESTRICTION	Senior Standing
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Elective
PROVIDED MATERIALS	**NJIT Library:** • Engineering Design: A Project-Based Introduction (ISBN 978-1-119-63541-3) by Elizabeth J. Orwin. **Access Engineering:** • Maynard's Industrial and Systems Engineering Handbook, 6th Edition by Bopaya M. Bidanda • Engineering Ethics and Design for Product Safety, 1st Edition by Kenneth L. d'Entremont • Maintenance Engineering Handbook, 8th Edition by R. Keith Mobley • Six Sigma Handbook: A Complete Guide for Green Belts, Black Belts, and Managers at All Levels, 6th Edition by Thomas Pyzdek, Paul Keller • Juran's Quality Handbook: The Complete Guide to Performance Excellence, 7th Edition by Joseph A. De Feo
COMPUTER USAGE	Software: MS Office; Microsoft Visio; CAD Package.
COURSE OUTCOMES(CO)	By the end of the course students should be able to: 1. Understand fundamental principles of engineering design, design control, and quality/reliability. 2. Understand process to apply design control and quality/reliability tools to different engineering cases.

3. Understand the relationship between quality/reliability and industrial communications (written/oral) for technical and non-technical audiences.
4. Apply knowledge of quality/reliability to the engineering design, realization, verification/validation, and communication of a product or process.
5. Develop skills to work in a team-based environment.

CLASS TOPICS

Design terminology and methods, Design Control, Function of Quality & Reliability in Engineering; Basic quality and reliability terminology; Regulations and standards (e.g. OSHA & ISO); Quality Management System (QMS); Design Input Verification and Validation documentation, Requirements Traceability Matrix; Types of risk; Cause and Effect analysis; Fault tree analysis (FTA); Failure mode and effects analysis (FMEA); Hazard analysis; Verification and Validation;

STUDENT OUTCOMES

The Course Learning Outcomes support the achievement of the following Student Outcomes and EAC of ABET Criterion 3 requirements:

Student Outcome (1) - an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
Related CO – 1-4

Student Outcome (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.
Related CO – 3,4

Student Outcome (3) - an ability to communicate effectively with a range of audiences.
Related CO – 4-5

Student Outcome (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.
Related CO – 3, 4

Student Outcome (5) - an ability to function effectively on a team whose members together provide leadership, create a collaborative

environment, establish goals, plan tasks, and meet objectives.
Related CO – 5

Student outcome (6) - an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
Related CO – 4

Student outcome (7) - an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
Related CO – 1-4

GRADING POLICY

Note: Grading Policy may be modified by Instructor for each Section in the Course)

Homework/Quizzes	20 %
Project Report	25 %
Project Presentation	10 %
Midterm Exam	15 %
Final Exam	30 %

Note: There will be no makeup exams.

ACADEMIC INTEGRITY

NJIT has a zero-tolerance policy regarding cheating of any kind and student behavior that is disruptive to a learning environment. Any incidents will be immediately reported to the Dean of Students. In the cases the Honor Code violations are detected, the punishments range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT with notations on students' permanent record. Avoid situations where honorable behavior could be misinterpreted. For more information on the honor code, go to http://www.njit.edu/academics/honorcode.php

STUDENT BEHAVIOR

- No eating or drinking is allowed at the lectures, recitations, workshops, and laboratories.

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- Cellular phones must be turned off during the class hours – if you are expecting an emergency call, leave it on vibrate.
- No headphones can be worn in class, unless allowed by the professor.
- Unless the professor allows the use during lecture, laptops should be closed during lecture.
- During laboratory, if you are finished earlier, you must show the professor your work before you leave class
- Class time should be participative. You should try to be part of a discussion

MODIFICATION TO COURSE	The Course Outline may be modified at the discretion of the instructor or in the event of extenuating circumstances. Students will be notified in class of any changes to the Course outline.
PREPARED BY	Dr. S. Lieber
COURSE COORDINATED BY	Dr. S. Lieber

CLASS HOURS

Friday	6:00 PM-7:55 PM	GITC 2311

OFFICE HOURS

By appointment e-mail

HOMEWORK & PROJECT - IMPORTANT

Homework

- Homework sets are due one week after they are assigned.
  - Late penalty is minus 25% each week.
  - Assignments more than one week late will not be accepted.
- Homework must be submitted in the format provided by the professor.
- Your instructor will inform you of the homework that is conducted as a team.

Project:

The semester project requires <u>all</u> students to design and realize their designs. Design communication needs to be conducted with Computer Aided Design (CAD) software. This can include:

- AutoCAD
- Inventor
- Revit
- Civil-3D
- Creo
- Solidworks
- Onshape

Discuss any other options with your instructor.

Realization may require the need to complete Makerspace Training courses. This includes:

- Make 101 Introduction to the Makerspace
- Make 102 Introduction to Laser Engraving and Cutting
- Make 103 Introduction to 3D Printing

The equipment and tools described in these trainings are sufficient for the realization of these projects in this course.

The project will be individual but involve team contributions

- Establishing a problem statement (individual).
- Develop an engineering design (individual).
- Preparing a Design Input Verification Validation document. (individual).
- Cause and Effect Analysis (Team)
- Fault Tree Analysis (Team)
- Failure Modes and Effect Analysis (FMEA) (individual).
- Realized prototype with example of verification. (individual).

Projects are due on the dates indicated.

- No late projects will be accepted.
- Projects should be submitted in the format provided by the professor.

GRADING LEGEND

GRADE	NUMERIC RANGE
A	90 to 100
B+	85 to 89
B	80 to 84
C+	75 to 79
C	70 to 74
D	60 to 69
F	0 to 59

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GENERATIVE AI

Student use of artificial intelligence (AI) is permitted in this course for certain assignments and activities. It is not permitted to be used in the assignments noted by the instructor, as doing so would undermine student learning and achievement of course learning outcomes. Additionally, if and when students use AI in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments.

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COURSE OUTLINE

All assignments will be posted on the Learning Management System.

Wk	Date	Topics
1	9/3	Lecture: • Introduction to Quality & Reliability in Engineering • Review of the Engineering Design process and terminology • Basic quality and reliability Terminology Laboratory: • Engineering design case study.
2-3	9/10 9/17	Lecture: • Design Control • Safety, Quality, & Reliability terms. • Quality Management System (QMS). • Regulations and standards (e.g. OSHA & ISO). • Design Input Verification and Validation Laboratory: • Preparing a Design Input Verification and Validation Document • Class Project Assigned
4-5	9/24 10/1	Lecture • Root Cause Analysis • Cause and Effect Analysis and Diagram Laboratory: • Preparing a Fishbone Diagram
6-7	10/8 10/15	Lecture • Root Cause Analysis • Fault tree analysis (FTA) **Midterm Exam** Laboratory: • Preparing a Fault Tree
8-10	10/22 10/29 11/5	Lecture • Risk and Hazard Analysis • Failure mode and effects analysis (FMEA) Laboratory:

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Wk	Date	Topics
		• Preparing an FMEA document
11	11/12	Industry Case Study One
12	11/19	Industry Case Study Two
NO CLASS 11/26 FRIDAY CLASSES MEET		
13	12/3	Project Time
14	12/10	**Submit Project** **Project Presentations**
15	TBD	**Final Exam**