

## **ENGR-5323: FAILURE ANALYSIS OF ENGINEERING SYSTEMS**

**Catalog Description:** An investigation of engineering analysis techniques used to determine source of design, system, and process failures. Multiple techniques applicable to most engineering disciplines are presented.

**Prerequisites:** Acceptance into the OC MSE Program.

**Co requisites:** None

**Textbooks:**

1. Berk, Joseph, Systems Failure Analysis, ASM International, 2009.  
ISBN: 978-1615030125.
2. Engineering Notebook

**Coordinator:** **Steve Maher**

**Course Outcomes:** Following this course, the student will be able to ...

1. Articulate, in a mature manner, the need for the Failure Analysis (FA) techniques addressed in this course within real-world engineering projects (#3 Solution Strategy, #4 Technical Evaluation, #6 Scholarly Communication)
2. Compare and contrast the advantages and disadvantages of the (FA) techniques addressed in the course for specific applications (#3 Solution Strategy, #4 Technical Evaluation, #6 Scholarly Communication)
3. Demonstrate the required understanding to implement the (FA) techniques addressed in the course using engineering case studies (#3 Solution Strategy, #4 Technical Evaluation, #5 Independent Research, #6 Scholarly Communication)

### **Course Topics:**

1. Root Cause Analysis
2. Fault Tree Analysis
3. Failure Mode Analysis
4. Analytical Equipment and Methods
5. Failure Modes and Types
6. Analysis of Design Failures
7. Design of Experiments
8. Corrective Actions
9. Failure Mode and Effects Analysis

**ENGR-5323-91**  
**Failure Analysis of Engineering Systems**  
**Fall 2020, Term 2 (Online)**

## **Course Policies and Procedures**

### **Attendance/Punctuality**

This course is conducted completely online. It is expected that 15-20 hours per week will be required to succeed in the course, including time to read the textbook, review the lecture material, do the discussion questions, do the assignments, and do the quizzes. Students will be expected to take the two tests as scheduled. An on-campus option for each test may be available for the convenience of the students. Late work may be accepted, depending on the assignment, but will have substantial penalty for being late.

### **Blackboard**

All information about this course will be on Blackboard, OC's online course management software. You can find information such as announcements, course material, course schedule, assignments, etc. on Blackboard. It is your responsibility to check this site often. There will be items posted to Blackboard frequently. All assignments and project work will be uploaded by the students in the Blackboard classroom using the appropriate links.

### **Lectures/Textbook**

The textbook, online lectures, and discussions are the primary resources for learning the material in the course. It is assumed that you will read the textbook when assigned. Additional material, outside the textbook, will also be covered and will be used to supplement information in the text. It is your responsibility to obtain the textbook and watch and listen to the online lectures.

### **Discussions board**

To effectively participate in the Discussions board, please provide organized and thoughtful responses showing connections from the readings and other materials in the course. Please avoid summarizing course text and writing lengthy posts to avoid receiving TL; DR (Too long; didn't read) replies. Post your primary response at least 24 hours before the posted due date/time. Post additional responses to other peers per the instructions by the posted due date/time. Replying to a peer's post should include more than affirmations or summary but extending the discussion, asking a probing and relevant question, and/or drawing any connections from the course material and others' responses.

### **Educational Technology**

It is expected that each student will have their own computer. All assignments, quizzes, and tests are worked on the computer and submitted electronically. The Respondus Lockdown Browser is used for all quizzes and tests. It is your responsibility to ensure that the Lockdown Browser is properly configured and working prior to beginning any quiz or test. The test sessions are often offered on campus at OC, but can be taken in any pre-approved supervised setting. Each student must have their own computer to take their test.

## Late Assignments

All assignments in this class are submitted electronically and “time stamped” upon submission. Assignments submitted late (even 1 minute), but within 1 day of the due date, will receive a 1/3 score reduction. Assignments submitted within 2 days, a 2/3 reduction. After 2 days, the assignment scores a zero.

## Engineering Notebook

Each student is encouraged to keep his/her own engineering class notebook. It is highly recommended that you use a notebook for all class notes and course-related work. The notebook is not allowed for exams, but can be used as a good study guide to help organize the materials in a way that is best suited for the student’s study style.

## Instructor

Steve Maher

Office: PEC 215

Office Phone: 405-425-5407 (x5407)    Cell Phone: 405-664-2822

Email [steve.maher@oc.edu](mailto:steve.maher@oc.edu)

On-campus Office Hours: Mon 10:00-10:50 am & 1:40-2:30 pm, Tue 1:00-2:30 pm and 7:30-8:30pm (the hour after the on-campus section of this class), Wed 10:00-10:50 am, Thu 1:00-2:30pm, Fri 10:00-10:50am and 1:40-2:30pm.

It is best to schedule an appointment ahead of time. Other times, including evening time, are also available by appointment. Times are subject to change; most current version of office hour schedule is posted outside of office door.

Consultations via email, phone calls, online chats, and office visits are available. Email any time; response will be as quickly as possible and generally within 24 hours. For interactive discussions, either on phone, online, or in person, it is best to schedule an appointment ahead of time.

## Class Times and Location

The class officially runs from October 5 – November 20. All materials are online. Test dates, times, and locations will be announced ahead of time and are included on the detailed course schedule.

## Textbooks

1. Berk, Joseph, Systems Failure Analysis, ASM International, 2009.  
ISBN: 978-1615030125 (required)
2. Engineering Notebook (optional, but encouraged)

## Grading

Grading for this course will follow the pattern shown:

90 - 100	A
80 - 89	B
70 - 79	C
< 70	F

Your grade will be determined as follows:

Weekly Assignments/Quizzes	30%
Mid-term Exam	25%
Project(s)	20%
Final Exam	25%

### Exams

There is 1 mid-term exam planned for the semester. See course schedule for timing and material covered. A Final Exam will be given at the end of the course. The Final Exam is comprehensive.

## Course Schedule

The course schedule is posted on Blackboard and will be kept up to date if any changes occur.

## OC Mission Statement

*Oklahoma Christian University is a higher learning community that transforms lives for Christian faith, scholarship, and service.*

### INTEGRATION OF FAITH & LEARNING

The OC MSE Program holds students to high academic and ethical standards. The student's responsibility is to fully apply themselves to their academic pursuit so as to maximize their gains from the program and to fulfill their full potential as individuals blessed with God given talents in engineering.

Work with enthusiasm, as though you were working for the Lord rather than for people. Remember that the Lord will reward each one of us for the good we do, whether we are slaves or free. [Eph. 6:7-8, NLT]

The faculty and staff of the OC MSE Program partner with students in their pursuit of knowledge and seek to provide each student with a rich academic experience while at OC. To pursue engineering is to pursue, though in a limited way, the creative and analytical nature of our Lord and Savior.

Where were you when I laid the foundations of the earth? Tell me, if you know so much. Who determined its dimensions and stretched out the surveying line? What supports its foundations, and who laid its cornerstone as the morning stars sang together and all the angels shouted for joy? [Job 38:4-7, NLT]

Table 1 indicates the links between the MSE Program Learning Outcomes (PLOs) and the Oklahoma Christian University Learning Outcomes (ULOs).

		University Learning Outcomes						
		Active Faith	Mastery of Knowledge	Information Skills	Structured Reasoning	Critical & Creative Thinking	Effective Communication	Sterwardship
Program Learning Outcomes	#1: Ethics	X			X	X	X	X
	#2: Diverse & Global	X		X	X	X	X	X
	#3: Solution Strategy		X	X	X	X		
	#4: Technical Evaluation		X	X		X	X	
	#5: Independent Research		X	X	X	X	X	
	#6: Scholarly Communication	X	X	X			X	X

### **ATTENDANCE POLICY**

For this course, your active participation will be measured by your ability to stay engaged with the content and your peers. The university expects professionalism and netiquette in the online space. Please abide by these norms when communicating online or via email:

- Be Respectful. No obscene, offensive, or discriminatory language.
- Be Professional and gentle when replying with critical questions or clarification
- Be scholarly.
- Be polite.

### **GRADING POLICIES**

This is a graduate engineering course and per the OC Graduate engineering catalog no "D" grades are allowed (performance below a "C" grade is considered failing). No late work will be allowed.

### **APPROPRIATE ATTIRE**

Students are required to dress appropriately for class. A student who is inappropriately dressed may be dismissed from class to change into acceptable attire. A copy of the OC Dress Code can be found on pages 30-31 of the Student Handbook online.

### **COURSE-LEVEL INFORMATION TECHNOLOGY POLICIES**

- **Blackboard and E-mail**

This course will use an Internet tool called Blackboard as well as E-mail. You can find information about this course such as announcements, course documents, assignments, etc. at the URL [bb.oc.edu](http://bb.oc.edu). You must login to the site and select this course to see the information. It is **your responsibility** to check this site and your university E-mail often. Only your university issued E-mail address will be used for communication.

- **Electronic equipment**

For all classes, you are expected to have access to a laptop computer. Many classes conduct testing on computing platforms in supervised settings, and it is mandatory that students will have a mobile platform compatible with those testing requirements.

For face-to-face classes, classroom use of the computers is determined by the instructor and following their instructions is expected. For online classes, you are expected to have a working computer at all times with the required software correctly installed and working. If you need assistance, immediately contact the OC Information Technology group.

Cell phones and pagers should not disrupt the class. If you continue to use any electronic device in class when asked not to, you will be asked to leave the classroom.

### **POLICIES ON ACADEMIC HONESTY**

- **Cheating**

Cheating on an examination or an assignment undermines the ethics of the academy and the specific Christian purposes of Oklahoma Christian University. Accordingly, students who cheat on examinations or assignments will face serious consequences, as outlined in the policy below.

- **Plagiarism**

One particular form of cheating is plagiarism. Plagiarism is the transmission of another's ideas, words, or materials as one's own and/or the failure to credit accurately the ideas, words, or

materials of another. Plagiarism also includes passing off another's work (a friend, a parent, a website) as one's own. Plagiarism undermines the ethics of the academy and the specific Christian purposes of Oklahoma Christian University. Accordingly, students who engage in plagiarism in papers submitted will face serious consequences, as outlined in the policy below.

- **Penalties for Academic Dishonesty.**

1. On the first offense, the student will receive zero (0) credit for the examination or assignment. For forms of cheating or dishonesty other than on examinations or assignments, the Professor shall have the discretion to impose an appropriate penalty. Professors must send documentation of the first offense to the appropriate chair, the dean of the appropriate college, the VPAA, and the Dean of Students.
2. On the second offense in the same course, the student will receive an F in the course. Professors must send documentation of the second offense to the appropriate chair, the dean of the appropriate college, the VPAA, and the Dean of Students.
3. At either the first offense or second offense, the student may appeal using the process set forth in the *OC Academic Policy Manual* covering Grade Appeals.
4. If the student commits offenses in two or more courses, the Academic Appeals Committee, established in the *OC Academic Policy Manual*, may assign penalties for academic dishonesty in addition to the penalties assigned by the professors in the courses. The Academic Appeals Committee may impose penalties up to and including suspension from the University in instances where a student has engaged in cheating or plagiarism in two or more courses. The Academic Appeals Committee will inform the VPAA and the Dean of Students in writing of any penalties imposed by it and will report annually on its activities to the University's Academic Affairs Committee.
5. Professors should maintain the highest standards of academic honesty both in and out of the classroom. Professors must report and apply the rules regarding cheating/plagiarism to the appropriate channels. The student should be referred to the Oklahoma Christian University Covenant for principles which should guide conduct in these matters.

As a student at Oklahoma Christian University you are bound by the OC Student Handbook. The OC Student Handbook details the rules and penalties related to Academic Dishonesty. Read the handbook and know what is expected!

- **Additional Program Details on Honesty**

During your course work within engineering there will be times when you are faced with deciding what is cheating or plagiarism. If you are in doubt about what constitutes cheating or plagiarism then ask your professor. You will not be accused of anything by asking before you do something. The following are some situations that the faculty considers cheating. This is not an exhaustive list so you need to evaluate your actions closely.

1. Getting information from someone else during an examination or quiz
2. Using any notes during an exam or quiz when not allowed
3. Using solution manuals or someone else's solution as your own solution on a homework even if you copy it in your own handwriting or type it yourself
4. Copying information from a website without proper credit or reference
5. Using someone else's computer code to "start" your program or as your program
6. Falsifying or fabrication of analytical or experimental results

It is also important for students to not enable others to cheat in their courses. By this we mean purposefully giving someone else your work for them to use even if you do not think they will

submit part or all of it as their own work. There is a difference between helping someone learn and helping someone cheat. If you help someone cheat you will also receive a zero for that assignment.

### **AMERICANS WITH DISABILITIES ACT (ADA) / 504 STATEMENT**

If you have a diagnosed disability and need special accommodations, please notify Ms. Katy Roybal (425-1876) before or immediately after your first scheduled class meeting. After your disability has been verified, your instructor will work with you, with Ms. Roybal, and with the Office of the Vice President of Academic Affairs (425-5460) to provide reasonable accommodations to ensure that you have a fair opportunity to perform in this course. It will be up to you to communicate with your professor by the end of the first week of class so there is time to make accommodations for the semester. Failure to do so may preclude accommodations from being made.

### **ACADEMIC USAGE OF STUDENT WORK AND INTELLECTUAL PROPERTY**

Student work for this course may be used for future academic purposes by the department and university. The student's submission of intellectual property in fulfilling the requirements of course work acknowledges joint ownership with the University of the Intellectual Property.

### **ANTI-HARASSMENT AND DISCRIMINATION POLICY (TITLE IX)**

Oklahoma Christian University is a Christian community that has committed itself, unequivocally, to ensuring a working and learning environment in which the dignity of every individual is respected and a campus environment that is free of unlawful harassment, which includes sexual assault or misconduct. OC's Anti-Harassment and Discrimination Policy (see the OC Student Handbook) is compliant with Title IX, which states, "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance." Discriminatory and sexual harassment is unchristian and uncivil behavior. It is a breach of community, which expresses disrespect, exploits and undermines relationships based on trusts, and interferes with learning and productive work.

Students are encouraged to immediately seek available assistance and report incidents of harassment to either the Title IX Coordinator or one of the Title IX Deputy Coordinators listed below:

<b>Title IX Coordinator</b>	Ms. Lisa Herndon	405.425.1820	lisa.herndon@oc.edu
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Students have access to confidential services through the Counseling Center and the Spiritual Life Office.

<b>OC Counseling Center</b>	405.425.5250
<b>Spiritual Life:</b>	
<b>Jeff McMillon, Dean of Spiritual Life</b>	405.425.5919
<b>Summer Lashley, Ethos Director</b>	405.425.5908

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The distribution or sale of course material to other parties is prohibited. Students must obtain written authorization from the professor of that course and the Dean of that college to make any audio or video recordings of course content.

Course materials provided or made available to students in class, online or via email are the property of Oklahoma Christian University, the instructor and other copyright holders and are made available for the sole use of students enrolled in this class during the semester in which the student is enrolled. Students may keep one copy (print or digital) for personal use only and may not distribute the materials in any media format to any person without the express permission of the Oklahoma Christian University and the instructor. Original materials posted and authored by students may not be distributed under any circumstances.