Engineering Statics
PHYS/ENGR 2401.001 & 2001.020 & 021 (Lecture and Lab)
Syllabus – Fall 2023

GENERAL COURSE INFORMATION
Name and Department: Dr. Harry D. Downing, Professor of Physics and Regents Scholar, Department of Physics, Engineering and Astronomy
Instructor Homepage: http://faculty.sfasu.edu/downingharry/downing.htm
Office: Room 207M Cole STEM Building
Student/Office Hours: 2-3 M&R, 10-11 T, 3-4 W&F, or by appointment/207M Cole STEM Bldg (Make an Appointment)
Phone, Fax, E-mail: 468-2290 or 468-3001, Fax: 468-4448, hdowning@sfasu.edu
Class Meeting Times and Place: 9:00-9:50 MWF, 12:30-3:20 T, Room 201 Cole STEM Bldg.
Physics Homepage: http://www.sfasu.edu/academics/colleges/sciences-math/physics-engineering-astronomy/academics/physics

Text and Materials:
Vector Mech. for Engineers: Statics/Dynamics
Authors: Beer, Johnston, Mazurek, Cornwell, Self

It is necessary that you acquire this edition of the text. Homework and reading will be assigned assuming the student has this text. Hard copies of homework assignments will not be handed out to the student.

Other materials needed in the course:
Engineering paper that is grid ruled (assignment submission)
Scientific calculator or better (for homework)
Ruler, compass, any other drafting tools for FBD sketches

COURSE DESCRIPTION
Basic theory of engineering mechanics using calculus involving the description of forces, moments and couples acting on stationary engineering structures; equilibrium in two and three dimensions; free-body diagrams; friction; centroids; centers of gravity; and moments of inertia. Prerequisite(s): MATH 2313 and PHYS 2325. Co-requisite(s): ENGR 2001L or PHYS 2001L. PHYS 2001 & ENGR 2001 are cross-listed.

This is the intermediate level course in statics that employs various problem-solving methods and the laws of mechanics to analyze and obtain solutions to fundamental problems in engineering and physics. The material covered and the associated laboratory exercises warrant this lecture and lab as being worthy of 4 semester hours credit.
PROGRAM LEARNING OUTCOMES (for PHYS Majors)
- Knowledge: The student will demonstrate knowledge and comprehension of the basic and applied fields of physics.
- Problem Solving: The student will develop independent problem-solving skills.
- Written Communications: The student will develop effective written communication skills by clear and concise problem solving, well-structured laboratory reports, and accepted formatting of research papers.
- Oral Communications: The student will develop effective oral communication skills in oral presentations of problem solution, seminars, and oral presentations at scientific meetings.

PROGRAM LEARNING OUTCOMES (for ENGR Majors)
See “Course Learning Outcomes” in the ABET syllabus at the end of this document.

GENERAL EDUCATION CORE CURRICULUM OBJECTIVES/OUTCOMES
This course is not included in the general education core curriculum.

STUDENT LEARNING OUTCOMES (for PHYS Majors)
By the end of the course, successful students will be able to:
- Demonstrate an advanced level knowledge and understanding of the laws of classical mechanics to include representing these laws in mathematical expressions with appropriate units for physical quantities.
- Show quantitative and analytical skills necessary to solving physics/engineering problems.
- Exhibit effective written communication skills in presentations of physics/engineering homework problems.
- Exhibit effective oral communication skills in presentations of physics/engineering problems to one’s peers.

STUDENT LEARNING OUTCOMES (for ENGR Majors)
See “Student Outcomes” in the ABET syllabus at the end of this document.

COURSE OBJECTIVES
The main objective of this course in mechanics is to develop in the engineering/physics student the ability to analyze any problem in a simple and logical manner and to apply to its solution a few, well-understood, basic principles. A cooperative problem-solving approach is taken where students develop time management skills and teaming skills.

COURSE REQUIREMENTS/GRADING POLICY
- Poor performance on any test will result in a personal visit to the instructor’s office or via Zoom.
- The tests will be done in symbolic form, therefore, no calculators will be allowed.
- All students must do one conference with the course instructor during the semester regardless of what their test scores are. This conference will be part of your lab grade. Will be done F2F or via Zoom early in the semester.
- Homework will be worth 1/8th of your overall grade.
- Oral presentations, attendance, pop quizzes, performance during the problem sessions (PHYS/ENGR lab), etc. will be 1/8th of your overall grade.
Exams
There will be three exams and a final, each covering a specific set of lecture, text, and homework material that will be communicated to the student in class. The tentative dates of these exams are listed in the course outline shown later in this document. Students will have one week after each exam to review the exams and discuss the grades. No make-up exams will be given except in the case of an excused absence. An official written notice is required for an excused absence within three days of the exam. Any makeup exam must be taken at a time and location assigned by the instructor. The style of exam as well as allowed materials for the four exams will be communicated to the student in class.

Pre-Lecture Assignments
Students will be tasked to complete reading assignments from their text and to view videos from D2L. Each reading assignment and video viewing will be posted well before the lecture in which the material is covered. It is the responsibility of the student to complete these reading assignments and videos BEFORE the appropriate class or the deadline shown. The grades for these assignments will be based on in class short quizzes, primarily multiple choice.

Format for ENGR 2401 Homework
Your homework that is submitted to me will be of professional quality and professionally presented. The problems will be complete in themselves to the extent that any competent person, without reference to any material other than what you present, can determine the following: (a) the problem you are solving, (b) your method of solution, and (c) your answer. The problems must be done in symbolic form (explained in class) until arriving at a final answer. Then any numbers given may be plugged into you final equation.
A limited amount of homework will be assigned from the required text for the course and should be turned in to me in class as a portfolio when it is due. Most homework will assigned in McGraw-Hill’s Connect website. Homework assignments (Connect and portfolio) will be given to you in class along with the due dates. When completing homework, the following guidelines must be followed:

1. Paraphrase the problem statement and draw a diagram if needed – make sure to label appropriately
2. Make sure to outline what values are given and the values you are trying to solve for
3. Use engineering style paper that is grid ruled, or equivalent electronic version
4. Use only one side of the paper (typically the side facing you on the pad)
5. Include your name and page number on each page
6. Use a ruler to set up your diagrams or in drawing elements, or appropriate electronic equivalent
7. Show the progression of your solution, clearly identify appropriate units when necessary
8. Indicate final answers by placing a surrounding box, don’t forget the units!!

The above criteria, as well as accuracy of the information, will be used to grade your homework.

Treat this as if I am your client and you need to impress me with your engineering calculations. Homework due dates and times will be communicated to the student in class. No late homework will be accepted unless you have an excused absence.
In Class Assignments and Presentations
All in class assignments, if any, must be completed by the end of the class period. This may include working out example or homework problems on the “board” or separate assignments given throughout the class. The student may also be asked to present completed homework to the rest of the class in a “flipped class” manner. This is done to assess the communication and presentation skills of the student. The grade for these assignments and participation will be averaged with the homework to give 25% of your final grade. It is the discretion of the instructor to grant additional time if deemed necessary.

Grading Policy

<table>
<thead>
<tr>
<th></th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>16%</td>
</tr>
<tr>
<td>Exam 2</td>
<td>16%</td>
</tr>
<tr>
<td>Exam 3</td>
<td>16%</td>
</tr>
<tr>
<td>Homework, assignments, in-class activities</td>
<td>25%</td>
</tr>
<tr>
<td>Pre-Lecture assignments, pop quizzes</td>
<td>11%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>16%</td>
</tr>
</tbody>
</table>

Letter grades are based on the following ranges:

- **A**  90.0 – 100%
- **B**  80.0 - 89.9%
- **C**  70.0 - 79.9%
- **D**  60.0 - 69.9%
- **F**  < 60.0%

HINTS FOR SUCCESS IN ENGR 2401
The most important things you can do are read the book, attend class and be attentive, and do the homework!!!

The lecture time will be primarily you and I working on problems. PowerPoint lectures for the material will be available on D2L in videos. It is your responsibility to review this video material and do the Connect readings prior to the class where problems related to the video and Connect material is done in class. As you watch these videos, note questions that you would like to ask in class. If you have problems trying to comprehend this material, please do not hesitate to come and visit with me. I have truly enjoyed working with students, and often I have found that I am most effective with them when they have brought their questions and problems to me in my office.

ATTENDANCE
Five unexcused absences from lecture and/or lab will result in a grade reduction of one letter grade. Seven will result in an F for the course. To get presentation points you must be present in class when your group’s problem is presented to the rest of the class. Students should become familiar with the policies on cheating and plagiarism.

CLASSROOM POLICIES
For the benefit of your fellow students and your instructor, you are expected to practice common courtesy with regard to all course interactions.

For example:
- Be considerate toward your classmates and instructor and arrive to class on time.
- Do not leave class early and do not rustle papers in preparation to leave before class is dismissed.
- Avoid classroom distractions. Be attentive in class, stay awake, and do not read newspapers, etc.
- If you are late to class or must leave early, please inform your instructor in advance (enter or leave quietly, don’t walk across the front of the classroom (use the side aisles).
- Cell phones and other communication devices must be turned off during class. Failure to do so could result in confiscation.
- Be kind and respectful to your fellow students and your teachers.
EMAIL COMMUNICATIONS
Make sure you always use your SFA e-mail account for network correspondence. Messages from your instructor will be sent to your SFA email account periodically. You may forward e-mail from your SFA e-mail address to another address of your choice. To do this, use this link: http://www.sfasu.edu/mysfa/o365/forwarding-email/

Academic Integrity
The Code of Student Conduct and Academic Integrity outlines the prohibited conduct by any student enrolled in a course at SFA. It is the responsibility of all members of all faculty, staff, and students to adhere to and uphold this policy.

Articles IV, VI, and VII of the new Code of Student Conduct and Academic Integrity outline the violations and procedures concerning academic conduct, including cheating, plagiarism, collusion, and misrepresentation. Cheating includes, but is not limited to: (1) Copying from the test paper (or other assignment) of another student, (2) Possession and/or use during a test of materials that are not authorized by the person giving the test, (3) Using, obtaining, or attempting to obtain by any means the whole or any part of a non-administered test, test key, homework solution, or computer program, or using a test that has been administered in prior classes or semesters without permission of the Faculty member, (4) Substituting for another person, or permitting another person to substitute for one’s self, to take a test, (5) Falsifying research data, laboratory reports, and/or other records or academic work offered for credit, (6) Using any sort of unauthorized resources or technology in completion of educational activities.

Plagiarism is the appropriation of material that is attributable in whole or in part to another source or the use of one’s own previous work in another context without citing that it was used previously, without any indication of the original source, including words, ideas, illustrations, structure, computer code, and other expression or media, and presenting that material as one’s own academic work being offered for credit or in conjunction with a program course or degree requirements.

Collusion is the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any provision of the rules on academic dishonesty, including disclosing and/or distributing the contents of an exam.

Misrepresentation is providing false grades or résumés; providing false or misleading information in an effort to receive a postponement or an extension on a test, quiz, or other assignment for the purpose of obtaining an academic or financial benefit for oneself or another individual or to injure another student academically or financially.

Withheld Grades Semester Grades Policy (5.5)
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the coursework because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course to compute the grade point average. For additional information, go to https://www.sfasu.edu/policies/course-grades-5.5.pdf.
Students with Disabilities
To obtain disability-related accommodations, alternate formats, and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services promptly may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

Student Wellness and Well-Being
SFA values students’ overall well-being, mental health and the role it plays in academic and overall student success. Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure and challenges associated with relationships, emotional well-being, alcohol and other drugs, identities, finances, etc.

If you are experiencing concerns, seeking help, SFA provides a variety of resources to support students’ mental health and wellness. Many of these resources are free, and all of them are confidential.

On-campus Resources:
The Dean of Students Office (Rusk Building, 3rd floor lobby)
www.sfasu.edu/deanofstudents
936.468.7249
dos@sfasu.edu

SFA Human Services Counseling Clinic Human Services, Room 202
www.sfasu.edu/humanservices/139.asp
936.468.1041

The Health and Wellness Hub “The Hub”
Location: corner of E. College and Raguet St.

To support the health and well-being of every Lumberjack, the Health and Wellness Hub offers comprehensive services that treat the whole person – mind, body and spirit. Services include:

- Health Services
- Counseling Services
- Student Outreach and Support
- Food Pantry
- Wellness Coaching
- Alcohol and Other Drug Education

www.sfasu.edu/thehub
936.468.4008
thehub@sfasu.edu

Crisis Resources:
- Burke 24-hour crisis line: 1.800.392.8343
- National Suicide Crisis Prevention: 9-8-8
- Suicide Prevention Lifeline: 1.800.273.TALK (8255)
- johCrisis Text Line: Text HELLO to 741-741
The class meets 3 hrs/wk for 15 weeks, and it also meets for a 2-hour final examination. This is a problem-oriented class and lab with homework problems. The lecture and lab combine for 6 hours of contact time each week and the work outside of classes each week for the combined courses averages much more than 12 hours in working homework problems, reading the book to understand the theories used in lecture and in homework problems and exams, and studying for exams which include major exams and possibly short lecture quizzes.

**PHYS/ENGR 2401.001 & 2001.020&021**

**Tentative Course Outline and Calendar**

**Course Calendar (Reading Assignments in Parentheses)**

<table>
<thead>
<tr>
<th>Chapter 1 Introduction</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental Dimensions and Units</td>
<td>Aug. 25</td>
<td>Aug. 29</td>
<td>Aug. 30</td>
<td>Aug. 31</td>
<td>Sep. 1</td>
</tr>
<tr>
<td>Problem Solving Methods</td>
<td>Intro, Ch. 1, (1.1-1.3)</td>
<td>Ch. 1, (1.1-1.6)</td>
<td>Ch. 1, (1.1-1.6)</td>
<td>Ch. 1, (1.1-1.6)</td>
<td>Ch. 2, (2.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 2 Statics of Particles</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adding Forces</td>
<td>Sep. 4</td>
<td>Sep. 5</td>
<td>Sep. 6</td>
<td>Sep. 7</td>
<td>Sep. 8</td>
</tr>
<tr>
<td>Ch. 2, (2.2)</td>
<td>Ch. 2, (2.3)</td>
<td>Ch. 2, (2.3)</td>
<td>Ch. 2, (2.3)</td>
<td>Ch. 2, (2.3)</td>
<td>Ch. 2, (2.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 3 Rigid Bodies</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forces and Moments</td>
<td>Sep. 11</td>
<td>Sep. 12</td>
<td>Sep. 13</td>
<td>Sep. 14</td>
<td>Sep. 15</td>
</tr>
<tr>
<td>Ch. 3, (3.1)</td>
<td>Ch. 3, (3.1)</td>
<td>Ch. 3, (3.1)</td>
<td>Ch. 3, (3.1)</td>
<td>Ch. 3, (3.1)</td>
<td>Ch. 3, (3.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 4 Equilibrium of Rigid Bodies</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Special Cases</td>
<td>Sep. 18</td>
<td>Sep. 19</td>
<td>Sep. 20</td>
<td>Sep. 21</td>
<td>Sep. 22</td>
</tr>
<tr>
<td>Ch. 3, (3.2)</td>
<td>Ch. 3, (3.2)</td>
<td>Ch. 3, (3.2)</td>
<td>Ch. 3, (3.2)</td>
<td>Ch. 3, (3.2)</td>
<td>Ch. 3, (3.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 5 Distributed Forces</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planar Centers of Gravity and Centroids</td>
<td>Oct. 2</td>
<td>Oct. 3</td>
<td>Oct. 4</td>
<td>Oct. 5</td>
<td>Oct. 6</td>
</tr>
<tr>
<td>Ch. 4, (4.1)</td>
<td>Ch. 4, (4.1)</td>
<td>Ch. 4, (4.1)</td>
<td>Ch. 4, (4.1)</td>
<td>Ch. 4, (4.1)</td>
<td>Ch. 4, (4.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 6 Analysis of Structures</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch. 5, (5.2)</td>
<td>Ch. 5, (5.3)</td>
<td>Ch. 5, (5.3)</td>
<td>Ch. 5, (5.3)</td>
<td>Ch. 5, (5.3)</td>
<td>Ch. 5, (5.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 7 Internal Forces and Moments</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch. 6, (6.1)</td>
<td>Ch. 6, (6.1)</td>
<td>Ch. 6, (6.1)</td>
<td>Ch. 6, (6.1)</td>
<td>Ch. 6, (6.1)</td>
<td>Ch. 6, (6.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 8 Friction</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch. 6, (6.2)</td>
<td>Ch. 6, (6.2)</td>
<td>Ch. 6, (6.2)</td>
<td>Ch. 6, (6.2)</td>
<td>Ch. 6, (6.2)</td>
<td>Ch. 6, (6.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 9 Distributed Forces: Moments of Inertia</th>
<th>M ON</th>
<th>T U E</th>
<th>W ED</th>
<th>T H U</th>
<th>F RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moments of Inertia of Areas</td>
<td>Nov. 20</td>
<td>Nov. 21</td>
<td>Nov. 22</td>
<td>Nov. 23</td>
<td>Nov. 24</td>
</tr>
<tr>
<td>Ch. 9, (9.1)</td>
<td>Ch. 9, (9.1)</td>
<td>Ch. 9, (9.1)</td>
<td>Ch. 9, (9.1)</td>
<td>Ch. 9, (9.1)</td>
<td>Ch. 9, (9.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thanksgiving</th>
<th>Nov. 27</th>
<th>Nov. 28</th>
<th>Nov. 29</th>
<th>Nov. 30</th>
<th>Nov. 31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thanksgiving</td>
<td>Ch. 7, (7.2)</td>
<td>Ch. 7, (7.2)</td>
<td>Ch. 7, (7.2)</td>
<td>Ch. 7, (7.2)</td>
<td>Ch. 7, (7.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final</th>
<th>Dec. 1</th>
<th>Dec. 2</th>
<th>Dec. 3</th>
<th>Dec. 4</th>
<th>Dec. 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final</td>
<td>Ch. 9, (9.2)</td>
<td>Ch. 9, (9.2)</td>
<td>Ch. 9, (9.2)</td>
<td>Ch. 9, (9.2)</td>
<td>Ch. 9, (9.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final 8:00 am -10:00 pm</th>
<th>Final 10:30 am - 12:30 pm</th>
</tr>
</thead>
</table>

**Lecture 9-9:50am MWF STEM 201**

**Lab 12:30-3:20am T STEM 201**

**Fall 2023**

**Thanksgiving**

**Test 1**

**Test 2**

**Test 3**

**Finals**
Stephen F. Austin State University
ABET Syllabus:
ENGR 2401 – Engineering Statics (Required)

Course Description:
Basic theory of engineering mechanics, using calculus, involving the description of forces, moments, and couples acting on stationary engineering structures; equilibrium in two and three dimensions; free-body diagrams; friction; centroids; centers of gravity; and moments of inertia. Four semester hours, three hours lecture, three hours lab per week. Prerequisites: MATH 2313 and PHYS 2325. Lab fee required.

Prerequisites: PHY 2325 & MTH 2313      Co-Requisites:    EGR 2001L

Credits:   4 Hours      (Lecture: 3 Hours, Laboratory: 1 Hours)

Instructor:  Harry Downing

Textbook:  Vector Mechanics for Engineers: Statics & Dynamics
Authors: Beer, Johnston, Mazurek, Cornwell, Self

Supplemental Materials:  Engineering paper
Scientific calculator or better

Topics Covered:
Forces and moments in three dimensions analyzed with vector mechanics, centroids and centers of gravity, analysis of trusses, frames, and machines, beams, friction, moments of inertia of mass and area.

Course Learning Outcomes
By the end of the course, a successful student will be able to:
1.  Draw a complete free-body diagrams describing position of forces and moments in terms of vector components in two and three dimensions. (SO-2)
2.  Apply appropriate equilibrium equations on a free-body diagram. (SO-1)
3.  Work in teams to solve equilibrium problems discussed in class. (SO-3)
4.  Determine resultant forces for a system acted upon by outside point and distributed forces. (SO-1)
5.  Translate systems of forces and moments to equivalent systems. (SO-1)
6.  Calculate forces in trusses and frames under equilibrium. (SO-1)
7.  Find internal forces of a structure or system in equilibrium. (SO-1)
8.  Analyze static systems that include forces from friction. (SO-1)
9.  Calculate the centroids and centers of gravity for particles with an arbitrary shape. (SO-1)
10. Determine moment of inertia for a simple area. (SO-1)
11. Apply parallel-axis theorem to find moment of inertia for a complicated area. (SO-1)
Student Outcomes
Graduates of the program will show:

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.