

University of Tabuk

Faculty of Engineering

Department of Mechanical Engineering

Students Handbook





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Chairman's Message

On behalf of the faculty and staff, I extend a warm welcome to all students joining the Mechanical Engineering Department at our esteemed institution. As the Chairman of the department, it is my honor to guide and support you throughout your academic journey. Mechanical engineering is a field that holds immense importance in shaping the world we live in. From designing innovative mechanical systems to developing sustainable energy solutions, Mechanical engineers play a vital role in creating a better future. Our department is committed to providing you with a comprehensive education that encompasses both theoretical knowledge and practical skills necessary for success in this dynamic profession.

This student handbook serves as a valuable resource to acquaint you with the policies, procedures, and guidelines specific to our department. It is designed to provide you with important information that will aid in your academic and personal success. I encourage you to read through the handbook thoroughly and refer to it whenever you have questions or need clarification. The student handbook is not only a reference guide but also a tool for empowerment. It is our hope that by familiarizing yourself with its contents, you will feel confident and supported as you navigate your academic journey.

Once again, I extend my warmest welcome to all the new and returning students of the Mechanical Engineering Department. Together, let us strive for excellence and create a positive impact on society through the remarkable field of Mechanical engineering.

Dr. Husam Alrehaili

Chair, Department of Mechanical Engineering

Faculty of Engineering

The Council for Higher Education Issued its decision No. (13/44/1427) dated 21/10/1427 H concerning establishment of the Faculty of Engineering. The decision to establish the faculty came to keep up with the renaissance taking place in the Kingdom in many areas, as the engineering is the profession that employs science to serve the welfare of society as well as to keep pace with the progress in scientific and technological advancement in the twenty-first century. The faculty was established to address the needs of the engineering market at the national and regional levels. The faculty started with its activities and functions from the academic year 1429/1430 H, whereby 80 students have been accepted in the first year. This number of students is continuously increasing every year.

The period of study in the Faculty of Engineering is five years divided into ten semesters (levels) of study. In addition, sixteen weeks of summer training in companies and institutions under the supervision of faculty members are also a must.

Vision

A distinguished and pioneering college locally and internationally in the field of engineering education, innovative research, and building a knowledge society.

Mission

To graduate qualified engineers in accordance with the International Academic Standards and prepare them to meet the changing needs of society. These graduates will be able to compete locally and internationally. The Faculty of Engineering is committed to providing excellent education and pursuing relevant scientific research and partnership with industry and governmental societies.

Goals

- 1. Provide distinguished academic Education that meets the needs of the labor market.
- 2. Conduct innovative research to contribute to the knowledge-based economy.
- 3. Contribute effectively to the sustainable development and community service.
- 4. Provide motivational and attractive environment.
- 5. Develop an effective administrative and organizational environment at the college.
- 6. Provide innovative financial resources.

Department of Mechanical Engineering (ME)

On December 11th of the year 2006, the Council for Higher Education approved establishing the Faculty of Engineering at the University of Tabuk in its decision No. (13/44/1427). Afterwards, the Department of Mechanical Engineering was established in 2008. The Department was established, in fact, to keep up with the continuous development taking place in the Kingdom of Saudi Arabia in many industrial sectors. It was a necessity to establish an undergraduate Mechanical Engineering (ME) Bachelor of Science (B.Sc.) program to keep up with the progress in scientific and technological advancements as well as the future demand for mechanical engineers. Presently, the department grants distinctions for a Bachelor of Science in Mechanical Engineering. The department has very well-equipped laboratories that can be used by the students to run experiments. In addition, the department has advanced computing facilities to assist students and faculty members in their daily work. The department computing facilities are equipped with several designs, simulation, and control packages that are used by the students to simulate Mechanical engineering systems.

Department Vision

A distinguished and pioneering ME department locally and internationally in the field of Mechanical engineering education, innovative research, and building a knowledge society.

Department Mission

To graduate qualified Mechanical engineers in accordance with the International Academic Standards and prepare them to meet the changing needs of society. These graduates will be able to compete locally and internationally. The Mechanical Engineering Department is committed to providing excellent education and pursuing relevant scientific research and partnership with industry and governmental societies.

Department Goals

- PG1: To deliver distinguished academic education that meets the needs of the labor market.
- PG2: Providing creative research to contribute to building the knowledge economy.
- PG3: Effective contribution to sustainable development and community service.
- PG4: Offer a stimulating and attractive educational environment.
- PG5: Provide efficient operational management and a supportive academic environment

Degree Requirements

The Department of Mechanical Engineering awards the B.Sc. degree in Mechanical Engineering. The curriculum within the Department of Mechanical Engineering is structured in such a way as to provide its graduates with the technical and professional expertise necessary for serving and developing the society and for conducting scientific research within the Islamic and Engineering Ethical framework.

To obtain the B.Sc. degree in mechanical engineering, the student must successfully complete 167 credit hours, which are split over 10 levels of study. In addition, the students are required to complete one practical summer training sessions (8 - weeks) in the industrial field.

Towards the total of 167 credit hours, 20 credit hours represent the university requirements, 62 credit hours represent the faculty requirements, whereas 85 credit hours represent the department requirements. The table below shows an overall summary of requirements to obtain a degree.

First Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisite
COMM 001	Communication Skills	2	Theory	None
CSC 001	Computer Skills & Applications	2	Theory	None
ECE 001	English for Technical Fields	3	Theory	None
MATH 100	Mathematics (1)	5	Theory	None
PHYS 101	General Physics	3	Theory	None

Second Semester

Course Code	Course Name	Credit Hours	Type	Prerequisite
LTS 001	Learning & Technology Skills	3	Theory	None
ECE 002	English for Technical Fields (2)	5	Theory	ECE 001
BIO 101	General Biology	3	Theory	None
CHEM 101	General Chemistry	3	Theory	None
MATH 101	Mathematics (2)	3	Theory	MATH 100

Third Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisite
ENG 201	Engineering Drawing	3	Theory	None
ENG 203	Engineering Mechanics (1)	3	Theory	PHYS 101
ENG 205	Introduction to Engineering	2	Theory	MATH 101
	Design			
ISLS 101	Islamic Culture (1)	2	Theory	None
MATH 284	Engineering Mathematics (3)	3	Theory	MATH 101
PHYS 205	Physics	4	Theory/Lab	PHYS 101

Fourth Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisite
CHEM 203	Chemistry Lab	2	Lab	CHEM 101
ENG 213	Engineering Design (2)	3	Theory	ENG 205
MATH 241	Linear Algebra	3	Theory	MATH 101
ENG 202	Production Engineering & Workshops	2	Lab	ENG 201
ENG 204	Engineering Mechanics (2)	2	Theory/lab	ENG 203
ISLS 201	Islamic Culture (2)	3	Theory	ISLS 101
MATH 383	Differential Equations	2	Theory	MATH 284

Fifth Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisite
ME 201	Engineering Materials	3	Theory/Lab	CHEM 203
ME 211	Mechanical Drawing	3	Theory/Lab	ENG 201
ME 221	Thermodynamics (1)	3	Theory/Lab	PHYS 205
ME 243	Electrical Engineering Fundamentals	3	Theory/Lab	None
ISLS 301	Islamic Culture (3)	2	Theory	ISLS 201
MATH 325	Statistics & Probability	3	Theory	MATH 284

Sixth Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisite
ME 202	Manufacturing Processes	3	Theory/Lab	ME 201
ME 212	Mechanics of Machines	3	Theory/Lab	ME 211
ME 213	Mechanics of Materials	3	Theory/Lab	ME 221
ENG 214	Engineering Economics	2	Theory	None
ME 231	Fluid Mechanics (1)	3	Theory/Lab	ME 221
ARB 101	Language Skills	2	Theory	None

Seventh Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisite
ME 314	Mechanical Vibrations	3	Theory/Lab	ME 212, ME 213
ME 315	Mechanical Design (1)	3	Theory/Lab	ME 212, ME 213
ME 322	Heat Transfer	3	Theory /Lab	ME 221, ME 231
ME 323	Thermodynamics (2)	3	Theory /Lab	ME 221
ME 341	Numerical Methods	3	Theory/ Lab	MATH 241
ARB 201	Writing Skills	2	Theory	ARB 101

Eighth Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisite
ME 316	Automatic Control and Systems	3	Theory/Lab	ME 243
ME 317	Mechanical Design (2)	3	Theory/Lab	ME 314
ME 332	Turbomachinery (1)	3	Theory/Lab	ME 315
ME 333	Instruments and Measurements	3	Theory/Lab	ME 231
ME 342	Computer-Aided Design (CAD)	3	Theory/Lab	ME 243
ME 495	Field Training	2	Training	ME 341
ISLS 401	Islamic Culture (4)	2	Theory	ISLS 301

Ninth Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisite
ME 424	Refrigeration and Air Conditioning	3	Theory/Lab	ME 323
ME 434	Basics Hydraulic & Pneumatic Systems	3	Theory/Lab	ME 323
ME 444	Mechatronics (1)	3	Theory/Lab	ME 343
ME 493	Graduation Project (1)	3	Project	ME 343

Tenth Semester

Course Code	Course Name	Credit Hours	Туре	Prerequisites
ENG 215	Engineering Management	2	Theory	MATH 325,
				ENG 214
ME 425	Power Plants & Water Desalination	2	Theory	ME 323, ME
			/lab	444
ME 494	Graduation Project (2)	3	Project	ME493

Elective Courses:

Course Code	Course Name	Credit Hours	Prerequisites
ME 445	Computer Programming and Applications	3	CSC, ME 341
ME 451	HVAC Systems (Heating, Ventilation and Air Conditioning)	3	ME 424
ME 452	Pipeline Engineering	2	ME 231, ME 332
ME 453	Renewable Energy Systems	2	ME 322, ME 332
ME 454	Aircraft Propulsion Systems	2	ME323, ME332
ME 455	Fluid Mechanics (2)	2	ME 341, ME 322
ME 456	Computational Fluid Dynamics	2	ME 322, ME 342
ME 457	Turbomachinery (2)	2	ME 322, ME 332
ME 458	Internal Combustion Engines	2	ME 323, ME 322
ME 459	Thermal and Fluid Systems Design	2	ME 322, ME 317
ME 461	Material Selection for Design	2	ME 201, ME 317
ME 462	CNC Machine Control	2	ME 202, ME 316
ME 463	Air Tanks and Pipeline Systems	2	ME 213, ME 231
ME 464	Production Tooling Design	2	ME 202, ME 342
ME 465	Automotive Engineering	2	ME 314, ME 317
ME 466	Finite Element Method and Design Applications	2	ME 342, ME 317
ME 467	Robotics Engineering	2	ME 316, ME 444
ME 468	Tribology	2	ME 315, ME 317
ME 469	Failure Analysis in Mechanical Systems	2	ME 213, ME 333
ME 471	Materials and Selection Methods	2	ME 202, ME 213
ME 472	Advanced Manufacturing Technology	2	ME 202, ME 444
ME 473	Composite Materials	2	ME 202, ME 213
ME 474	Automation and Production Systems	2	ME 202, ME 444
ME 475	Metal Cutting Theory	2	ME 202, ME 317
ME 476	Polymer and Ceramic Engineering	2	ME 201, ME 202
ME 477	Plasticity and Metal Forming	2	ME 202, ME 213
ME 478	Corrosion Engineering	2	ME 201, ME 213
ME 479	Welding Technology	2	ME 202
ME 481	Electronics Fundamentals	2	MATH 284, ME 243
ME 482	Programmable Logic Controllers	2	ME 342, ME 316
ME 483	Mechatronics (2) Engineering Programming	2 2	ME 444, ME 434
ME 484 ME 485	Investment and Image Processing Devices	2	CSC 001, ME 341 ME 434
ME 485 ME 486	Modeling and Simulation in Mechatronics	2	ME 316, ME 434
ME 480	Machine Design Applications in Mechatronics	2	ME 317, ME 444
ME 488	Robotics and Industrial Automation	2	ME 341, ME 444
ME 489	Smart Building Systems	2	ME 231, ME 444
ME 490	Selected Topics in Mechanical Engineering (1)	3	ME 231
ME 491	Selected Topics in Mechanical Engineering (2)	3	ME 202

Faculty of Engineering Admission Process Video

https://shorturl.at/hlHL6

Mechanical Engineering Structure and Requirements

The curriculum of the ME program has been adapted to let students have the opportunity to specialize, up to a certain depth, in the following three concentration areas. These areas cover the full spectrum of Mechanical Engineering activities.

This is achieved by a set of compulsory and elective courses. A list of the ME compulsory courses is presented in the below table:

The mechanical engineering curriculum allows the student to choose four elective courses (12 credit hours) from the following tracks:

- A. Energy, Thermal and Fluid Systems Track.
- B. Mechanical Systems and Design Track.
- C. Materials and Manufacturing Engineering Track.
- D. Mechatronics and Controls Track.
- E. General Mechanical Engineering Track. (The student should select four courses from the previous options with an academic advisor)

Program Admission Requirements

- 1. Pass all preparatory year courses.
- 2. After completing 45 credit hours (completing the Level 3-second year), the student can choose from the four engineering programs offered (Civil, Mechanical, and Industrial).
- 3. Applications are submitted electronically through the student's academic portal.
- 4. Admissions are based on students' GPA, selections, and the program's capacity, as approved by the Faculty of Engineering Council for that academic year.
- 5. Dean Approval.

B.Sc. in ME Program Learning Outcomes (PLOs)

- 1. An ability to demonstrate knowledge and comprehension with both breadth and depth in the underlying theories, principles, and concepts of Mechanical engineering and science.
- 2. An ability to identify, formulate, and solve complex engineering problems by applying principles of Mechanical engineering, science, and mathematics.
- 3. 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.
- 4. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgement to draw conclusions.
- 5. An ability to communicate effectively with a range of audiences.
- 6. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- 7. 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.
- 8. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Senior Design Project

The senior design project (SDP) is an emulation of real-life engineering projects where students develop their technical and professional skills and apply their knowledge to solve a complicated engineering problem. The project is designed to enable the students to practice their research and problem-solving skills and enhance their communication, teamwork, time management and project planning skills. Furthermore, it emphasizes students' understanding of safety polices, ethical issues, conflict of interest as well as social and environmental impacts of engineering solutions.

Students undertaking senior design project work under the direct supervision of a faculty advisor. Students will collaborate in teams to solve engineering problems, conduct sufficient literature survey, recognize the objectives of their work and identify any relevant constraints, perform experiments, build prototypes and/or produce simulations as appropriate to their problem, analyze the results and present their work in the form of a report and a presentation.

Senior Design Project Perquisites and Duration

Students must complete at least 120 credit hours as well as certain courses depending on the field of study prior registering for Senior Design Project I. Then, the student continues their project in Senior Design Project II. The completion of senior design project requires two semesters (1 academic year).

Senior Design Project Guide

https://www.ut.edu.sa/ar/Faculties/engineering/civil/Documents/Senior%20Design% 20Project%20Guide.pdf

Steps to Assign Senior Project

Students registered for the course apply for available projects individually or as a team. Students interested in a specific problem may approach a faculty member whose specialty is compatible with the proposed project before the beginning of the term for approval.

The process for project proposals and registration are as follows:

1. Supervisors submit the senior project proposal (SDP Proposal Form).

- 2. Proposals are presented in a department meeting for approval.
- 3. Approved proposals are announced to the students for the selection process.
- 4. Students may apply for one or more of the approved projects (SDP Application Form).

5. If the number of students apply for a project exceeds five, the five students with highest GPAs will be selected.

6. Students are registered with the designated faculty member

Field Training:

In order to allow students to experience a real-life Engineering career environment, summer training is offered in the ME program. The Mechanical Engineering curriculum requires students to complete eight weeks of summer training in the industry, either at private or government Engineering environments. This training is a compulsory component of graduation requirements. Summer training gives students the chance to combine formal classroom study with relevant practical experience.

Steps to apply for Field Training

- 1. Students must complete at least 120 Credit hours.
- 2. Students are required to select the companies they wish to undergo training with through the following link, which is available on the faculty's website. Using University ID and National ID

https://gate.ut.edu.sa/etrainingstudents/login.aspx

- 3. During the training, the student is required to submit a weekly report form to their advisor. In this form, the student documents their activities and tasks undertaken during each week.
- 4. Students are expected to submit a comprehensive report that includes the knowledge and skills they have acquired during the training.

Study Strategies for Success

Understand, Don't Memorize

- Focus on foundational understanding before jumping into problem-solving.
- Use simulations and real-world examples to visualize concepts.
- Effective Note-Taking
- Use methods like <u>Cornell notes</u> or <u>mind maps</u>.
- Summarize Theorys into bullet points and key formulas.

Time Management for Studying

- Plan regular, short study sessions rather than cramming.
- Use the Pomodoro technique: 25 minutes study, 5-minute break.
- Practice, Practice, Practice
- Solve past papers and textbook problems.
- Join or form study groups to share learning strategies.

Leverage Resources

- Use platforms like <u>MIT OpenCourseWare</u>, or <u>Khan Academy</u>.
- Don't miss office hours and tutorials.
- Link Theory with Practice
- Apply what you learn in labs and projects.
- Work on personal or team electronics projects for hands-on experience.

Research and Academic writing tips

Academic writing is about communicating technical ideas clearly, logically, and formally. Your goal is to inform, explain, or argue a point using evidence and structured reasoning.

Writing Structure

Most engineering writing follows a formal structure. Learn and use standard formats such as:

1. Lab Reports:

- Title
- Objective
- Methodology
- Results
- Discussion
- Conclusion

• References

Research Papers:

- Abstract concise summary of your work
- Introduction what you're studying and why
- Literature Review what others have done
- Methodology how you did your work
- Results & Analysis what you found
- Conclusion summary and implications
- References list of all sources used

Develop a Clear Writing Style

- Be precise and concise especially when explaining formulas, circuits, or technical systems.
- Avoid unnecessary jargon unless required; define all acronyms when first used.
- Use active voice when possible: "We measured the voltage..." instead of "The voltage was measured..."

Support Your Claims

- Use data, equations, figures, and citations to support your statements.
- Include graphs or charts to visualize complex results.

Reference Properly

- Use referencing styles required by your department (e.g., IEEE, APA).
- Tools like Zotero, Mendeley, or EndNote help manage citations easily.
- Always cite others' ideas, even if you paraphrase them.

Do Your Research Thoroughly

- Use Google Scholar, IEEE Xplore, ScienceDirect, and your university library.
- Keep notes while reading articles—write down the main ideas, how they relate to your work, and the citation.

Revise and Proofread

- Don't submit your first draft.
- Review your work for:
- Clarity and logic
- Grammar and spelling
- Proper citations
- Ask a friend, or advisor to review your draft.

Common Mistakes to Avoid

• Plagiarism: copying text without citation is a serious offense.

- Mixing tenses or inconsistent verb usage
- Overuse of passive voice or filler phrases
- Incomplete figure/table captions

Tips for Research Projects

- Start early—research is time-consuming.
- Choose a topic that genuinely interests you.
- Narrow your focus: one clear objective leads to better depth.
- Document everything—notes, data, changes, ideas—throughout your research journey.
- Ask your advisor questions regularly and be open to feedback.

Copyright of computer software

- Students must abide by all terms of software license agreement and must be aware that ALL computer software is protected by copyright unless it is explicitly labeled as PUBLIC DOMAIN.
- Students must not copy software for any purpose outside those allowed in that particular software's license agreement.
- Students must not accept unlicensed software.
- Students must not install, nor direct others to install, illegal copies of computer software or unlicensed software onto any University-owned or operated computer system.

Learning Resources & Support

Laboratories

The laboratories used by the ME Department are located in the Laboratories Buildings (Buildings-11 and 12). The laboratories have adequate equipment for carrying out experimental work for courses, senior projects and community service. The laboratories are well maintained and regularly upgraded. The laboratories thus adequately support the curriculum delivery. These include the following laboratories:

- A. Engineering Workshop
- B. Mechanics of materials and engineering materials laboratory
- C. Mechanical systems and vibration laboratory
- D. Robotics and theory of machines laboratory
- E. Heat transfer, thermodynamics and combustion laboratory
- F. Fluid mechanics and hydraulic laboratory
- G. Refrigeration and air condition laboratory
- H. Energy laboratory

A. Engineering Workshop

The ME workshop is equipped with machines and apparatus for training the students in the fields of casting, metal forming, and machining processes. This Engineering Workshop covers the experimental work associated with the ENG 202, ENG 205, ENG 213, ME 493 and ME 494 courses.



B. Mechanics of materials and engineering materials laboratory

This lab actively contributes to teaching activities in the ME Department. It enables faculty and students to perform tests such as tension, compression, shear, buckling, hardness, bending, deep drawing, impact, and metallurgical observations, and is used in determining the mechanical properties and characterization of materials. It provides educational facilities at different levels to undergraduate students. The lab is used in the graduation projects related to mechanical testing of materials and the graduation projects related to materials and engineering materials laboratory covers the experimental work associated with ME 201, ME 213, ME 493 and ME 494 courses.



C. Mechanical Systems and Vibration Laboratory

The Mechanical Systems and Vibration Lab is used to perform the experiments of the mechanical systems and vibration courses and to introduce the nature of mechanical mechanisms and their operation, as well as the vibration phenomena and effects on sensitive parts and how to control the vibration and its damping. The lab covers the experimental work associated with the ME 314, ME 315, ME 317, ME 493 and ME 494 courses.



D. Fluid Mechanics and Hydraulic Laboratory

The Fluid Mechanics and Hydraulic laboratory has an essential and effective role enabling mechanical engineering students to gain educational understanding and experimental information in the field of fluid mechanics and hydraulics, turbomachines and projects. It also provides a "hands on" environment that is crucial for developing students understanding of theoretical concepts. The laboratory contains equipment for the measurement of various fluid properties and flow characteristics. Facilities are available for investigating the fundamentals of fluid statics as well as kinematics and kinetics of fluid flow to enhance the hands-on experience of our students. The lab is equipped with test rigs for experiments pertinent to fluid mechanics, pumping machinery, and hydraulic turbines. The pumping machinery and hydraulic turbines devices aim to give students hands-on experience at conducting experiments and analyzing the data to obtain the performance characteristics of various types of pumps, fans and compressors. The Fluid Mechanics and Hydraulic lab covers the experimental work associated with the ME 231, ME 332, ME 493, ME 494, ME 452 and ME 455 courses.



E. Refrigeration and Air Conditioning Laboratory

The Refrigeration and Air Conditioning laboratory is equipped with a wide variety of instructional facilities in the area of refrigeration and air-conditioning. The laboratory contains modern instruments which are used to train students in the practical aspect of the refrigeration and air conditioning. This lab provides students opportunity to develop an overall background in the components of Refrigeration and Air-Conditioning systems. Determination of the coefficient of performance, cooling and heating loads, rates of humidification and dehumidification of Refrigeration and Air-Conditioning systems. Construction and systems evaluation of graduate projects. Possibilities of organizing short training courses in Refrigeration and Air-Conditioning systems design, operation, performance evaluation and fault simulation. The Refrigeration and Air Conditioning laboratory covers the experimental work associated with the ME 221, ME 424, ME 451, ME 493 and ME 494 courses.



F. Energy Laboratory

The Energy Laboratory provides students opportunity to develop an overall background in the thermal and electrical applications of solar energy for domestic and industrial uses. It also enables students to study and practice Determination of the feasibility and efficiency of solar engineering systems, like water and air heating, water desalination, solar ovens, solar concentrators for industrial processes heat and power generation and solar energy storage systems. It is a venue for construction and systems evaluation of graduate projects, and organization of short training courses in engineering solar systems design, operation and performance evaluation. The Energy laboratory covers the experimental work associated with the ME 221, ME 322, ME 323, ME 425, ME 453, ME 493 and ME 494 courses.



G. Heat Transfer, Thermodynamics and Combustion Laboratory

This lab provides students an overall background in the thermal applications of thermodynamics, heat transfer, and heat engines for industrial uses. This laboratory covers the experimental work associated with the ME 221, ME 322, ME 323, ME 425, ME 465, ME 458, ME 459, ME 493 and ME 494 courses.



H. The mechanics of machines and Mechanical vibrations laboratory

The mechanics of machines and Mechanical vibrations laboratory aims to give students hands-on experience in conducting experiments and analyzing the data to obtain the characteristics of various types of mechanisms of machines. This laboratory covers the experimental work associated with the ME 212, ME 315, ME 467, ME 493 and ME 494 courses.



Library and Research Resources

The University of Tabuk is committed to providing extensive academic and research resources to support students' learning and research activities. The General Administration of Libraries offers a wide range of electronic, printed, and research services accessible to all Mechanical Engineering students.

Library Services Overview

Students have access to:

- Electronic resources including e-books, academic journals, databases, and digital archives.
- Research support for finding, retrieving, and using information from different sources.
- Physical resources such as printed books, reference materials, and official publications.



• Training sessions on how to use research databases, search techniques, and citation management.

The university library also provides:

- Room reservation services for meetings, study sessions, or academic workshops through the Sahel System.
- Borrowing services for printed materials with clear policies for renewal, return, and fines.
- Remote reference services, allowing students to request research help by email or phone.

Digital Library Access

All students have full access to the Saudi Digital Library (SDL)

- More than 11,400 full-text digital references across all academic disciplines.
- Access to major international databases such as:
- Scopus (abstract and citation database)
- ScienceDirect (scientific and technical research)
- EBSCO, Springer, Wiley, SAGE, Cambridge, and more.
- Electronic books, journals, conference papers, and theses.

Through the library portal, students can:

- Search by keyword, author, title, subject, or publication date.
- Access resources 24/7 from anywhere using university credentials.
- Download materials, manage citations, and organize research more effectively.

Training sessions on how to use the digital library and specific databases are conducted regularly, both in-person and online, helping students and researchers maximize the use of these resources.

A. Research Services Support

The Research Services Unit helps students:

- Search for books, journals, and theses using the electronic catalogue.
- Retrieve information from databases and the internet.
- Locate materials across all branches of the University of Tabuk library system.
- Receive research guidance through personalized support or remote consultation.
- Get help in choosing suitable resources for research projects and theses.
- Improve the quality of academic outputs through research consultations.
- Helping with citation and bibliographic referencing.
- Offering workshops on how to use databases and digital research tools.
- Providing access to information even if not available in the university's collections by cooperating with other libraries or purchasing materials.

Borrowing and Lending Services

Students are eligible to borrow printed books according to the following:

- Undergraduate students: 5 books for 15 days.
- Graduate students: 7 books for 30 days.
- Faculty members: up to 12 books for 90 days.
- Borrowing can be renewed before the due date, and overdue fines apply for late returns. Certain materials such as encyclopaedias, theses, and rare books are not available for external borrowing but can be accessed within the library.

Copyright

As a general rule, students can make a single photocopy of a "reasonable" proportion of a published work, typically up to 5% of a book, or one chapter of a book, or one article from a journal for own private study. This is permitted under the terms of the Copyright Exception for <u>Personal research & private study</u>.

How to Access Saudi Digital Library

- Visit the University of Tabuk Website.
- Click on "المكتبة الرقمية" (Digital Library) from the homepage.
- Log in using your university credentials to access thousands of digital resources instantly.
- Training videos, live workshops, and online guides are also available to help students become proficient in using the digital library and research tools.

Saudi Digital Library User Guide

Saudi Digital Library Access Guide

Learning Management System (LMS)

The Learning Management System (LMS) is an essential tool for managing your learning experience at the University of Tabuk. It serves as the central platform where students access course materials, submit assignments, participate in discussions, and communicate with instructors.

At the University of Tabuk, the LMS used is **Blackboard**.

What You Can Do on Blackboard (LMS)

- Access Course Materials: Download Theory slides, reading materials, assignments, lab instructions, and supplementary resources for each course.
- **Submit Assignments:** Upload your homework, lab reports, projects, and papers directly through the system before deadlines.
- Take Quizzes and Exams:

Many quizzes, midterms, and even final exams are administered through Blackboard. Ensure you follow time limits and instructions carefully.

- **Participate in Discussions:** Engage in course discussion boards, collaborate with classmates, and contribute to academic forums set by instructors.
- **Track Your Grades:** View your marks and feedback on assignments, quizzes, and exams throughout the semester.
- Receive Announcements:

Stay informed about course updates, deadlines, exam schedules, and other important announcements from your instructors.

• Communicate with Faculty:

Send messages to professors and teaching assistants, either privately or through course discussion boards.

How to Access the LMS (Blackboard)

- Visit <u>lms.ut.edu.sa</u>
- Enter your **university email** and **password**.
- Access your list of enrolled courses and select the course you want to open.

For Full Guidance on Using the LMS

Students are encouraged to visit the official University of Tabuk website for complete guides, manuals, and support regarding Blackboard (LMS):

Distance Education Unit – University of Tabuk

There, you will find:

- Step-by-step tutorials on how to use Blackboard.
- Video guides for submitting assignments, taking exams, and attending online Theorys.
- Troubleshooting tips and technical support contacts.

Academic Counselling Services

Academic Advising is an essential and central pillar of the educational system, and focuses on the two axes of the educational process: the educational institution and the student. This role is strengthened by the specialized academic advisor. Students have the option to communicate with their academic advisors through in-person meetings, email, or by utilizing the virtual services offered by the university.

Academic Advising Guide

https://shorturl.at/ovHX8 Virtual Academic Advising https://tabuk.blackboard.com/

https://myut.ut.edu.sa/

Exams, Assessment & Academic Integrity

Types of Assessment

In Mechanical Engineering, your knowledge and skills are tested in many ways. Each type of assessment helps measure a different aspect of your learning.

Written Exams

- Typically involve problem-solving, calculations, and theoretical questions.
- Common in midterms and finals.
- Focus on accuracy, logic, and time management.

Practical/Lab Assessments

- Evaluate your ability to apply concepts in real or simulated environments.
- May include Machine Tools, Hand tools and using lab equipment.
- Preparation: Understand theory, follow safety protocols, and document your work clearly.

Oral Exams or Presentations

- Measure your ability to explain complex ideas clearly.
- You may present projects, defend designs, or explain results.
- Tip: Practice in front of friends and anticipate questions.

Projects and Reports

- Show how you apply engineering skills to solve real problems.
- Emphasize teamwork, design process, and professional documentation.
- Include coding, modeling, simulations, or research.

Academic integrity

Academic integrity is the foundation of trust in education and engineering practice.

Avoiding Plagiarism

Plagiarism is a form of cheating and is a serious academic offence. It arises where work submitted by a student is not their own and has been taken from another source. To avoid plagiarism:

- Always cite your sources even when paraphrasing.
- Use plagiarism checkers before submitting assignments, reports, papers or research
- Never exceed 30% similarity threshold for multiple sources and 5% for single source.
- Never copy solutions from classmates or the internet.

Ethical Conduct

- Don't falsify data in labs or reports.
- Collaborate when allowed but submit individual work when required.
- In projects, share responsibilities and give credit to all contributors.

Why It Matters

- Engineers must be trustworthy and accurate ethics in school prepares you for professional life.
- Violations can lead to disciplinary action and harm your academic record.

ME Program Enforcement and Disciplinary Procedures

The Department of Mechanical Engineering at the University of Tabuk enforces a strict academic integrity policy to ensure fairness and professionalism. The procedures include:

Preventive Measures:

- Academic integrity workshops, training on referencing, and the use of plagiarism detection software (e.g., SafeAssign).
- All submissions are monitored through Blackboard with automated plagiarism checking (30% similarity threshold).

Detection and Verification:

- Faculty actively monitor submissions and compare them for originality.
- Students may be asked to defend their work in interviews or oral exams (especially for labs, projects, and field training).
- Practical assessments, raw data logs, and unique assignments are used to confirm individual effort.

Strict Response to Violations:

- In cases of proven cheating in exams or assignments, penalties may include:
- Failing the specific exam or assignment
- Failing multiple courses
- Failing all courses for the semester
- Each case is documented and investigated thoroughly, and decisions are based on severity, past offenses, and the nature of misconduct.

Exam Preparation Strategies and Stress Management

Preparation Tips:

- Start reviewing at least 2 weeks before the exam.
- Use past exams, quizzes, and assignments as study materials.
- Create summary sheets for formulas and key concepts.
- Practice solving problems under timed conditions.

Study Methods:

- Use active recall: test yourself rather than just re-reading.
- Teach the material to a friend or pretend to explain it.
- Create study groups to discuss tough topics.

Managing Exam Stress:

- Get enough sleep, especially the night before.
- Take regular breaks using the Pomodoro technique.
- Use breathing exercises or short walks to clear your mind.
- Avoid last-minute cramming—it adds anxiety and reduces retention.

Feedback and Self-Assessment Techniques

Using Feedback Effectively:

- Review graded assignments and exams to see where you went wrong.
- Ask your instructor for clarification when needed.
- Focus on learning from mistakes, not just the grade.

Self-Assessment Tips:

- After each topic or chapter, ask:
- Can I explain this without notes?
- Can I solve a variety of related problems?

Tips for Excelling in Professional Exams (FE, PE and Jahziah)

If you plan to pursue professional licensing, it is important to start preparing early and strategically.

Understand the Exam Structure:

- For example, the Fundamentals of Engineering (FE) exam includes math, circuits, ethics, and more.
- The National Exam for Readiness ("اختبار جاهزية") assesses your knowledge in Mechanical Engineering.
- Review the official exam specifications and requirements.

Study Plan:

- Begin preparation at least 3–6 months in advance.
- Use official preparation books, reference manuals, and question banks.
- Take full-length practice exams under timed conditions to simulate the real test environment.

Focus on:

- Core mathematics and science foundations.
- Circuit analysis, electronics, Signal and Systems ad Digital Systems.
- Professional ethics and engineering standards
- Time management and problem-solving strategies

Take Advantage of ME Program Preparation Initiatives:

- The Mechanical Engineering program regularly announces **exam preparation workshops, courses, and training sessions** for professional exams.
- Students are encouraged to **participate actively** in these initiatives, as they provide focused support, study materials, and expert guidance aligned with licensing exam requirements.
- Watch for announcements via the department website, Blackboard, and official emails.

Professional & Career Development

How to build a professional network

Building a professional network opens doors to internships, job opportunities, and career mentorship.

Steps to Start Building Your Network:

- **1. Engage with Professors and Advisors:** Attend office hours and seek academic and career guidance.
- **2. Join Professional Societies:** Become an active member of organizations like ASME, the Saudi Council of Engineers, and technical student chapters.
- 3. Attend Program and University Events:

The Mechanical Engineering program regularly organizes:

- Alumni Guest Speaker Sessions where former graduates share their career experiences and insights.
- Professional Expert Guest Theorys where industry leaders offer guidance on career paths and technical trends.
- Career Guidance Fairs and Workshops in collaboration with the Deanship of Student Affairs.
- 4. Use LinkedIn:

Create a professional LinkedIn profile. Connect with classmates, professors, alumni, and professionals in your field.

- 5. Participate in Competitions and Projects:
 - The **Faculty of Engineering** holds an **annual projects competition** sponsored by **BAE Systems**, where students showcase innovative engineering solutions and compete for awards and recognition.
 - Students also participate in the **Engineering Day**, an annual event where projects are exhibited to faculty members, industry professionals, and invited guests.

These activities provide excellent opportunities to network with engineers, recruiters, and technical experts from leading companies.

Internships, Apprenticeships, and Co-op Programs

Internships and practical training bridge the gap between academic learning and real-world application.

Why They Matter:

- Gain hands-on experience and technical skills.
- Understand the day-to-day work of engineers.
- Build your resume with real-world projects.
- Expand your professional network inside companies.

Program Support for Internships:

The **Faculty of Engineering** and the **Mechanical Engineering program** actively help students secure internships through strong partnerships with industry leaders, such as:

- BAE Systems
- NEOM
- AECOM
- Saudi Mechanical Company
- STC
- Other regional and international companies

Students are encouraged to take advantage of internship announcements made by the program and faculty.

Resume and Cover Letter Writing Tips

Your resume and cover letter are often your first introduction to an employer. Make them professional, clear, and targeted.

Resume Tips:

- Keep it to **one page** (especially for students and new graduates).
- Highlight education, skills, internships, and projects.
- Use strong action verbs (designed, developed, led, analyzed).

- Tailor your resume to each job or internship.
- Include relevant technical skills: programming languages, simulation tools, hardware skills.

Cover Letter Tips:

- Personalize each cover letter to the job and company.
- Introduce yourself clearly: your background, what you're applying for, and why.
- Highlight how your skills match the company's needs.
- Keep it formal, clear, and to the point (no more than one page).
- Support Available:

The Deanship of Student Affairs organizes career development workshops throughout the academic year, covering:

- Resume writing.
- Cover letter preparation.
- Interview skills.
- Job search strategies

These workshops are regularly announced through university emails, social media, and the program's communication channels.

Career Opportunities and Job Market Trends

Mechanical Engineering offers a wide range of career paths, and staying informed about the market helps you prepare better.

Growing Career Fields:

- Renewable Energy Systems (solar, wind energy)
- Heating, ventilation, and air conditioning systems
- Automation and Control Systems
- Robotics and Artificial Intelligence
- CNC and Additive manufacturing

Emerging Trends:

- Demand for engineers with programming and AI integration skills is growing.
- Sustainability and clean energy technologies are creating new job opportunities.
- Interdisciplinary skills (combining Mechanical engineering with computer science or data science) are highly valued.

University Support:

Career fairs, internship days, and industry visits organized by the Faculty of Engineering and the Deanship of Student Affairs provide students with direct exposure to employers and job market expectations.

Where to Look for Jobs:

- Engineering firms, power companies, manufacturing industries.
- Research centers and technology startups.
- Government agencies and regulatory bodies.
- International companies seeking specialized engineers.

Extracurricular Activities and Leadership

Students Organizations and Clubs

Joining student clubs allows you to develop teamwork, leadership, and technical skills outside of the classroom.

Opportunities for ME Students:

Mechanical Engineering Community:

An educational platform for developing technical and professional skills in Mechanical engineering. The Mechanical Engineering Community provides:

- Access to mentorship from experienced engineers and industry experts.
- Workshops in Mechanical Engineering.
- Seminars on academic, professional, and ethical responsibilities.
- Opportunities for skill-building in energy systems design and analysis.
- Networking sessions with industry specialists and alumni.

Engineering Club:

Join activities such as site visits, project showcases, technical talks, and team competitions organized across different engineering disciplines.

Clubs Affiliated with the Deanship of Student Affairs:

The Deanship of Student Affairs oversees a wide variety of student clubs across academic, cultural, artistic, social, sports, volunteering, and innovation fields. Students can join existing clubs or propose the formation of new ones.

Examples of available clubs include:

- Scientific and Academic Clubs (Engineering, Computer Science, Business, Medicine, etc.)
- Volunteering and Community Service Clubs
- Scientific Research Club

How to Join or Start a Club:

Students interested in joining a club or establishing a new one should refer to the Deanship of Student Affairs

For full details of available clubs refer to Students Club Guide by the Deanship of Student Affairs.

Volunteering and Community Engagement

Volunteering not only contributes to the community but also develops soft skills that employers highly value.

How to Get Involved:

Participate in University-Led Initiatives:

The Deanship of Student Affairs frequently announces volunteering opportunities across campus for events, conferences, exhibitions, and community service programs.

Technical Volunteering through the Faculty of Engineering:

The Faculty of Engineering and the Mechanical Engineering program organize technical volunteering opportunities annually for students and faculty members.

These opportunities include:

- Assisting in STEM outreach activities.
- Supporting technical workshops and competitions.
- Contributing to engineering exhibitions, Engineering Day, and technical fairs.

Volunteering opportunities are announced regularly via the faculty, university emails, and official social media channels.

Recognition of Volunteering Activities:

All approved volunteering hours are formally recognized and will be registered through the National Platform for Volunteering (المنصة الوطنية للعمل التطوعي), enhancing students' official volunteering records and resumes.

Leadership Development Programs

Developing leadership skills early gives you a strong advantage in both academic and professional life.

Student Leadership Development Workshops:

Conducted by the Deanship of Student Affairs throughout the year, covering:

- Team management
- Decision-making
- Public speaking
- Conflict resolution

Innovation, Research, and Entrepreneurship Opportunities

Mechanical Engineering is a field full of innovation, students are encouraged to explore research and entrepreneurial projects during their studies.

Opportunities to Get Involved:

- Senior Design Projects: Innovate and solve real-world engineering problems through your graduation projects.
- Undergraduate Research Opportunities: Work with faculty members on research in power systems, electronics, renewable energy, and communications.
- Entrepreneurship Competitions: Join competitions organized by the Innovation and Entrepreneurship club Center, or external organizations to pitch your project or startup ideas.

The university and the program provide resources and guidance for students interested in research and innovation.

Personal Well-Being & Work-Life Balance

Time Management Strategies and Productivity Tips

With Theory, labs, assignments, and exams, Mechanical Engineering demands strong time management. Use these strategies to stay organized and productive.

Weekly Planning:

- Use a weekly planner to map out classes, study blocks, and project deadlines.
- Allocate specific time slots for each subject and task.

Pomodoro Technique:

- Study for 25 minutes, take a 5-minute break.
- After 4 rounds, take a longer break.
- Helps maintain focus and avoid burnout.

Eisenhower Matrix:

- Categorize tasks as:
- Urgent & important: Do now.
- Important but not urgent: Schedule it.
- Urgent but not important: Delegate or minimize.
- Neither: Avoid.

Tools to Stay on Track:

Google Calendar for time-blocking
Notion or Trello for organizing assignments and projects.
Forest app or Focus To-Do to minimize distractions.
Balancing Academics, Social Life, and Personal Time

Academic life doesn't have to come at the cost of your social or personal life. Balance is not only possible, it's essential for long-term success.

Plan with Flexibility:

- Treat social and personal time as important events on your calendar.
- Plan for rest, meals, and relaxation the same way you plan for classes.

Stay Connected:

- Attend student events, join clubs, or play sports.
- Build friendships with classmate, it makes studying more enjoyable and less stressful.

Learn to Say "No":

- Avoid overcommitting to events or side projects.
- Protect your time by setting boundaries around study hours.

Know Yourself:

- Are you more productive at night or in the morning?
- Schedule your toughest tasks during your peak focus times.
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Healthy Habits for Physical and Mental Well-being

Your physical and mental health directly impact your academic performance. Developing healthy routines is essential in a demanding program like ME.

Sleep is Non-Negotiable:

- Aim for 7–8 hours per night.
- Poor sleep affects memory, focus, and decision-making.

Eat Smart:

- Don't skip meals. Keep healthy snacks on hand (nuts, fruits, yogurt).
- Reduce energy drinks—try green tea or water with lemon for energy boosts.

Stay Active:

- Exercise 3–5 times a week. Even 20-minute walks improve focus and mood.
- Stretch between study sessions to reduce stiffness and fatigue.

Stay Hydrated:

• Carry a water bottle. Dehydration leads to fatigue and low concentration.

Coping with Stress and Burnout Prevention

Stress is common in engineering studies, but it can be managed with the right mindset and habits.

Know the Signs of Burnout:

- Constant fatigue or lack of motivation
- Trouble concentrating
- Emotional exhaustion
- Losing interest in things you enjoy

Stress Management Tips:

- Practice deep breathing or mindfulness (use apps like Headspace or Calm).
- Journal your thoughts and frustrations, it brings clarity.
- Take short, device-free walks outdoors.

Talk About It:

- Reach out to friends, academic advisors, or mental health counselors.
- You're not alone, many students go through the same challenges.

Build a Balanced Routine:

- Don't over-study. Mix study time with breaks, hobbies, and sleep.
- Plan "no-study" evenings once a week to fully rest.

University mental health services and wellness programs

Your mental health and well-being are just as important as your academic success. The University of Tabuk provides comprehensive mental health support and wellness programs to help students maintain balance, manage stress, and thrive personally and academically.

University Mental Health Services

The university offers professional psychological and counseling services through the Student Guidance and Rights Unit under the Deanship of Student Affairs.

Services Include:

- Individual Counseling: Private sessions to address personal, academic, or emotional challenges.
- **Group Counseling:** Group therapy sessions for students facing common challenges like stress management or academic pressure.
- Crisis Intervention:

Immediate support in case of psychological emergencies or critical stress situations.

Consultations in Key Areas:

- Psychological health support
- Quality of university life
- Exam periods support and stress management.
- Solving university life challenges
- Psychological and social compatibility support

Confidentiality:

All counseling services are strictly confidential to ensure a safe and supportive environment.

University Wellness Programs

The University also organizes ongoing wellness activities to promote healthy living and stress management announced regularly through email, and social media.

Wellness Activities Include:

Workshops and Seminars on:

- Stress management.
- Time management
- Mindfulness and relaxation
- Healthy lifestyle habits
- Emotional resilience building

Awareness Campaigns:

Annual events promoting mental health awareness, fitness, and preventive health.

Sports and Fitness Facilities:

Access to gyms, swimming pools, and sports fields.

How to Access Mental Health and Wellness Services

Students can easily reach out for support or book appointments:

Contact Method	Details
📨 Email	srights@ut.edu.sa

& Phone +966 144563216

Appointment Booking Form Click here to book an appointment



University Policies & Regulations

Academic Policies

Student Academic Guide

Provides comprehensive guidance for students on academic policies, course registration, grading, examinations, and graduation requirements.

Study and Tests Regulations

Provides comprehensive guidance for students on academic policies, study rules and examinations

Code of Conduct:

Expected behavior on campus and in online settings, and Students' rights and responsibilities.

Academic Integrity & Ethics:

Policies on plagiarism, research misconduct, and intellectual property; penalties for violating academic integrity

Equality, Diversity, and Inclusion Policy

Campus Security & Emergency Protocols: Emergency contact numbers and procedures; policies on campus safety.

Use of University IT Resources: Internet usage guidelines and cybersecurity rules; policies on using Blackboard and other learning platforms

Essential Information & Quick Reference

Important Contacts

Program Faculty Members

Faculty Name	Rank	Area of Expertise	Email
Dr. Husam Alrehaili	Assistant Professor (Head of the Department)	Applied Mechanics	hmalrehaili@ut.edu.sa
Mohammed AlSwat	Associate Professor	Thermo-fluid	malswat@ut.edu.sa
Dr. Hossam AbdelMeguid	Associate Professor	Thermo-fluid	habdelmeguid@ut.edu.sa
Dr. Abderraouf GHERISSI	Associate Professor	Applied Mechanics	a.gresi@ut.edu.sa
Dr. Walaa Ramadan Abd Elrahman	Assistant Professor	Thermo-fluid	wabdelrahman@ut.edu.sa
Dr. Ibrahim Nasri	Associate Professor	Applied Mechanics	inasri@ut.edu.sa
Dr. khalid mansour Alenezi	Assistant Professor	Thermo-fluid	kalshmlani@ut.edu.sa
Dr.Aid Alatwi	Assistant Professor	Thermo-fluid	es_alatawi@ut.edu.sa
Dr. Mohamed Alrehili	Associate Professor	Thermo-fluid	malrehili@ut.edu.sa
Dr.Saleh Saad Yousef Hayek	Assistant Professor	Applied Mechanics	sshayek@ut.edu.sa
Dr. Marouf aldosari	Assistant Professor	Thermo-fluid	marouf.aldosari@ut.edu.sa
Dr. Zubairu Abubakar	Assistant Professor	Thermo-fluid	zabubakar@ut.edu.sa
Dr. Abdullah Bazartow	Assistant Professor	Automatic Control and Measurements	abazartow@ut.edu.sa

University of Tabuk Mobile Application

The University of Tabuk Mobile App helps students easily access essential services. Through the app, students can manage course registration (add/drop), view grades, access academic records and study plans, and submit complaints or support requests. The app uses the student university ID as the username and the portal password for login.

It is available for download on:

Apple App Store

Google Play Store

Students are encouraged to use the app to simplify their academic and administrative tasks and stay updated throughout their studies.

Emergency Contacts

Contact	Details
University Security	+966144561600
University Medical Center	+966144564400
Emergency	911

Useful Links:

- 1. Mechanical Engineering Department https://www.ut.edu.sa/en/Faculties/engineering/Mechanical/Pages/default.aspx
- 2. UT Deanship of Students Affairs https://www.ut.edu.sa/en/Deanship/student-affairs/Pages/default.aspx
- 3. Saudi Council of Engineers https://www.saudieng.sa/English/Pages/default.aspx
- 4. ASTM International-Standards Worldwide https://www.astm.org/
- 5. Mechanical Enigneeing Portal https://Mechanical -engineering-portal.com/

- 6. The Renewable Energy Institute <u>https://www.renewableinstitute.org/</u>
- 7. Project Management Institute <u>https://www.pmi.org/</u>
- 8. National Renewable Energy Laboratory (NREL) <u>https://www.nrel.gov/</u>