جامعة الطائف
TAIF UNIVERSITY

كلية الهندسة
College of Engineering
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MECHANICAL ENGINEERING DEPARTMENT

PROGRAM HANDBOOK

Taif University
11- August- 2022

Contents

Introduction

Dear Student

Welcome to the Mechanical Engineering Department!

This handbook is designed to provide you with important information about the Mechanical Engineering Program (MEP), its policies, procedures, and requirements that will help you succeed as a student in this field.

Mechanical Engineering is a broad field that covers a wide range of topics, from design and analysis of mechanical systems to manufacturing processes and materials science. As a mechanical engineering student, you will learn how to apply the principles of physics, mathematics, and materials science to design and analyze complex mechanical systems, such as engines, machines, and robots.

In this handbook, you will find information about the curriculum, course requirements, and academic policies of the MEP. You will also find information about research opportunities, career paths, and resources available to support your academic and professional development.

We encourage you to use this handbook as a guide throughout your time as a mechanical engineering student. If you have any questions or concerns, please do not hesitate to reach out to your academic advisor or any member of the Mechanical Engineering Department. We are here to support you and help you achieve your academic and professional goals in this exciting field.

Mission:

The Mechanical Engineering Department at Taif University aims to provide a high-quality education to undergraduate students in the field of mechanical engineering. Our mission is to prepare students with the knowledge, skills, and attitudes needed to excel in their careers as mechanical engineers and to contribute to the advancement of technology and society.

We strive to achieve our mission by offering a rigorous and innovative curriculum that includes a strong foundation in mathematics, science, and engineering principles. We also emphasize hands-on experience through laboratory projects, design projects, and research opportunities. Our faculty members are committed to excellence in teaching, research, and service, and provide a supportive and inclusive learning environment for all students.

In addition to our core mission of education, we also seek to advance the frontiers of knowledge in mechanical engineering through cutting-edge research in areas such as robotics, materials science, energy systems, and biomechanics. Our research activities are driven by the needs of industry and society, and we strive to make a positive impact on the world through our discoveries and innovations.

Overall, our mission is to foster a community of lifelong learners who are equipped with the knowledge and skills to address the complex challenges facing our world, and who are committed to making a positive impact through their work in mechanical engineering.

Program Educational Goals:

The MEP at Taif university is designed to prepare graduates with the knowledge, skills, and attitudes needed to excel as mechanical engineers. The program Educational Goals (PEGs) for the Department of Mechanical Engineering at Taif University:

PEG#1- Work professionally as mechanical engineers on projects within various disciplines of mechanical engineering, demonstrating breadth of knowledge, professional integrity, and compliance with ethical standards.

PEG#2- Advance in professional practice by conducting academic as well as applied research in public or private sectors.

PEG#3- Enhance their skills through lifelong learning by enrolling in graduate studies, attending workshops, or becoming a member in one or more professional societies.

MEP at Taif university aims to produce graduates who possess problem-solving skills, are ready for a range of careers, exhibit intellectual depth and creativity, and uphold ethical and socially responsible values. These objectives are achieved through a comprehensive and innovative curriculum, hands-on experience, research opportunities, and support for personal and professional growth.

Graduate Students Attributes:

The Mechanical Engineering program aims to produce graduates who possess the necessary attributes to excel in their professional careers and contribute to the betterment of society. The following are the key graduate attributes that the program aims to instill in its students:

A. Creativity and Innovation: Graduates of the program should be able to design innovative solutions to complex problems and think creatively to develop new products and systems.

B. Critical Thinking and Problem Solving: Graduates should be able to analyze and evaluate information critically to identify problems, develop solutions, and make informed decisions.

C. Communication Skills: Graduates should be able to communicate effectively in a variety of contexts, including technical reports, presentations, and interpersonal interactions.

D. Efficiency and Technical Skills: Graduates should possess the technical skills necessary to design, manufacture, and maintain mechanical systems and components efficiently.

E. Self-direction Skills for Life-long Learning: Graduates should be able to take responsibility for their own professional development and continue to learn and adapt to new technologies and practices throughout their careers.

F. Professionalism and Ethics: Graduates should demonstrate professionalism and ethical behavior in their work and interactions with colleagues, clients, and the community.

G. Leadership and Responsibility Skills: Graduates should possess the leadership skills necessary to work effectively in teams, manage projects, and take responsibility for their actions and decisions.

The Mechanical Engineering program strives to produce graduates who are well-rounded, innovative, and capable professionals who can contribute to the advancement of the field and society as a whole.

Student Learning Outcomes:

The MEP at Taif university is designed to provide students with a comprehensive education that prepares them for success as mechanical engineers. The program has identified the following learning outcomes for students:

Knowledge and Understanding	
K1	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies
Skills	
S1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
S2	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
S3	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
S4	An ability to communicate effectively with a range of audiences
Values	
V1	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
V2	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

These learning outcomes are achieved through a curriculum that emphasizes hands-on experience, teamwork, and problem-solving skills. The program also provides opportunities for research, entrepreneurship, and engagement with industry and society. Faculty members are committed to excellence in teaching, research, and service, and are dedicated to providing a supportive and inclusive learning environment for all students.

Assessment of student learning outcomes is an integral part of the MEP, and the program regularly evaluates student performance to ensure that the learning outcomes are being achieved. This assessment process is used to improve the program and to ensure that graduates are prepared for success as mechanical engineers.

Undergraduate Program

The undergraduate program in mechanical engineering takes five years to complete and provides a foundation in mathematics, physics, and engineering principles, along with specialized courses in mechanical engineering topics such as mechanics, thermodynamics, materials science, robotics, measurements, and manufacturing processes.

The program will also emphasize hands-on experience, with laboratory experiments and design projects to help students apply their theoretical knowledge to practical problems. Students may have the opportunity to work on research projects with faculty members or industry partners and participate in internships or co-op programs to gain industry experience.

In addition to technical coursework, students in a MEP will typically take courses in communication, teamwork, and ethics to develop professional skills. They may also can participate in student organizations, competitions, and other extracurricular activities to further develop their skills and interests.

Upon graduation, students in a MEP will be prepared for a variety of career paths, including jobs in industries such as aerospace, automotive, manufacturing, energy, and robotics. They may also pursue further education in graduate programs in mechanical engineering or related fields, or in other professional programs such as law or business.

Degree Plan

To graduate with a degree in Mechanical Engineering, you will need to complete a total of 155 credit hours, which are typically achieved over a period of five years. These credit hours include the following requirements:

1. University Requirements: You will need to complete 22 credit hours of university requirements, which includes 4 credit hours of two university elective courses.

2. College Requirements: You will need to complete 43 credit hours of college requirements, which cover fundamental topics in mathematics, physics, chemistry, and engineering.

3. Program Electives: You will need to complete four program electives, each of which is worth 3 credit hours. These courses are selected from a list of approved electives and allow you to specialize in areas such as mechatronics, production, power systems, or materials science.

4. Capstone Project: You will need to complete a capstone project worth 5 credit hours, which typically involves working on a real-world engineering problem in collaboration with industry partners.

- Courses with red-like color are *University Requirements.*
- Courses with Purple-like color are *College Requirements.*
- Courses with green-like color are *Program Requirements.*

Three Semesters (1 & 2 & 3)								
Course No.	**Course Title**	**Study Hours Distribution**				**Prerequisite Title**	**Total Cont. Hours**	**Level**
		Cr	Lec	Lab	Tut			
990311-2	University Skills	2	3				29	1
999805-2	Int. English Language for Acad. Purposes (1)	2	12					
2028110-3	Mathematics (1)	3	4					
204102-3	General Chemistry	3	3	2				
105115-2	History of Kingdom	2	3					
2004111-2	Fundamentals of Islamic Culture	2	3				24	2
999806-2	Int. English Language for Acad. Purposes (2)	2	12					
203205-4	Physics	4	4	2.5				
802201-3	Introduction to Computer Programming	3	3		5		25	3
2028120-3	Mathematics (2)	3	4			Mathematics (1)		

990311-2	Arabic Language Skills	2	3					
999816-2	English for Specific Purposes for Engineering	2			4			
8021201-2	Engineering Drawing	2	6					

Three Semesters (4 & 5 & 6)								
Course No.	**Course Title**	**Study Hours Distribution**				**Prerequisite Title**	**Total Cont. Hours**	**Level**
		Cr	Lec	Lab	Tut			
2022101-3	Multi Variable Calculus	3	6			Mathematics (2)	21	4
8022205-3	Thermodynamics	3	6			Physics		
8022101-3	Introduction to Engineering Design (1)	3	6			Int. English Language for Acad. Purposes (2)		
XXXX-2	University Elective (1)	2	3					
2022102-4	Mathematical Methods	4	7			Multi Variable Calculus	26	5
8032101-3	Basics of Electrical Circuits	3	5	1.5		Physics		
8012103-3	Statics	3	5			Mathematics (2)		
8022204-2	Mechanical Drawing	2	6			Engineering Drawing		
8012101-2	Fundamentals of Engineering Economy	2	4			Mathematics (1)	26	6
8022202-2	Introduction to Engineering Design (2)	2	6			Introduction to Engineering Design (1)		

8022203-3	Dynamics	3	5			Statics		
8022201-2	Production Technology	2	3	2.5				
2004112-2	Islamic Culture (Morals and Values)	2	3					

Three Semesters (7 & 8 & 9)								
Course No.	**Course Title**	**Study Hours Distribution**				**Prerequisite Title**	**Total Cont. Hours**	**Level**
		Cr	Lec	Lab	Tut			
2004313-2	Islamic Culture (Social System in Islam)	2	3			Islamic Culture (Morals and Values)	19	7
2028102-4	Differential Equations	4	6			Multi Variable Calculus		
2023104-2	Linear Algebra	2	4			Mathematics (2)		
8023101-3	Mechanics of Machines	3	6			Dynamics		
2023206-3	Numerical Analysis	3	6			Differential Equations	18	8
8023204-3	Fluid Mechanics	3	6			Physics		
8023102-3	Materials Science	3	6			General Chemistry		
2004414-2	Islamic Culture (Human Rights)	2	3			Islamic Culture (Social System in Islam)	20	9
8023201-3	Mechanics of Materials	3	6			Materials Science &		

						Differential Equations		
8023202-3	Mechanical Vibrations	3	6			Differential Equations & Dynamics		
8023203-1	Mechanical Engineering Laboratories 1	1	2	3		Materials Science Mechanics of Materials		

Three Semesters (10 & 11 & 12)								
Course No.	**Course Title**	**Study Hours Distribution**				**Prerequisite Title**	**Total Cont. Hours**	**Level**
		Cr	Lec	Lab	Tut			
2024116-3	Probability and Statistics	3	6			Mathematics (2)	24	10
8024102-3	Heat Transfer	3	6			Numerical Analysis & Thermodynamics		
8024101-3	Manufacturing Processes	3	6			Production Technology & Materials Science		
8024103-3	System Dynamics and Control	3	6			Mechanical Vibrations & Mechanics of Machines		
8024104-3	Machine Elements Design	3	6			Mechanical Drawing & Mechanics of Materials	21	11
XXXX-2	University Elective (1)	2	3					
8024201-3	Hydraulic Machines	3	6			Fluid Mechanics		
8024203-3	Measurements & Measuring Instruments	3	6			Fluid Mechanics		

8024205-3	Machine Design	3	6			Machine Elements Design	23	12
8024202-3	Refrigeration and Air Conditioning	3	6			Thermodynamics		
8024204-1	Mechanical Engineering Laboratories 2	1	2	3		Fluid Mechanics Hydraulic Machines		
8024206-3	Systems of Renewable Energy	3	6			Heat Transfer		
8024207-2 Practical Summer Training for six weeks (30 hours training weekly)								

Three Semesters (13 & 14 & 15)								
Course No.	**Course Title**	**Study Hours Distribution**				**Prerequisite Title**	**Total Cont. Hours**	**Level**
		Cr	Lec	Lab	Tut			
8025103-3	Computer Aided Design	3	6			Machine Design	20	13
8025202-3	Power Plants and Desalination	3	6			Fundamentals of Engineering Economy & Heat Transfer		
8025102-2	Engineering Management	2	3			Probability and Statistics		
8025203-1	Mechanical Engineering Laboratories 3	1	2	3		System Dynamics and Control Measurements & Measuring Instruments		
8025101-2	Senior Project (1)	2	3		3	Introduction to Engineering Design (1)	18	14
80251xx-3	Mechanical Elective Course -1	3	6			According to the selected		

80251xx-3	Mechanical Elective Course -2	3	6			mechanical elective courses 1 &2		
8025201-2	Senior Project (2)	2	3		3	Senior Project (1)	18	15
80252xx-3	Mechanical Elective Course - 3	3	6			According to the selected mechanical elective courses 3 &4		
80252xx-3	Mechanical Elective Course - 4	3	6					

The elective courses in the MEP cover a variety of fields within the discipline, providing students with the opportunity to specialize in areas of their choosing. These courses are designed to deepen the students' knowledge and skills in specific areas, enabling them to gain a competitive advantage in the job market.

The elective courses cover a broad range of topics, including mechanical design, power and energy systems, and mechatronics. For instance, courses in mechanical design focus on the principles of machine design, including the selection of materials, mechanisms, and manufacturing processes. In contrast, courses in power and energy systems cover topics such as thermodynamics, renewable energy, and power generation and distribution. Mechatronics courses, on the other hand, integrate mechanical, electrical, and computer engineering to design and develop smart systems such as robots, automated manufacturing systems, and autonomous vehicles.

By providing a range of elective courses, the MEP ensures that students are exposed to a variety of fields within the discipline and can choose courses that align with their interests and career aspirations. This approach helps students to develop a diverse set of skills and knowledge that can be applied in a range of industries, making them highly desirable to potential employers.

List of Mechanical Elective Courses 1 & 2					List of Mechanical Elective Courses 3 & 4				
	Course No. - Credits	**Course Title**	**Prerequisite Code - Credits**	**Prerequisite Title**		**Course No. - Credits**	**Course Title**	**Prerequisite Code - Credits**	**Prerequisite Title**
Group A	8025206-3	Design of Pipe Networks	8024201-3	Hydraulic Machines	**Group A**	8025204-3	Internal Combustion Engines	8024102-3	Heat Transfer
	8025105-3	Turbo Machines	8023204-3	Fluid Mechanics		8025205-3	Energy Efficiency	8024206-3	Systems of Renewable Energy
	8025106-3	Applied Heat Transfer	8024102-3	Heat Transfer		8025104-3	Fluid Dynamics	8023204-3	Fluid Mechanics

	8025107-3	Energy Conversion	8022205-3	Thermodynamics		8025207-3	Renewable Energy Powered Desalination Processes	8024206-3	Systems of Renewable Energy
Group B	8025108-3	Plasticity	8023201-3	Mechanics of Materials		8025208-3	Applied Renewable Energy Technologies	8024206-3	Systems of Renewable Energy
	8025109-3	Tribology	8022204-2	Mechanical Drawing	Group B	8025209-3	Reverse Engineering	8024205-3	Machine Design
	8025110-3	Composite Materials	8023201-3	Mechanics of Materials		8025210-3	Materials Handling Systems	8024205-3	Machine Design
	8025111-3	Fracture in Engineering Materials	8023201-3	Mechanics of Materials		8025211-3	Operations Research	8024101-3	Manufacturing Processes
	8025112-3	Finite Elements Analysis	802XX-3	Numerical Analysis		8025212-3	Design Optimization	8024205-3	Machine Design
	8025113-3	Nanomaterials and Nanotechnology	8023102-3	Materials Science		8025213-3	Advanced Manufacturing Technology	8024101-3	Manufacturing Processes
Group C	8025114-3	Robotics	8023101-3	Mechanics of Machines		8025214-3	Recycling of Industrial Wastes	8023102-3 8024101-3	1-Materials Science 2-Manufacturing Processes
	8025115-3	Introduction to Real Analysis	802XX-3 802XX-4	1- Multi Variable Calculus 2-Differential Equations	Group C	8025215-3	Industrial Automation	8024103-3	System Dynamics and Control
	8025116-3	Modeling and Simulation	8024103-3	System Dynamics and Control		8025216-3	Programmable Logic Controllers	8025118-3	Industrial Process Control
	8025117-3	Mechatronics System Design	8024103-3	System Dynamics and Control		8025217-3	System Theory	8024103-3 8025115-3	1- System Dynamics and Control 2- Introduction to Real Analysis
	8025118-3	Industrial Process Control	8024103-3	System Dynamics and Control					

Course Descriptions

This section is an essential resource for understanding the courses offered, their content, and their relevance to your academic and professional goals. The courses cover a wide range of topics, including mechanics, materials science, thermodynamics, control systems, robotics, and design, and are designed to provide you with a strong foundation in fundamental principles as well as practical skills in the field of mechanical engineering.

This section provides you with detailed information on the courses, including codes, titles, descriptions, and prerequisites. It aims to enable you to make informed decisions about your academic and professional paths and help you to develop your technical skills, critical thinking abilities, and professional competencies.

COMPULSORY COURSES

8021201-2 Engineering Drawing (2:1, 3) **Prerequisite:**

This course teaches important communication aspects of Engineering Drawing using AutoCAD. The topics of Engineering Drawing include Geometric and tangency constructions, Isometric drawings, Orthographic projection of engineering bodies, Derivation of different views from isometric drawings, Roles of dimensions on different views, Derivation of missed views from given two views, Intersection of bodies and surfaces and sectioning.

8022101-3 Introduction to Engineering Design 1 (3:2, 2)
Prerequisite: 999806-2 Intensive English Language (2)

Engineering design: How engineers approach and solve problems; process and product design; quality principles; working in teams; presentation, organization, and assessment of technical work, preparation of brief reports on assigned work, self-regulation or the behaviors associated with taking personal responsibility for time management, learning new material, setting goals, etc...

8022201-2 Production Technology (2:1, 3)
Prerequisite:

Introduction to principles of production, engineering materials, introduction to metal cutting and machine tools (sawing, drilling, turning, milling, shaping, slotting, grinding), fitting shop, sheet metal work. metal joining (welding and riveting), introduction to metal casting (principle of metal casting, sand casting), introduction to metal forming processes (forging, extrusion, drawing, rolling, wire drawing, spinning). Introduction to linear measurements. Recyclable of work shop wastes.

8022202-2 Introduction to Engineering Design II (2:2, 2)
Prerequisite: 8022101-3 Introduction to Engineering Design I

Engineering design process. Computer modeling and heuristics for solving problems, in teams, in the areas of comparison of strategies, trade-offs, decision making, stochastic processes, optimization and expert systems. Interpretation of results. Preparation of professional technical reports of engineering work and multimedia presentation.

8022203-3 Dynamics (3:1, 2)
Prerequisite: 8012103-3 Statics

Introduction to dynamics. Kinematics of a Particle. Kinetics of a Particle. Planer Kinematics of a Rigid Body. Planar Kinetics of a Rigid Body.

8022204-2 Mechanical Drawing (2:1, 3)
Prerequisite: 8021201-2 Engineering Drawing

Mechanical engineering drawing conventions, abbreviations and system of dimensioning. Organization and preparation of engineering drawings. Drawing of simple machine parts. Extracting front, top and end views from isometric drawing of machine parts. Introduction to SolidWorks for two and three dimensional drafting. Fastening elements, mechanical joints and shaft couplings. Fits and tolerances, Bill of material table. Assembly and detailed drawing of complex machine parts according to ISO standards.

8022205-3 Thermodynamics (3:2, 2)
Prerequisite: 203205-4 Physics

Thermodynamic concepts. Properties of pure substances. Ideal gases. Work and heat. The First law of thermodynamics. The second law of thermodynamics. Vapor and gas power cycles.

8023101-3 Mechanics of Machines (3:2, 2)
Prerequisite: 8022203-3 Dynamics

Kinematics of mechanisms, vector method of analysis of plane mechanisms. Static and dynamic analysis of machines, inertia forces, gyroscopic forces, Static and dynamic balancing, balancing machines. Dynamics and balancing of reciprocating engines. Flywheels. Kinematics and dynamics of cam mechanisms. Elements of mechanical vibrations.

8023102-3 Materials Science (3:2, 2)
Prerequisite: 204102-3 General Chemistry

Engineering materials (types & properties). Crystal structure of metals. Principles of solidification. Binary phase diagrams. Iron-Iron carbide phase diagram. Phase transformations. Heat treatment processes. Engineering alloys and their properties. Corrosion of metals. Introduction to nano materials.

8023201-3 Mechanics of Materials (3:2, 2)
Prerequisite: 8023102-3 Materials Science
202810257-4 Differential Equations

Introduction to mechanics of materials. Types of stresses. Stress-strain analysis. mechanical properties of materials. Axial loading, torsion, bending, transverse shear, combined loading, and statistically indeterminate structures. Stress and strain transformation. Failure theories.

Deflection of beams. Buckling of columns. Energy method, stress-strain relation of Nano-materials.

8023202-3 Mechanical Vibrations (3:2, 2)
Prerequisite: 8022203-3 Dynamics
202810257-4 Differential Equations

Fundamentals of vibration. Controls and optimization. Analysis and design in time, Laplace and frequency domains. Mathematical description of system response, stability analysis.

8023203-1 Mechanical Engineering Lab 1 (1:0, 3)
Prerequisite: 8023102-3 Materials Science
8022205-3 Thermodynamics

Different Experimental labs are carried out during this course.

8023204-3 Fluid Mechanics (3:2, 2)
Prerequisite: 203205-4 Physics

Fluid properties. Fluid statics. Fluid kinematics. Continuity equation. Momentum equations for fluids. Bernolli's equation. Laminar and turbulent flows. Steady flow in pipes. Dimensional analysis.

8024101-3 Manufacturing Processes (3:2, 2)
Prerequisite: 8022201-2 Production Technology
8023101-3 Materials Science

Machining processes: geometry at single point tool of cutting speeds and feeds, machining time and power consumed, tool materials, applications to Turing, Milling, grinding, honing and lapping. Cutting forces and cooling liquids for machining processes. metal forming processes (forging, extrusion, drawing, rolling, wire drawing). metal casting (principle of metal casting, die casting, special casting processes). Welding processes (Gas welding, Arc welding). Recycle of metal processes.

8024102-3 Heat Transfer (3:2, 2)
Prerequisite: 2023206-3 Numerical Analysis
8022205-3 Thermodynamics

Introduction to modes of heat transfer; one-dimensional steady state conduction; Two-dimensional steady state conduction; unsteady state conduction, lumped heat capacity system; introduction to convection, Hydrodynamic and thermal boundary layers. Convection in internal and external flows; empirical correlations for forced convection heat transfer; natural convection systems; Introduction to thermal radiation. Introduction to heat exchangers.

8024103-3 System Dynamics and Control (3:2, 2)
Prerequisite: 8023202-3 Mechanical Vibrations
8023101-3 Mechanics of Machines

Introduction to control systems analysis and design and related concepts. Systems representation: mathematical modeling of physical systems, linearization of nonlinear systems, Block diagram representation, transfer function. Introduction to stability analysis. Dominant poles of high order systems. Control systems design: Design and analysis using root locus. Analysis using frequency response technique. The use of control systems analysis and design software- MATLAB with facility to aid in the analysis.

8024104-3 Machine Elements Design (3:2, 2)
Prerequisite: 8022204-2 Mechanical Drawing
8023201-3 Mechanics of materials

Introduction to machine element design (steps, consideration and manufacturing), Fits and tolerance, materials selection for design, Factors of safety, calculations and analysis of mechanical stresses on mechanical elements subjected to static and variable loads. Design of mechanical joints, Design of springs, Design of power screws.

8024201-3 Hydraulic Machines (3:2, 2)
Prerequisite: 8023204-3 Fluid Mechanics

Classification of hydraulic machines. Positive displacement pumps. Centrifugal pumps. Axial pumps. Similarity and performance of hydraulic machines. Hydraulic system components. Introduction to hydraulic turbines. Impulse and Reaction turbines.

8024202-3 Refrigeration and Air Conditioning (3:2, 2)
Prerequisite: 8022205-3 Thermodynamics

Air Refrigeration Cycles. Vapor compression cycles. Vapor compression refrigeration systems with multiple evaporators and compressors. Introduction to absorption refrigeration. Psychometrics and psychometric processes. Cooling load calculations. Air conditioning components and controls.

802421-3 Measurements and Measuring instruments (3:2, 2)
Prerequisite: 8023204-3 Fluid Mechanics

Introduction to measurements in science and engineering. Standards and Calibration. Accuracy and precision. Sensitivity and magnification systems. Errors in measurement, Performance characteristics of instruments. Transducers, measurements of force, torque, strain, vibration, temperature, pressure, level and flow. geometric tolerances. Surface texture. Interferometry

and laser applications. Inspection and limit gauging. Statistical treatment of experimental data. Regression analysis, signal conditioning, Data acquisition and processing.

8024204-1 Mechanical Engineering Lab 2 (1:0, 3)
Prerequisite: 8024102-3 Heat Transfer
8024103-3 System Dynamics and Control

Different Experimental labs are carried out during this course.

8024205-3 Machine Design (3:2, 2)
Prerequisite: 8024104-3 Machine Elements Design

Introduction to Power transmitted elements, Design of rotating shafts, design of keys, Pins and splines, design and analysis of belt drive (flat and v belt), ropes, chains. Rolling contact bearings, selection and mounting. Lubrication and journal bearings. Clutches, coupling and brakes. Gearing: Geometry and force analysis. Design of spur, helical, bevel and worm gears. Gear Box.

8024206-3 Systems of Renewable Energy (3:2, 2)
Prerequisite: 8024102-3 Heat Transfer

This course provides a comprehensive overview of renewable energy systems, including solar energy, wind power, hydropower, fuel cells, and biomass. The course covers physical and technological principles and impact of energy on the economy and environment.

8025101-2 Senior Project (1) (2:2, 4)
Prerequisite: 8022202-2 Introduction to Engineering Design 2 (Department Approval)

8025102-2 Engineering Management (2:2, 0)
Prerequisite: 2024116-3 Probability and Statistics

The role of engineers in management of engineering organizations, technical control of supervision of these organizations including aspects related to production planning. Decisions Making. Inventory control, human resources control, and financial control. Planning and Forecasting. Project planning and control. Case studies from pertinent engineering problems.

8025103-3 Computer Aided Design (3:2, 2)
Prerequisite: 8024205-3 Machine Design

Computer Aided design (CAD) environment, 2D and 3D Solid modeling, computer aided manufacturing, numerically controlled (CNC) machine tools, Multidisciplinary System design by computer, system stress analysis, Production system design Planning and control Production system assessment design, Case studies and Applications.

8025201-2 Senior Project (2) (2:2, 4)
Prerequisite: 8025101-2 Senior Project (1)

8025202-3 Power Plants and Desalination (3:2, 2)
Prerequisite: 8012101-2 Fundamentals of Engineering Economy
8024102-3 Heat Transfer

Combined power cycles. Geothermal power cycles. Components of power plant. Introduction to desalination, thermal and membrane desalination processes. Economics and environ802ntal impacts of power and desalination plants. Renewable energy coupled with desalination processes.

8025203-1 Mechanical Engineering Lab 3 (1:0, 3)
Prerequisite: 8024203-3 Measurements and Measuring Instruments
8024201-3 Hydraulic Machines

Different Experimental labs are carried out during this course.

Elective Courses in Level 9

8025104-3 Fluid Dynamics (3:2, 2)
Prerequisite: 8023204-3 Fluid Mechanics

Review of Mass conservation and Momentum conservation. Behavior of real fluids, incompressible flow around a body, Concepts of Boundary layer, Laminar-turbulent transition, Turbulent boundary layer flow.

8025105-3 Turbo Machinery (3:2, 2)
Prerequisite: 8023204-3 Fluid Mechanics

Principles of fluid mechanics and thermochemistry of combustion related to turbo machines. Gas turbine cycles for shaft power. Gas turbine cycles for aircraft propulsion. Compressor principles and energy transfer. Turbine principles and energy transfer.

8025106-3 Applied Heat Transfer (3:2, 2)
Prerequisite: 8024102-3 Heat Transfer

Review of heat transmission and fluid flow. Heat exchanger classifications. Thermal analysis and performance calculation of heat exchangers. Design of gas to gas heat exchanger, gas to liquid heat exchangers and liquid to liquid heat exchangers. Introduction to boiling and condensation process. Cooling tower and condenser analysis. Applications of heat exchangers.

8025107-3 Energy Conversion (3:2, 2)
Prerequisite: 8022205-3 Thermodynamics

Introduction and basic background, terminology. Fundamentals of energy conversion. Energy conversion matrix. Current and emerging technologies for production of thermal. mechanical, and electrical energy conversion systems. Topics include fossil and nuclear fuels, solar energy, wind energy, fuel cells, and energy storage.

8025108-3 Plasticity (3:2, 2)
Prerequisite: 8023201-3 Mechanics of Materials

Elastic deformation. Plastic deformation (slip). Twining. Factors affecting plasticity. Critical resolved shear stress. Plastic deformation in polycrystalline materials. Imperfections in crystal structure. Dislocation theory for plastic behavior of metals. Recrystallization. Strain hardening. Yield criteria. Relationship between tensile and shear yield stresses. Theories of plastic flow.

8025109-3 Tribology (3:2, 2)
Prerequisite: 8022204-2 Mechanical Drawing

Introduction to tribology, Friction, Wear, Lubrication and Lubricants, Fluid film lubrication and Application of Tribology.

8025110-3 Composite Materials (3:2, 2)
Prerequisite: 8023201-3 Mechanics of Materials

Classification, Applications, Processing and fabrication of composites (metal-matrix, ceramic-matrix, reinforced plastics, honeycomb materials, forming structural shapes), Design Considerations, Laminate structures. Stress-strain characteristics of fiber-reinforced materials. Lamination theory. Nano-Composites. mechanical properties of nano-composites. Failure theories of fiber-reinforced materials. Environmentally induced stresses in laminates.

8025111-3 Fracture in Engineering Materials (3:2, 2)
Prerequisite: 8023201-3 Mechanics of Materials

Fracture mechanics and fatigue mechanisms: mechanisms of ductile and brittle fracture. Environmentally induced fracture and fatigue. Considerations in design of engineering materials and structures are covered.

8025112-3 Finite Elements Analysis (3:2, 2)
Prerequisite: 2023206-3 Numerical Analysis

Introduction to finite element analysis, finite element methods for the analysis of solid mechanics, structural, linear and nonlinear analyses, static and dynamics analyses, fluid and heat

transfer problems, using finite element analysis software package ANSYS. MEMS and NEMS simulation.

8025113-3 Nanomaterials and Nanotechnology (3:2, 2)
Prerequisite: 8023102-3 Materials Science

Introduction (definitions, types of nano materials and nano composites, advantages of materials in nano scale). Processing of nano materials. Processing methods for nano composites. Characterization of nano materials and nano composites. Potential applications of nano materials and nano composites. mechanical behavior of nano composites.

8025114-3 Robotics (3:2, 2)
Prerequisite: 8023101-3 Mechanics of Machines

Introduction to robotics: types and applications, kinematic configurations, forward and inverse kinematic and dynamic analysis. Lagrange formulation method. Path planning and motion programming. Robot control.

8025115-3 Introduction to Real Analysis (3:2, 2)
Prerequisite: 2022101-3 Multi Variable Calculus
2028102-4 Differential Equations

Properties of the real number system, properties of continuous functions, and sequences of functions. The precise definitions of notions (e.g. limits, continuity, differentiability, integrability).

8025116-3 Modeling and Simulation (3:2, 2)
Prerequisite: 8024103-3 System Dynamics and Control

Mathematical modeling of physical systems- mechanical, electrical, fluid and thermal systems. Transmission systems, Automobile suspension systems- Numerical solution using Runge-Kutta methods- State-space representations of Dynamic system- Computer simulation with MATLAB software packages- Case studies**.**

8025117-3 Mechatronics System Design
Prerequisite: 8024103-3 System Dynamics and Control

Introduction to mechatronics. Introduction to main subsystems of mechatronics system; selection criteria, evaluation, synergetic integration. mechatronics (Parallel) design methodology. Introduction to Embedded systems design. Using virtual design programs to test and evaluate subsystem and whole system designs. Case studies.

8025118-3 Industrial Process Control (3:2, 2)
Prerequisite: 8024103-3 System Dynamics and Control

Revision of fundamentals associated with control theory, and related mathematical theories. Industrial process characteristics, identification, and parameters estimation. Main industrial Processes, Modeling, characteristics and instrumentations; flow, temperature, pressure, and level industrial processes. Industrial control systems: Industrial process control loops categories; main control algorithms design and tuning: On/Off, PID, SC, DCS. SCADA system. Data and interfaces. Types of human interface. Fundamentals associated with the use of control systems analysis and design software- MATLAB with facility to aid in the analysis, design and simulation of control systems/algorithms.

Elective Courses in Level 10

8025204-3 Internal Combustion Engines (3:2, 2)
Prerequisite: 8024102-3 Heat Transfer

Fundamentals of engines and their types. Characteristics of engine operation and performance. Thermodynamics cycles of engines (ideal and actual). Thermo-chemical and fuels, Induction of air and fuel systems. Turbocharging and supercharging. Combustion and combustion systems in SI and CI engines. Air pollution. Heat transfer in engine.

8025205-3 Energy Efficiency (3:2, 2)
Prerequisite: 8024206-3 Systems of Renewable Energy

This course provides students with an understanding of how to analyze, identify and improve energy efficiency opportunities in all areas of the energy supply sector. The course covers calculations related to energy conversion and energy auditing. Topics include life cycle cost analysis, economic payback and environmental benefits of energy efficiency. The course culminates with a case study.

8025206-3 Design of Pipe Networks (3:2, 2)

Prerequisite: 8024201-3 Hydraulic Machines

Review of flow in pipe principles. Pipe network analysis. Design of Pipe Networks. methods for solving steady flow in pipe networks, Economic Network Design. Introduction to transient flow. Water hammer.

8025207-3 Renewable Energy Powered Desalination Processes (3:2, 2)
Prerequisite: 8024206-3 Systems of Renewable Energy

A course provides a comprehensive overview of current desalination technologies and existing desalination technologies that are suitable for use with renewable energy. A course will provide in depth coverage of all types of solar thermal desalination technologies including: solar stills, membrane and indirect desalination methods. The criteria to be used for comparing solar desalination technologies are presented. Potentials of renewable energy powered desalination to help solve water scarcity, environmental and economic problems are investigated. A team-based student project will be assigned to design renewable energy powered a desalination plant.

8025208-3 Applied Renewable Energy Technologies (3:2, 2)
Prerequisite: 8024206-3 Systems of Renewable Energy

A course covers the principles and utilization of renewable energy. The course covers practical applications, component design, and theory for systems. The possibility of combining renewable and non-renewable energy technologies in hybrid systems is analyzed. Economic, geographical and environmental considerations are discussed. Challenges for enhancing the future use of renewable energy resources are presented. The course culminates with a renewable energy design project.

8025209-3 Reverse Engineering (3:2, 2)
Prerequisite: 8024205-3 Machines Design

Effect of reversing engineering in 802chanical design, Reversing engineering techniques, 3D contact and non-contact scanning Pattern recognition steps, Deriving standard and free surfaces equations Recognition of other design characteristics, Rapid Prototyping techniques, Pattern transfer to CAD/CAM systems, Software equipment for reverse engineering.

8025210-3 Material Handling Systems (3:2, 2)
Prerequisite: 8024205-3 Machines Design

Introduction to materials handling- unit load concept- industrial vehicles/trucks- conveyors Analysis and design - hoisting equipment- bulk handling equipment and systems- robotic handling- auxiliary equipment- organization, maintenance and safety.

8025211-3 Operations Research (3:2, 2)
Prerequisite: 8024101-3 Manufacturing Processes

Mathematical modeling and operations research. Linear programming. Simplex algorithm. Duality. Transportation and assignment problems. Network models.

8025212-3 Design Optimization (3:2, 2)
Prerequisite: 8024205-3 Machines Design

Principles of optimum design in mechanical components, systems modeling and optimization, Desirable and undesirable factors in design, objective Functions, constraints, penalty functions, formalized optimization problem statements, Techniques for solving single variable optimization problems, Techniques for solving constrained and unconstrained multi-variable problems, Modeling engineering design problems for optimization, linear and non-linear constrained optimization formulations, multidisciplinary design optimization (MDO) for systems, optimality criteria methods, Computer implementation of optimization schemes with applications Applied examples and case studies.

8025213-3 Advanced Manufacturing Technology (3:2, 2)
Prerequisite: 8024101-3 Manufacturing Processes

Non-conventional machining: Principles, Ultrasonic machining, Electromechanical Machining, Electro-discharge Machining, Plasma Arc Machining, Laser Beam Machining, Electron Beam Machining. Numerical Control of Machine Tools: Automation of Manufacturing Processes, Types and components of CNC machines, Programming of CNC machines.

8025214-3 Recycling of Industrial Wastes (3:2, 2)
Prerequisite: 8023102-3 Materials Science
8024101-3 Manufacturing Processes

Importance of recycling. Environ802ntal effect of wastes. Classification and properties of wastes. Sources of solid wastes (types & amounts). Industrial solid wastes. Planning for recycling of solid wastes. Management of wastes: methods of dealing with wastes, methods to disposal of wastes, methods to recycling and reuse wastes. Wastes hazardous management. Recycling Technology. Case studies (plastics, cans, rubber…etc.)

8025215-3 Industrial Automation (3:2, 2)
Prerequisite: 8024103-3 System Dynamics and Control

Introduction to industrial automation. Overview of: manufacturing operations, industrial control systems; industrial Hardware components; sensors, actuators, ADC, DAC. Basic principles and strategies of automation; Basic elements of an automated system. Automation and Control: Logic control systems, PLC, NC, Microcontrollers. Robotics and Automated Manufacturing

Systems; Industrial robotics, Flexible manufacturing systems, Computer Integrated Manufacturing.

8025216-3 Programmable Logic Controllers (3:2, 2)
Prerequisite: 8025118-3 Industrial Process Control

Introduction to industrial automation; types, classification, components, interrelation, and related concepts for each of industry, manufacturing, production, automation systems. Review of logic, Boolean algebra and programming/program designing. Introduction to Programmable Logic Controllers (PLC) and related concepts: history, classification, working principles, selection criteria. Input/output devices: analog and digital inputs, Sensors, Actuators, Interfaces. PLC Programming; Testing and debugging; Input/output processing, internal relays. Special functions. PLC practical industrial applications.

8025217-3 System Theory (3:2, 2)
Prerequisite: 8024103-3 System Dynamics and Control
8025115-3 Introduction to Real Analysis

A rigorous introduction to the structure and analysis of linear dynamical systems with inputs and outputs, and the synthesis and design of controllers for such systems. Fundamental concepts of solutions, internal (state- space) and external (input-output map or transfer function) descriptions, controllability and observability, stability of zero solution, canonical forms, realization of state space models from external data, and feedback and its effect on spectral properties. Applications of these basic results to deterministic estimation of state (observer theory) and closed loop stabilization.

By completing the MEP, you will gain the skills and knowledge necessary to succeed in a range of careers in the field. We regularly review and update the program to ensure that it remains relevant to the needs of the industry and the job market.

Career Opportunities

Mechanical engineering is a highly in-demand field in Saudi Arabia, with numerous career opportunities available for graduates. In addition to the common career paths mentioned earlier, there are also opportunities for mechanical engineers in the areas of robotics and automation.

Mechanical engineers can work in the oil and gas industry, which is a significant sector in Saudi Arabia, to design and develop mechanical systems for drilling, production, refining, and distribution of oil and gas products. They can also work in the manufacturing industry, including industries such as automotive, aerospace, and defense, to design and develop products and systems.

The construction industry in Saudi Arabia is also booming, and mechanical engineers can work on the design and development of HVAC systems, plumbing systems, and other mechanical systems in buildings and infrastructure. With the increasing focus on renewable energy sources, mechanical engineers can also work in the development and implementation of wind, solar, and other renewable energy systems.

In addition, there are opportunities for mechanical engineers in the areas of robotics and automation. Mechanical engineers can work on the design, development, and implementation of robotic systems for various applications, such as manufacturing, healthcare, and defense. They can also work on the design and development of automated systems, such as assembly lines and industrial control systems, to improve efficiency and productivity in various industries.

Control systems engineering and mechatronics engineering are also fields where mechanical engineers can specialize. Control systems engineering involves the design and development of systems that control and regulate various mechanical processes, while mechatronics combines mechanical engineering with electronics and computer engineering to develop advanced systems that integrate mechanical, electrical, and software components.

Some examples of these companies in Saudi Arabia that offer career opportunities for mechanical engineers:

1. Saudi Aramco: Saudi Aramco is a multinational petroleum and natural gas company based in Dhahran, Saudi Arabia. As the largest oil company in the world, Saudi Aramco offers career opportunities for mechanical engineers in areas such as drilling, production, refining, and distribution of oil and gas products.

2. SABIC: SABIC is a global leader in diversified chemicals headquartered in Riyadh, Saudi Arabia. The company offers career opportunities for mechanical engineers in areas such as manufacturing, including automotive, aerospace, and defense industries.

3. Saudi Electricity Company: Saudi Electricity Company is the largest power generation and distribution company in Saudi Arabia, and offers career opportunities for mechanical engineers to work in the design, development, and maintenance of mechanical systems for power generation and distribution.

4. Saline Water Conversion Corporation: Saline Water Conversion Corporation is a government-owned company in Saudi Arabia that specializes in desalination of seawater. The company offers career opportunities for mechanical engineers to work in the design, development, and maintenance of mechanical systems for desalination plants.

5. Advanced Electronics Company: Advanced Electronics Company is a Saudi Arabian company that offers advanced electronics, information technology, and communication solutions. The company offers career opportunities for mechanical engineers to work in areas such as control systems engineering and mechatronics engineering.

These are just a few examples of companies in Saudi Arabia that offer career opportunities for mechanical engineers. Other companies in sectors such as construction, renewable energy, and robotics and automation also offer career opportunities for mechanical engineers in Saudi Arabia.

Overall, mechanical engineers in Saudi Arabia have a wide range of career opportunities available to them, with the potential for career growth and advancement. With the country's focus on economic diversification and technological advancements, the demand for mechanical engineers, including those in the fields of robotics and automation, is only expected to increase in the coming years.

Application and admission:

Admission and Application Requirements for the Department of Mechanical Engineering:

General Requirements:

- The applicant must be a Saudi citizen or have a Saudi mother or father.
- The applicant must hold a high school diploma or its equivalent from inside or outside the Kingdom.
- The applicant must have successfully passed the General Aptitude Test and Academic Achievement Test from the National Center for Measurement for the Health and Science track.
- The applicant must have successfully passed the General Aptitude Test from the National Center for Measurement for the Humanities track.
- The applicant must be medically fit, and the university has the right to change the applicant's major if their health condition is not suitable for the major they were accepted into.
- The applicant must be a full-time student.
- The applicant must obtain approval from their employer to attend full-time study if they are employed in a government or private sector.
- The applicant must not have been expelled from the university or any other university due to disciplinary action.
- The applicant must successfully pass any test or interview determined by the relevant department.
- No application will be accepted for the applicant to enroll in two scientific degrees at the same time.
- The applicant must not be enrolled in another university.
- A graduate from the university cannot enroll again for the same degree.
- The applicant must meet any other requirements determined by the university.
- The applicant is responsible for the accuracy of the data, and the university has the right to cancel their acceptance if the data is inaccurate.

Admission Criteria:

- The relative weight is calculated as follows:

High school diploma:	30%
GAT	30%
SAAT	40%

Application Stages:

1. Application Submission: The applicant submits their application, and the available majors will appear according to the requirements.
2. Application Follow-up: The applicant must follow up on their application status on the admission portal according to the announced dates.
3. Provisional Acceptance: The major in which the applicant was accepted will appear based on their weighted percentage and the order of their preferences on their personal page in the admission portal.
4. Confirmation of Preferences: The applicant confirms their preference for the major in which they were accepted. Failure to confirm within the specified time frame will result in the forfeiture of their acceptance.
5. Final Acceptance: The applicant can obtain their university ID number by following up on their application on the admission portal according to the announced dates.
6. Upgrade: Acceptance is upgraded automatically, and the applicant cannot return to their previous major, so they must carefully and accurately order their preferences based on their interests and inclinations.

Admission Procedures:

1. The applicant logs into the admission portal via the following link (https://admission.tu.edu.sa).
2. The applicant enters the required information on the website and ensures the accuracy of the entered mobile number for communication purposes.
3. The applicant confirms their major preferences based on their interests and inclinations. (Note that acceptance will be upgraded automatically if there are available seats.)
4. The applicant must retain the application number that will appear after completing the data entry process.
5. The university obtains the student's data (high school, aptitude test, academic achievement test) automatically through a link with the relevant authorities.
6. All admission stages are conducted electronically, and the applicant does not need to visit the university.

Have a pleasant time at MEP and all the best with your studies and bright career ahead!!

Head, Mechanical Engineering Department