KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING DEPARTMENT

1. INTRODUCTION

The Department of Mechanical Engineering at King Saud University is one of the oldest mechanical engineering departments in the Kingdom and the Arab Gulf states; in fact it has been established at the time of founding of the College of Engineering in 1382 H (1962 G). The mechanical engineering (ME) program has been designed in accordance with the international standards and criteria of engineering education to serve the goals of the development plans of the Kingdom in preparing the graduates to fit in different job sectors within the field of specialization.

The undergraduate program offered by the Department of Mechanical Engineering provides an opportunity for students with an aptitude for physical sciences, mathematics and use of computers to fully develop their capabilities and apply them to the engineering program. Graduates of Mechanical Engineering acquire an excellent background in mechanics and thermal sciences to analyze the conversion and transmission of energy in its many forms. Mechanical engineers use this knowledge to solve new problems and to make things work better, more efficiently, and more economically.

Energy generation and utilization, manufacturing processes and products, and design of mechanical equipment and systems are traditional mechanical engineering fields. Students receive basic preparation in all of these areas. The Mechanical Engineering program prepares students for entrance into industry, for independent business (e.g., consulting, contracting, or manufacturing), or for work in government agencies. A degree in Mechanical Engineering may be used as a background for a business degree, as well as for graduate study in engineering.

Employment opportunities for graduates from Mechanical Engineering program are in the areas of research and development of new products, design of equipment or systems, supervision of production, maintenance, administration, sales engineering, and testing. Mechanical engineers may work in engineering organizations, in the government sector, and in major industries such as power and desalination plants, heavy equipment, plastic, aerospace, chemical, electronics, materials processing, etc.

Department Vision

To become the leading Mechanical Engineering Department in the Middle East, recognized for its outstanding education, research and outreach.

Department Mission

To provide quality mechanical engineering education and research programs that produce graduate and post-graduate engineers who meet the needs of industry, government, and academia; advance the state of knowledge and technology through innovative fundamental and applied research; and serve the community and profession through programs of education, technology transfer, and consulting.

2. BACHELOR OF SCIENCE PROGRAM

2. 1 Program Objectives

The Program Educational Objectives (PEOs) are:

1. ME graduates will have successful careers in mechanical engineering, and graduate or professional studies in mechanical and related disciplines, if pursued.
2. ME graduates will possess a high degree of professionalism.
3. ME graduates will be applying practical knowledge in the global marketplace and will be continuously developing their skills throughout their careers**.**

2.2 Program Learning Outcomes

The Program Learning Outcomes state that "Students who complete the Mechanical Engineering program at King Saud University will have:

a) an ability to apply knowledge of mathematics, science, and engineering to mechanical engineering problems
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d) an ability to function on multidisciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional and ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i) a recognition of the need for, and an ability to engage in life-long learning
j) a knowledge of contemporary issues
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
l) an ability to work professionally in both mechanical and thermal systems areas.
m) an ability to apply advanced mathematics through multivariate calculus and differential equations

2.3 Graduation Requirements

The requirements for the Degree in Bachelor of Science in Engineering at the College of Engineering, King Saud University, consist of a preparatory year, 132 credit-hours in Mechanical Engineering Program and 10 weeks Industrial Training. In the course numbering for the Mechanical Engineering curriculum, code of courses was selected as illustrated in Appendix A. For the Mechanical Engineering Program, the requirements are as follows:

Preparatory Year

Preparatory year participates in developing student's skills through English courses, communication skills, and computer applications courses. The following table shows the preparatory year courses.

Level 1		
Course Code	**Course Title**	**Hr. H(X,Y,L)**
MATH 140	Introduction to Mathematics	2(2-1-0)
ENGL 14z	English language – 1 -	8(20-0-0)
CHS 140	Health & fitness 2	1(1-1-0)
CI 140	Learning, thinking &	3(3-1-0)
		14

Level 2		
Course Code	**Course Title**	**Hr. H(X,Y,L)**
MATH 150	Differential Calculus	3(3-1-0)
ENGL 15z	English language -2 -	8(20-0-0)
CT 140	IT skills	3(0-0-6)
MC 140	Communication skills	2(2-1-0)
INT 101	Entrepreneurship	1(1-1-0)
		17

T(X-Y-L) T=Total Credit Hours X = Lectures; Y = Tutorials; L = Laboratory

z based on placement test level

Program Requirements

After successfully passing the preparatory year and to complete the graduation requirements for a B.Sc. in Mechanical Engineering, the students are required to successfully pass a total of 132 credit hours (Table 1). The program is divided into:

- 12 credit hours of university requirements (Table 2)
- 56 credit hours of college requirements of which 41 credit hours are compulsory courses for all departments (Table 3A) and 15 credit hours of complementary courses for Mechanical Engineering program (Table 3B)
- 64 credit hours of departmental requirements of which:
  - 45 credit hours for core courses (Table 4A),
  - 4 credit hours for senior design project (Table 4B),
  - 3 credit hours for an electrical engineering course (Table 4C), and
  - 12 credit hours for elective courses (Table 5)

Senior Capstone Design Project Requirements

The design project is divided into two parts (2 credit hours each). The student is eligible to register for senior capstone design project -1 if he completes successfully at least 100 credit hours after preparatory year. Senior capstone design project -2 can be taken during the first and second semesters only (not during summer semester).

Summer Training Requirements

Students in the department are required to complete a 10 weeks summer training requirement in an area related to Mechanical Engineering. Prior to undertaking the summer training program, the student must obtain the approval of the department and he must have successfully completed at least 65 credit hours after preparatory year. Students enrolling in the summer training program are not allowed to take simultaneously any course or projects.

A typical plan for the B. Sc in Mechanical Engineering is presented in Table 6.

Table 1 SUMMARY OF B.SC. DEGREE REQUIREMENTS IN MECHANICAL ENGINEERING

Requirements	Description	Cr. Hr.
University	Islamic (8) and Arabic (4) Studies	12
College	Compulsory (41), Complementary (15)	56
Department	Core, Engineering, and Specialty	64
	Total	**132**

Table 2 UNIVERSITY REQUIREMENTS

TABLE 2-A: COMPULSORY UNIVERSITY REQUIREMENTS

Course Code	Course Title	Cr. Hr.
IC 107	Professional Ethics	2(2,0,0)
ARAB 101	Language Skills	2(2-0-0)
ARAB 103	Expository Writing	2(2-0-0)
Total		**6**

TABLE 2-B: OPTIONAL COURSES (The student must choose 3 courses (6 hours) from the list below)

Course Code	Course Title	Cr. Hr.
IC 100	Studies in Prophet Biography	2(2, 0, 0)
IC 101	Principles of Islamic Culture	2(2, 0, 0)
IC 102	Family in Islam	2(2, 0, 0)
IC 103	Economic System in Islam	2(2, 0, 0)
IC 104	Islamic Political System	2(2, 0, 0)
IC 105	Human Rights	2(2, 0, 0)
IC 106	Medical Jurisprudence	2(2, 0, 0)
IC 108	Current Issues	2(2, 0, 0)
IC 109	Role of Women in Development	2(2, 0, 0)
QURN 100	Quran Kareem	2(2, 0, 0)
Total		**6**

H(X-Y-L) H=Total Credit Hours X = Lectures; Y = Tutorials; L = Laboratory

Table 3 COLLEGE REQUIREMENTS

Table 3A COMPULSORY COURSES

Course Code	Course Title	Cr. Hr. H(X,Y,L)	Requisites	
			Pre-	Co-
MATH 106	Integral Calculus	3(3,2,0)	*MATH 150*	---
MATH 107	Vectors and Matrices	3(3,2,0)	*MATH 150*	---
MATH 203	Differential and Integral Calculus	3(3,2,0)	*MATH 106* *MATH 107*	---
MATH 204	Differential Equations	3(3,2,0)	*MATH 203*	---
STAT 324	Engineering Probability and Statistics	3(3,1,0)	---	---
PHYS 103	General Physics (1)	4(3,0,2)	---	---
PHYS 104	General Physics (2)	4(3,0,2)	---	---
CHEM 101	General Chemistry	4(3,0,2)	---	---
ENGL 107	Technical Writing	3(3,0,0)	---	---
ENGL 108	Communication Skills for Engineers	3(3,0,0)	---	---

GE 104	Basics of Engineering Drawing	3(2,0,2)	---	---
GE 201	Statics	3(3,1,0)	*MATH 106 MATH 107*	---
GE 404	Engineering Management	2(2,1,0)	---	
	Total	**41**		

H(X-Y-L) H=Total Credit Hours X = Lectures; Y = Tutorials; L = Laboratory

Table 3B COMPLEMENTARY COURSES

Course Code	Course Title	Cr. Hr. H(X,Y,L)	Requisites	
			Pre-	Co-
GE 105	Introduction to Engineering Design	2(1,1,2)	*GE 104*	
GE 202	Dynamics	3(3,1,0)	*GE 201*	
MATH 254	Numerical Methods	3(3,2,0)	*MATH 107, GE 211*	---
GE 302	Industry and Environment	2(2,0,0)	*PHYS 104, CHEM 101, MATH 107*	---
GE 403	Engineering Economy	2(2,1,0)		
GE 211	Computer Programming using C++	3(2,0,2)	---	---
	Total	**15**		

H(X-Y-L) H=Total Credit Hours X = Lectures; Y = Tutorials; L = Laboratory

Table 4 Program Requirements

Table 4A Core Courses

Course Code	Course Title	Cr. Hr. (X,Y,L)	Requisites	
			Pre-	Co-
ME 201	Geometric Modeling in Engineering	2(1,0,3)	*GE 104*	
ME 254	Materials Engineering	4(3,1,2)	*CHEM 101, PHYS 104*	
ME 304	Mechanical Engineering Design (1)	3(3,1,0)	*ME 352*	
ME 305	Mechanical Engineering Design (2)	4(3,1,2)	*ME 304*	
ME 311	Manufacturing Processes	4(3,1,2)	*ME 254*	*ME 352*
ME 321	Mechanical Measurements	2(1,0,2)		*ME 383, STAT 324*
ME 322	Mechanical Engineering Lab (1)	2(1,0,2)	*ME 321*	*ME 375*
ME 323	Mechanical Engineering Lab (2)	2(1,0,2)	*ME 321*	*ME 364*
ME 352	Mechanics of Materials	3(3,1,0)	*GE 201*	
ME 363	Mechanics of Machinery	3(3,1,0)	*GE 202*	
ME 364	System Dynamics and Control	3(3,1,0)	*GE 202*	
ME 371	Thermodynamics (1)	3(3,1,0)	*PHYS 104*	
ME 374	Thermodynamics (2)	2(2,1,0)	*ME 371*	
ME 375	Heat Transfer	3(3,1,0)	*ME 383*	
ME 376	Thermal-Fluid Systems	2(2,1,0)	*ME 375*	
ME 383	Fluid Mechanics	3(3,1,0)	*ME 371*	
	Total	**45**		

(X,Y,L) X = Lectures; Y = Tutorials; L = Lab.

Table 4B Senior Design Project

Code & Number	Course Title	Hours (X-Y-L)	Requisites	
			Pre-	Co-
ME 496	Graduation Project -1	2(2,0,0)	*Completion of 100 credits hours after preparatory year*	

ME 497	Graduation Project -2	2(2,0,0)	*ME 496*	---
Total		**4**		

H(X-Y-L) H=Total Credit Hours X = Lectures; Y = Tutorials; L = Laboratory

Table 4C Electrical Engineering Course

Course Code	Course Title	Cr. Hr. (X,Y,L)	Requisites	
			Pre-	Co-
EE 308	Electrical Circuits and Machines	3(3,1,0)	*PHYS 104*	
Total		**3**		

(X,Y,L) X = Lectures; Y = Tutorials; L = Lab.

Table 5 Elective Courses

Code & Number	Course Title	Credit Hours (X,Y,L)	Requisites	
			Pre-	Co-
ME 402	Finite Element Method	3(2,0,2)	*ME 304* *ME 375*	*ME 364*
ME 403	Technology-Based Entrepreneurship	3(3,0,0)	*ME 305*	
ME 404	Computer-Aided Design	3(3,0,0)	*ME 305*	
ME 405	Conceptual Design	3(3,0,0)	*ME 304*	
ME 406	Design Optimization	3(3,0,0)	*ME 304*, *ME 375*	
ME 408	Friction, Wear and Lubrication	3(3,0,0)	*ME 304*	
ME 409	Materials Selection in Design	3(3,0,0)	*ME 304*	
ME 411	Modern Manufacturing Processes	3(3,0,0)	*ME 311*	
ME 412	Metal Forming and Metal Cutting Analysis	3(3,0,0)	*ME 311*	
ME 413	Manufacturing Systems	3(3,0,0)	*ME 311*	
ME 414	CNC Machines	3(2,0,2)	*ME 311*	
ME 431	Aerodynamics	3(3,0,0)	*ME 383*	
ME 432	Introduction to Flight Mechanics	3(3,0,0)	*ME 383*	
ME 433	Introduction to Aeroelasticity	3(3,0,0)	*ME 383* *ME 304*	
ME 443	Principles of Refrigeration	3(2,0,2)	*ME 374*	
ME 444	Air Conditioning	3(3,0,0)	*ME 375*	
ME 451	Mechanical Behavior of Materials	3(3,0,0)	*ME 304*	
ME 452	Physical Metallurgy	3(3,0,0)	*ME 254*	
ME 453	Intermediate Mechanics of Materials	3(3,0,0)	*ME 304*	
ME 454	Aircraft Structures	3(3,0,0)	*ME 304*	
ME 455	Automotive Structures	3(3,0,0)	*ME 304*	
ME 456	Introduction to Composite Materials	3(3,0,0)	*ME 304*	
ME 462	Mechanical Vibrations	3(3,0,0)	*ME 364*	
ME 463	Automatic Control	3(3,0,0)	*ME 364*	
ME 465	Mechatronics	3(2,0,2)	*ME 364*	*ME 463*
ME 466	Rotating Machinery	3(3,0,0)	*ME 364*	
ME 467	Introduction to Robotics	3(3,0,0)	*ME 363*	
ME 468	Mechanisms and Linkage Design	3(3,0,0)	*ME 363*	
ME 469	Automotive Engineering	3(3,0,0)	*ME 304*	*ME 364*
ME 472	Power Plants	3(3,0,0)	*ME 374*	
ME 473	Introduction to Combustion	3(3,0,0)	*ME 374*	
ME 474	Internal Combustion Engines	3(2,0 ,2)	*ME 374*	
ME 476	Solar Energy	3(3,0,0)	*ME 375*	
ME 477	Energy Conversion Systems	3(3,0,0)	*ME 375*	
ME 478	Design of Energy Systems	3(3,0,0)	*ME 375*	
ME 479	Water Desalination	3(3,0,0)	*ME 375*	
ME 481	Introduction to Computational Fluid Dynamics	3(2,0,2)	*ME 383*	
ME 482	Gas Dynamics	3(3,0,0)	*ME 383*	

ME 483	Introduction to Propulsion	3(3,0,0)	*ME 383*	
ME 485	Fluid Machinery	3(3,0,0)	*ME 383*	
ME 487	Air Pollution Control	3(3,0,0)	*ME 383*	
ME 493	Selected Topics in Mechanical Engineering (1)	3(3,0,0)	*Completion of 100 credits hours after preparatory year*	
ME 494	Selected Topics in Mechanical Engineering (2)	3(3,0,0)	*Completion of 100 credits hours after preparatory year*	

Table 6 Typical Plan for B.Sc. Program in Mechanical Engineering**

Level 3			
Course No.	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre- Requisites**
CHEM101	General Chemistry	4(3,0,2)	
PHYS 103	General Physics (1)	4(3,0,2)	
MATH 106	Integral Calculus	3(3,2,0)	MATH 150
MATH 107	Vectors and Matrices	3(3,2,0)	MATH 150
ENGL 107	Technical Writing	3(3,0,0)	
	Total	**17**	

Level 4			
Course No.	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre- Requisites**
PHYS 104	General Physics (2)	4(3,0,2)	
GE 104	Basics of Engineering Drawing	3(2,0,2)	
MATH 203	Differential and Integral Calculus	3(3,2,0)	MATH 106 MATH 107
ARAB 101	Language Skills	2(2,0,0)	
ENGL 108	Communication Skills for Engineers	3(3,0,0)	
IC **	Elective Islamic	2(2,0,0)	
	Total	**17**	

Level 5			
Course No.	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre- Requisites**
MATH 204	Differential Equations	3(3,2,0)	MATH 203
ME 254	Materials Engineering	4(3,1,2)	CHEM 101 PHYS 104
GE 201	Statics	3(3,1,0)	MATH 106 MATH 107
GE 211	Computer Programming using C++	3(2,0,2)	
IC **	Elective Islamic	2(2,0,0)	
GE 105	Introduction to Engineering Design	2(1,1,2)	GE 104
	Total	**17**	

Level 6			
Course No.	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre- Requisites**
GE 202	Dynamics	3(3,1,0)	GE 201
ME 352	Mechanics of Materials	3(3,1,0)	GE 201
ME 201	Geometric Modeling in Engineering	2(1,0,3)	GE 104
ME 371	Thermodynamics (1)	3(3,1,0)	PHYS 104
ME 311	Manufacturing Processes	4(3,1,2)	ME 254 ME 352 (Co)

IC **	Elective Islamic	2(2,0,0)	
	Total	**17**	

Level 7			
Course No.	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre- Requisites**
ME 363	Mechanics of Machinery	3(3,1,0)	GE 202
EE 308	Electrical Circuits and Machines	3(3,0,0)	PHYS 104
ME 321	Mechanical Measurements	2(1,0,2)	ME 383 (Co) STAT 324(Co)
ME 304	Mechanical Engineering Design (1)	3(3,1,0)	ME 352 ME 201 (Co)
STAT 324	Engineering Probability and Statistics	3(3,1,0)	
ME 383	Fluid Mechanics	3(3,1,0)	ME 371
	Total	**17**	

Level 8			
Course No.	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre- Requisites**
ME 375	Heat Transfer	3(3,1,0)	ME 383
MATH 254	Numerical Methods	3(3,2,0)	*MATH 107, GE 211*
ME 322	Mechanical Engineering Lab (1)	2(1,0,2)	ME 321 ME 374 (Co)
ME 305	Mechanical Engineering Design (2)	4(3,1,2)	ME 304
ARAB 103	Expository Writing	2(2,0,0)	
ME 374	Thermodynamics (2)	2(2,1,0)	ME 371
	Total	**16**	

Level 9			
Course No.	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre- Requisites**
ME 364	System Dynamics and Control	3(3,1,0)	GE 202
ME 323	Mechanical Engineering Lab (2)	2(1,0,2)	ME 321 ME 364 (Co)
ME xxx	Elective I	3	
ME xxx	Elective II	3	
ME 376	Thermal-fluid Systems	2(2,1,0)	ME 375
GE 403	Engineering Economy	2(2,1,0)	
ME 496	Graduation Project (1)	2(2,0,0)	*Completion of 100 credits hours* **
	Total	**17**	

Level 10			
Course No.	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre- Requisites**
ME xxx	Elective III	3	
ME xxx	Elective IV	3	
GE 302	Industry and Environment	2(2,0,0)	MATH 107 PHYS 104 CHEM 101
IC 107	Professional Ethics	2(2,0,0)	

GE 404	Engineering Management	2(2,1,0)	
ME 497	Graduation Project (2)	2(2,0,0)	ME 496
ME 999	Industrial Training	0	*Completion of 65 credits hours* **
	Total	**14**	

(X,Y,L) X = Lectures; Y = Tutorials; L = Lab.
** PROGRAM IS PRECEDED BY A 2-LEVEL PREPARATORY YEAR

3. DEPARTMENT AND SOCIETY

The department offers its extensive facilities and capabilities to serve the collaboration between the university and the society. The activities of the department in this venue include:

1. Offering several short courses for engineers and technicians working in the governmental and industrial sectors.
2. Offering specialized technical consultancies.
3. Participation in different national committees as university representatives.
4. Carrying out technical studies and conducting needed experimental work in department laboratories

4. RESEARCH DIGEST

Rotating Machinery

- Development of techniques for lateral vibration control and suppression of instability for high performance turbo machines.
- Conducting theoretical and experimental research toward improving the dynamics and designs of rotating machinery.
- Development of techniques for fault diagnosis of rotors, and identification of cracks in rotating shafts.

Vibration and Control

- Development of an economical field testing procedure including equipment and methodology to evaluate steel bridges in Riyadh city.
- Carrying out a feasibility study on the design and use of a remote monitoring system to continuously monitor steel bridges.
- Design of advanced car suspension systems (fully active, slow active, semi active) including optimal preview control.
- Carrying out dynamic analyses of road and railway vehicles.
- Design of different control strategies for suppression of vibration of flexible structures.

- Stability analysis and methods of solution of pipes conveying fluid.
- Vibration suppression of beams subjected to a moving mass.
- Controlling of vibrations in clutches and braking systems.

Composite and Smart Materials

- Thermo elastic behavior of composite structures.
- Design and fabrication of piezoelectric materials.
- Suppression of vibration of composite structures using smart materials.

Materials Engineering

- High-temperature deformation and processing of aluminum alloys to enhance their strength through the addition of alloying elements.
- Super plasticity of metallic materials to improve the formability of these alloys.
- Heat treatments of metallic alloys for improvement of their properties.
- Modeling of metal forming and machining processes to utilize computational techniques in predicting the material behavior under various conditions.
- Thermo elastic instability analysis and its application to design automobile brakes and casting processes.
- Strain Hardening and the concurrent plastic deformation mechanisms and microstructure evolution.
- Grain refinement for enhancing mechanical properties and super plastic behavior.
- Powders, polymers, and mixtures mechanics.
- Viscoelastic behavior in polymers.
- Fracture mechanics of porous structures.
- Impact mechanics in porous and powder components.
- Fatigue of metals and welded structures.
- Strain rates and temperature effects in metals and polymers.

Design, Materials and Manufacturing

- High speed fluid jets, mechanics, applications and technology.
- CAD/ CAM and manufacturing engineering.
- Expert systems for powder technology.
- Wear, lubrication and performance of porous journal bearings.

Solar Energy

- Design, manufacture, and assembly of solar trough collector with its tracking mechanism, which will be used for research on the utilization of solar energy.
- The use of solar energy for water desalination.
- Optimum tilt angle for solar collection systems.

Energy and Environment

- Energy auditing, and energy management in building and industrial plants; thermal characteristics of insulation in building; optimum insulation thickness.
- Improvement of power generation efficiency in gas turbine plants: heat recovery from exhaust gasses; inlet air cooling; cogeneration plants.
- Evaluation of air pollution resulting from power plants; thermal water pollution for steam power plants.
- Development of a heat-operated automobile air-conditioning system.
- Air flow and dispersion of pollutants in road tunnels.

Desalination

- Water desalination using ion exchange membrane techniques.
- Performance evaluation of multi stage flash (MSF) desalination systems.

Thermal Engineering

- Materials processing: heat and mass transfer over moving surfaces; hardening of polymer tubes using vertical water jets.
- Engineering analysis of convection heat transfer from helical coils (new correlation).
- Computational fluid dynamics (CFD) and numerical heat transfer.
- Practical relevance: heat transfer enhancement; heat exchanger design; water and air pollution.

Fluid Engineering

- Sand dunes studies including manipulation of wind flow around dunes to control its migration.
- Vortex flow including generation of cold stream of air using vortex tube.
- Interaction of boundary layer with longitudinal vortices which has an application in aerospace industry (fuselage).
- Shear flow including boundary layer, jet impingement flow, and wake.
- Stability of Taylor Colette flow and its application in purification of industrial waste water and in a rotating filter device during dynamic filtration process.

5. FACULTY AND STAFF

The department has 38 faculty members holding PhD in different mechanical engineering disciplines. Out of these, there are 10 professors, 15 associate professors and 13 assistant professors. In addition, the department has 4 lecturers, 7 teaching assistants and 7 technicians.

6. COURSE DESCRIPTION

6.1 Preparatory Year

MATH 140: Introduction to Mathematics *2(2,1,0)*

Basic Algebraic Operations, Equations and Inequalities, Graphs, Functions, Polynomials and Rational Functions, Exponential and Logarithmic Functions, Trigonometric Functions, Trigonometric Identities and Conditional Equations, Systems of Equations and Inequalities; Matrices, Sequences and Series.

Pre-requisites: None.

CHS 150 - Health and Fitness *1(1,1,0)*

Subjects about general health and body and brain fitness.

Pre-requisites: None.

ENGL 140: English language (1) *8(20,0,0)*

This initial stage of the course is designed to give the students a strong foundation in the language, improving their command of English as well as improving their vocabulary, reading, writing and communication skills. In the process of improving these skills, students will also develop their confidence in the language and also their presentation skills. These all contribute to the life skills of the student and help to prepare them for their future studies and careers beyond KSU. As the course progresses and students reach a higher level of English, the focus will switch to the academic side of the language. This will involve preparing students for the style of language they will need for their future studies.
Pre-requisites: None.

CI 140: Learning , thinking and Research skills *3(3,1,0)*

Learning skills**:** Self management for learning, Learning tools, Reading strategies, Second language learning skills, Test administration.
Thinking skills: Theory Of Inventive Problem Solving (TRIZ), Rounding Thinking, Expanding perception, Creative thinking.
Research skills: Problem determining, Search for information strategies, Sites of sources, access this information, Using thin formation, Information construction, Information evaluation.

IT 140: Computer skills *3(0,0,6)*

Basic Concepts of Information Technology, Using a computer and Managing Files, Word Processing, Spreadsheets, Databases, Presentation.

MC 140: Communication Skills *2(2,1,0)*

This course deals with communication kills as a tool for achieving personal psychological and social adaptability. It is one of the key skills in matrix of (self development skills) this course covers skills related to communication sufficiency comprised of a wide array of major matrix of knowledge, skills and approaches comprised in four main sufficiency: Knowledge sufficiency, Social sufficiency, Comprehension sufficiency, Productive sufficiency.

ENGL 150: English language (2) *8(20,0,0)*

The final assessment for the course is the highly regarded International English Language Testing System (IELTS), which is used as a qualifying test for students wishing to attend university in many countries including the UK and Australia. Specialist material will be used to prepare students for this test with the aim of reaching an IELTS score of 5.0 by the end of the year.

MATH 150: Differential Calculus *3(3,0,0)*

Limits and Continuity: The Concept of Limit, Computation of Limits, Continuity and its Consequences, Limits Involving Infinity, Formal Definition of the Limit. Differentiation: The Concept of Derivative, Computation of Derivatives (The Power Rule, Higher Order Derivatives, and Acceleration), the Product and Quotient Rules, The Chain Rule, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation and Inverse Trigonometric Functions, the Mean Value Theorem. Applications of Differentiation: Indeterminate Forms and L'Hopital's rule, Maximum and Minimum Values, Increasing and Decreasing Functions, Concavity and the Second Derivative Test, Optimization, Related Rates.

Pre-requisite: MATH 140

ENT 101 Entrepreneurship *1(1,1,0)*

Pre-requisites: None.

6.2 University Requirements

IC 101- Introduction to Islamic Culture *2(2-0-0)*

This subject aims to introduce the student to the Islamic culture; manifestation of the Muslims attitude towards other cultures; explaining the characteristics of Islam, such as: Universality, Comprehensibility, integrity, consistency with human nature (instinct), reason, and science. This subject also explains the Islamic tenet and its fundamentals, such as: To believe in Allah, the Hereafter, the Angles, the Holy Books, the Messengers, and Divine Destiny.

Pre-requisite: ---

IC 102 Islam and Society Building *2(2-0-0)*

This course studies the following: The concept of the Muslim society; its basics, its method and characteristics, means of consolidating its social ties; the most important social problems, the Islamic philosophy of family affairs, marriage: its introductory formalities, aims and effects. It also deals with ways of strengthening the family bonds.

Pre-requisite: ---

IC 103 The Islamic Economic System *2(2-0-0)*
This course depicts the Islamic concept of life, the nature of man, the basic constituents of the Islamic economics and its objectives; it studies as well the legal evidences of these topics. It also explains the opinion of Islam toward finance, ownership, production, maintenance, conception, distribution of wealth, and the exchange in the Islamic Economic system.
Pre-requisite: ---

IC 104 Fundamentals of Islamic Political System *2(2-0-0)*
This subject contains the following: Introduction to the Political System and its fundamentals; the Islamic Political System is the best system for human societies to follow and apply; the rise up of Islamic State during the Prophet's lifetime, Caliphate, and the fundamentals of State.
Pre-requisite: ---

ARAB 101 - Language Skills *2(2-0-0)*
The original and secondary parsing, the dual, the five verbs, masculine and feminine, (the weak letter), etymology and the semantic evolution, nunation of accusative, diptote the original and secondary parsing, apocopate and jussive, dative/ genitive, verbal sentences, the signification of tenses, the passive verb (its signification and its forms in present and past verbs), the nominal sentences, the pronouns, the neglected letters, the conjunctions, numbers (how to write them).
Pre-requisite: ---

ARAB 103 - Expository Writing *2(2-0-0)*
Applications in reading and speaking skills, the adverb of time and the adverb of place, accusative of explanation (specification), Punctuations, computer-based writing, dictionaries and E-dictionaries, applications to reading and writing skills, accusative of cause or reason, denotative of state (circumstantial accusative or accusative of the state or condition), writing a paragraph and essay, application to reading and writing skills, appositions (adjective/ corroboration/ substitute/ explanatory apposition and syndetic explicative, diminutive (nomen deminutivum), applications in reading and writing skills, relation quiescence (pause), completion fifth text's exercises, and writing formal and informal letters.

6.3 College Requirements

MATH 106 - Integral Calculus *3(3-2-0)*
The definite integral, fundamental theorem of calculus, the indefinite integral, change of variable, numerical integration. Area, volume of revolution, work, arc length. Differentiation and integration of inverse trigonometric functions. The logarithmic, exponential, hyperbolic and inverse hyperbolic functions. Techniques of integration: substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions. Indeterminate forms, improper integrals. Polar coordinates.

Pre-requisites: MATH 150

MATH 107 – Vectors and Matrices *3(3-2-0)*
Vectors in two and three dimensions, scalar and vector products, equations of lines and planes in space, surfaces, cylindrical and spherical coordinates. Vector valued functions, their

limits, continuity, derivatives and integrals. Motion of a particle in space, tangential and normal components of acceleration. Functions in two or three variables, their limits, continuity, partial derivatives, differentials, chain rule, directional derivatives, tangent planes and normal lines to surfaces. Extrema of functions of several variables, Lagrange multipliers. Systems of linear equations, matrices, determinants, inverse of a matrix, Cramer's rule.

Pre-requisites: MATH 150

MATH 203: Differential and Integral Calculus *3(3-2-0)*

Infinite series, convergence and divergence of infinite series, integral test, ratio test, root test and comparison test. Conditional convergence and absolute convergence, alternating series test. Power series, Taylor and Maclaurin series. Double integral and its applications to area, volume, moments and centre of mass. Double integrals in polar coordinates. Triple integral in rectangular, cylindrical and spherical coordinates and applications to volume moment and centre of mass. Vector fields, line integrals, surface integrals, Green's theorem, the divergence theorem, Stoke' theorem.

Pre-requisites: MATH 106 and MATH 107

MATH 204 - Differential Equations *3(3-2-0)*

Various types of first order equations and their applications. Linear equations of higher order. Systems of linear equations with constant coefficients, reduction of order. Power series methods for solving second order equations with polynomial coefficients. Fourier series, Fourier series for even and odd functions. Complex Fourier series. The Fourier integral.

Pre-requisites: MATH 203

MATH 254 - Numerical Methods *3(3-2-0)*

Various numerical methods for solving nonlinear equations. Direct and iterative methods for solving systems of linear equations along with error estimate. Polynomial interpolation with error formula. Numerical differentiation and integration with error terms. An introduction to numerical solution of ordinary differential equations.

Pre-requisites: MATH 107, GE 211

STAT 324 - Engineering Probability and Statistics *3(3-1-0)*

Probability and probability distribution - Mathematical expectations of random variables. Discrete and continuous distributions. Sampling distributions - Estimation, testing of hypothesis - Regression and correlation.

Pre-requisites**:** None

PHYS 103 - General Physics (1) *4(3-0-2)*

Introduction (Vectors), Motion in one dimension with constant acceleration, Motion in two dimension with application to projectile motion and circular motion, Newton’s Laws of Motion, Work and Energy, Potential Energy and conservation of Energy, Linear Momentum and Collisions, Rotation of rigid object about a fix axis

Pre-requisites**:** None

PHYS 104 - General Physics (2) *4(3-0-2)*

Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance and dielectric, currents and resistance, electrical energy and power, direct current circuits, Kirchhoffs rules, magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field, Ampere's law, Faraday's law of induction, self inductance, energy in a magnetic field, mutual inductance, alternating current circuits, the RLC series circuit, power in an A.C. circuit, resonance in RLC services circuit.

Pre-requisites**:** None

CHEM 101 - General Chemistry *4(3-0-2)*

Stoichiometry: SI Units, chemical formulas, the mole, methods of expressing concentration, Calculations based on chemical equations. Gases: laws, kinetic theory, deviation and van der Waals equation. Thermochemistry: Types of enthalpy changes, Hess Law and its applications,, first law of thermodynamics. Solutions: Type of solutions and laws related , colligative properties. Chemical kinetics: Law of reaction rate, reaction order, factors affecting the rates. Chemical Equilibrium : Relation between Kc & Kp, Le Chatelier's principle and factor affecting equilibrium. Ionic equilibrium: Acid and base concepts, pH calculations of acid, base and buffer solutions. Atomic Structure: emission spectrum, Bohr's theory de Broglre's hypothesis, quantum numbers, electronic configuration of elements, consequences of the periodic table.

Pre-requisites**:** None

ENGL 107 - Technical Writing *3(3-0-0)*

Types of documents. Principles of organizing, developing and writing technical information. Report structure and components. Report forms and rhetorical patterns common to scientific and technical Disciplines. Technical writing conversions including headings, illustrations, style and tone. Extensive writing assignments for various report and document types.

Pre-requisites: None.

ENGL 108 - Communication Skills for Engineers *3(3,0,0)*

Searching, compiling, referencing and writing ethics. Guidelines for good written communication. Guidelines for slide preparation and good oral presentation. Delivering successful speeches. Writing memos and business letters. Introduction to academic and business proposals. Guidelines for writing CV's, successful interviews and job search skills. Group dynamics, effective meetings, team-work, leadership and management skills. Engineering ethics and professional conduct.

Pre-requisites: None.

GE 104 - Basics of Engineering Drawing *3(2,0,2)*

Constructional geometry and basics of lettering; Sketching; Orthographic projection; Sectional and auxiliary views; Dimensioning; Introduction to computer graphics; Engineering applications.

Pre-requisites: None.

GE 105 - Introduction to Engineering Design *2(1,1,2)*

Introducing and practicing the engineering professional culture and ethics. Enhancing on personal skills such as teamwork, leadership, written and oral presentation. Introduction to design process. Techniques for stimulation of ideas. Human factors in design. Intellectual property.

Pre-requisites: GE 104.

GE 201 - Statics *3(3,1,0)*

Force systems; vector analysis, moments and couples in 2D and 3D. Equilibrium of force systems. Analysis of structures; plane trusses and frames. Distributed force system; centroids and composite bodies. Area moments of inertia. Analysis of beams. Friction.

Pre-requisites: MATH 106 and MATH 107.

GE 202 – Dynamics *3(3,1,0)*

Kinematics of a particle: curvilinear motion, and relative motion; Kinematics of a rigid body in plane motion: relative velocity and acceleration, and rotating axes; Kinetics of particles: Newton's law, work and energy, impulse and momentum, and impact; Kinetics of a rigid body in plane motion: translation, fixed axis rotation, general motion, work and energy, and impulse and momentum.
Pre-requisites: GE 201

GE 211 - Computer Programming using C++ *3(2,0,2)*

Introduce the students to basic concepts of both procedural and object-oriented programming using the C++ programming language, provide them with basic techniques to formulate problems, and implement the solutions using C++. Develop, write, test, and debug computer programs in C/C++ for solving engineering problems.

Pre-requisites: *None*.

GE 302 – Industry & Environment *2(2,0,0)*

Introduction to environmental problems and their anthropogenic causes, with emphasis on the causes, effects, and controls of air, water, and land pollution. The political, ecological, economic, ethical, and engineering aspects of environmental pollution and control are discussed. Topics include: water and air pollution, global climate changes, hazardous chemicals, radioactive materials and wastes, and noise pollution. Demonstration of pollution measuring techniques.

Pre-requisites: PHYS 104, CHEM 101, MATH 107

GE 403 Engineering Economy *2(2,1,0)*

Cost concepts. Time value of money operations. Measuring the worth of investments. Comparison of alternatives. Depreciation. Economic analysis of public projects.

Pre-requisites: *None*.

GE 404 Engineering Management *2(2,1,0)*

This course is in an introductory course on project management. The course covers the project management process from the beginning to the end, focusing on practical skills that make students able to immediately complete projects on time and on budget, while achieving their targets.

Pre-requisites: None

6.4 Additional Courses required by Mechanical Engineering Program

EE 308 Electrical Circuits and Machines *3(3,0,0)*

6.5 Mechanical Engineering Courses

6.5.1 Core Courses

ME 201 Geometric Modeling in Engineering *2(1,0,3)*

Principles and techniques of 3D surface and solid modeling; Feature-based and constraint-based modeling systems; Data transfer between systems; Relationship of geometric modeling to manufacturing; Analysis and rapid prototyping; Development of 2D drawing from the solid model database: Design annotation including mechanical fastener specification, geometric Dimensioning and tolerancing.
Prerequisite: GE 104

ME 254 Materials Engineering *4(3,1,2)*

Introduction to materials engineering; Atomic bonding; Structure and characteristics of metals; polymers and ceramics; Imperfections; Diffusion; Mechanical properties of metals, polymers, ceramics; Equilibrium-phase diagrams; Microstructures of alloys; Heat treatment of plain-carbon steels, cast irons and precipitation hardening.
Prerequisite: CHEM 101, PHYS 104

ME 304 Mechanical Engineering Design (1) *3(3,1,0)*

Introduction to design: design process, problem formulation, engineering model, factors of safety and codes, overall design considerations; Stresses: stress concentration factors, residual stresses; Deflection and Stiffness; Stability and Buckling; Theories of failure: failure under static loading, fatigue loading; fracture mechanics.
Prerequisite: ME 352

ME 305 Mechanical Engineering Design (2) *4(3,1,2)*

Design of Mechanical Elements: Screws and Fasteners; Joining Components and Methods; Springs; Gears: Spur, Helical; Shafts, Brakes and Clutches, Flexible elements; Rolling Element Bearings; Journal Bearings.
Prerequisite: ME 304

ME 311 Manufacturing Processes *4(3,1,2)*

Manufacturing: introduction, design for manufacture and assembly, basic manufacturing processes, roles of engineers in manufacturing, Metal Casting Processes and Equipment:, Solidification of metals, Expandable mould casting processes, Multiple-use-mould casting,

melting and pouring, Metal forming processes: Bulk forming processes, Sheet forming processes, Machining processes: Conventional machining processes: Turning, Drilling, Milling, Grinding; Joining and assembly processes: Fusion welding processes, Solid state welding, adhesive bonding and mechanical fastening.
Prerequisite: ME 254, Co-requisite ME 352

ME 321 Mechanical Measurements *2(1,1,2)*
Measuring concepts; Uncertainty analysis; Instrumentation specifications; Analog and digital signal analysis including LabView tutorials; Data collection and analysis; Applications on measurements.
Co requisite: ME 383, STAT 324

ME 322 Mechanical Engineering Lab I *2(1,0,2)*
The design, execution, and evaluation of physical experiments in the area of fluid mechanics, thermodynamics and heat transfer. Emphasis on application of classroom theory to experimental engineering and on interpretation and presentation of results.
Prerequisite: ME 321
Co requisite: ME 375

ME 323 Mechanical Engineering Lab II *2(1,0,2)*
The design, execution, and evaluation of physical experiments in the area of solid mechanics, dynamics of physical systems and control. Digital simulation of linear systems using a software package (MATLAB). Emphasis on application of classroom theory to experimental engineering and on interpretation and presentation of results.
Prerequisite: ME 321
Co requisite: *ME 364*

ME 352 Mechanics of Materials *3(3,1,0)*
Study of the mechanical behavior of solid bodies (Rods, shafts, beams, etc.) under various types of loading. Mechanical and thermal stresses and strains; Stress-strain relations; Axial deformation; Shear and bending moments in beams; Stresses in beams; Torsion of shafts, thin walled vessels; Combined loadings; Analysis of plane stress and plane strain; Stress and strain transformation.
Prerequisite: GE 201

ME 363 Mechanics of Machinery *3(3,1,0)*
Topological characteristics of planar mechanisms; Degree-of-freedom; Position, velocity and acceleration analysis of linkages: graphical and analytical methods; Static and dynamic force analysis of machinery: graphical and analytical methods; Flywheels; Cam mechanisms; Law of gearing; Simple and planetary gear trains; Term project.
Prerequisites: GE 202

ME 364 System Dynamics and Control *3(3,1,0)*
Modeling of physical systems: mechanical, electrical, hydraulic, pneumatic, and thermal systems; Laplace Transformation; Transfer Functions and Block diagrams; Basic concepts of automatic control; Dynamic system response (time and frequency domains), and stability.
Prerequisite: GE 202

ME 371 Thermodynamics I *3(3,1,0)*
Basics concepts; Energy transfer; First law of thermodynamics; Second law of thermodynamics; Entropy; Carnot and reversed Carnot cycles; Rankine cycle; Vapor compression refrigeration cycle.
Prerequisites: PHYS 104

ME 374 Thermodynamics II *2(2,1,0)*
Availability; Ideal gas mixtures; Gas-vapor mixtures; Reciprocating gas compressors; Combustion; Gas power cycles.
Prerequisite: ME 371

ME 375 Heat Transfer *3(3,1,0)*
Steady and unsteady one and two-dimensional heat conduction; Numerical analysis of steady and unsteady conduction; Free and forced convection for external and internal flows; Heat exchangers; Properties and processes of radiation, radiation exchange between surfaces.
Prerequisite: ME 383

ME 376 Thermal - Fluid Systems *2(2,1,0)*
Design of piping systems; Performance and selection of pumps, compressors and fans; Estimating heating and cooling loads in buildings; Selection of thermal-fluid system components.
Prerequisite: ME 375

ME 383 Fluid Mechanics *3(3,1,0)*
Dimensions and units; Fundamental concepts in fluids; Fluid statics; Control volume; Conservation of mass and momentum equations; Differential form of equations; Stream function and velocity potential; Euler's equations; Bernoulli's equation; Dimensional analysis and model studies; Internal incompressible viscous flow; External viscous flow.
Prerequisite: ME 371

ME 496 Graduation Project -1 *2(2,0,0)*
Graduation project (ME 496 and ME 497) is a two-semester capstone experience in which Mechanical Engineering seniors tackle open-ended engineering problems and formulate solutions. During the first semester (ME 496) students are required to propose or select a project, select an advisor, and submit a pre-proposal. The major deliverable at the end of the first semester is a comprehensive proposal that includes details of the background research, tasks, timelines, budget, preliminary feasibility studies, and bread-boarding. Ethics in engineering practice and research, and professionalism are emphasized. Team design projects are highly encouraged.
Prerequisite: Senior standing

ME 497 Graduation Project -2 *2(2,0,0)*
Continuation of the project started in ME 496. Oral presentation, posters/demonstration, and submission of final written report of the project are essential requirements for the completion of the course.
Prerequisite: ME 496

6.5.2 Elective Courses

ME 402 Finite Element Method *3(2,0,2)*
Finite element solutions to one- and two-dimensional mechanical engineering problems in solid mechanics, heat transfer, and vibrations; Galerkin's and variational finite element models; Commercial finite element analysis software ANSYS.
Pre-requisites: ME 304, ME 375
Co-requisites: ME 364

ME 403 Technology-Based Entrepreneurship *3(3,0,0)*
Concentrates on hands-on aspects of innovation and entrepreneurial enterprise development. Examines relationships between innovation, iterative prototyping, and marketing testing. Students identify market opportunities, create new technology-based products and services to satisfy customer needs, and construct and test prototypes.
Pre-requisites: ME 305

ME 404 Computer-Aided Design *3(3,0,0)*
Introduction to the use of the digital computer as a tool in engineering design and analysis of mechanical components and systems. Simulation of static, kinematic and dynamic behavior. Optimal synthesis. Computer generation of geometric models, calculation of design parameters, trade-off diagrams, and finite-element modeling and analysis. Structural component design using industry-standard software. Term projects.
Pre-requisites: ME 305

ME 405 Conceptual Design *3(3,0,0)*
Systematic approach to design problems, morphology of design, feasibility study, preliminary design phase, detailed design phase, generation of ideas, evaluation of design concepts, use of computer techniques, designing for production, designing for ease of maintenance, assembly and detail drawings, reverse engineering. Term design projects.
Pre-requisites: ME 304

ME 406 Design optimization *3(3,0,0)*
Optimum design problem formulation to Mechanical Engineering systems. Optimum design concept. Linear programming. Numerical methods for unconstrained and constrained optimum design, Lagrange method.
Pre-requisite: ME 304, ME 375

ME 408 Friction, Wear and Lubrication *3(3,0,0)*
Study of principles of friction and wear behavior of materials and of those material properties that affect such behavior. Principles of lubrication. Applications to design of surfaces for wear resistance.
Pre-requisites: ME 305

ME409 Materials Selection in Design *3(3,0,0)*

Classification of all engineering material; Materials properties; Performance indices; Materials selection charts; Performance indices with geometry factors; Case studies
Pre-requisite: ME 305

ME 411 Modern Manufacturing Processes *3(3,0,0)*
Gear and thread manufacturing; Non-conventional metal cutting; Electro-chemical machining; Electro discharge machining; Laser beam machining; Electron beam machining; Water jet machining; Rapid Prototyping; micro system product; micro fabrication processes; Property enhancing of metals; cleaning and surface treatment; Coating and deposition processes; Thermal and mechanical coating; Processing of integrated circuit.
Pre-requisites: ME 311

ME 412 Metal Forming and Metal Cutting Analysis *3(3,0,0)*
Introduction: forming processes in industry, classification of forming processes, objectives of metal forming analysis. Yielding under combined stresses; Basic analytical methods; determination of flow patterns in metal forming; formability of sheet metals. Theory of metal cutting: mechanics of metal cutting, shear angle relationships, theory of Ernst and Merchant; Temperature in metal cutting; Cutting tool geometry; Tool wear and tool life: types of wear, effects of cutting parameters, cutting fluids; Economics of metal cutting.
Pre-requisites: ME 311

ME 413 Manufacturing Systems *(3,0,0)*
NC machines, basic principles; Numerical control and industrial robotics; Group technology and flexible manufacturing systems; Production lines; Machining centers; High speed machining; Manufacturing engineering: Process planning; Problem solving and continuous improvement; Concurrent engineering design for manufacturability; Production planning and control; Quality control.
Pre-requisites: ME 311

ME 414 CNC machines *3(2,0,2)*
Introduction to Computer Numerical Control Machining; Coordinates, Axes, and Motion, CNC Systems, CNC Controls, Operating a CNC Machine, Program Planning, Level-One Programming, Level-Two Programming, Setting Up a CNC Machine, Computer-Assisted Machining (CAM) Programming, Statistical Process Control (SPC), Computer Coordinate Measuring.
Pre-requisites: ME 311

ME 431 Aerodynamics *3(3,0,0)*
Fundamental principles and equations of inviscid incompressible flow; Conformal transformations; Flow over airfoils; Thin airfoil theory; Kutta condition; Panel methods; Flow over finite wings: lifting-line theory; Vortex lattice method.
Prerequisite: ME 383

ME 432 Introduction to Flight Mechanics. *3(3,0,0)*
Properties of standard atmosphere; Airfoils, wings, and other aerodynamic components; Lift, drag, and moments; Equations of motion; Airplane performance: Rate of climb, range, endurance, take off, and landing; Stability and control; Astronautics.
Prerequisites: ME 383

ME433 Introduction to Aeroelasticity *3(3,0,0)*
Introduction to aeroelasticity; Static aeroelasticity: twisting of a typical wing section, straight wing in a wind tunnel, straight wing aircraft, swept wing aircraft; Dynamic aeroelasticity: Review of vibration problems, Static and dynamic instabilities, Flutter of a typical wing section.
Prerequisites: ME 383

ME 443 Principles of Refrigeration *3(2,0,2)*
Vapor - compression refrigeration systems: standard cycle and its modification, compressors, condensers, evaporators, expansion devices, system analysis, multipressure systems; Absorption refrigeration systems: Lithium-Bromide system, cycle and improvements, combined systems; Aqua-Ammonia systems.
Prerequisite: ME 374

ME 444 Air Conditioning *3(3,0,0)*
Air conditioning systems; HVAC applications; Basic air conditioning processes; Indoor air quality; Heat transmission in buildings; Solar radiation; Load calculations; Pipes and ducts design; Air distribution; Equipment selection; HVAC control.
Co requisite: ME 375

ME 451 Mechanical Behavior of Materials *3(3,0,0)*
Fundamentals of elastic, viscoelastic and plastic deformation of materials; the elementary theory of static and dynamic dislocations; fracture, fatigue, creep; strengthening mechanisms.
Pre-requisites: ME 304

ME 452 Physical Metallurgy *3(3,0,0)*
Structure and Phase; Melting and Solidification; Phase diagrams; Heat treatment; Classification of metals and Alloys: Ferrous and Non-ferrous alloys; Deformation and Annealing Processes; Corrosion and Corrosion Protection
Pre-requisites: ME 254

ME 453 Intermediate Mechanics of Material *3(3,0,0)*
Review of energy methods, Betti's reciprocal theorem; bending of beams of asymmetrical cross-section; shear center and torsion of thin-walled sections; membrane stresses in axisymmetric shells; elastic-plastic bending and torsion; axisymmetric bending of circular plates; elastic, bending of rectangular and circular plates, including asymmetric problems; beams on elastic foundations; axisymmetric bending of cylindrical shells; Analysis of torsion: non-circulation sections.
Pre-requisites: ME 304

ME 454 Aircraft Structures *3(3,0,0)*
Energy methods of structural analysis, bending of thin plates, structural instability, aircraft structure, airframe loads, bending, shear, and torsion of open and close thin-walled beam. Stress analysis of aircraft components, matrix methods of structural analysis, mechanical properties of vehicle materials, strength-weight comparisons of materials. Term Projects
Pre-requisite: ME 304

ME 455 Automotive Structures *3(3,0,0)*
Energy methods of structural analysis, bending of thin plates, structural instability, Automotive structures, loads, bending, shear, and torsion of open and close thin-walled beam.

Stress analysis of automotive components, mechanical properties of vehicle materials, body requirement, aluminum body design, plastic scale modeling. Term Projects
Pre-requisite: ME 304

ME 456 Introduction to Composite Materials *3(3,0,0)*
Stress and strain analysis of continuous fiber composite materials. Orthotropic elasticity, lamination theory, failure criterion, and design philosophies, as applied to structural polymeric composites.
Pre-requisites: ME 304

ME 462 Mechanical Vibrations *3(3,0,0)*
Single degree of freedom systems: undamped and damped free vibrations and forced vibrations, multi-degree of freedom systems, vibration absorbers and isolators, basics of rotating machinery fault diagnosis.
Pre-requisite: ME 364

ME 463 Automatic Control *3(3,0,0)*
Introduction to feedback control systems; Representation of control system components; Feedback control design and analysis for linear dynamic systems with emphasis on mechanical engineering applications; transient and frequency response; stability; system performance; Lead and lag compensations; state-space design techniques; introduction to digital control systems; Term project.
Pre-requisite: ME 364

ME 465 Mechatronics *3(2,0,2)*
Electromechanical system modeling, control and applications. Design of electronic interfaces and controllers for mechanical devices. Sensor technology, signal acquisition, filtering, and conditioning. Microcontroller-based closed-loop control and device communications. Sensor and actuator selection, installation, and application strategies.
Pre-requisite: ME 364
Co-requisite: ME 463

ME 466 Rotating Machinery *3(3,0,0)*
Techniques and analysis issues associated with the dynamics, operation, and maintenance of rotating machinery with a focus on turbomachinery issues; Vibration analysis, introductory rotor dynamics, oil and wear particle sampling, gearbox and bearing issues, and industrial case studies; Monitoring instrumentation in common use throughout the petrochemical and power generation industries.
Prerequisite: ME 364

ME 467 Introduction to Robotics *3(3,0,0)*
Definitions, popular robots, history of technology, and future robots. Planar and spatial rigid body motion. Robot configurations, links, joints, geometry, and coordinates. Forward kinematics and inverse kinematics of planar, 3-R wrist, and 3D robots. Robot Jacobian, trajectory planning, statics and gripping, and dynamics and control.
Pre-requisite: ME 363

ME 468 Mechanisms and Linkage Design *3(3,0,0)*
Introduction and mobility of spatial mechanisms. Analytical position, velocity and acceleration of planar linkage mechanisms using vector loop equation. Linkage analytical

synthesis. Motion and force analysis of mechanisms using homogeneous transformation and matrix method. Term Project
Pre-requisites: ME 363

ME 469 Automotive Engineering *3(3,0,0)*
Systems approach to automotive design. Automotive structures, suspension systems, steering, brakes, and driveline. Basic vehicle dynamics in the ride and handling modes. Team-based design project.
Pre-requisites: ME 304
Co- requisite: ME 364.

ME 471 Power Plants *3(3,0,0)*
Steam cycles; Reheat and Regenerations; Condensers; Cooling Towers; Steam Turbines and Turbine Governing; Steam Generators; Simple Gas Turbine Cycles; Combined and Cogeneration cycles; Power Plant Load Curves.
Pre-requisite: ME 374

ME 473 Introduction to Combustion *3(3,0,0)*
Description of the mechanisms by which fuel and oxidizers are converted into combustion products. Applications to practical combustion devices such as Otto, Diesel, gas turbine, and power plant combustion systems. Consideration of combustion generated air pollution and combustion efficiency.
Prerequisites: ME 374

ME 474 Internal Combustion Engines *3(2,0,2)*
Air standard cycle approximation; Fuel air cycle analysis; Actual engine cycles; Engine friction; Detonation; Air capacity performance and supercharging; Performance tests for SI and CI engines.
Prerequisite: ME 374

ME 476 Solar Energy *3(3,0,0)*
Introduction; Solar radiation; Solar collectors: Flat plate, Concentrating parabolic, Photovoltaic; Thermal analysis and performance of solar collectors; Solar energy applications: Water heating, Desalination, Refrigeration.
Pre-requisites: *375*

ME 477 Energy Conversion Systems *3(3,0,0)*
High efficiency combined cycles; renewable energy systems; direct energy conversion and fuel cells; nuclear energy; hydrogen as an energy carrier; energy storage; environmental effects and control.
Pre-requisites: *375*

ME 478 Design of Energy Systems *3(3,0,0)*
Review of piping systems and prime movers; design of heat exchangers; evaluation of system performance; system simulation; system optimization; economic evaluation including capital and operating cost estimations and evaluation of investment opportunities.
Pre-requisites: *375*

ME 479 Water Desalination *3(3,0,0)*

Fundamentals of water desalination; thermal methods of desalination: MSF, MED, Freezing, Vapor compression, humidification-dehumidification, solar still; Reverse Osmosis, Electro dialysis, Membrane evaporation desalination, Nanotechnology and desalination.
Pre-requisites: *375*

ME 481 Introduction to Computational Fluid Dynamics *3(2,0,2)*
Classification of partial differential equations; finite volume methods; modeling of physical processes including fluid flow and heat and mass transfer; computational grids; assessment of stability and accuracy of numerical solutions, use of general purpose computer codes.
Prerequisites: ME 383

ME 482 Gas Dynamics *3(3,0,0)*
Derivation and review of basic equations of compressible fluid flow; Reduction of the general problem to 1-D flow; 1-D flow in nozzles with and without friction; 1-D flow with heat addition; normal shock and oblique shock waves.
Prerequisites: ME 383

ME 483 Introduction to Propulsion *3(3,0,0)*
Basic one-dimensional flow isentropic flow with area change, Construction details, working and performance characteristics of propellers, ramjets, turbojets, turbofans, turboprop jets. Performance analysis of inlets, exhaust nozzles, compressors, burners, and turbines. The thrust equation - Factors affecting thrust - Effect of pressure, velocity and temperature changes of air entering compressor - Methods of thrust augmentation. Performance characteristics of rockets engine. Liquid and solid propellant rocket motors. Performance of rocket flight, Single and multi-stage chemical rockets.
Pre-requisites: ME 383

ME 485 Fluid Machinery *3(3,0,0)*
Fundamental equations of fluid flow; Euler equation of turbomachinery; Efficiency definitions of turbomachines and their components; Axial-flow turbomachinery; Radial-flow turbomachinery; 3D flow considerations.
Pre-requisite: ME 383

ME 487 Air Pollution Control *3 (3,0,0)*
Fundamental chemical and physical principles of generation and control of air pollutants, Fluid-Particulate Dynamics, Applications to pollution control equipment: Gravity Settlers; Centrifugal Separators; Fabric Filters; Pollutant and particle formation during combustion; Gas adsorption and absorption fundamentals and tower/column design, Pollution control strategies
Pre-requisites: *ME 383*

ME 493 Selected Topics in Mechanical Engineering (1) *3*
Pre-requisites: *Completion of 100 credits hours after preparatory year*

ME 494 Selected Topics in Mechanical Engineering (2) *3*
Pre-requisites: *Completion of 100 credits hours after preparatory year*

Appendix A

Codes of Courses

The courses' code consists of symbol (ME) and a number. The number contains three digits and can be represented as follows:

a) The first digit indicates the level of the courses:
   1 Primarily, introductory and beginning courses.
   2 Intermediate-level courses.
   3 Advanced-intermediate-level courses.
   4 Advanced-level courses.

b) The second digit indicates the field:
   0 Mechanical Engineering Design
   1 Manufacturing Processes
   2 Experimentation and Labs
   3 Aerodynamics Engineering
   4 Air-conditioning Engineering
   5 Materials Engineering
   6 Dynamics, Vibration and Control of Mechanical Systems
   7 Thermal Sciences/Engineering
   8 Fluid Sciences/Engineering
   9 Senior Project and Selected Topics

c) The third digit indicates a course sequence.