KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING DEPARTMENT

BACHELOR OF SCIENCE IN
MECHANICAL ENGINEERING
Academic Plan

1439 H
2018 G

***Approved by*:** Chairman: …… Dean: ……

KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING DEPARTMENT

1. INTRODUCTION

The Mechanical Engineering Department 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 Mechanical Engineering Department 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.

The department of mechanical engineering employs about 38 full-time staff members with Ph.D. degrees in Mechanical Engineering or closely related fields who teach all courses offered by the department. The faculty represents a diversity of curricular and research expertise, educational and industrial backgrounds, and cultures. Faculty competence can be judged by factors such as education, diversity of backgrounds, registered professional engineers, engineering experience, teaching experience, participation in professional societies, and level of scientific research.

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.

The mechanical Engineering Program was accredited twice in 2009 and 2015 by the Accreditation Board for Engineering and Technology (ABET). In addition, it was

accredited by the National Commission for Academic Accreditation & Assessment (NCAAA) in 2015.

2. BACHELOR OF SCIENCE in MECHANICAL ENGINEERINGPROGRAM

The Bachelor of Science in Mechanical Engineering at the College of Engineering, King Saud University, is a five years' program, including the first common year, which are divided to ten semesters.

2.1 Course Requirements (165 credit hours)

To complete the graduation requirements for a B. Sc. in Mechanical Engineering, the students are required to successfully pass a total of 165 credit hours with minimum GPA of 2.75 of 5. The program is divided into:

- 32 credit hours of Common First Year Requirements. The breakdown is shown in Table 2.
- 8 credit hours of University requirements (Table 3) of which:
  - 2 credit hours are compulsory (Table 3-A)
  - 6 credit hours are elective to be taken from IC courses (Table 3-B).
- 51 credit hours of College requirements (Table 4) of which:
  - 40 credit hours are compulsory courses for all departments (Table 4-A)
  - 9 credit hours of additional courses from a list of optional courses offered by the College of Engineering (Table 4-B)
  - 2 credit hours of free courses to be taken by the student from any college but not from his department (Table 4-C)
- 74 credit hours of departmental requirements (Table 5) of which:
  - 54 credit hours are core courses (Table 5-A),
  - 4 credit hours of graduation project (Table 5-B),
  - 3 credit hours for an electrical engineering course (Table 5-C),
  - 12 credit hours for elective courses (Table 5-D, Table 5-E),
  - 1 credit hour (NP, no-grade, pass or fail) of practical training (Table 5-F).
  - The department provides its students with a chance to register a zero credit hour, no-grade course in research project (Table 5-G); this course is NOT required for graduation.

In the course numbering for the Mechanical Engineering curriculum, code of courses was selected as illustrated in Appendix A.

2.2 Senior Graduation Project Requirements (4 credit hours)

The graduation project is divided into two parts (2 credit hours each). The student is eligible to register for Senior Graduation Project-1 if he completes successfully at least 129 credit hours including the CFY (or 97 credit hours excluding the CFY) and successfully passing ALL courses at level 7 and below (levels 1-7). The Senior Graduation Projects (1 and 2) can only be taken during the first and second semesters (not during summer semester).

2.3 Practical Training Requirements (1 no-grade credit hour)

Students in the department are required to complete a 10 weeks practical training requirement in an area related to Mechanical Engineering. Prior to undertaking the practical training program, the student must obtain the approval of the department and he must have completed, successfully, at least 110 credit hours including the CFY (or 78 credit hours excluding the CFY). Students enrolling in the practical training program are not allowed to take simultaneously any course or the graduation project.

A typical plan of study for a B. S. in Mechanical Engineering is presented in Table 6.

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

Requirements	Cr. Hr.	Description
Common First Year	**32**	General Chemistry (4) Differential Calculus (3) Introduction to Statistics (3) English (12) Writing Skills (2) University Skills (3) IT Skills (3) Entrepreneurship (1) Health and Fitness (1)
University	**8**	**Islamic Studies**: Compulsory (2) Elective (6)
College	**51**	Common (40) Additional (9) Free course (2)
Department	**74**	Core (54) Graduation Project (4) Electric Circuits (3) Electives (12) Practical training (1, NP) Research Project (0, NP)
Total	**165**	

Table 2 Common First Year (32 credit hours)

Level 1			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 100	English language	6(6,9,0)	
MATH 101	Differential Calculus	3(3,1,0)	
ENT 101	Entrepreneurship	1(1,0,0)	
CHEM 101	General Chemistry	4(3,0,2)	
ARAB 100	Writing Skills	2(2,0,0)	
Total		**16**	

Level 2			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 110	English	6(6,9,0)	
CUR 101	University Skills	3(3,0,0)	
CT 101	IT skills	3(0,0,6)	
STAT 101	Introduction to Statistics	3(2,2,0)	
EPH 101	Health & fitness	1(1,1,0)	
Total		**16**	

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

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Table 3 UNIVERSITY REQUIREMENTS (TOTAL 8 CREDIT HOURS)

TABLE 3-A: COMPULSORY COURSE (2 CREDIT HOURS)

Course Code	Course Title	Cr. Hr.	Nature
IC 107	Ethics of the Profession	2	Compulsory
Total		**2**	

TABLE 3-B: ELECTIVE COURSES

(The student must choose 3 courses (6 hours) from the list below)

Course Code	Course Title	Cr. Hr.	Nature
IC 100	Studies in Prophet Biography	2	Elective
IC 101	Origins of Islamic Culture	2	Elective
IC 102	Family in Islam	2	Elective
IC 103	The Economic System in Islam	2	Elective
IC 104	The Political System in Islam	2	Elective
IC 105	Human Rights	2	Elective
IC 106	Medical Jurisprudence	2	Elective
IC 108	Contemporary Issues	2	Elective
IC 109	Role of Women in Development	2	Elective
QURN 100	Quran Kareem	2	Elective
Total		**6**	

Table 4 COLLEGE REQUIREMENTS (51 CREDIT HOURS)

Table 4-A COLLEGE COMPULSORY COURSES (40 CREDIT HOURS)

Course Code	Course Title	Cr. hr. (X,Y,L)	Pre-requisites
MATH 106	Integral Calculus	3 (3,2,0)	MATH 101
MATH 107	Vectors and Matrices	3 (3,2,0)	MATH 101
MATH 203	Differential & Integral Calculus	3 (3,2,0)	MATH 106; MATH 107
MATH 204	Differential Equations	3 (3,2,0)	MATH 203
PHYS 103	General Physics (1)	4 (3,0,2)	
PHYS 104	General Physics (2)	4 (3,0,2)	PHYS 103
ENGL 109	Language & Communication	2 (2,1,0)	
ENGL 110	Technical Writing	2 (2,1,0)	ENGL 109
GE 201	Statics	3 (3,1,0)	MATH 106; MATH 107
GE 104	Basics of Engineering Drawing	3 (2,0,2)	
GE 106	Introduction to Engineering Design	3 (2,1,2)	GE 104
GE 203	Engineering and Environment	2 (2,0,0)	CHEM 101; MATH 101
GE 402	Engineering Projects Management	3 (3,1,0)	
GE 403	Engineering Economy	2 (2,1,0)	
Total		**40**	

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

Table 4-B COLLEGE ADDITIONAL COURSES FOR ME PROGRAM (9 CREDIT HOURS)

Course Code	Course Title	Cr. hr. (X,Y,L)	Pre-requisites
MATH 254	Numerical Methods	3 (3,2,0)	MATH 107
GE 202	Dynamics	3 (3,1,0)	GE 201, PHYS 103
GE 211	Computer Programming using C++	3 (2,0,2)	
Total		**9**	

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

Table 4-C COLLEGE FREE COURSE (2 CREDIT HOURS)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
xxxxxx	Free elective course	2	
Total		**2**	

Table 5 MECHANICAL ENGINEERING REQUIREMENTS

TABLE 5-A CORE COURSES (54 CREDIT HOURS)

No.	Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
1	ME 201	Geometric Modeling in Engineering	2(1,0,2)	GE 104
2	ME 254	Materials Engineering	4(3,1,2)	CHEM 101, PHYS 104
3	ME 304	Mechanical Engineering Design (1)	3(3,1,0)	ME 352, ME 201
4	ME 305	Mechanical Engineering Design (2)	4(3,1,2*)	GE 106, ME 304
5	ME 312	Manufacturing Processes (1)	3(2,1,2)	ME 254 , ME 352
6	ME 313	Manufacturing Processes (2)	3(2,1,2)	ME 312
7	ME 321	Mechanical Measurements	2(1,1,2)	STAT 101, ME 384
8	ME 322	Mechanical Engineering Lab (1)	2(1,0,2)	ME 321, ME378
9	ME 323	Mechanical Engineering Lab (2)	2(1,0,2)	ME 321, ME 365
10	ME 352	Mechanics of Materials	3(3,1,0)	GE 201
11	ME 363	Mechanics of Machinery	3(3,1,0)	GE 202
12	ME 365	Dynamics of Mechanical Systems	3(3,1,0)	GE 202, MATH 204
13	ME 366	Automatic Control	3(3,1,0)	ME 365
14	ME 371	Thermodynamics (1)	3(3,1,0)	PHYS 104
15	ME 377	Thermodynamics (2)	3(3,1,0)	ME 371
16	ME 378	Heat Transfer	4(4,1,0)	ME 384
17	ME 379	Thermal-Fluid Systems	3(3,1,0)	ME377, ME 378
18	ME 384	Fluid Mechanics	4(4,1,0)	ME 371, MATH 204
	Total		**54**	

(X, Y, L) X = Lectures; Y = Tutorials; L = Lab. NP= No grade (Pass or Fail); * Studio

Table 5-B SENIOR DESIGN PROJECTS (4 CREDIT HOURS)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
ME 496	Graduation Project -1	2(2,0,0)	Completion of 129 cr. Hr. + completion of levels 1-7
ME 497	Graduation Project -2	2(2,0,0)	ME 496
Total		**4**	

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

Table 5-C Electrical Engineering Course (3 CREDIT HOURS)

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

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

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Table 5-D ELECTIVE COURSES (12 CREDIT HOURS)

(Each student is required to take 12 cr. hr. from the list of Mechanical elective courses)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
ME 4xx	Elective (1)	3	
ME 4xx	Elective (2)	3	
ME 4xx	Elective (3)	3	
ME 4xx	Elective (4)	3	
Total		**12**	

Table 5-E LIST OF MECHANICAL ELECTIVE COURSES

(Each student is required to take 12 cr. hr. from the following list of ME elective courses)

No.	Code & Number	Course Title	Credit Hours (X,Y,L)	Pre-Requisites
1	ME 402	Finite Element Method	3(2,0,2)	*ME 304*
2	ME 404	Computer-Aided Design	3(3,0,0)	*ME 305*
3	ME 405	Conceptual Design	3(3,0,0)	*ME 304*
4	ME 406	Design Optimization	3(3,0,0)	*ME 304, ME 378*
5	ME 408	Friction, Wear and Lubrication	3(3,0,0)	*ME 304*
6	ME 409	Materials Selection in Design	3(3,0,0)	*ME 304*
7	ME 411	Modern Manufacturing Processes	3(3,0,0)	*ME 312*
8	ME 412	Metal Forming and Metal Cutting Analysis	3(3,0,0)	*ME 312*
9	ME 413	Manufacturing Systems	3(3,0,0)	*ME 313*
10	ME 414	CNC Machines	3(2,0,2)	*ME 313*
11	ME 415	Introduction to Railway Engineering	3(3,0,0)	*ME 305, ME 313*
12	ME 431	Aerodynamics	3(3,0,0)	*ME 384*
13	ME 432	Introduction to Flight Mechanics	3(3,0,0)	*ME 384*
14	ME 433	Introduction to Aeroelasticity	3(3,0,0)	*ME 384, ME 304*
15	ME 443	Principles of Refrigeration	3(2,0,2)	*ME 377*
16	ME 444	Air Conditioning	3(3,0,0)	*ME 378*
17	ME 451	Mechanical Behavior of Materials	3(3,0,0)	*ME 304*
18	ME 452	Physical Metallurgy	3(3,0,0)	*ME 254*
19	ME 453	Intermediate Mechanics of Materials	3(3,0,0)	*ME 304*
20	ME 454	Aircraft Structures	3(3,0,0)	*ME 304*
21	ME 455	Automotive Structures	3(3,0,0)	*ME 304*
22	ME 456	Introduction to Composite Materials	3(3,0,0)	*ME 304*
23	ME 460	Railway Systems Engineering	3(3,0,0)	*ME 365*
24	ME 462	Mechanical Vibrations	3(3,0,0)	*GE 202*
25	ME 465	Mechatronics	3(2,0,2)	*GE 202*
26	ME 466	Rotating Machinery	3(3,0,0)	*ME 365*
27	ME 467	Introduction to Robotics	3(3,0,0)	*ME 363*
28	ME 468	Mechanisms and Linkage Design	3(3,0,0)	*ME 363*
29	ME 469	Automotive Engineering	3(3,0,0)	*ME 365*
30	ME 472	Power Plants	3(3,0,0)	*ME 377*
31	ME 473	Introduction to Combustion	3(3,0,0)	*ME 377*
32	ME 474	Internal Combustion Engines	3(2,0 ,2)	*ME 377*
33	ME 475	Energy Efficiency	3(3,0,0)	*ME 371*
34	ME 476	Solar Energy	3(3,0,0)	*ME 378*
35	ME 477	Energy Conversion Systems	3(3,0,0)	*ME 378*
36	ME 478	Design of Energy Systems	3(3,0,0)	*ME 378*
37	ME 479	Water Desalination	3(3,0,0)	*ME 378*
38	ME 481	Introduction to Computational Fluid Dynamics	3(2,0,2)	*ME 384*

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39	ME 482	Gas Dynamics	3(3,0,0)	*ME 384*
40	ME 483	Introduction to Propulsion	3(3,0,0)	*ME 384*
41	ME 485	Fluid Machinery	3(3,0,0)	*ME 384*
42	ME 487	Air Pollution Control	3(3,0,0)	*ME 384*
43	ME 493	Selected Topics in Mechanical Engineering (1)	3(3,0,0)	*Completion of 129 Cr.Hr*
44	ME 494	Selected Topics in Mechanical Engineering (2)	3(3,0,0)	*Completion of 129 Cr. Hr*

(X, Y, L) X = Lectures; Y = Tutorials; L = Lab; NP=No grade (Pass or Fail)

Table 5-F PRACTICAL TRAINING REQUIREMENT (COMPULSORY; 1 NP)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
ME 999	Practical Training	1 (NP)	Successful Completion of 110 credit hours
Total		**1**	

NP= No grade (Pass or Fail)

Table 5-G ELECTIVE COURSE WITHOUT CREDIT HOURS (NP)

(This is an optional elective course with no credit hours; not required for the B.S. degree in ME)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
ME 998	Research Project	0 (NP)	Successful completion of 129 cr. hr.

Table 6 RECOMMENDED SEMESTER PLAN - MECHANICAL ENGINEERING PROGRAM*

Level 1			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 100	English language	6(6,9,0)	
MATH 101	Differential Calculus	3(3,1,0)	
ENT 101	Entrepreneurship	1(1,0,0)	
CHEM 101	General Chemistry	4(3,0,2)	
ARAB 100	Writing Skills	2(2,0,0)	
Total		**16**	

Level 2			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 110	English	6(6,9,0)	
CUR 101	University Skills	3(3,0,0)	
CT 101	IT skills	3(0,0,6)	
STAT 101	Introduction to Statistics	3(2,2,0)	
EPH 101	Health & fitness	1(1,1,0)	
Total		**16**	

Level 3			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
IC 1xx	Optional IC course	2(2,0,0)	
PHYS 103	General Physics (1)	4(3,0,2)	
MATH 106	Integral Calculus	3(3,2,0)	MATH 101
MATH 107	Vectors & Matrices	3(3,2,0)	MATH 101
ENGL 109	Language & Communication	2(2,1,0)	
GE 104	Basics of Engineering Drawing	3(2,0,2)	
Total		**17**	

Level 4			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
PHYS 104	General Physics (2)	4(3,0,2)	PHYS 103
ENGL 110	Technical Writing	2(2,1,0)	ENGL 109
MATH 203	Differential and Integral Calculus	3(3,2,0)	MATH 106 MATH 107
GE 106	Introduction to Engineering Design	3(2,1,2)	GE 104
GE 201	Statics	3(3,1,0)	MATH 106 MATH 107
GE 203	Engineering and Environment	2(2,0,0)	CHEM 101 MATH 101
Total		**17**	

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Level 5			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
MATH 204	Differential Equations	3(3,2,0)	MATH 203
GE 202	Dynamics	3(3,1,0)	GE 201 PHYS 103
GE 211	Computer Programming using C++	3(2,0,2)	
ME 371	Thermodynamics (1)	3(3,1,0)	PHYS 104
ME 254	Materials Engineering	4(3,1,2)	CHEM 101 PHYS 104
ME 201	Geometric Modeling in Engineering	2(1,0,2)	GE 104
Total		**18**	

Level 6			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
MATH 254	Numerical Methods	3(3,2,0)	MATH 107
ME 352	Mechanics of Materials	3(3,1,0)	GE 201
ME 384	Fluid Mechanics	4(4,1,0)	ME 371 MATH 204
IC 107	Ethics of the Profession	2(2,0,0)	
ME 377	Thermodynamics (2)	3(3,1,0)	ME 371
ME 363	Mechanics of Machinery	3(3,1,0)	GE 202
Total		**18**	

Level 7			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ME 312	Manufacturing Processes (1)	3(2,1,2)	ME 254 ME 352
ME 304	Mechanical Engineering Design (1)	3(3,1,0)	ME 352 ME 201
ME 378	Heat Transfer	4(4,1,0)	ME 384
EE 308	Electrical Circuits and Machines	3(3,1,0)	PHYS 104
ME 321	Mechanical Measurements	2(1,1,2)	STAT 101 ME 384
	Free Course	2	
Total		**17**	

Level 8			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ME 313	Manufacturing Processes (2)	3(2,1,2)	ME 312
ME 305	Mechanical Engineering Design (2)	4(3,1,2*)	GE 106 ME 304
ME 322	Mechanical Engineering Lab (1)	2(1,0,2)	ME 321 ME 378
ME 365	Dynamics of Mechanical Systems	3(3,1,0)	GE 202 MATH 204
ME 379	Thermal-fluid Systems	3(3,1,0)	ME 377 ME 378
IC 1xx	Optional IC course	2(2,0,0)	
Total		**17**	

Level 9			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ME 323	Mechanical Engineering Lab (2)	2(1,0,2)	ME 321 ME 365
GE 403	Engineering Economy	2(2,1,0)	
ME 366	Automatic Control	3(3,1,0)	ME 365
ME 4xx	Elective (1)	3	
ME 4xx	Elective (2)	3	
ME 496	Graduation Project (1)	2(2,0,0)	Completion of 129 cr. Hr. + completion of levels 1-7
Total		**15**	

Level 10			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
IC 1xx	Optional IC course	2(2,0,0)	
GE 402	Engineering Projects Management	3(3,1,0)	
ME 4xx	Elective (3)	3	
ME 4xx	Elective (4)	3	
ME 497	Graduation Project (2)	2(2,0,0)	*ME 496*
ME 999	Practical Training	1(NP)	*Completion of 110 credits*
ME 998	Research Project	0 (NP)	*Completion of 129 credits*
Total		**14**	

NP: No grade (Pass or Fail)
(X, Y, L) X = Lectures; Y = Tutorials; L = Lab. * Studio

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3. COURSE DESCRIPTION

3.1 Common First Year

ENGS 100: English language *6(6,9,0)*

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.

MATH 101: Differential Calculus *3(3,1,0)*

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.

Textbook: Robert T. Smith, and Roland R. Minton, "Calculus, early Transcendental functions", Third Edition, 2007.

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

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.

ARAB 100: Writing Skills *2(2,0,0)*

ENGS 110: Academic English language *6(6,9,0)*

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.

Pre-requisites: None.

CUR 101: University skills *3(3,0,0)*
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.
Pre-requisites: None.

CT 101: IT skills *3(0,0,6)*
Basic Concepts of Information Technology, using a computer and Managing Files, Word Processing, Spreadsheets, Databases, Presentation.
Pre-requisites: None.

STAT 101: Introduction to Statistics *3(3,0,0)*
Descriptive statistics; Probability; Random variables and probability distribution functions; Statistical inference; Correlation and simple linear regression.
Pre-requisites: None.

EPH 101: Health and Fitness *1(1-1-0)*
Subjects about general health and body and brain fitness.

Pre-requisites: None.

3.2 University Requirements

IC 100 - Studies in Prophet Biography 2(2,0,0)

IC 101 - Origins of Islamic Culture 2(2,0,0)

IC 102 - Family in Islam 2(2,0,0)

IC 103 - The Economic System in Islam 2(2,0,0)

IC 104 - The Political System in Islam 2(2,0,0)

IC 105 - Human Rights 2(2,0,0)

IC 106 - Medical Jurisprudence 2(2,0,0)

IC 107 - Ethics of the Profession 2(2,0,0)

IC 108 - Contemporary Issues 2(2,0,0)

IC 109 - Role of Women in Development 2(2,0,0)

3.3 College Requirements

a. Compulsory College Courses

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.

Textbooks: 1- Robert T. Smith, and Roland R. Minton, "Calculus, early Transcendental functions", 3rd Edition.
2- Earl W. Swokowski, Michael Olinick, Dennis Pence, and Jeffery A. Cole "Calculus", 6th Edition.

Pre-requisite: MATH 101

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.

Textbook: Edward and Penny, "Calculus", international edition.

Pre-requisite: MATH 101

MATH 203: Differential & 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.

Textbook: 1- Robert T. Smith, and Roland R. Minton, "Calculus, early Transcendental functions", 3rd Edition.
2- Earl W. Swokowski, Michael Olinick, Dennis Pence, and Jeffery A. Cole "Calculus", 6th Edition.

Pre-requisite: 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.

Textbook: Dennis G. Zill and Michael R Cullen, "Differential equations with boundary value problems", 6th edition
Pre-requisite: MATH 203

PHYS 103: General Physics (1) *4(3,0,2)*
Introduction (Vectors), Motion in one dimension with constant acceleration, Motion in two dimensions with application to projectile motion and circular motion, Newton's Laws of Motion, Work and Energy, Potential Energy and law of conservation of Energy, Linear Momentum and Collisions, Rotation of rigid object about a fixed 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: PHYS 103.

ENGL 109 – Language and Communication *2(2,1,0)*
ENGL 109 includes *English for Specific Purpose* (ESP) units that cover terminology and expressions, in various engineering disciplines. The course is designed to improve the communication and reading skills of engineering students. It equips the student with essential linguistic expertise for his engineering study and prospective professional career.

Textbook: Eric H. Glendinning & Norman Glendinning, "Oxford English for Electrical and mechanical Engineering", Oxford University Press (2000).
Pre-requisites: None.

ENGL 110 – Technical Writing *2(2,1,0)*
English 110 is intended to enhance technical writing skills. It equips students with writing basics and techniques required for constructing clear and persuasive presentation of their ideas, on various forms including reports, presentations, worksheets, CVs' and memos. The course highlights effective writing features including: focus, organization, support & elaboration, style, and conventions. It emphasizes on observing ethical norms in writing.

Textbook: Daphne Mackey, "Send me a Message: *A step-by-step approach to business and professional writing*", McGraw Hill (2006)
Pre-requisites: ENGL 109.

GE 104: Basics of Engineering Drawing *3(2,0,2)*
The course includes the drawing of Orthographic and isometric projections. Other topics include scaling, sectioning, dimensioning and blue print reading. The course is taught using free hand, AutoCAD and AutoDesk Invetor

Textbook: Fundamentals of Graphics Communication, Bertoline, G.R., And Weibe, E.N., Mc Grew-Hill Inc., New York, 5th edition, 2007

References: (1) A Manual of Engineering Drawing Practice, C.H. Simons and D.E. Maguire, Hodder & Stoughton.
(**2**) Engineering Drawing and Graphic Technology, French T. E., Charles J. V. and Foster R.J., 14th Edition, McGraw-Hill,1993.

Pre-requisites: None.

GE 106: Introduction to Engineering Design *3(2,1,2)*

Engineering profession, jobs, and disciplines; Elements of engineering analysis; Introduction to engineering design and team formation; Engineering problem definition; Engineering system Architecture and physical function decomposition; human factor, environment, and safety issues in design; Generation of alternative concepts; Evaluation of alternatives and selection of a concept, Design defense, performance evaluation, and reporting; Engineering ethics.

Textbook: Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, Exploring Engineering: An Introduction to Engineering and design, 4th ed.

Pre-requisite: 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; centroid of simple and composite bodies. Area moments of inertia. Analysis of beams. Friction.

Textbook: Meriam, J. L. and Kraige, L. G. "Engineering Mechanics, Volume 1, Statics", SI units Version

Pre-requisite: MATH 106 & MATH 107

GE 203: Engineering and Environment *2(2,0,0)*

This course introduces the impact of engineering and industrial activities on the environment. The lectures cover basics of ecosystems, environmental balance, types of pollution, and types, sources, and limits of pollutants; in addition to fundamentals of Environmental Impact Assessment (EIA). Pollution control technologies and examples of pollution from various engineering and industrial sectors are also covered.

Textbook: G. Tyler Miller, Scott Spoolman. Living in the Environment, 17th edition. Cengage Learning (2014)
Jerry A. Nathanson, Richard A. Schneider. Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control, 6th edition. Pearson Education, Limited (2014)

Pre-requisite: CHEM 101, MATH 101

GE 402: Engineering Projects Management *3(3,1,0)*

This course introduces techniques that provide rational solutions to a range of project management decisions encountered in engineering projects. Students are expected to gain a detailed understanding of some of the techniques, tools and processes available and their application in starting, planning, managing and finishing engineering projects; The course covers project management fundamentals including projects life cycle, project planning and scheduling techniques, cash flow forecasting, performance evaluations, estimating and cost control; project organizations; Introduction to risk management.

Textbook: Meredith, J. R., Mantel Jr, S. J., & Shafer, S. M. (2013). Project management in practice. Wiley Global Education

Prerequisite: None

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

This course is being offered to the students who enroll in the College of Engineering to give them fundamental knowledge and understandings on Cost concepts, Time value of money operations, Measuring the worth of investments, Comparison of alternatives, Depreciation, and Economic analysis of public projects

Textbook: John A. White, Kenneth E. Case and David B. Pratt, "Principles of engineering economic analyses", 5th edition.
Pre-requisites: None.

b. Additional College Courses

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, PHYS 103

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.

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.

Textbook: Rizwan Butt and Yacine Benhadid, "An Introduction to Numerical Analysis"
Pre-requisite: MATH 107

3.4 Mechanical Engineering Department Courses Descriptions

a. Mechanical Engineering Core Courses

ME 201 Geometric Modeling in Engineering *2(1,0,2)*
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, ME201

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: GE 106, ME 304

ME 312 Manufacturing Processes (1) *3(2,1,2)*
This course will provide the student with an introduction, classification, concepts and various technologies of bulk and sheet metal forming, metal casting in expendable and permanent molds and metal joining processes including fusion and solid state welding. Calculation of process particulars as well as the interrelationships between the material properties and the manufacturing process.
Prerequisite: ME 254, ME 352

ME 313 Manufacturing Processes (2) *3(2,1,2)*
Metal cutting processes including: turning, milling, drilling, grinding; material properties related to metal cutting; tool life and wear, cutting forces and power calculation in all machining process; cutting tools geometry, material selection, and properties, procedure sheet for manufacture; high precision measuring tools, fits and tolerances.
Prerequisite: ME 312

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.
Prerequisite: STAT 101, ME 384

ME 322 Mechanical Engineering Lab (1) *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, ME378

ME 323 Mechanical Engineering Lab (2) *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, ME 365

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 365 Dynamics of Mechanical Systems *3(3, 1, 0)*
Introduction to physical systems; Modeling of mechanical, electrical, hydraulic, pneumatic and thermal systems; Systems analogies; Mixed systems; Response of first order systems; Response of second order systems; Free and forced vibration of second order systems
Prerequisite: GE 202, MATH 204

ME 366 Automatic Control *3(3, 1, 0)*
Introduction to Control Systems; Mathematical modeling of dynamic systems; The Laplace transform; Solving linear time-invariant differential equations; Transfer functions, Block diagrams and Signal flow representation; Response of open and closed loop systems; Transient response specifications of second order system; Stability (Routh's-Hurwitz stability criterion-*Nyquist*); Root locus, Root locus analysis; P, PD, PI and PID controllers; Frequency response analysis, Bode plots; Term project.
Prerequisites: ME 365

ME 371 Thermodynamics (1) *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 377 Thermodynamics (2) *3(3,1,0)*
Thermodynamics (II) is a fundamental course in Mechanical Engineering. It provides a continuation of topics covered in Thermodynamics (I). The course starts with the definition of exergy and continues with applied concepts, including engine, power plant, and refrigeration cycles. Property relations and methods for dealing with mixtures and gas-vapor mixtures with applications to air conditioning are then covered. The course concludes with the introduction of hydrocarbon fuels and the application of the first law to reacting systems.

***Approved by*:** Chairman: …… Dean: ……

Prerequisite: ME 371

ME 378 Heat Transfer *4(4,1,0)*
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 384

ME 379 Thermal - Fluid Systems *3(3,1,0)*
Design of piping systems and the optimization process; Flow in pipe networks; Pipes in parallel; Performance and selection of pumps; Fans and fan performance; heat exchangers of different kinds such as double pipe, shell and tubes and cross flow; Selection of thermal-fluid system components.
Prerequisite: ME 377, ME 378

ME 384 Fluid Mechanics *4(4,1,0)*
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; Introduction to compressible flow.
Prerequisite: MATH 204, 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: Completion of 129 cr. Hr. + completion of level 1-7

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

ME 999 Practical Training
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 completed, successfully, at least 110 credit hours. Students enrolling in the summer training program are not allowed to take simultaneously any course or projects.
Prerequisite: Successful completion of 110 credit hours.

b. Additional Courses required by Mechanical Engineering Program

EE 308 Electrical Circuits and Machines *3(3,1,0)*
Electrical quantities and units; DC and AC circuits; Phasor representation of AC quantities; Three Phase Systems; Generation of AC voltage; Transformers, Fundamentals of electrical motors; Induction motors; Small AC motors.
Pre-requisites: PHYS 104

c. Mechanical Engineering 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.
Prerequisites: ME 304

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.
Prerequisites: 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.
Prerequisites: 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.
Prerequisite: ME 304, ME 378

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 304

ME 409 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
Prerequisite: ME 304

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.
Prerequisites: ME 312

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.
Prerequisites: ME 312

ME 413 Manufacturing Systems **3***(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.
Prerequisites: ME 313

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.
Prerequisites: ME 313

ME 415 Introduction to Railway Engineering *3(3,0,0)*
Introduction and History of Railway Design; Comparisons to Other Transport Systems; Economy, Requirements, Resources and Strategy; Demand Tariffs and Capacity; Rolling Stock; Railway Operations; Modern Railways Designs; Gauge Selection; Railway Traction and Loading; Route Design; Platforms, Bridges, Crossings, Canopies and Depots; Sand Blankets, Drains, Masonry, Fasteners, Concrete, Bolts and Welds; Sleeper, Ballast and Sub-Beds; Wheel-Rail Interface; Curves and Gradients; Track Loads; Wheel Design; Mechanical Problems: Life-time, Failures, Thermal, Stresses, Strains, Elasticity, Wear and Creep Issues. Track Defects
Prerequisites: ME 305, ME 313

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 384

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 384

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 384, ME 304

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 377

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.
Prerequisite: ME 378

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
Prerequisites: 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.
Prerequisites: 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
Prerequisite: 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
Prerequisite: 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.
Prerequisites: ME 304

ME 460 Railway Systems Engineering *3(3,0,0)*
Introduction to System Railway; Static Track Design; Dynamic Track Design; Track Stability and Longitudinal Forces; Ballasted Track; Slab Track; Switches and Crossings; Traffic Control; Network Setups; Wheel-Track Interaction: Forces, Vibration and Noise; Derailment and Train Dynamics; Engines and Prime Movers; Train Locomotive Systems; High Speed Trains; Electrical Railway Systems: Electrical Systems: Overhead, Poles, Motors, Thyristors; Electrical Power Distribution: AC/DC, 15kV, 25kV; Railway Support Systems; Railway Signaling; Safety and Special Issues; Energy Consumption.
Prerequisites: ME 365

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.
Prerequisite: GE 202

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.
Prerequisite: GE 202

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 365

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.
Prerequisite: 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
Prerequisite: 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.
Prerequisite: ME 365

ME 472 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 377

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 377

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 377

ME475 Energy Efficiency *3(3,0,0)*
Energy Efficiency is a multi-disciplinary course that introduces energy consumption reduction measures in buildings, transportation and industrial sectors. The main objective of the course is to provide engineering and architect students with the basic principles of energy efficiency, fundamental concepts, sustainability, energy policy, energy finance and energy and environment.
Perquisite: ME371

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.

Prerequisites: ME 378

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.
Prerequisites: ME 378

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.
Prerequisites: ME 378

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: ME 378

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 384

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 384

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 384

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-requisites: ME 384

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 384

ME 493 Selected Topics in Mechanical Engineering (1) *3(3,0,0)*
Prerequisites: Completion of 129 credits hours

ME 494 Selected Topics in Mechanical Engineering (2) *3(3,0,0)*
Prerequisites: Completion of 129 credits hours

ME 998 Research Project *0NP*
The course is designed to serve the research needs of the students. The course is not required for graduation; so students may opt to register it or otherwise. The consent of the faculty member with whom the student might work is essential.
Prerequisite: Completion of 129 credits

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.

***Approved by*:** Chairman: …… Dean: ……