



**Al-Hussein Bin Talal University**

**Faculty of Engineering**

**Department of**

**Mechanical Engineering**

**Study Plan**

**2017-2018**

## **Vision**

Our vision is that department of mechanical engineering will be an active department which has distinctive academic and research program that achieve a distinguished education for his students and a high level of research among regional and world institutions by providing academic and research services through enthusiastic teaching staff and students.

## **Mission**

Our mission in mechanical Engineering Department is to graduate high qualified, trained mechanical engineers, whose background and education reflect the current level of technology which enable them to enter directly into engineering practice or, pursue higher education.

## **Educational objectives**

The objectives of the undergraduate program in mechanical engineering take into consideration the intellectual and personal development of students so that after graduation they will be able to:

- Advance in their careers, adapting to new situations and emerging problems, through the application of general purpose engineering skills and the core technical disciplines, analytical procedures, and design practices of the mining engineering profession;
- Function ethically in a variety of professional roles such as designer, production manager, maintenance engineer, consultant, technical support representative and regulatory specialist with emphasis on the mining industries of Jordan and the surrounding region;
- Pursue advanced degrees in mining-related fields and also those fields that support the mining industries such as business
- Utilize professional skills such as effective communication, teamwork, and leadership; and
- Demonstrate an understanding of the critical role mining engineers play in society with respect to health, safety, and the environment in tangible ways such as achieving professional licensure.

## **Program outcomes:**

A mechanical engineering graduate from AHU will have the ability to:

- Apply knowledge of mathematics, science, and engineering,
- Identify, formulate, and solve engineering problems,
- Design and conduct experiments, as well as to analyze and interpret data,
- Design a system, component, or process to meet desired needs,
- Function on multi-disciplinary teams,
- Understand the professional and ethical responsibility,
- Communicate effectively,
- Understand the impact of engineering solutions in a global and societal context,
- Recognize the need for, and an ability to engage in lifelong learning
- Use the techniques, skills, and modern engineering tools necessary for engineering practice.

## 1. Framework for B.Sc. Degree ( 160 Credit Hours)

Classification	Credit Hours		
	Compulsory	Elective	Total
University Requirements	12	15	27
College Requirements	28	-	28
Department Requirements	93	9	102
Free Electives	-	3	3
<b>Total</b>	133	27	160

## 2. University Requirements: ( 27 Credit Hours)

### 2.1. Compulsory : (12 Credit Hours)

Course No.	Course Title	Cr. Hr.	Lecture	Lab.	Prerequisite or *Corequisite
0100101	Military Science	3	3		-
0201101	Arabic Language I	3	3		0201099
0202101	English Language I	3	3		0202099
0205100	National Education	3	3		-
	<b>Total</b>	<b>12</b>			

0201099: Arabic language level (test or supplement course),

0202099: English language level (test or supplement).

### 2.2. Elective: (15 Credit Hours)

Course No.	Course Title	Cr. Hr.	Lecture	Prerequisite or *Corequisite
0204101	French Language Skills 1	3	3	-
0207101	German Language	3	3	-
0206101	Principles of Library Science	3	3	-
0209101	Spanish Language	3	3	-
0202102	Communication skills in English	3	3	0202101
0201102	Communication skills in Arabic	3	3	0201101
0701100	Jordan's Contribution to the Human Civilization	3	3	-
0412100	Economy in Our Life	3	3	-
0411101	Principles of Management	3	3	-
0701105	Cultural Heritage and People	3	3	
0100111	Islamic culture	3	3	
0113112	Principles of Psychology	3	3	-
0205130	Law in our life	3	3	
0102141	Principles of Education	3	3	
0100172	History of Jerusalem	3	3	-
0100173	History of the Arab-Islamic culture	3	3	
0111222	Skills	3	3	-
0502100	Environmental Issues	3	3	-
0303100	Principles of Astronomy	3	3	-
0100171	Principles of physical education	3	3	

### 3. College Requirements: ( 28 Credit Hours)

Course No.	Course Title	Cr. hr.	Lecture	Lab.	Prerequisite or *Corequisite
0302101	Calculus (1)	3	3	-	-
0302102	Calculus (2)	3	3	-	0302101
0303101	General Physics (1)	3	3	-	-
0303102	General Physics (2)	3	3	-	0303101
0303103	General Physics Lab. (1)	1	-	3	0303101
0303104	General Physics Lab. (2)	1	-	3	0303102
0502200	Numerical Analysis for Engineers	3	3	-	0302102
0507231	Engineering Drawing	2	-	6	0612099
0501100	Introduction to Engineering	1	1	-	-
0507291	Workshop	1	-	3	
0502300	Communication Skills	1	1	-	0202101
0501454	Engineering Economy	3	3	-	0302102
0612114	C++	3	3	-	0612099
<b>Total</b>		<b>28</b>			

0612099: Computer skills (test or supplement course).

### 4. Department Requirements ( 102 Credit Hours)

#### Course Numbering

The indications of the course subject's digits:

Field Number	Specialization
0	General Engineering Sciences
1	Mechanics
2	Fluids
3	Engineering Drawing and Design
4	Thermal Sciences
5	Materials, Manufacturing
6	Vibration, control
7	Energy
8	Miscellaneous
9	Projects, management, workshop, training

#### Example

Dynamics			0507212	
05	07	2	1	2
Faculty	Department	Level	Field	Sequence

#### 4.1. Department Core: ( 93 Credit Hours)

Course No.	Course Title	Cr. Hr.	Lecture	Lab.	Prerequisite or *Corequisite
0306101	General Chemistry (1)	3	3	-	-
0306103	General Chemistry Lab. (1)	1	-	3	0306101
0507101	Technical Writing	1	1	-	-
0508202	Engineering Mathematics (1)	3	3	-	0302102
0508203	Engineering Mathematics (2)	3	3	-	0508202
0504102	Statics	3	3	-	0303101
0507212	Dynamics	3	3	-	0504102
0507232	Machine Drawing	1	-	3	0507231
0507251	Materials Science	2	2	-	0306101
0507281	Computer Programming for Engineers	2	2	-	0612114
0507321	Fluid Mechanics (1)	3	3	-	0504102
0507322	Fluid Mechanics Lab.	1	-	3	0507321
0507333	Theory of Machinery	3	3	-	0507212
0507341	Thermodynamics (1)	3	3	-	0303102
0507342	Thermodynamics (2)	3	3	-	0507341
0507343	Thermodynamics Lab.	1	-	3	0507341, or 0507342*
0507344	Heat Transfer (1)	3	3	-	0507321
0507345	Heat Transfer Lab.	1	-	3	0507344
0507351	Strength of Materials (1)	3	3	-	0504102
0507352	Strength of Materials Lab.	1	-	3	0507351
0507353	Manufacturing Processes	3	3	-	0507251
0507381	Electrical Circuits	3	3	-	0303102
0508311	Electrical Circuits Lab.	1	-	3	0507381
0507421	Fluid Mechanics (2)	3	3	-	0507321
0507431	Mechanical Design (1)	3	3	-	0507351
0507432	Mechanical Design (2)	3	3	-	0507431
0507441	Air Conditioning (1)	3	3	-	0507342 and 0507344
0507451	Engineering Measurements	3	3	-	0507353
0507452	Manufacturing and Measurements Lab.	1	-	3	0507451
0507461	Mechanical Vibrations	3	3	-	0507212 and 0508202
0507462	Mechanical Vibrations and Control Lab.	1	-	3	0507461 and 0507463
0507463	System Dynamics and Control	3	3	-	0507212 and 0508202
0507481	Electrical Machines	3	3	-	0507381
0507541	Internal Combustion Engines	3	3	-	0507342 and 0507344
0507542	Energy Conversion	3	3	-	0507342 and 0507344
0507591	Operation and Maintenance Engineering	3	3	-	0507461
0507592	Practical Training	3	-	3	Pass 120 cr. hrs-
0507593	Graduation Project (1)	1	-	3	Pass 110 cr. hrs
0507594	Graduation Project (2)	3	-	3	0507593
	<b>Total</b>	<b>93</b>			

#### 4.2. Department Electives: ( 9 Credit Hours)

Course No.	Course Title	Cr. Hr.	Lecture	Lab.	Prerequisite or *Corequisite
0507543	Thermal Power Plants	3	3	-	0507342 and 0507344
0507444	Heat transfer (2)	3	3	-	0507344
0507442	Air Conditioning (2)	3	3	-	0507441
0507422	Turbomachinery	3	3	-	0507321 and 0507342
0507521	Design of Sanitary Systems	3	3	-	0507321
0507453	Strength of Materials (2)	3	3	-	0507351
0507454	Failure and Fracture Analysis	3	3	-	0507351
0507531	Computer-Aided Design	3	3	-	0507281 and 0507432
0507532	Introduction to Finite Element Method	3	3	-	0507344 and 0507281
0507562	Robotics	3	3	-	0507463 and 0507333
0507522	Hydraulic and Pneumatic Systems Design	3	3	-	0507463
0507511	Autotronics	3	3	-	0507541
0507581	Selected Topics in Mech. Eng.	3	3	-	0507342 and 0507344
0501324	Rock and Soil Mechanics	3	3	-	0507351
0501533	Mine Equipment and Machinery	3	3	-	0507351

#### 5. Free Elective ( 3 Credit Hours)

One course (3 credit hours) to be taken from university wide open courses.

## Study Plan Guide for the Bachelor Degree in Mechanical Engineering

First Year					
First Semester			Second Semester		
Course No.	Course Title	Cr. Hrs	Course No.	Course Title	Cr. Hrs
0303101	General Physics (1)	3	0303102	General Physics (2)	3
0302101	Calculus (1)	3	0303103	General Physics Lab. (1)	1
0306101	General Chemistry (1)	3	0302102	Calculus (2)	3
-	Compulsory University Requirement	3	0612114	C++	3
-	Elective University Requirement	3	0306103	General Chemistry Lab. (1)	1
0507101	Technical Writing	1	0507291	Workshop	1
			-	Compulsory University Requirement	3
<b>Total</b>		<b>16</b>			<b>15</b>

Second Year					
First Semester			Second Semester		
Course No.	Course Title	Cr. Hrs	Course No.	Course Title	Cr. Hrs
0508202	Engineering Mathematics (1)	3	0508203	Engineering Mathematics (2)	3
0504102	Statics	3	0507212	Dynamics	3
0507231	Engineering Drawing	2	0507232	Machine Drawing	1
			0507251	Materials Science	2
-	Elective University Requirement	3	0502200	Numerical Analysis for Engineers	3
0501100	Introduction to Engineering	1	0502300	Communication Skills	1
0303104	General Physics Lab. II	1	-	Compulsory University Requirement	3
0501453	Engineering Economy	3	0507281	Computer Programming for Engineers	2
<b>Total</b>		<b>16</b>			<b>18</b>

Third Year					
First Semester			Second Semester		
Course No.	Course Title	Cr. Hrs	Course No.	Course Title	Cr. Hrs
0507321	Fluid Mechanics (1)	3	0507342	Thermodynamics (2)	3
0507333	Theory of Machinery	3	0507344	Heat Transfer (1)	3
0507341	Thermodynamics (1)	3	0507353	Manufacturing Processes	3
0507351	Strength of Materials (1)	3	0507381	Electrical Circuits	3
-	Elective University Requirement	3	0507421	Fluid Mechanics (2)	3
			0507352	Strength of Materials Lab.	1
			0507343	Thermodynamics Lab.	1
			0507322	Fluid Mechanics Lab.	1
<b>Total</b>		<b>15</b>			<b>18</b>

Fourth Year					
First Semester			Second Semester		
Course No.	Course Title	Cr. Hrs	Course No.	Course Title	Cr. Hrs
0507441	Air Conditioning (1)	3	0507451	Engineering Measurements	3
0507431	Mechanical Design (1)	3	0507432	Mechanical Design (2)	3
0507461	Mechanical Vibrations	3	0507481	Electrical Machines	3
0507463	System Dynamics and Control	3	0507541	Internal Combustion Engines	3
-	Elective University Requirement	3	0507591	Operation and Maintenance Engineering	3
0508311	Electrical Circuits Lab.	1	0507462	Mechanical Vibrations and Control Lab.	1
0507345	Heat Transfer Lab.	1			
<b>Total</b>		<b>17</b>			<b>16</b>

Fourth Year		
Summer Semester		
Course No.	Course Title	Cr. Hrs
0507592	Practical Training	3

Fifth Year					
First Semester			Second Semester		
Course No.	Course Title	Cr. Hrs	Course No.	Course Title	Cr. Hrs
0507542	Energy Conversion	3	0507594	Graduation Project II	3
0507593	Graduation Project I	1	-	Compulsory University Requirement	3
-	Elective Department Requirement	3	-	Free elective Requirement	3
-	Elective Department Requirement	3	-	Elective Department Requirement	3
0507452	Manufacturing and Measurements Lab.	1	-	Elective University Requirement	3
<b>Total</b>		<b>11</b>			<b>15</b>



## Description of Courses Offered by Department of Mechanical Engineering

Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
0507291	Workshop	1	---	---
Introduction to workshops, safety in industrial organizations and workshops, training on the use of manual tools, training on metal workings, wood workings, welding, lathe machine, and home electrical circuits.				
0507231	Engineering Drawing	2	0612099	-
Drawing equipment and use of instruments. Lettering, Geometric construction, Sketching and shape description. Basic descriptive geometry, Developments and intersections. Axonometric, oblique and perspective drawings, Multiview projection, Principal views, Conventional practice, and sectional views. Auxiliary views. Dimensioning techniques. Introduction to computer drawing.				
0507101	Technical Writing	1	-	
Basic technical writing concepts and techniques including report writing. Presentation skills, Dialogue management, team work concept.				
0507281	Computer Programming for Engineers	2	0612114	-
A systematic development of programming via flowcharts and pseudo codes; The course highlights include: assignment, repetition, decision making, arrays, file processing and subprograms in program construction. Program design includes: algorithm design, procedures and data program structure, module design, programming standards, program documentation, testing, debugging, verification and validation, file organization and processing, array processing, abstract data structures, data driven programs and simulation. Matlab language will be used. Homework problems and projects of direct engineering applications will be assigned.				
0507212	Dynamics	3	0504102	-
Kinematics of particles; Rectilinear and curvilinear motion in various coordinate systems. Kinetics of particles; Newton's second law, Central force motion, Work-energy equation, Principle of impulse and momentum, Impact, Conservation of energy and momentum, Application to a system of particles. Kinematics of rigid bodies; Relative velocity and acceleration, Instantaneous center, Analysis in terms of a parameter. Plane kinetics of rigid bodies with application of Newton's second law, Energy and impulse-momentum.				
0507232	Machine Drawing	1	0507231	-
Mechanical engineering drawing conventions and abbreviations, various systems of size description, including precision dimensioning, fastening elements, standard organization and preparation of engineering drawings, assembly and detailed drawings, design applications.				
0507251	Material Science	2	0306101	-
Bonding forces and energies. Classification of engineering materials. Crystallography. X-ray diffraction. Imperfection in solids and strengthening mechanisms. Diffusion. Metallography. Mechanical properties of materials. Material testing evaluation and failure. Thermal equilibrium diagram. Corrosion of metals and their protection. Case studies in material selection. Relative cost of materials.				
0507321	Fluid Mechanics (1)	3	0504102	-
Introduction, Fluid properties, Basic units. Fluid statics, Pressure and its measurements, Forces on plane and curved submerged surfaces, buoyancy & floatation, Fluids in motion, Flow kinematics and visualization, Basic control volume approach, Differential and integral continuity equation. Pressure variation in flowing fluids, Euler's and Bernoulli's equations, Applications of Bernoulli equation. Momentum principle and its applications, Navier-Stokes equations. Energy equation, Hydraulic and energy grade lines. Dimensional analysis and similitude. Surface resistance and introduction to boundary layer theory. Flow in conduits, laminar and turbulent flows, Frictional and minor losses, Piping systems.				
0507322	Fluid Mechanics Lab.	1	0507321	-
Experimental methods in the following systems : center of pressure; impulse momentum principle; pumps, friction losses in pipes, stream lines and flow fields, buoyancy and boundary layer theory. Radial flow fan, Water turbine, Flow measurement.				

0507333	Theory of Machinery	3	0507212	-
Mechanisms and applications, mobility and linkages. Cams, gears and gear trains. Velocity and acceleration analysis in mechanisms. Inertia forces. Principles of balance in rotating & reciprocating masses.				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
0507341	Thermodynamics (1)	3	0303102	-
Thermodynamic concepts and definitions, states, properties, systems, control volume; processes, cycles, and units; pure substances, equation of states, table of properties; work and heat; the first law, internal energy and enthalpy; conservation of mass; SSSF and USUF processes; the second law, heat engines and refrigerators, reversible processes, Carnot cycle; entropy, Clausius inequality, principle of the increase of entropy, Efficiencies.				
0507342	Thermodynamics (2)	3	0507341	-
Review of basic laws and principles. Irreversibility and availability, Vapor and air power and refrigeration cycles. Mixtures of real gases and vapors. Psychrometry. Combustion. Elementary chemical kinetics.				
0507343	Thermodynamics Lab.	1	0507341	0507342
Experimental methods in the following : Mechanical equivalent of heat; The adiabatic exponent; Marcet boiler; Bomb calorimeter; Flow through nozzle; Refrigeration system; Air conditioning system; Heat pump and air cooler; single stage air compressor; cooling tower; Thermic unit (steam turbine power plant).				
0507344	Heat Transfer (1)	3	0507321	-
Introduction to modes of heat transfer; one-dimensional steady state conduction; unsteady state conduction, lumped heat capacity system; introduction to convection, flow and thermal boundary layers. laminar and turbulent boundary layers; convection in internal and external flows; empirical relations for forced convection heat transfer; natural convection systems; condensation and boiling; introduction to thermal radiation.				
0507345	Heat Transfer Lab.	1	0507344	-
Experimental work in heat transfer covering: Measurement of thermal conductivity, Natural and forced convection, Radiation, Boiling and condensation. Heat exchangers.				
0507351	Strength of Materials (1)	3	0504102	-
Axial loading, Material properties obtained from tensile tests, Stresses and strains due to axial loading, Thermal Stresses, Elementary theory of torsion, Solid and hollow shafts, Thin-walled tubes, Rectangular cross-section, Stresses in beams due to bending, shear and combined forces. Composite beams, Analysis of plane stress, Mohr's Circle, Combined stresses, Thin-walled pressure vessels, Deflection of beams, Buckling of columns, Energy Methods.				
0507352	Strength of Materials Lab.	1	0507351	-
This laboratory serves mainly the measuring and/or determination of some material properties (strain and stress, yield stress, ultimate stress, fracture stress). Non destructive testing of materials (NDT), micro and macro examination of materials and phase diagrams for steel. It is equipped with machines for conducting tests, such as: Tension, impact fatigue, bending, creep, hardness, and photo elasticity tests.				
0507353	Manufacturing Processes	3	0507251	-
Mechanical behavior and forming of metals, different types of mechanical behavior and main factors affecting it. Yield criteria, representative stress and representative strain, work due to plastic deformation, classification of forming processes with respect to strain rate and temperature. Temperature rise in dynamic forming. Bulk deformation processes: forging, extrusion, rolling, rod and wire drawing. Sheet forming processes: blanking, deep-drawing and bending.				
0507381	Electrical Circuits	3	0303102	-

Introduction, Circuits types, Ohm's law, Kirshoff's Laws, DC circuit analysis techniques, review of complex numbers, RLC Circuits, AC circuit Analysis. Phasor concept and RLC relations. Introduction to Magnetic circuits and 3 phase circuit analysis.				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
0507421	Fluid Mechanics (2)	3	0507321	-
Review of basic definitions; system and control volume; Foundations of flow analysis; differential from of the basic laws; general viscous flow; boundary layer theory, Navier – Stokes equation, Blassius equation, Von Karman equation, Irrotational flow; stream function, vorticity and rotationality, Incompressible inviscid frictionless flow, 2-D Flow solutions around bodies, compressible flow; adiabatic and isentropic flow; Normal shock waves; Nozzles; Introduction to turbomachinery, centrifugal pumps.				
0507431	Mechanical Design (1)	3	0507351	-
Meaning, phases, evaluation, considerations of design, stress analysis, deflection analysis, static strength and theories of failure, fatigue strength. Design of fasteners and connections; riveted joints, bolts and screws, force-deflection diagrams of bolted connections. Welded joints. Mechanical springs, helical, leaf, torsional spring shafts.				
0507432	Mechanical Design (2)	3	0507431	-
Rolling contact bearings, selection, mounting and enclosure. Lubrication and journal bearings. Clutches, coupling and brakes. Gearing : Geometry, kinematics gear trains and force analysis. design of spur, helical, bevel and worm gears. multi-speed gear boxes. design and analysis of belts, ropes, chains, term project.				
0507441	Air Conditioning (1)	3	0507342 and 0507344	-
Review of psychrometry; thermal comfort; air conditioning processes; inside and outside design conditions; heating load calculations, infiltration; cooling load calculations, solar gain; heating systems, design, layout; hot water, steam, hot air systems; under floor heating.				
0507451	Engineering Measurements	3	0507353	-
Report writing, basics of metrology, inspection and measurements. Errors & error analysis, uncertainty analysis, statistical methods, least squares method. Basics of transducers. Static and dynamic characteristics of systems. Measurement of flow, pressure, and temperature. Strain gauges, strain rosettes.				
0507452	Manufacturing and Measurements Lab.	1	0507451	
Experimental methods on the following systems: pressure measurement, flow measurement, temperature measurement, strain gauges, strain rosettes.				
0507461	Mechanical Vibrations	3	0507212 and 0508202	-
Simple harmonic motion. Elements of vibratory systems. Systems with single degree of freedom and applications; damped free vibration, rotating and reciprocating unbalance, vibration isolation and transmissibility, and period excitation, systems with multiple degrees of freedom and applications, methods of finding natural frequencies.				
0507462	Mechanical Vibrations and Control Lab.	1	0507461 and 0507463	-
Static & dynamic balancing, centrifugal force, simple & compound pendulum, bifilar suspension, mass spring system, damping coefficient and logarithmic decrement. center of percussion, kater's reversible pendulum, torsional free vibrations, resonance response of a single degree of freedom system. Base excitation and vibration isolation.				
0507463	System Dynamics and Control	3	0507212 and 0508202	
Review of complex variables and Laplace transform .Poles and element transfer function and block diagram. Modeling of physical systems; Electrical, mechanical, hydraulic and pneumatic systems. Linearization of nonlinear systems. System representations. Thermal, System block diagrams and signal flow graphs. Overall transfer function, block diagrams reduction techniques and Mason's gain formula. Time response analysis and performance indices of first and second order systems. Dominate poles of high order systems. Routh-hurwitz stability criterion. Stability analysis using root locus. Bode diagrams and Nyquist stability criterion. Introduction to analysis using state-space equations.				

Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
0507481	Electrical Machines	3	0507381	-
Magnetic circuits; single-phase and three-phase transformers: Principles, analysis, performance characteristics and testing; electromechanical energy conversion; principles and classification of DC generators; DC motors: analysis, performance characteristics, starting, testing and speed control; synchronous motors: analysis, performance characteristics, applications, starting, and testing; three-phase induction motors: analysis, performance characteristics, testing, starting and speed control; single-phase induction motors; special types of motors: stepper motors, universal motors, reluctance motors, brushless DC motors.				
0507541	Internal Combustion Engines	3	0507342 and 0507344	-
Fundamentals of engines and their types. Review of air-standard, fuel-Air and actual cycles. Fuel and combustion. Fuel feeding systems. Engine testing and performance characteristics. Air pollution. Forced induction systems. The course also includes an experimental part which allows the student to estimate the performance of both spark ignition and compression ignition engines, effect of some parameters on engine performance like ignition timing, Air/Fuel ratio, compression ratio and perform an energy balance of the compression ignition engine.				
0507542	Energy Conversion	3	0507342	
Energy classification, sources and utilization; Energy growth and economics; Fossil-Fuel Systems and combustion in steam power plants. Steam generators. Boiler rating and performance. Environmental aspects of thermal power plants. Overview on renew-able energy sources with emphasis on solar and wind energy systems. Introduction to direct energy conversion systems; ThermoElectrical, photovoltaic and thermionic converters. Energy Storage.				
0507591	Operation and Maintenance Engineering	3	0507461	
Introduction to maintenance engineering and management, background and history of maintenance engineering, definition of maintenance and influencing factors, maintenance engineering goal, maintenance process and function, economical consequence of maintenance, maintenance cost: direct and indirect, maintenance strategy and objective, maintenance classification: corrective, preventive and proactive, introduction to RAMS, TPM, RCM, RCFA and LCC, maintenance methods and tools, maintenance management: definitions and methods, maintenance methodologies in industry: modification, inspection, performance measurement, safety and quality in maintenance.				
0507592	Practical Training	3	Pass 120 cr. hrs	
The student undertakes practical training after completing the required number of credit hours in accordance with the relevant regulations for training in the Faculty of Engineering.				
	Graduation Project I	1	Pass 110 cr. hrs	
In this project, students (individually or in teams) are assigned engineering problems which may be theoretical, experimental or both and contains a major design component. The students study the problem assigned and its theoretical background, set the approach, conduct a literature review, make the problem analysis and preliminary design and write a proposal including a cost estimate and time table for implementation over the second semester.				
0507594	Graduation Project II	3	0507593	
In project II, the students carry out detailed design, construction and testing (if any), write a comprehensive report on the work as per the format posted on the department web site. The report may include, where applicable, economical and environmental assessments. The project work is presented by the students to an examination panel who judge the work.				
0507543	Thermal Power Plants	3	0507342 and 0507344	
Review of power cycles related to steam and gas turbine power plants; types and characteristics of steam power plants including various plant components; water treatment; corrosion; load management; power plant economics. Environmental aspects.				
0507444	Heat transfer (2)	3	0507344	
Review of basic concepts; radiation properties and processes; radiation exchange among surfaces; two dimensional steady state conduction; analytical, graphical, and numerical solutions; one-dimensional transient conduction; topics in convective heat transfer; exact and approximate problem solutions, combined entry length solution in pipe flow; heat transfer in turbulent and high speed flows; liquid metal heat transfer; freezing, melting, heat-pipe heat transfer; multimode heat transfer.				

Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
0507442	Air Conditioning (2)	3	0507441	-
Review of psychrometry; analysis of inside and outside design conditions; low speed air conditioning systems; cooling coils, basic cooling load analysis; by-pass systems; single duct, double and multi-duct systems; unit location and position funding; duct design, fans, energy; ventilation; control systems.				
0507422	Turbomachinery	3	0507321 and 0507342	-
Review of basic thermodynamics and fluid mechanics; types of turbomachines; 2-D cascades; Principles of operation of compressors and pumps; centrifugal pumps, axial-flow pumps, axial-flow turbines; and radial-flow turbines.				
0507521	Design of Sanitary Systems	3	0507321	-
History of plumbing systems, Basic definitions; Water sources, water quality and treatment, drinking water quality. Basic fluid mechanics principles, building cold water supply systems and design, building hot water supply systems and design. Valves in water supply systems and selection, plumbing materials; plumbing fixtures. Building soil and waste drainage systems (internal and external), traps, clean-outs, interceptors, and back water valves; indirect waste piping and special wastes; drainage systems design; vents and venting; design of storm water drains; building fire fighting systems.				
0507453	Strength of Materials (2)	3	0507351	-
Non-Linear behavior of materials, dynamic & repeated loading, stress concentration, stresses in initially curved beams. Deflection of beams, moment-area method, Three-Moment equation, strain-energy method. Statically indeterminate beams, theory of columns. Energy methods in applied mechanics.				
0507454	Failure and Fracture Analysis	3	0507351	-
Role of failure prevention in Mechanical design. Stress and deformation. Classical theories of failure. Notches and notch sensitivity. Fracture Mechanics: Rowan –Irwin relationship, Linear elastic fracture mechanics, Elastic stress field approach, Energy balance approach, J-Integral. Fatigue: Low cycle fating, High cycle fatigue, and remaining life. Creep and some mathematical; models. Wear.				
0507531	Computer-Aided Design	3	0507281 and 0507432	-
Fundamentals of Hardware and Software. Techniques for Geometric Modeling (Line, Surface and Volume Modeling). Elements of Interactive Computer Graphics. Entity Manipulation. Introduction to Finite Element Techniques. Using in-house software: Introduction to Graphics User Interface, Sketcher Environment, Parametric & Feature-Based Solid Modeling, Surface Modeling, Concept of Parent/Child Relationships, Part Construction Techniques, Patterns, Advanced Features, Cross-Sections, Parametric Relations, Component Assembly Techniques, Drafting (Drawing) Techniques, Animation, Introduction to Mechanism Design and Analysis, Introduction to Structural and Thermal Simulation.				
0507532	Introduction to Finite Element Method	3	0507344 and 0507281	-
Introduction and basic concepts of finite element method. Finite element formulation and stiffness matrix. One-dimensional elements (spring, bar and beam elements) Two-dimensional elements (Plane triangular element). Finite element analysis of vibration, heat transfer, fluid flow, and thermal stress problems. Discussion.				
0507562	Robotics	3	0507463 and 0507333	-
Introduction and robot application, kinematic configuration, kinematic analysis, forward & inverse dynamic analysis. Lagrange formulation, Newton-Euler Method. Path planning and motion programming. Robot arm control. Robot languages. Vision systems.				
0507522	Hydraulic and Pneumatic Systems Design	3	0507463	-
The objective of this course is to familiarize student with fluid power systems design control and operation. It covers the fundamentals of fluid flow, modeling and n port concepts, fluid power modulation, static and dynamic modeling of pumps, motor, control valves, transmission lines and fluid drives. It also deals with design control and operation of mechanical and Electrical hydraulic servodrives with feedback. Emphasis is placed on linear hydraulic systems behavior.				

Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
0507511	Autotronics	3	0507541	-
Design and control of Fuel Feeding system, Ignition system, Suspension system, Steering system, Brake system, Differential gear box, Navigation system, Air conditioning and Car safety.				
0507581	Selected Topics in Mech. Eng.	3	0507342 and 0507344	
The contents of this course are outlined after the approval of the department council.				

### *Courses offered for other Departments*

Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
0507350	Introduction to Mechanics of Materials	3	0303101	
Basic concepts, force systems, equilibrium, free body diagram, structures, stress and strain, mechanical properties of materials, axial loading, torsion and bending, stress and strain transformation.				
0507354	Material Science and Engineering	3	0507350	
Atomic structure and bonds between atoms, crystal structure, solidification, defects of crystal structure, diffusion in solid materials, mechanical properties of materials, heat treatment of metals, phase diagrams and engineering alloys, ceramics, polymers and composite materials, corrosion				
0507340	Introduction to Thermodynamics and Heat Transfer	3	0507321	
Introduction to thermodynamics, first law of thermodynamics, flow and work, second law of thermodynamics, thermal cycles, third law of thermodynamics, Introduction to heat transfer, heat transfer modes and application for heat exchangers.				