



Guideline Handbook

Bachelor of Science in Mechanical Engineering Program

College of Engineering - University of Bahrain

Version 2026

Bachelor of Science in Mechanical Engineering Program 2026

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Bachelor of Science in Mechanical Engineering Program 2026

1. Program Description:

The Bachelor of Science in Mechanical Engineering Program 2026 in the Department of Mechanical Engineering offers students a solid foundation in engineering mathematics, mechanics, thermofluids, materials, manufacturing, mechanical design, control systems, and energy systems, highlighting the vital role of mechanical engineering in supporting industrial development, technological innovation, energy efficiency, sustainability, and economic growth in the Kingdom of Bahrain and beyond. Through a practice oriented learning experience that integrates laboratory work, engineering design projects, computer-aided engineering tools, industrial training, capstone projects, and exposure to contemporary engineering practices, the program systematically develops analytical problem-solving, engineering design, data analysis, teamwork, communication, and the effective use of modern engineering tools, enabling students to apply their knowledge effectively in the analysis, design, operation, improvement, and maintenance of mechanical and industrial systems. As a result, graduates are well positioned to pursue careers in manufacturing, production, energy, engineering design and maintenance sectors, in roles such as Mechanical Engineer, Design Engineer, Maintenance Engineer, Manufacturing Engineer, and Project Engineer, and they are also equipped to undertake further study or follow professional pathways in advanced mechanical engineering disciplines.

The curriculum comprises 46 courses, with total of 137 credit hours.

The Program is placed at NQF level 8 with (597) NQF credits, which is equivalent to 137 University of Bahrain credits.

Students can normally complete all program requirements over 4 years, studied full time across 8 semesters.

2. Program Educational Objectives (PEOs):

The program seeks to achieve the following objectives:

1. *Execute professional role in mechanical and allied disciplines*
2. *Engage in professional development activities excelling in their chosen domains.*
3. *Perform leadership and societal wellbeing roles in a responsible manner.*

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3. Program Intended Learning Outcomes (PILOS):

Upon graduation, graduates of the Bachelor of Science in Mechanical Engineering Program 2026 will be able to:

1. *An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.*
2. *An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.*
3. *An ability to communicate effectively with a range of audiences.*
4. *An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.*
5. *An ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives.*
6. *An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.*
7. *An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.*

4. Admission Requirements:

The target learners of the program are applicants who meet the general admission requirements of the University of Bahrain as stated in the Study and Examinations Regulation.

In addition, applicants must satisfy the following program-specific requirements:

First: General conditions for admission to the university:

- The applicant must have a high school diploma or a grade point average of at least 70%, noting that acceptance is according to a competitive manner.
- The applicant must not have exceeded two academic years of high school or whatever is equivalent.
- To pass the General Aptitude Test conducted by the University in Arabic language for Arab-speakers, and in English language for non-Arabic Speakers.
- Successfully pass the personal interview organized by the Admission and Registration Office.
- Be medically fit.
- Must be of good conduct and behavior.

Second: Admission requirements for colleges:

- Be proportional to the branch certificate (literacy, medicine, business, etc.) and colleges allocated to each of them.
- Best applicant will be chosen for admission to colleges on a competitive manner for those who meet all the conditions, according to the absorptive capacity for academic programs and competitive based on the average high school test results, acceptance tests and personal interview.

Certificates of high schools and branches under which allows students to submit an application at the University of Bahrain:

- Bahraini secondary school certificate in the following tracks (provided that no less than 70% average): literacy, medicine, business, religion, industry, advertisements and the unified routes.
- University also accepts certificates awarded by private schools in the Kingdom of Bahrain, which is recognized by the Ministry of Education, noting that these certificates are based on twelve years of schooling starting from the first year of primary school.
- Arab high school diploma awarded by the Ministries of Education in the Arab States: Such certificate shall be treated with the same standard that is dealt by the General Certificates of Bahraini high schools after being approved by the authorities of the Ministry of Education, where these certificates are based on twelve years of schooling starting from the first year of primary school.
- High Pakistani secondary school certificate: The University accepts only the second section of this certificate.
- High Indian Certificate of Secondary Education: The University only accepts the senior level of these certificates.
- British secondary school certificates (O-level, IGCSE, GCSE, A-level, GCE): The University does not accept the normal level of (O-level, IGCSE, GCSE) for these certificates, holders of these certificates must obtain high grades in two subjects in the advanced level of (A-level,

GCE) and five other subjects in the normal level of (O-level, IGCSE, GCSE), noting that the grade is not less than the required grade according to the requirements of each college.

Special requirements for the College of Engineering for students coming from private schools:

Ordinary Level (O-level, IGCSE, GCSE) estimate at least C in the following subjects:

- English.
- Mathematics.
- Two of the following subjects (physics, chemistry, biology).
- Any other subject

Advanced Level (A-level, GCE) a minimum of C in the following subjects: -

- Mathematics.
- Any scientific subject: (e.g. physics, chemistry, biology, etc.).

The admission policy is stated in the Study and Exam Regulations, Chapter 2, Article 4 up to Article 8. Admission to the Bachelor of Science in Mechanical Engineering Program depends on the policies and standards set by the university where the admission/screening is normally done at the university level. Hence, students admitted in the Program are matched to the Program Educational Objectives and available resources of the department through the University Admission requirements.

The Department of Mechanical Engineering does not have particular/special admission requirements.

It is noted that for College of Engineering, the new following admission criteria is approved:

- Math's Level must be at least A-Level.
- Physics must be at least AS-Level.
- Chemistry must be GCSE level at least.

5. Graduation Requirements:

To graduate, students must:

1. Successfully complete all courses in the study plan, totaling 137 credit hours, within the maximum period specified in the University regulations.
2. Achieve a minimum cumulative GPA of 2 out of 4.
3. Complete all program-specific requirements, including graduation project / internship / thesis / comprehensive exam, if applicable.
4. Fulfil all other requirements stipulated in the University of Bahrain Study and Examinations Regulation.

5.1. Exit Degrees:

In accordance with the University of Bahrain regulations, the program includes the following exit degrees:

1. Diploma in Diploma in Mechanical Engineering 2026:
 - Minimum required credit hours: 69
2. Associate Diploma in in Mechanical Engineering Program 2026:
 - Minimum required credit hours: 96

6. Program Duration

The normal duration of the program is 4 years (8 semesters).

Students are expected to complete the program within this period, with the possibility of extension in accordance with the University of Bahrain Study and Examinations Regulation.

7. Language of Instruction

The language of instruction for the Bachelor of Science in Mechanical Engineering Program-2026 is English.

8. Career Opportunities and Graduate Destinations

Those graduating with Bachelor of Science in Mechanical Engineering Program 2026 degree can pursue careers such as:

- *Mechanical Design Engineer/ Entrepreneur*
- *Manufacturing / Production Engineer*
- *Maintenance and Reliability Engineer*
- *Energy and HVAC Engineer*
- *Project Engineer / Engineering Consultant*

9. Attendance and Learning Mode

The program follows a fulltime attendance system.

The primary mode of teaching and learning is (**Traditional Education**) delivery, supported by e-learning tools and digital platforms to enhance the learning experience.

10. Study Methodology

The program is delivered through the study of the topics outlined in the course syllabi, using appropriate teaching and learning methods consistent with the nature of the discipline.

Students are assessed using approved evaluation methods aligned with the intended learning outcomes of each course.

11. Academic Probation and Dismissal

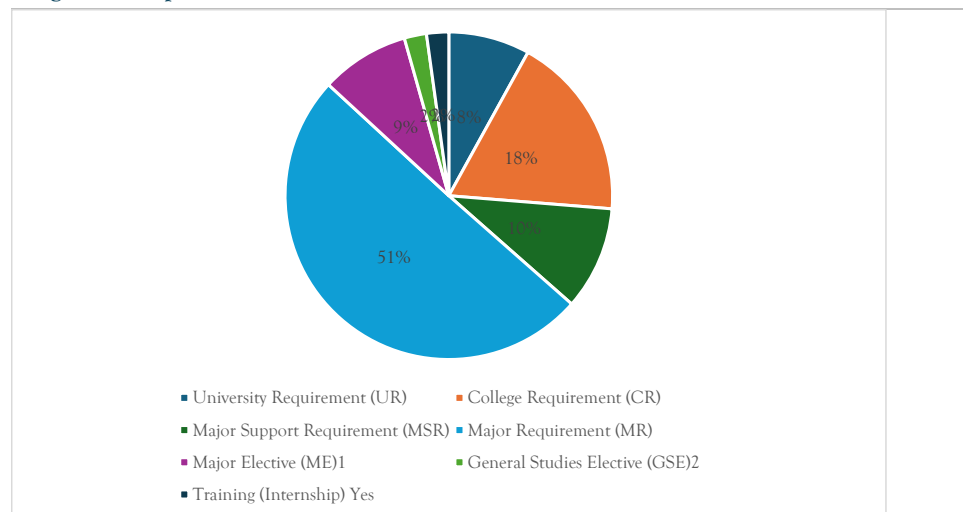
Students are placed on academic probation if their cumulative GPA falls below the minimum required at the end of any semester. If the student fails to raise their GPA to a minimum in the next semester, a second academic probation is issued.

A student will be dismissed from the University in the following cases:

1. Failure to raise the cumulative GPA (CR no) after the prescribed probation period.
2. Exceeding the maximum period 7 years allowed for completion of the program.
3. Committing a violation that warrants dismissal in accordance with the University regulations.

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Program Components



University Requirement (UR)	11
College Requirement (CR)	25
Major Support Requirement (MSR)	14
Major Requirement (MR)	69
Major Elective (ME) ¹	12
General Studies Elective (GSE) ²	03
Training (Internship) Yes	03
Total Credit (CRD)	137

1. Students must select four (4XX) courses from Major Elective (ME) List. Additional to this, two courses must be selected from ME list as Job Placement Courses. This needs consultation and approval of the department.
2. Student must select one from Humanities and Social Science Component. This includes any course from the following.

HU/SS Courses - Humanities and Social Science Component: Any course from the following:

- o Humanities: Fine Arts, History, American Studies, Classics, Communications, English, (Foreign Language) French, Music, Philosophy, Theatre, Literature (Arabic), Religion (comparative).
- o Social Science: Anthropology, Economics, Education, Geography, History, Psychology, Sociology, Women's Studies, Political Science

Detailed Study Plan

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
ISLM 103	Islamic Culture	2	0	2	UR	----	NO	Traditional Education
ENGL 101	Communication Skills I	3	0	3	CR	----	NO	Traditional Education
MATHS 101	Calculus I	3	0	3	CR	----	NO	Traditional Education
PHYCS 101	Introductory Physics I	3	2	4	MSR	----	NO	Traditional Education
MECH 161	Engineering Drawing	1	6	4	MR	----	YES	Traditional Education
Total		12	8	16				

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
CHEMY 101	General Chemistry I	3	2	4	CR	----	NO	Traditional Education
PHYCS 102	Introductory Physics II	3	2	4	MSR	PHYCS 101	NO	Traditional Education
MATHS 102	Calculus II	3	0	3	CR	MATHS 101	NO	Traditional Education
MECH 132	Thermofluids	2	2	3	MR	----	YES	Traditional Education
MECH 163	Statics	2	2	3	MR	PHYCS 101	YES	Traditional Education
Total		13	8	17				

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
HRLC 107	Human Rights Principles	2	0	2	UR	----	NO	Traditional Education
ENGL 242	Report Writing and Presentation	3	0	3	CR	ENGL 101	NO	Traditional Education
MATHS 205	Differential Equations	3	0	3	CR	MATHS 102	NO	Traditional Education
MECH 212	Manufacturing Fundamentals	2	2	3	MR	----	YES	Traditional Education
MECH 236	Applied Thermodynamics	2	2	3	MR	MECH 132	YES	Traditional Education
MECH 263	Dynamics	2	2	3	MR	PHYCS 101	YES	Traditional Education
Total		14	6	17				

Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
ARAB 108	Arabic Language Skills	2	0	2	UR	----	NO	Traditional Education
MATHS 203	Calculus III	3	0	3	CR	MATHS 102	NO	Traditional Education
STAT 276	Statistical Data Analysis for Engineering	3	0	3	CR	MATHS 102	NO	Traditional Education
MECH 202	Materials Science	2	2	3	MR	CHEM Y 101	YES	Traditional Education
MECH 271	Mechanics of Materials	2	2	3	MR	MECH 163	YES	Traditional Education
MECH 274	Numerical Analysis	2	2	3	MSR	MATHS 102	NO	Traditional Education
Total		14	6	17				

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
ENTR 101	Basics of Innovation & Entrepreneurship	2	0	2	UR	—	NO	Traditional Education
EENG 303	Elements of Electrical Engineering	2	2	3	MSR	PHYCS 102	NO	Traditional Education
MECH 333	Fluid Mechanics	2	2	3	MR	MATHS 205	YES	Traditional Education
MECH 373	Theory of Machines and Mechanisms	2	2	3	MR	MECH 263	YES	Traditional Education
MECH 375	Design of Mechanical Elements	2	2	3	MR	MECH 161 & Completion of 60 credits	YES	Traditional Education
MECH 382	Computer Programming and its Applications in Mechanical Engineering	2	2	3	MR	Completion of 60 credits	YES	Traditional Education
Total		12	10	17				

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
GSE XXX	Humanities / Social Sciences	3	0	3	GSE	—	NO	Traditional Education
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	—	No	Traditional Education
MECH 302	Engineering Economics	3	0	3	MR	Completion of 70 credits	YES	Traditional Education
MECH 312	Manufacturing Processes	2	2	3	MR	MECH 212	YES	Traditional Education
MECH 335	Heat Transfer	2	2	3	MR	MATHS 205	YES	Traditional Education
MECH 384	Vibration	2	2	3	MR	Completion of 70 credits	YES	Traditional Education
Total		15	6	18				

Training Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MECH 396	Industrial Training	0	6*	3	Training	Completion of 85 credits	YES

Year 4 - Semester 7

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
MECH 418	Engineering Management	2	2	3	MR	MECH 302	YES	Traditional Education
MECH 440	Refrigeration and Air Conditioning	2	2	3	MR	MECH 236 & Completion of 90 credits	YES	Traditional Education
MECH 475	Design of Mechanical Systems	3	2	4	MR	MECH 375	YES	Traditional Education
MECH 497	Senior Design Project I	0	3*	1	MR	MECH 375 & Completion of 90 credits	YES	Traditional Education
MECH 4xx	Major Elective I ¹	2	2	3	ME	As per ME list	YES	Traditional Education
MECH 4xx	Major Elective II ¹	2	2	3	ME	As per ME list	YES	Traditional Education
Total		11	13	17				

Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
MECH 430	Power Plant and Desalination	2	2	3	MR	MECH 335	YES	Traditional Education
MECH 485	Systems and Control	2	2	3	MR	MECH 384	YES	Traditional Education
MECH 4xx	Major Elective III ¹	2	2	3	ME	As per ME list	YES	Traditional Education
MECH 4xx	Major Elective IV ¹	2	2	3	ME	As per ME list	YES	Traditional Education
MECH 498	Senior Design Project II	0	9*	3	MR	MECH 497	YES	Traditional Education
Total		08	17	15				

Major Elective Courses

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
MECH 410	Production and Processing of Aluminum	2	2	3	ME	MECH 312	YES	Traditional Education
MECH 411	3D Printing Technologies	2	2	3	ME	MECH 312	YES	Traditional Education
MECH 412	Sustainable Design & Manufacturing	2	2	3	ME	MECH 312	YES	Traditional Education
MECH 421	Operations Research	2	2	3	ME	STAT 276	YES	Traditional Education
MECH 422	Industry 4.0 and Smart Manufacturing	2	2	3	ME	MECH 312	YES	Traditional Education
MECH 426	Quality Control	2	2	3	ME	STAT 276	YES	Traditional Education
MECH 442	Advanced Fluid Mechanics	2	2	3	ME	MECH 333	YES	Traditional Education
MECH 444	Internal Combustion Engines	2	2	3	ME	MECH 236	YES	Traditional Education
MECH 446	Renewable Energy Technologies	2	2	3	ME	MECH 335	YES	Traditional Education
MECH 455	Special Topics	2	2	3	ME	Competition of 100 credits	YES	Traditional Education
MECH 471	Failure Analysis	2	2	3	ME	MECH 202, MECH 312	YES	Traditional Education
MECH 473	Tribology	2	2	3	ME	MECH 333	YES	Traditional Education
MECH 476	Entrepreneurship	2	2	3	ME	MECH 302	YES	Traditional Education
MECH 477	Machine Health Monitoring	2	2	3	ME	MECH 384	YES	Traditional Education
MECH 478	Product Design and Development	2	2	3	ME	MECH 302	YES	Traditional Education
MECH 479	Introduction to Finite Element Methods	2	2	3	ME	MECH 375	YES	Traditional Education
MECH 480	Robotics and Mechatronics Engineering	2	2	3	ME	MECH 373	YES	Traditional Education
MECH 481	AI Application in Mechanical Engineering	2	2	3	ME	MECH 382	YES	Traditional Education
MECH 482	Microelectromechanical Systems (MEMS)	2	2	3	ME	MECH 373	YES	Traditional Education
MECH 499	Cooperative Learning	0	12	6*	ME - Training	Department Approval & Co-requisite MECH 498	YES	Industrial Training

*This course may be undertaken by students in Semester 8 as a substitute for two elective courses, subject to approval by the department and in accordance with program requirements.

General Studies Elective Courses

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ART 221	Traditional Music of Bahrain and Its Application	3	0	3	GSE	---	NO
CHL 101	Introduction to Chinese Language	3	0	3	GSE	---	NO
EDPS 144	Psychology of Learning and Memory	3	0	3	GSE	---	NO
EDTC 100	Teaching and Learning Technology	3	0	3	GSE	---	NO
FREN 141	French I	3	0	3	GSE	---	NO
GERM 101	Introduction to German	3	0	3	GSE	---	NO
JAPN 101	Japanese Level I	3	0	3	GSE	---	NO
SPAN101	Spanish I	3	0	3	GSE	---	NO
TL 101	Turkish Language	3	0	3	GSE	---	NO
KL 101	Korean Language	3	0	3	GSE	---	NO
LAW 101	Introduction to Legal Studies	3	0	3	GSE	---	NO
SPSC 100	Health and Sports	3	0	3	GSE	---	NO
LAW 106	Constitutional Law I	3	0	3	GSE	---	NO
PSYC 103	Introduction to Psychology	3	0	3	GSE	---	NO
PSYC 120	Psychology of Marriage	3	0	3	GSE	---	NO
PSYC 211	Educational Psychology	3	0	3	GSE	---	NO
SOCIO 161	Introduction to Sociology	3	0	3	GSE	---	NO
SOCIO 181	Introduction to Anthropology	3	0	3	GSE	---	NO
SOCIO 191	Citizenship, Identity and Globalization	3	0	3	GSE	---	NO
SOCIO 224	Sociology of Health	3	0	3	GSE	---	NO
SOCIO 226	Sociology of Arabian Gulf	3	0	3	GSE	---	NO
GSE XXX	Other electives	X	X	3	GSE	Department Approval	NO

Course Description

Course Code: MECH 132 Course Title: Thermofluids

NQF Level: (06)

Energy and the first law of thermodynamics: Energy balance for closed systems, energy analysis for cycles. Properties of pure substances. Control volume energy analysis. Second law of thermodynamics: statements of second law, Carnot cycle. Fluid Statics: Properties of fluids, Hydrostatic force on a plane and curved surface, Pressure measurements, Buoyancy, Stability of floating and submerged bodies. Rigid body motion, Internal viscous flows.

Course Code: MECH 161 Course Title: Engineering Drawing

NQF Level: (06)

Freehand sketch. Isometric and oblique views, orthographic projection, sectional and auxiliary views, linear dimensioning, fundamentals of interpenetrations and developments of surfaces. Limits and fits: geometric tolerances, fasteners and fastenings, surface finish notations, welding symbols and representations of standard elements. Applications with CAD software.

Course Code: MECH 163 Course Title: Statics

NQF Level: (06)

Introduction to statics, forces in plane, forces in space, equilibrium of particles and rigid bodies in two and three dimensions, centroid and center of gravity, distributed forces, moment of inertia, analysis of trusses, frames and machines, forces in beams, friction in square-threaded screws and bolts.

Course Code: MECH 202 Course Title: Materials Science

NQF Level: (06)

The Materials Science course explores the relationships between structure, processes, and properties of materials, covering bonding types and materials classification. It examines mechanical behavior, failure analysis, and standards for mechanical testing. Key topics include imperfections in solids, phase diagrams, phase transformations, corrosion types and prevention methods, heat treatment, composite materials, and microstructure visualization techniques. The course concludes with case studies on material selection.

Course Code: MECH 212 Course Title: Manufacturing Fundamentals

NQF Level: (06)

Metal casting: casting fundamentals, sand casting, die casting and investment casting. Sheet metal working: fundamental's, piercing, blanking, stamping, deep drawing, and stretch forming. Production of aluminum. Production of iron and steel. Welding of metals: welding physics, fusion welding processes, solid state welding processes. Introduction to basic turning, milling & drilling operations. Surface metrology.

Course Code: MECH 236 Course Title: Applied Thermodynamics

NQF Level: (06)

Second law of thermodynamics. Irreversibility and availability: second law efficiency, non-flow exergy and flow exergy. Exergy destruction. Vapor power cycles and exergy analysis: basic Rankine cycle, Otto cycle, Diesel cycle Brayton cycle. Refrigeration: vapor-compression refrigeration, refrigerant properties, absorption refrigeration. Heat pump systems.

Course Code: MECH 263 Course Title: Dynamics

NQF Level: (06)

Rectilinear and curvilinear motion of the particles, kinetics of particles, linear and angular momentum, work, energy and power, principle of impulse and momentum, impact: kinematics of rigid bodies, kinetics of rigid bodies, introduction to three-dimensional dynamics of rigid bodies. Computer applications are employed throughout the course.

Course Code: MECH 271 Course Title: Mechanics of Materials NQF Level: (06)
The concept of stress and strain, types of stresses, Hooke's law, stress strain relationship, axial loads, torsion and pure bending. Shearing force and bending moment diagrams, symmetric and unsymmetrical bending, composite beams, deflection of beams, shear stress in beams, statically indeterminate beams. Stress/strain transformation, principal planes & principal stresses, buckling of columns, thin/thick-walled pressure vessels. creep, and introduction to fatigue.

Course Code: MECH 302 Course Title: Engineering Economics NQF Level: (07)
Fundamentals of engineering economy. Time value of money. Present worth analysis. Annual worth analysis. Rate of return analysis. Replacement and retention analysis. Capital rationing. Breakeven analysis. Payback period analysis. Depreciation methods.

Course Code: MECH 312 Course Title: Manufacturing Processes NQF Level: (07)
Bulk deformation processes: rolling, forging and extrusion. Metal cutting: theory of metal cutting, single and multi-point cutting operations, high speed machining, tool life, tool materials. Grinding processes: wheel parameters, grinding parameters, grinding operations. Non-traditional machining: mechanical energy processes, electrical energy processes, thermal energy processes. Introduction to CNC machining: G&M codes, radius compensation, part programming. Machining economics: optimization of speed for production rate and cost, High efficiency machining, design considerations. Polymer's processing: basic concepts, extrusion, injection molding, dies/molds.

Course Code: MECH 333 Course Title: Fluid Mechanics NQF Level: (07)
Fluid kinematics, energy, and Bernoulli's equation. Dimensional analysis and similitude. Momentum and energy equations (Integral Relations), Differential relations in two and three dimensions: velocity and acceleration, Introduction to stream and potential functions, Compressible flow, normal shock waves. Introduction to Internal flow, Major and minor losses in pipe.

Course Code: MECH 335 Course Title: Heat Transfer NQF Level: (07)
Basic modes of heat transfer, surface energy balance. Heat Conduction equation in various coordinate systems. Steady one-dimensional heat conduction, conduction across flat plate, cylindrical, spherical shells, and extended surfaces (fins). Convection fundamentals and correlations, non-dimensional numbers in convection, external flow, internal flow, tube banks. Heat exchangers and their types, overall heat transfer coefficient, and design of heat exchangers. Radiation fundamentals, blackbody radiation, view factor, and radiation exchange between surfaces.

Course Code: MECH 373 Course Title: Theory of Machines and Mechanisms NQF Level: (07)
Basic concepts of mechanisms and machines; analysis of displacement, velocity, acceleration, static and dynamic forces of mechanisms; cam design; introduction to spur, helical, bevel, and worm gears, ordinary and epicycle gear trains, and Analysis. Balancing of rotating and reciprocating machinery. Governors, Computer applications are employed throughout the course.

Course Code: MECH 375 Course Title: Design of Mechanical Elements NQF Level: (07)
Design Process and Standards; Engineering Materials Selection based on Ashby's Charts; 3D Stress Analysis; Static Loading; Fatigue; Mohr's Circle; Stress Concentration; Safety Factor; Static and Failure Theories, fatigue strength, marine factors, Analysis of interference fit applications, curved beams; Shafts; Fasteners; Springs.

Course Code: MECH 382 Course Title: Computer Programming and its Applications in Mechanical Engineering NQF Level: (07)

This course introduces students to programming concepts and their applications in mechanical engineering using MATLAB. Topics include flowcharts, pseudocode, algorithms, data types, loops, functions, and input/output operations. Students will solve linear and nonlinear equations, perform data analysis, and model mechanical systems using MATLAB, Simulink, and Simscape. The course also covers basic numerical methods for optimization and introduces microcontroller programming for embedded applications. Fundamentals of artificial intelligence (AI) and an introduction to basic Python programming are incorporated to highlight their growing importance in engineering analysis, control, and design.

Course Code: MECH 384 Course Title: Vibration NQF Level: (07)

A review of the harmonic motion and Fourier series, undamped and damped free vibration of single degree of freedom systems, coulomb damping and torsional vibration. Forced Vibration. Vibration isolation and control. Transient vibration to arbitrary excitation. Multi-degree of freedom systems, inertia and stiffness coupling, natural modes of vibration, normal coordinates and modal analysis. Lagrange's equation and applications.

Course Code: MECH 396 Course Title: Industrial Training NQF Level: (08)

All students in the program must participate in an approved training program in a relevant industry. At the completion of 300 hours of supervised training, each student must submit a formal report and conduct an oral presentation.

Course Code: MECH 418 Course Title: Engineering Management NQF Level: (08)

Introduction to engineering management. Types and characteristics of production systems. Product design. Process and service design. Capacity planning. Project planning. Supply chain management. Forecasting methods and techniques. Inventory management. Quality management. Material requirements planning (MRP). Production scheduling.

Course Code: MECH 430 Course Title: Power Plant and Desalination NQF Level: (08)

Power plant classifications, load curves, and factors. Steam power plants, Rankine cycle with reheaters and feedwater heaters, Cogeneration. Gas turbine power plant, Brayton cycle with intercooling, reheating, and regeneration, combined gas-vapor power cycle, binary vapor cycle. Components of thermal power plants, steam generators, performance of boilers, Impulse and reaction turbines, convergent and convergent-divergent nozzles, etc. Water desalination, thermal desalination, reverse osmosis.

Course Code: MECH 440 Course Title: Refrigeration and Air Conditioning NQF Level: (08)

Basic principles of refrigeration and air conditioning systems, Reverse Carnot Cycle, Coefficient of Performance, Vapor compression Refrigeration cycle, Refrigeration system components, Multi-pressure Systems, Air cycle refrigeration systems, Vapor absorption refrigeration systems, Refrigerants, Air conditioning systems, Psychrometry and Psychrometric processes, Heating and cooling load calculations, Duct design.

Course Code: MECH 475 Course Title: Design of Mechanical Systems NQF Level: (08)

Design and analysis of mechanical systems based on critical studies of high-performance machinery. Applications of design fundamentals to mechanical components, and integration of components to form systems. Application of optimization and finite element analysis in design case studies.

Course Code: MECH 485 Course Title: Systems and Control NQF Level: (08)

Concept of systems, concept of open and closed loop systems, modeling of dynamic systems, state space models, systems performance and characteristics, stability and sensitivity analysis, basic control actions, root-locus analysis & design, frequency response analysis & design, Simulation of dynamics of complex systems introduction to modern control, applications.

Course Code: MECH 497 Course Title: Senior Design Project I NQF Level: (08)

In this 1st phase of the project, a preliminary study is carried out in teams under the supervision of a faculty member on an approved proposal of a research project relevant to the field. The research project may be of experimental or theoretical nature, where the application of engineering knowledge towards the project development is demonstrated. This phase involves a thorough literature review, the development of a detailed implementation plan, as well as the conduction of any preliminary studies and preparation needed for the execution of the 2nd phase of the project in the subsequent course (Senior Project II). An end-of-term written report is required.

Course Code: MECH 498 Course Title: Senior Design Project II NQF Level: (08)

In this 2nd phase of the project, the development and implementation of the research project are continued by the same team under the supervision of the same faculty member. This phase involves accurate implementation and completion of the project tasks, deep analysis of the results, and logical and evident-based reasoning of the outcomes and drawn conclusions. End-of-term written formal report, poster, and oral presentation are required.

List of Elective Courses

Course Code: MECH 410 Course Title: Production and Processing of Aluminum NQF Level: (08)

The course is designed to equip engineering students with various stages in aluminum production and its processing. The contents include flow diagrams and process descriptions of various sections of the aluminum plant. Smelting aluminum ores. Principles of electrochemistry and current efficiency. Production of aluminum alloys. Casting of aluminum alloys and cast structure. Cold work and hot working of aluminum and its alloys. Recrystallization during hot working. Welding of aluminum alloys. Annealing and precipitation hardening of aluminum alloys.

Course Code: MECH 411 Course Title: 3D Printing Technologies NQF Level: (08)

3D Printing is drawing attention as a collaborator of traditional manufacturing processes, thereby resulting in enhanced product and process performance. This course aims to equip future brains with various innovative 3D printing technologies to get them prepared for future challenges. Particular contents include VAT Polymerization,

Powder Bed Fusion, Direct Energy Deposition, Extrusion Based Printing, LOM processes, and Applications of 3D Printing.

Course Code: MECH 412 Course Title: Sustainable Design & Manufacturing NQF Level: (08)

This course explores the principles and practices of sustainable design and manufacturing, focusing on strategies to minimize environmental impact throughout the product lifecycle. Students will learn how to create products that are not only functional and aesthetically pleasing but also environmentally responsible and economically viable. The specific contents include sustainability fundamentals, sustainable design and manufacturing, product life cycle, eco-efficiency, energy and carbon modeling of manufacturing processes, circular economy and close loop manufacturing

Course Code: MECH 421 Course Title: Operations Research NQF Level: (08)

Concepts and techniques of deterministic operations research with emphasis on industrial applications. Topics include Linear Programming; Integer Programming; Duality; Sensitivity Analysis; Transportation; Networks; and Non-Linear Programming.

Course Code: MECH 422 Course Title: Industry 4.0 and Smart Manufacturing NQF Level: (08)

This course introduces the core concepts of Industry 4.0 and Smart Manufacturing, focusing on the digital transformation of mechanical systems through cyber-physical systems, the Industrial Internet of Things (IIoT), digital twins, and data analytics. It also covers smart machining, additive manufacturing, and human-machine interfaces, preparing students to apply modern automation and connectivity technologies in future manufacturing environments.

Course Code: MECH 426 Course Title: Quality Control NQF Level: (08)

This course focuses on the principles and techniques of quality control in manufacturing and engineering processes. It covers statistical quality control, process variation, control charts, sampling inspection, and process capability analysis. The course introduces the role of quality standards and systems such as ISO 9001 in supporting effective control practices. Emphasis is placed on applying analytical tools to monitor, maintain, and improve product and process quality in engineering environments.

Course Code: MECH 442 Course Title: Advance Fluid Mechanics NQF Level: (08)

Introduction to Advance Fluid Mechanics, External flow (Drag and Lift), Introduction to Computational Fluid Dynamics, Classifications of fluid machinery. Momentum and energy transfer between fluid and rotor. Principles and practice of scaling laws. Performance characteristics of centrifugal and axial flow fans, compressors, and pumps. Positive displacement pumps. Valves, types, and characteristics. Performance characteristics of axial and radial flow turbines. Fluid machinery noise, Approximate solutions of the Navier-Stokes Equation.

Course Code: MECH 444 Course Title: Internal Combustion Engines NQF Level: (08)

Fundamentals of internal combustion engine operation, thermodynamic cycles, and performance characteristics. Study of spark-ignition and compression-ignition combustion, fuel systems, lubrication, cooling, ignition, and exhaust systems. Analysis of performance parameters, testing, emissions, and modern developments in hybrid and alternative fuel engines.

Course Code: MECH 446 Course Title: Renewable Energy Technologies NQF Level: (08)

Fundamentals of renewable and sustainable energy resources, including solar, wind, hydro, tidal, and biomass systems. Study of solar radiation, photovoltaic and thermal energy conversion, wind turbine operation, and hydro-tidal power generation principles. Analysis of design features, system performance, and hybrid renewable energy integration for mechanical and electrical applications.

Course Code: MECH 455 Course Title: Special Topics NQF Level: (08)

Any important, relevant and possibly hot topic in the field that is not covered in the approved elective list. Topics may vary based on students' interest and availability of staff.

Course Code: MECH 471 Course Title: Failure Analysis NQF Level: (08)

Introduction to mechanical component failures, General procedures for failure analyses, Failure due to deficient design, Poor material selection, Stress concentrations, Imperfections in base metals, Improper manufacturing practices, Inadequate service conditions, Poor assembly/maintenance. Industrial engineering tools for Failure prediction and analysis and Case Studies.

Course Code: MECH 473 Course Title: Tribology NQF Level: (08)

Surface properties and surface contact stress; Friction, measurement of friction, theories of friction, thermal effects in sliding friction; Types of wear, wear of lubricated surfaces. Tribological properties of solid materials, solid lubricants, polymers, composites, the pv factor, lubricant properties, fluid lubricated thrust bearings. Fluid-lubricated journal bearings, oil supply grooves, wear analysis, and industrial preventive maintenance: case studies.

Course Code: MECH 476 Course Title: Entrepreneurship NQF Level: (08)

Introduction to entrepreneurship, recognizing opportunities and generating ideas, feasibility analysis, developing an effective business model, industry and competitor analysis, writing a business plan, establishing the ethical and legal foundation, evaluating financial strength and viability of a new venture, assembling a new-venture team, securing financing and funding, the importance of intellectual property and franchising.

Course Code: MECH 477 Course Title: Machine Health Monitoring NQF Level: (08)

Modern maintenance strategies with emphasis on predictive maintenance, including costs, planning and operational benefits, fundamentals of condition monitoring, vibration analysis, temperature and bearing condition monitoring, lubricant oil and wear debris analysis, acoustic and thermographic monitoring, core signal processing

concepts (time waveform interpretation, FFT spectra and diagnostic charts), sensors, data acquisition, monitoring hardware and software tools, introduction to ultrasonic inspection, motor current signature analysis (MCSA) and prognostics, and practical case studies for fault diagnosis and machine health monitoring.

Course Code: MECH 478 Course Title: Product Design and Development NQF Level: (08)

Product Development Process, Opportunity Identification, Product Planning, Identifying Customer Needs, Product Design Specifications, Product Concept Creation, Selection, and Testing, Industrial Design, Design for Manufacture and Environment, Prototyping, Service Design, Economic, Intellectual Property Rights, Sustainability in Product Design and Development.

Course Code: MECH 479 Course Title: Introduction to Finite Element Methods NQF Level: (08)

Basics of Finite Element Method, Stiffness (Displacement) Method, Truss Equations, Weighted Residual (Galerkin's Residual Method), Beam Equations, Plane Stress and Plane Strain Concepts/Stiffness Equations, Constant Strain Triangular Element (CST), Linear Strain Triangular Element (LST), Isoparametric Formulation, Numerical Integration (Gaussian & Newton-Cotes Quadrature), 3D Stress Analysis, Heat Transfer, Basic Differential Equations, One Dimensional Elements, Two Dimensional Elements, Fluid Flow, Application of FEM to structural dynamics. Applications using commercial packages. Application of ANSYS (student version is available for free download) package to solid mechanics, fluid mechanics, heat transfer problems and dynamic structural problems.

Course Code: MECH 480 Course Title: Robotics and Mechatronics Engineering NQF Level: (08)

Fundamentals of Robotics and Mechatronics Engineering, modeling, kinematics, design, and control of robotic and electromechanical systems. Integration of mechanical, electrical, and computational concepts, intelligent automated solutions. Mechatronics fundamentals, electrical and electronic components, semiconductor devices, system response, analog signal processing with operational amplifiers, Boolean logic, sequential circuits, sensors and actuators, and microcontroller programming using the PIC/Arduino platform.

Course Code: MECH 481 Course Title: AI Application in Mechanical Engineering NQF Level: (08)

Fundamental concepts and practical applications of Artificial Intelligence (AI) in mechanical engineering. AI methods including machine learning, neural networks, fuzzy logic, and expert systems, Practical application in mechanical system modeling, maintenance, and control using available software.

Course Code: MECH 482 Course Title: Microelectromechanical Systems (MEMS) NQF Level: (08)

Fundamentals of Microelectromechanical Systems (MEMS), historical significance of MEMS, applications in various fields, microscale mechanics, fabrication techniques, sensors and actuators principles, MEMS design tools, and practical case studies.

Course Code: MECH 499 Course Title: Cooperative Learning

NQF Level: (08)

This course provides the students an opportunity to working full time in a relevant industrial establishment for one academic semester. Gaining the experience of a structured job experience and working on a realistic capstone project using knowledge and skills obtained in prior courses wherein they incorporate Engineering standards and multiple realistic constraints such as economic, ethical, social, political, environmental, health and safety, manufacturability and sustainability. The students are expected to submit a written report of the work experience together with a written report detailing the project design efforts, and often a working prototype.

University Requirements Courses Descriptions

Course Code: ARAB 108 **Course Title:** Arabic Language Skills **NQF Level:** (6)

Study the fundamentals of the Arabic language in terms of formulation, syntax, vocabulary, and semantics, with emphasis on analyzing its styles through reading, appreciation, and critical analysis. The course also examines the aesthetic features and semantic and expressive values of the Arabic language through texts representing various literary genres, both poetry and prose.

Course Code: HIST 122 **Course Title:** Modern History of Bahrain and Citizenship **NQF Level:** (6)

Spatial identity of Bahrain: Brief history of Bahrain until the 18th century; the historical roots of the formation of the national identity of Bahrain since the 18th century; the modern state and evolution of constitutional life in Bahrain; the Arabic and Islamic dimensions of the identity of Bahrain; the core values of Bahrain's society and citizenship rights (legal, political, civil and economic); duties; responsibilities and community participation; economic change and development in Bahrain; Bahrain's Gulf, Arab and international relations.

Course Code: HRLC 107 **Course Title:** Human Rights Principles **NQF Level:** (6)

This course deals with the principles of human rights in terms of the definition of human rights, scope, sources with a focus on the International Bill of Human Rights; The Charter of the United Nations; Universal Declaration of Human Rights; The International Covenant on Economics, Social and Culture rights; Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment; Mechanics and the Constitutional Protection of Rights and Public Freedoms in Kingdom of Bahrain.

Course Code: ISLM 103 **Course Title:** Islamic Culture **NQF Level:** (6)

Study the concept of Islamic culture, its sources, and its fundamental principles, as well as the major Islamic systems and their contemporary applications. Explain the position of Islamic values and culture on contemporary issues, including their rejection of terrorism, support for dialogue and tolerance, and emphasis on peaceful coexistence in a multicultural world.

Course Code: ENTR 101 **Course Title:** Basics of Innovation & Entrepreneurship **NQF Level:** (6)

This course introduces students to the main theories, principles and concepts of innovation and entrepreneurship, and develops a creative and entrepreneurial mindset. It equips students with the tools and skills to analyze market opportunities, construct and assess innovative business models, and plan the resourcing and marketing of a proposed venture. Through structured online sessions, applied case analyses and a sequence of venture-development tasks, students work independently to take an innovative idea from opportunity identification through to a business model, an indicative budget and a marketing plan, taking account of the ethical, social and sustainability dimensions of entrepreneurial decisions.

College Requirement Courses Descriptions

Course Code: CHEMY 101 **Course Title:** General Chemistry I **NQF Level:** (5)

Atomic structure; formulas and names of chemical molecules; Avogadro's number and the mole; stoichiometry of chemical reactions; acid-base and redox reactions, solutions, concentration units, and colligative properties; gases and gas laws; electronic structure and the electron configuration; periodic properties and chemical bonding: ionic and covalent; Lewis structures and formal charge; molecular geometry and hybridization. Related practical work.

Course Code: ENGL101 **Course Title:** Communication Skills I **NQF Level:** (6)

This course focuses on reading skills and strategies and language development. The reading section concentrates on high-interest contemporary topics and encourages students to increase speed and efficiency. The writing component, integrated to the reading materials, reviews grammatical structures, develops language accuracy and introduces paragraph writing. Students are required to upgrade their grammar, reading and listening skills on the internet.

Course Code: MATHS 101 **Course Title:** CALCULUS I **NQF Level:** (5)

Algebra. Functions and graphs. Trigonometry. Conic sections. Limits and continuity. Derivatives and integrals. Applications of derivatives which include Mean Value Theorem, extrema of functions and optimization. Definite integrals and the Fundamental Theorem of Calculus.

Course Code: MATHS 102 **Course Title:** CALCULUS II **NQF Level:** (6)

Applications of definite integrals, including areas, volume, and surface areas of solids of revolution, arc length and centroids. Transcendental functions, indeterminate form, and L'Hopital's Rule. Techniques of integration and improper integrals. Infinite series, power series. Maclaurin and Taylor Theorem.

Course Code: MATHS 203 **Course Title:** CALCULUS III **NQF Level:** (6)

Parametric equations and Polar coordinates. Vectors and surfaces. Limits, derivatives, and integrals of vector-valued functions. Partial differentiation. Multiple and line integrals and their applications. Green's and Stokes' Theorems.

Course Code: MATHS 205 **Course Title:** Differential Equations **NQF Level:** (6)

Differential equations of first order and their solutions. Separable and exact equations. Equations convertible to separable type. Higher order linear ODE's with constant coefficients (homogeneous and nonhomogeneous). Power series method for second order linear equations. Variation of parameters. Laplace transform techniques. Applications of differential equations.

Course Code: ENGL242 **Course Title:** Technical Report Writing and Presentation **NQF Level:** (7)

This course offers theoretical and practical experience in technical report writing and presentation. It presents the steps involved in writing a report in detail and in presenting its findings. Presentation skills are also introduced.

The emphasis throughout is upon tasks and assignments, the most important of which is the production of a full-length report and formally present it using power point

Course Code: STAT 276 **Course Title:** Technical Report Writing and Presentation **NQF Level:** (6)

Introduction to statistical methods for data analysis and interpretation, descriptive statistics and data visualization, statistical inference, probability distributions, significance tests, Analysis of Variance (ANOVA), linear and nonlinear regression analysis. Principles of design of experiments, statistical quality control. Tools: spreadsheet software and programming environment.

Major Support Requirement Courses Descriptions

Course Code: PHYCS 101 Course Title: Introductory Physics I NQF Level: (5)

Units and Measurements; Motion; Brief Review of Vectors; Projectile Motion; Newton's Laws of Motion; Work and Energy; Impulse and Momentum; Rotational Dynamics; Equilibrium of a Rigid Body; Periodic Motion.

Course Code: PHYCS 102 Course Title: Introductory Physics II NQF Level: (6)

Electric charges and fields; Coulomb's and Gauss's laws, electric potential, capacitors and dielectrics, direct current circuits, Kirchhoff's rules, magnetic field and flux, Ampere's law, induced emf, Lenz's laws, mutual and self-inductance; AC circuits; RLC circuit.

Course Code: MECH 274 Course Title: Numerical Analysis NQF Level: (6)

Taylor series and error analysis. Essential linear algebra for numerical methods including matrix operations, linear independence, rank, determinant, singularity, conditioning, residual error, inner products, orthogonality, symmetric positive definite matrices, and basic eigenvalue concepts. Solution of linear algebraic systems using Gauss elimination, Gauss-Jordan elimination, LU decomposition, and Conjugate Gradient Method. Interpolation, least squares method, roots of nonlinear equations, numerical differentiation and integration using trapezoidal and Simpson's rules. Finite difference formulation, initial and boundary value problems of ODEs using Euler and Runge-Kutta methods. Applications using MATLAB.

Course Code: EENG 303 Course Title: Elements of Electrical Engineering NQF Level: (7)

Circuit Elements: Resistance, capacitance and inductance. Fundamental circuit laws. Resistive circuit analysis. Sinusoidal steady-state analysis of AC circuits. Three phase circuits. Magnetic circuits and transformers. Three and single-phase induction motors: Operating principles, equivalent circuits, torque-speed characteristics, speed control. DC motors: Operating principles, equivalent circuits, torque-speed characteristics, speed control.

Mapping Courses to PILOs:

Course Code	Course Title	Course Type	PILOs						
			1	2	3	4	5	6	7
MECH 161	Engineering Drawing		1	1		1			1
MECH 163	Statics		1	1				1	
MECH 132	Thermofluids		1	1				1	
MECH 202	Materials Science		1			1	1	1	
MECH 212	Manufacturing Fundamentals		1					1	1
MECH 263	Dynamics		1		1			1	
MECH 236	Applied Thermodynamics		1	1					
MECH 274	Numerical Analysis		1					1	
MECH 271	Mechanics of Materials		1	1				1	
EENG 303	Elements of Electrical Engineering		1	1				1	
MECH 382	Computer Programming and its Application in Mechanical Engineering		1	1	1		1	1	1
MECH 333	Fluid Mechanics		1					1	
MECH 375	Design of Mechanical Elements		1	1		1		1	
MECH 373	Theory of Machines and Mechanisms		1					1	
MECH 312	Manufacturing Processes		1			1		1	1
MECH 302	Engineering Economics		1			1			
MECH 384	Vibration		1	1				1	
MECH 335	Heat Transfer		1	1				1	
MECH 395	Industrial Training		1			1	1		1
MECH 418	Engineering Management		1	1		1			
MECH 440	Refrigeration and Air Conditioning			1	1		1	1	
MECH 475	Design of Mechanical Systems		1	1	1				1
MECH 497	Senior Design Project I		1	1	1	1	1	1	1
MECH 4xx	Major Elective I ¹		1	1	1	1			
MECH 4xx	Major Elective II ¹		1	1	1	1	1	1	
MECH 430	Power Plant and Desalination				1	1	1	1	1
MECH 485	Systems and Control		1	1	1		1	1	
MECH 4xx	Major Elective III ¹		1		1	1	1	1	1
MECH 4xx	Major Elective IV ¹		1		1	1		1	1
MECH 498	Senior Design Project II		1	1	1	1	1	1	1
			28	18	12	14	10	23	11

