NAZARBAYEV UNIVERSITY
SCHOOL OF ENGINEERING

Department of Mechanical and Aerospace Engineering

Program Handbook

BEng (Hons) Degree Program in Mechanical and Aerospace Engineering

Academic year 2018-19

BEng (Hons) Degree Program
in Mechanical and Aerospace Engineering

Full-time, Credit-based

Program Handbook

(2018/19)

Department of Mechanical and Aerospace Engineering

Bachelor of Engineering (Honors) Degree Program

in

Mechanical and Aerospace Engineering

Full-time Credit-based

Program Booklet

2018/2019

BENG(HONS) IN Mechanical and Aerospace ENGINEERING (FULL-TIME)

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1. GENERAL INFORMATION

1.1 Cohort of Intakes and readership

This program handbook is the definitive program document for the 2018/19 cohort. Just in case any updated information is necessary after the publication of this handbook, students are requested to refer to MAE department's pages at **https://seng.nu.edu.kz/** for the most updated information. Should there be any discrepancy between the contents of this handbook and Nazarbayev University (NU) regulations, University regulations always prevail.

1.2 Program Information

Title of Program	**Bachelor of Engineering (Honors) in Mechanical and Aerospace Engineering**
Host Department	Department of Mechanical and Aerospace Engineering
Program Structure	Credit-based
Final Award	Bachelor of Engineering (Honors) in Mechanical and Aerospace Engineering
Mode of Attendance	Full-time
Professional Recognition	The program has been designed based on the ABET accreditation requirements.

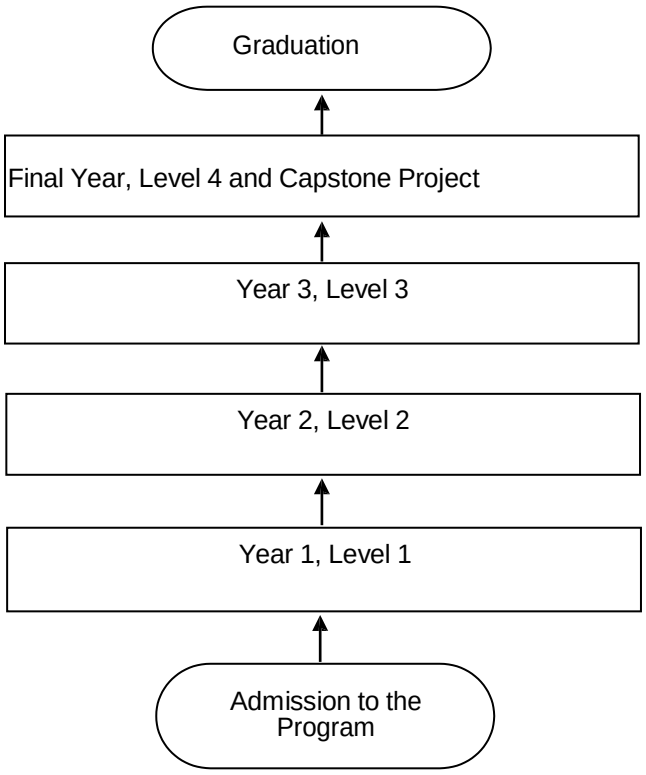
Duration	Normal Year 1 Intake Full-time Mode: 4 years nominal, 5 years maximum
Total Credits for Graduation	**248** ECTS credits

1.3 Modes of Study

A mode of study is characterized by the credits, courses required and the progression pattern in Year 1 to Year 4. Currently the program can only be pursued in the "Normal full-time" study mode.

Normal Full-time Mode

The students will normally pursue their study by going through Year 1, Year 2, Year 3 and Year 4 in full time and then graduate at the end of Year 4 after having satisfied all program requirements. Each year of study is split into discrete interlinked courses. The courses of earlier years can be pre-requisites to subsequent courses in later years. Some courses are common between programs.



2. RATIONALE, AIMS AND LEARNING OUTCOMES OF THE PROGRAM

2.1 Background and Rationale

The Bachelor of Engineering, henceforth referred to as BEng, in Mechanical & Aerospace Engineering is not a completely new program and it has been operating, under the name Bachelor of Engineering in Mechanical Engineering, since August 2011. The first batch of students graduated in 2015, with the second batch following in June 2016. Students' interest in this program has increased over the years reaching a currently stable number of around 40 new admissions per year.

As revealed by the external advisors in the Industrial Advisory Board in the Department of Mechanical & Aerospace Engineering, a high demand for mechanical and aerospace engineers is anticipated in the forthcoming years. The current blooming of industrial development in Kazakhstan, as highlighted by the Expo 2017 developments "Future Energy", the LRT project in Astana, and many other projects in Kazakhstan reinforce the high demand for mechanical & aerospace engineering graduates. Further opportunities are raised in many directions as highlighted by the "100 Steps" plan of economic development of Kazakhstan. The mechanical & aerospace engineering graduates are expected to be both academically and technically competent to meet the requirements of the industry worldwide. Recent graduates of the Mechanical & Aerospace Engineering program either go on further study or enter into the relevant work force shortly after graduation.

2.2 Aims

The BEng program in Mechanical & Aerospace Engineering aims to provide the education and training that will enable its graduate to:

1. Acquire strong fundamental scientific and technological knowledge base with critical thinking skills necessary for life-long learning and to pursue a variety of aerospace and/or mechanical engineering careers in industry, academic, and research within Kazakhstan or abroad;
2) Apply engineering skills incorporating the use of standards, computers, experiments, and realistic constraints to analyze, design, and solve problems associated with the aerospace and/or mechanical engineering profession;
3) Understand the moral obligations, ethical standards, and professional integrity of aerospace and/or mechanical engineering practice and have an awareness of safety, legal, environmental, and social impact on the role of the engineering professional in a multicultural, global economy; and
4) Develop the foundation for leadership through the abilities to communicate effectively technical and professional information as well as to work independently or as member in teams.

The achievement of these aims is facilitated with the introduction and monitoring of 7 Program Learning Outcomes as described in Section 2.5

2.3 Relationship of Program Aims to University Mission

The mission of the University is: “To be a model for higher education reform and modern research in Kazakhstan and to contribute to the establishment of Astana as an international innovation and knowledge hub”.

The Program Aims are aligned to the University Mission.

2.4 University Graduate Attributes

It is NU’s educational mission to nurture competent professionals who are also critical thinkers, effective communicators, innovative problem solvers, lifelong learners, and ethical leaders. The university graduate attributes: are as follows:

1) Possess an in-depth and sophisticated understanding of their domain of study;
2) Be intellectually agile, curious, creative, and open-minded;
3) Be thoughtful decision-makers who know to involve others;
4) Be entrepreneurial, self-propelling and able to create new opportunities;
5) Be fluent and nuanced communicators across languages and cultures;
6) Be cultured and tolerant citizens of the world while being good citizens of their respective countries;
7) Possess high personal integrity; and
8) Be prepared to take a leading role in the development of their country.

2.5 Learning Outcomes of the Program

On successful completion of the BEng (Hons) in Mechanical and Aerospace Engineering program, students will be able to:

1. identify, formulate, and solve complex mechanical & aerospace engineering problems by applying principles of engineering, science, and mathematics,
2. develop innovative engineering design processes and solutions for mechanical and aerospace engineering products and systems that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic, and other factors as appropriate to the discipline,
3. develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions,
4. communicate effectively with a range of audiences, demonstrating professional and ethical responsibility,
5. 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,
6. recognize the ongoing need to acquire new knowledge, to choose appropriate learning strategies, and to apply this knowledge,
7. function effectively as a member or leader of a team that establishes goals, plans tasks, meets deadlines, and creates a collaborative and inclusive environment.

2.6 Relationship of Program Learning Outcomes to Program Aims

Program Learning Outcomes	Program Aims			
	1	2	3	4
1	■	■		
2			■	■
3		■		
4				■
5			■	
6	■			
7				■

2.7 Relationship of Program Learning Outcomes to University Graduate Attributes

NU graduate attributes	**Program Learning Outcomes**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. Possess an in-depth and sophisticated understanding of their domain of study	■	■	■				
2. Be intellectually agile, curious, creative and open-minded						■	
3. Be thoughtful decision makers who know how to involve others		■					
4. Be entrepreneurial. Self-propelling and able to create new opportunities		■				■	
5. Be fluent and nuanced communicator across languages and cultures				■			■
6. Be cultured and tolerant citizen of the world				■			■
7. Demonstrate personal integrity			■		■		
8. Be prepared to take a leading role in the development of their country					■		■

3. ADMISSION REQUIREMENTS

3.1 Progression from the NU Foundation Year Program (NUFYP)

Upon completion of the NUFYP, students may be eligible to continue their studies in one of the undergraduate programs at the School of Engineering. Any student who is progressed and then decides not to attend NU Undergraduate (UG) program must notify the university as quickly as possible by submitting a completed withdrawal form. NUFYP student who do not submit the withdrawal form will be automatically dismissed after a certain period.

Unconditional progression: Those students who satisfy the requirements for unconditional progression as described in the Criteria below are automatically eligible for progression subject to the availability of space in the program. Progression decisions are recommended by the School's Progression Committee.

UNCONDITIONAL PROGRESSION REQUIREMENTS

	Abbreviations	**Course Title**	**Score**
	FMAT 020	Foundation Statistics	70
	FMAT 030	Foundation Mathematics for Life Science (Biology & Chemistry)	
	FMAT 040	Foundation Mathematics for Physical Science	
AND	FEAP 020	Foundation English for Academic Purposes 2	65
OR	FHUM 030	Foundation of Humanities & Social Sciences 2	65
	FSCI 030	Essential Biology & Chemistry 2	
	FPHY 030	Foundation 'Physics'	

GPA conditional progression: Students who do not meet the requirements for unconditional progression may be progressed on a GPA conditional basis as explained below:

1) A student, whose NUFYP subject scores do not meet the minimum unconditional progression criteria but meet the criteria for conditional progression (see table on Conditional Progression GPA), may be recommended to progress on a GPA conditional basis at the discretion of the School Progression Committee;
2) Student progressed as a GPA Conditional basis must achieve a minimum GPA of 2.00 at the end of his or her first semester of undergraduate study or the student is subject to dismissal;

As some majors are in more demand than others, the Schools have the right to limit their progression decisions based on the capacity of any individual program. Non-progressed students will be processed in accordance with University internal regulations on dismissal and withdrawal.

CONDITIONAL PROGRESSION (GPA)

	Abbreviations	**Course Title**	**Score**
	FMAT 020	Foundation Statistics	60
	FMAT 030	Foundation Mathematics for Life Science (Biology & Chemistry)	
	FMAT 040	Foundation Mathematics for Physical Science	
AND	FEAP 020	Foundation English for Academic Purposes 2	65
OR	FHUM 030	Foundation of Humanities & Social Sciences 2	60
	FSCI 030	Essential Biology & Chemistry 2	
	FPHY 030	Foundation 'Physics'	

3.2 Direct Entry Admission Requirements

3.2.1 Admission to the undergraduate program is based on selection process

3.2.2 One of the following categories of applicants may participate in the selection process:

a) Secondary school graduates with certificate or its foreign equivalent or certificates/diploma on completion of a college or IB Diploma Program, A-level, UK Foundation Program or NIS Grade 12 Certificate;

b) Students of the final year of secondary school or its foreign equivalent, or final year college or IB Diploma Program or UK Foundation Program or NIS Grade 12 Certificate students;

c) Applicants who completed at least one academic year of an undergraduate program at a university with CGPA not less than 3.0 out of 4.0. They shall be considered for admission to the first or second year of the undergraduate program as transfer students. Transfer credits are identified by Admission committee on the basis of detailed course descriptions in accordance with the Academic Policies and Procedures for Undergraduate Schools of NU and internal rules of individual schools. The maximum number of transferable credit hours shall be 60 ECTS. No grades will be assigned to transfer courses, only credits. The grades received at the previous institution(s) will not be calculated into student's grade point average.

3.2.3 Applicants listed in 3.2.2 must meet the entry requirements with the exception of cases when:

a) An applicant is a winner/prize winner of the International Subject Olympiads awarded by gold, silver and bronze medals for the last three years. In order to participate in selection competition these candidates must submit the results of IELTS or TOEFL test and be interviewed by the Admission Committee.
The International Subject Olympiads include International Mathematics Olympiad – IMO; International Physics Olympiad – IPHO; International Chemistry Olympiad – IChO; International Biology Olympiad – IBO; International Olympiad in Informatics – IOI; International Zhautykov Olympiad in Mathematics, Physics and Informatics; and International Mendeleyev Chemistry Olympiad;

b) An applicant is a winner/prize winner of the awarded by gold and silver medals for the current academic year. In order to participate in selection competition these candidates must submit the results of IELTS or TOEFL test and be interviewed by the Admission Committee.
The Republican Olympiads include Republican Mathematics Olympiad; Republican Physics Olympiad; Republican Chemistry Olympiad; Republican Biology Olympiad; and Republican Informatics Olympiad;

c) Applicants who have successfully completed at least one academic year of an undergraduate program at a university with English language as an official language of instruction and included into the list of top 200 universities according to the Times Higher Education World University or QS World University ranking at the time of application. These candidates are exempt from submitting test reports on ACT/SAT Reasoning Test and SAT Subject test as well as IELTS/TOEFL;

d) Applicants who have been studying in English last three years at a secondary school in a country with English as an official language or in an institution with English as a primary language of instruction are exempted from submission of IELTS/TOEFL certificates.

3.2.4 The minimum requirements for graduates of secondary school (or its foreign equivalent), students of the final year of secondary school (or its foreign equivalent) and higher education institution's students are as follow:

Minimum requirements for SAT Subject Test	Minimum requirements for IELTS and TOEFL	Minimum requirements for SAT Reasoning Test and ACT
SAT Subject Test – Math and Physics with at least 600 in each subject	IELTS – no less than 6.5 overall (with at least 6.0 in each sub-score) or TOEFL iBT = 79-93 or TOEFL PBT* = 574-599	SAR reasoning Test – no less than 1240 (starting from March 2016). Essay is required, no minimum score Or ACT – composite score no less than 27. Writing part is required, no minimum score

Note: *TOEFL PBT are admitted only from the international applicants from the countries where an official IELTS and TOEFL iBT are not available

3.2.5 The minimum requirements for graduates and current students of IB Diploma are as follow:

Minimum requirements for IELTS and TOEFL	Minimum requirements for IB DP scores
IELTS – no less than 6.5 overall (with at least 6.0 in each sub-score) or TOEFL iBT = 79-93 or TOEFL PBT* = 574-599	Not less than 30 total score and 4, 4, 5 for 3 subjects of HL

Note: *TOEFL PBT are admitted only from the international applicants from the countries where an official IELTS and TOEFL iBT are not available

3.2.6 The minimum requirements for scores for graduates and holders of NIS Grade 12 are as follow:

Minimum requirements for IELTS and TOEFL	Minimum requirements for NIS Grade 12 Certificate scores
IELTS – no less than 6.5 overall (with at least 6.0 in each sub-score) or TOEFL iBT = 79-93 or TOEFL PBT* = 574-599	Not less than ABB

Note: *TOEFL PBT are admitted only from the international applicants from the countries where an official IELTS and TOEFL iBT are not available

3.2.7 Internal Transfers between NU Schools:

After entering NU, students may discover that their initial choice of major does not correspond to their interests or intellectual abilities. Those students may seek to change their degree. NU supports these decisions by allowing internal transfers between undergraduate Schools.

Internal transfer students must bring along their educational transcripts to meet the Head of the Department which offers the program. An internal transfer student will only be accepted for transfer based on the decision of the Head of the Department which offers the program in the receiving School's. The course transfer information that details how previously completed courses will be assigned to the new degree plan must be determined if the applicant satisfies the transfer requirements. The internal transfer must be endorsed by the Dean of the receiving School. The transfer of student will become effective in the semester following approval of the application by the receiving School.

4. PROGRAM, COURSES, AND CREDITS

4.1 Program Specified Courses

Nazarbayev University has adopted the Bologna Accord and the School of Engineering therefore uses the European Credit Transfer System (ECTS). Most courses to be studied at Year 1, Year 2, Year 3, and Year 4 are of standard credit value carrying 6 ECTS each, except for some courses, such as Calculus I, etc. which carry ECTS other than 6. A student is expected to spend about 25 to 30 hours of study per semester (inclusive of class contact and other study effort) for 1 ECTS. The following Table lists the subjects, their ECTS values, and the category they belong to (Compulsory, Optional, or Elective). All discipline-specific courses shown as compulsory are non-deferrable and must be taken in accordance to the progression pattern. The courses offered will be updated from time to time according to the need of society and the profession.

Students admitted to the program are required to complete a minimum of 248 or more ECTS to satisfy the degree requirements. However, they may choose to take additional courses beyond the basic requirements. Please refer to Section 24 for detailed information on the requirements for graduation.

Course Code	Course Title	ECTS	Comments	Category of Courses
A. Nazarbayev University Undergraduate Core Curriculum Requirements				
Communicate fluently in the English Language				
SHSS150	Rhetoric and Composition	6		Compulsory
SHSS210	Technical Writing	6		Compulsory
Demonstrate competence in the Kazakh Language				
Select 2 courses at appropriate level in Kazakh Language, Literature or Culture		12	Based on diagnostic test	Compulsory
Describe and interpret major events in Kazakh and Kazakhstani history				
HST100	History of Kazakhstan	6		Compulsory
Demonstrate knowledge of the natural and social sciences				
ECON323	Managerial Economics	6		Compulsory
PHYS161	Physics I for Scientists and Engineers	8		Compulsory
Apply numerical and digital literacy skills				
MATH161	Calculus I	8		Compulsory
ENG101	Programming for Engineers	6		Compulsory
Apply skills in business, design and entrepreneurial thinking				
	Fundamentals of Entrepreneurship and Management	6		Compulsory
Use research skills and methods to complete projects				
ENG100	Introduction to Engineering	6		Compulsory
Identify ethical and leadership issues and take appropriate leadership actions				
Select 1 among 3 SHSS offered courses on Ethics		6		Compulsory

Course Code	Course Title	ECTS	Comments	Category of Courses
B. Common/shared Courses				
ENG102	Engineering Materials I	6		Compulsory
PHYS162	Physics II for Scientists and Engineers	6		Compulsory
MATH162	Calculus II	8		Compulsory
ENG200	Engineering Mathematics (Differential Equations & Linear Algebra)	6		Compulsory
ENG202	Numerical Methods in Engineering	6		Compulsory
ENG201	Applied Statistics	6		Compulsory
CEE201	Environmental Chemistry	6		Compulsory
ENG400	Capstone project	12		Compulsory
ENG300	Interdisciplinary Project	6		Elective

Course Code	Course Title	ECTS	Comments	Category of Courses
C. Discipline-Specific Requirement				
MAE 200	Structural Mechanics I	6		Compulsory
MAE 201	Computer Aided Design	6		Compulsory
MAE 205	Materials and Manufacturing I	6		Compulsory
MAE 206	Engineering Dynamics I	6		Compulsory
MAE 300	Fluid Mechanics I	6		Compulsory
MAE 301	Engineering Thermodynamics	6		Compulsory
MAE 302	Machine Elements Design	6		Compulsory
MAE 303	Control Systems	6		Compulsory
MAE 305	Fluid Mechanics II	6		Compulsory
MAE 306	Computer Aided Engineering	6		Compulsory
MAE 307	Engineering Dynamics II	6		Compulsory
MAE 400	Heat Transfer	6		Compulsory
MAE 401	Mechanical Systems Design	6		Compulsory
D. Discipline-Specific Requirement (Specialization areas and electives)				
Specialization area 1 (Thermofluids & Energy Applications)				
MAE 450	Heating Ventilating & Air-Conditioning	6		Elective
MAE 453	Fire Engineering	6		Elective
MAE 457	Feasibility Analysis of Clean Energy Technologies	6		Elective
MAE 461	Advanced Heat Transfer	6		Elective

Course Code	Course Title	ECTS	Comments	Category of Courses
E. Discipline-Specific Requirement (Specialization areas and electives)				
Specialization area 2 (Materials & Manufacturing)				
MAE 350	Structural Mechanics II	6		Elective
MAE 456	Materials and Manufacturing II	6		Elective
Specialization area 3 (Design & Analysis)				
MAE 452	Computer Aided Geometric Design	6		Elective
MAE 460	Advanced Topics in Computational Fluid Dynamics	6		Elective
Specialization area 4 (System Dynamics & Control)				
MAE 451	Oscillations of Mechanical Systems	6		Elective
MAE 458	Fundamentals of Multi-Body Dynamics	6		Elective
MAE 459	Advanced Control Systems and Industrial Automation	6		Elective
Specialization area 5 (Aerospace Engineering)				
MAE 351	Vehicle Propulsion Systems	6		Elective
MAE 454	Aerodynamics	6		Elective
MAE 455	Flight Mechanics	6		Elective

4.2 Kazakh Language Policy Requirements

Beginning students will be given the stage 1, diagnostic KAZTEST during student orientation. This test will be administered to students free of charge. Based on the results of their diagnostic KAZTEST, students will be placed either in the basic, intermediate or advanced Kazakh courses. Every student must pass a minimum of 12 ECTS (two 6 ECTS courses) in the NU UG Core Curriculum at the appropriate level in Kazakh Language, Literature or Culture before graduation.

5. NORMAL PROGRESSION PATTERN

A student must obtain at least a D grade to pass a course offered in SEng. Students will need to determine the passing grade for courses offer by other schools.

Year 1	
Semester 1 (34 ECTS)	**Semester 2 (34 ECTS)**
Introduction to Engineering	Engineering Materials I
Calculus I (and Labs)	Physics II for Scientists and Engineers (and Labs)
Physics I for Scientists and Engineers (and Labs)	Calculus II (and Labs)
History of Kazakhstan	Rhetoric & Composition
Programming for Engineers	Kazakh I
Year 2	
Semester 1 (30 ECTS)	**Semester 2 (30 ECTS)**
Structural Mechanics I	Engineering Dynamics I
Computer Aided Design	Materials and Manufacturing I
Engineering Mathematics (Differential Equations & Linear Algebra)	Applied Statistics
Environmental Chemistry	Numerical Methods in Engineering
Technical Writing	Ethics (selection among three courses)
Year 3	
Semester 1 (30 ECTS)	**Semester 2 (30 ECTS)**
Fluid Mechanics I	Fluid Mechanics II
Engineering Thermodynamics	Engineering Dynamics II
Machine Elements Design	Computer Aided Engineering
Control Systems	Managerial Economics
Fundamentals of Entrepreneurship and Management	Elective 1 (from 6th semester electives pool)
NOTICE: Students must pick at least one elective from each of the following ME-specific teaching areas: 1. *Thermofluids & Energy Applications* 2. *Material & Manufacturing* 3. *Design & Analysis* 4. *System Dynamics & Control* 5. *Aerospace Engineering*	*6th semester electives pool:* *1) Structural Mechanics II (TA: Materials & Manufacturing)* *2) Interdisciplinary Project – IDP* *3) Vehicle Propulsion Systems (TA: Aerospace Engineering)*
Year 4	
Semester 1 (30 ECTS)	**Semester 2 (30 ECTS)**
Capstone Project	
Heat Transfer	Elective 3 (from 8th semester electives pool)
Mechanical Systems Design	Elective 4 (from 8th semester electives pool)
Kazakh II (Language and ethnicity)	Elective 5 (from 8th semester electives pool)
Elective 2 (from 7th semester electives pool)	Elective 6 (from 8th semester electives pool)

7th semester electives pool:	***8th semester electives pool***
1) Heating Ventilating & Air Conditioning (TA: Thermofluids & Energy Applications) *2) Oscillations of Mechanical Systems (TA: System Dynamics & Control)* *3) Computer Aided Geometric Design (TA: Design & Analysis)*	*1) Fire Engineering (TA: Thermofluids & Energy Applications)* *2) Aerodynamics (TA: Aerospace Engineering)* 3) Flight Mechanics (TA: Aerospace Engineering) 4) Materials and Manufacturing II (TA: Materials & Manufacturing) 5) Feasibility Analysis of Clean Energy Technologies (TA: Thermofluids & Energy Applications) 6) Fundamentals of Multi-Body Dynamics (TA: System Dynamics & Control) 7) Advanced Control Systems and Industrial Automation (TA: System Dynamics & Control) 8) Advanced Topics in Computational Fluid Dynamics (TA: Design & Analysis) 9) Advanced Heat Transfer (TA: Thermofluids & Energy Applications)

Total Number of Credits: 248 ECTS

Note 1: The study pattern for the courses is indicative only. Students may take these courses according to their own schedule. They are recommended to consult their Academic Advisor for guidance and planning if necessary.

6. CURRICULUM MAP

Alignment of Courses with Program Learning Outcomes:

	Program Learning Outcomes						
	1	**2**	**3**	**4**	**5**	**6**	**7**
A. NAZARBAYEV UNIVERSITY UNDERGRADUATE CORE CURRICULUM REQUIREMENTS[(1)]							
Communicate fluently in the English Language							
English (2 Courses)				■		■	■
Demonstrate competence in the Kazakh Language							
Kazakh (2 Courses)				■			
Describe and interpret major events in Kazakh and Kazakhstani history							
HST 100 History of Kazakhstan				■	■	■	
Demonstrate knowledge of the natural and social sciences							
Managerial Economics		■			■		■
PHYS161 Physics I for Scientists and Engineers	■	■	■				
Apply numerical and digital literacy skills							
MATH161 Calculus I	■					■	
Programming for Engineers	■	■				■	
Apply skills in business, design and entrepreneurial thinking							
Fundamentals of Entrepreneurship and Management				■	■	■	■
Use research skills and methods to complete projects							
ENG100 Introduction to Engineering	■	■	■	■	■	■	■
Identify ethical and leadership issues and take appropriate leadership actions							
Select 1 among 3 SHSS offered courses on Ethics				■			
B. COMMON/SHARED COURSES							
ENG101 Engineering Materials I	■		■			■	
PHYS161 Physics II for Scientists and Engineers	■	■	■				
MATH162 Calculus 2	■					■	
ENG200 Engineering Mathematics (Differential Equations & Linear Algebra)	■	■	■				
ENG202 Numerical Methods in Engineering	■	■	■			■	
ENG201 Applied Statistics	■	■	■		■		
CEE201 Environmental Chemistry	■	■	■	■			
ENG400 Capstone project	■	■	■	■	■	■	■
ENG300 Interdisciplinary Project	■	■	■	■	■	■	■

	Program Learning Outcomes						
	1	**2**	**3**	**4**	**5**	**6**	**7**
C. DISCIPLINE-SPECIFIC REQUIREMENTS (INCLUDING ELECTIVES)							
MAE 200 Structural Mechanics I	■	■					
MAE 201 Computer Aided Design	■	■				■	
MAE 205 Materials and Manufacturing I	■	■	■		■	■	■
MAE 206 Engineering Dynamics I	■	■					
MAE 300 Fluid Mechanics I	■	■	■				
MAE 301 Engineering Thermodynamics	■		■			■	
MAE 302 Machine Elements Design	■		■			■	
MAE 303 Control Systems	■	■	■	■	■	■	
MAE 305 Fluid Mechanics II	■	■	■			■	
MAE 306 Computer Aided Engineering	■	■				■	
MAE 307 Engineering Dynamics II	■	■	■	■	■	■	■
MAE 400 Heat Transfer	■	■	■	■	■	■	■
MAE 401 Mechanical Systems Design	■	■	■	■	■	■	■
MAE 450 Heating Ventilating & Air-Conditioning	■	■	■	■			
MAE 453 Fire Engineering	■	■	■			■	
MAE 457 Feasibility Analysis of Clean Energy Technologies	■	■	■	■		■	■
MAE 461 Advanced Heat Transfer	■	■	■	■	■	■	■
MAE 350 Structural Mechanics II	■	■	■	■	■	■	■
MAE 456 Materials and Manufacturing II	■	■	■		■	■	■
MAE 452 Computer Aided Geometric Design	■	■	■			■	
MAE 460 Advanced Topics in Computational Fluid Dynamics	■		■	■		■	■
MAE 451 Oscillations of Mechanical Systems	■	■	■			■	
MAE 458 Fundamentals of Multi-Body Dynamics	■	■					
MAE 459 Advanced Control Systems and Industrial Automation	■	■	■	■	■	■	
MAE 351 Vehicle Propulsion Systems	■	■	■			■	
MAE 454 Aerodynamics	■	■	■			■	
MAE 455 Flight Mechanics	■	■	■			■	

7. CAPSTONE PROJECT

The Capstone Project is a 2-semester common course for all engineering programs which spans across the fall and spring semesters of the same academic year. The importance of the Capstone project is reflected in the total number of credits it carries, being 12 ECTS which are equivalent to two standard-sized courses.

One of the important features of the Capstone Project is “learning by doing”. It is intended to be a platform for the students to develop their intellectual and innovative abilities and to give them the opportunities to integrate and apply the knowledge and analytical skills gained in previous stages of study. It should also provide students with opportunities to develop their problem-solving skills and communication skills. The process from concept to final implementation and testing, through problem identification and the selection of appropriate solutions will be practiced by the students.

7.1 Capstone Project Management

Normally a group of students will be assigned one project under the supervision of an academic staff member so that they will work independently and collaboratively to achieve the project objectives. Students may work on different aspects of a project. The group size may increase for a larger-scale project or a more complex project.

The assignment of projects is expected to be completed at the beginning of the fall semester in the final year of study. Guidelines for Capstone Project are given to students at the beginning of the final year.

7.2 Capstone Project Assessment

Assessment of the Capstone Project focuses in three main areas: project reports, oral presentations and work done over the whole project period. Assessment will be done by a team of staff including the project supervisor.

8. DEPARTMENTAL BEng PROGRAM COMMITTEE

8.1 The composition of the Departmental BEng Program Committee is decided by the Head of Department with the approval of the Dean. The Committee is responsible for program performance monitoring, review, and enhancement.

8.2 The Departmental BEng Program Committee will regularly collect the course portfolios, program statistics and conduct surveys of students and other key stakeholders on the relevance, delivery, quality and the standards of the courses. The Committee will analyze the collected data and recommend areas for improvement taking into consideration the adequacy of resources, learning and teaching approaches, best practices, as well as the local and global trends. The Committee will also oversee the implementation of recommendations to improve the program.

8.3 The Departmental BEng Program Committee is responsible for the program portfolio for each academic year including the annual program monitoring report.

9. STUDENT STATUS, ACADEMIC CALENDAR, POLICIES AND PROCEDURES

The program currently only accepts full-time students.

The program operates on the basis of an academic year divided into three academic periods: the regular fall and spring semesters and a summer term (if offered). Depending on public holidays, the fall semester and spring semester should have up to fourteen weeks for studies with two weeks for end-of-semester examinations. The School does not normally offered summer terms. Summer terms at NU are generally eight weeks.

The official NU Academic Calendar, Course Schedules, Final Examinations Schedule, and Policies and Procedures are available online at the Office of the Registrar website (https://registrar.nu.edu.kz/). It is the responsibility of the students to familiarize themselves with the following Policies and Procedures:

1) Academic Policies and Procedures for Undergraduate Programs
2) Regulations on Leave of Absence for Undergraduate and Foundation Year Program
3) Policy and Procedures on the Fifth Year of Undergraduate Study
4) Undergraduate Attendance policy and Procedures
5) Regulation on Dismissal and Voluntary Withdrawal for Undergraduate and Foundation Year Program Students
6) Graduation policy and Procedure for Undergraduate and Graduate Programs

Induction and orientation week takes place at the beginning of the fall semester to allow new students to adapt to the program requirements. New students are expected to familiarize themselves with the layout of the buildings, location of the staff offices, lecture theatres, laboratories, and other teaching facilities during the orientation.

10. COURSE REGISTRATION AND WITHDRAWAL

10.1 In addition to program registration, students need to register for courses at specified periods prior to the commencement of a semester. NU has an online course registration system. Students are notified by email from the Office of the Registrar of the dates for the registration period.

10.2 NU uses a priority registration system that ensures students in their last year of undergraduate study will have the first opportunity to register for classes. Students are notified, via email from the Office of the Registrar, of the dates for the registration period.

10.3 A student is waitlisted when the course they have attempted to register for is full. When a place in the course becomes available the top student in the waitlist is registered in the course and notified by email. Once the waitlist period ends, the student will have time to register for alternate courses before the end of the "add" deadline. Students must register for courses by the end of the first week of class in the fall or spring semester, and by the end of the second day of classes during the summer term (if offered).

10.4 An add/drop period will also be scheduled by the Office of the Registrar for each semester and during the summer term (if offered). The add/drop period can be found in the Academic Calendar. For courses not available for online registration, students must complete the add/drop form available from the Office of the Registrar.

10.5 Students who failed to attend the first week of any class for which they have completed registration and appear on the class roster can be dropped from the course by the administrators.

10.6 Students may apply for withdrawal of their registration on a course after the add/drop period, if they have a genuine need to do so. The application should be made on the Course Withdrawal form available from the Office of the Registrar. The course withdrawal deadline can be found in the Academic Calendar.

10.7 The pre-requisite requirements of a course must have been fulfilled before a student registers for that course. However, the pre-requisite requirements of a course can be waived under exceptional circumstances by submitting a completed Requisite override form available from the Office of the Registrar. If the pre- requisite course concerned forms part of the requirements for award, the course has to be passed in order to satisfy the graduation requirements for the program concerned, despite the waiving of the pre-requisite.

11. STUDY LOAD

11.1 For students following the progression pattern specified for their program, they have to take the number of credits and courses, as specified in this Program Handbook, for each semester. Students cannot drop those courses assigned by the department unless prior approval has been given by the department.

11.2 The normal study load is about 30 ECTS credits in a regular fall or spring semester. The maximum study load to be taken by a student in a regular fall or spring semester is 36 ECTS credits, unless exceptional written permission is given by the Dean and from the Vice-Provost for Academic Affairs. The maximum study load to be taken by a student in a summer term (if offered) is 12 ECTS credits, unless exceptional written permission is given by the Dean and from the Vice-Provost for Academic Affairs. For such cases, students are reminded that the study load approved should not be taken as grounds for academic appeal.

11.3 The minimum load for a full-time student in any given regular fall or spring semester is 24 ECTS credits of coursework that count toward graduation. Under exceptional circumstances, a student may be permitted to enroll for fewer than 24 ECTS credits if written permission is received from the Dean and from the Vice-Provost for Academic Affairs.

11.4 To help improve the academic performance of students on academic probation (the meaning of “academic probation” can be found in Section 19.2), these students will not be allowed to take 36 ECTS or more during their probation period in the fall and spring semesters.

11.5 Students who have obtained approval to pace their studies and students on program without any specified progression pattern who wish to take more than the normal course load in a fall or spring semester should seek advice from the Department concerned before the selection of courses.

11.6 Students are required to be present at the beginning of the semester and to remain until the semester is completed.

12. COURSE EXEMPTION AND CLASS ATTENDANCE

There is no course exemption policy for this program. In exceptional cases, students may substitute courses in the curriculum (including the mandatory Nazarbayev University Undergraduate Core Curriculum Requirements' courses) with other courses, if written permission is given by the Head of Department and the Dean.

12.1 All students are expected to attend all classes at the University. Penalties as stated in the course policies will be applied if attendance falls below 80% of scheduled classes. At the start of the semester, each instructor is responsible for clearly communicating the course attendance policies and/or School attendance policies. Faculty has right to lower grades or initiates a drop/withdrawal from a course if there is a violation of the attendance policies. Students should be mindful of the course policies and make sure they completely understand the consequences of missing classes (either excuse or unexcused).

12.2 Excused absence is when a student misses classes for one of the following documented reasons: personal illness; family emergency; school approved absence such as conference, Olympiad, or other academic events. All medical certificates must be endorsed by the NU doctors and recorded by the Department of Student Affairs. Only the instructors may approve a student's request to be absent from class. Students should get the appropriate "excuse" forms available from the School Office and submit the completed forms to each course instructor for approval for each missed class. In the event of a dispute, the matter may be reported to the Vice dean for Academic Affairs or equivalent official of the School. The determination of the Vice Dean or equivalent School official shall be final.

12.3 Unexcused absence occurs when a student deliberately misses a class with no reasons.

12.4 Students are responsible for monitoring their own attendance. Students who exceed the maximum number of absences in the current and previous semester will not be eligible for University sponsored study abroad programs or University sponsored events.

13. CREDIT TRANSFER

13.1 Students may transfer credits for recognized previous studies which will be counted towards meeting the requirements for award. Transferred credits may be counted towards more than one award. The granting of credit transfer is a matter of academic judgment. The student should provide a detailed course syllabus showing the topics covered and assessment tasks which were completed for each course and a certified official transcript with the number of credits and the grade or final assessment in the course. Unless the course is a language course all language of instruction must be in English. To ascertain the academic standing of the institution offering the previous studies, the Department might need to request the institutions concerned to provide more information.

13.2 Transfer credit is not given for courses in which the student earned lower than C grade (or its equivalent). Grades earned at other universities are not included in computing the student's CGPA at NU. All transfer credits will be annotated as such on the student's NU transcript.

13.3 The maximum number of transferable credits is 60 ECTS credits. Discretion may be made with approval of the Dean for a student who was on an approved Academic Mobility program.

13.4 Certain types of credit cannot be transferred to the NU, including but not limited to the credits awarded by higher education institutions for noncredit courses, workshops, and seminars offered by other higher education institutions as part of continuing education programs.

13.5 The transfer decision and final judgement are made by the relevant Department or if there is no relevant Department by the School. The School will decide the number of credits to be transferred, and if appropriate the level of the course and the course equivalent.

13.6 Transfer credits at the time of admission can only be granted for courses taken in the preceding two academic years.

13.7 Credit for courses taken at institutions outside NU subsequent to admission can only be granted by prior written approval from the relevant Department, or if there is no relevant Department from the School Admissions Committee.

13.8 Credits earned in other higher education institutions during the time spent at NU shall be processed in accordance with appropriate internal regulations of NU.

13.9 Credit transfer can be applicable to credits earned by students through studying at an overseas institution under an approved Academic Mobility program. Students should, before they go abroad for the approved Academic Mobility program, seek prior approval from the program offering Department (who will consult the course offering Departments as appropriate) on their study plan and credit transferability. As with all other credit transfer applications, the Departments concerned should scrutinize the syllabuses of the courses which the students are going to take at the overseas institution, and determine their credit transferability based on academic equivalence with the corresponding courses on offer at the NU, and the comparability of the grading systems adopted by NU and the overseas institution. The transferability of credits and the suitability for allowing grades to be carried over must be determined and communicated to students before they go abroad for the approved Academic Mobility program.

13.10 For credit transfer of retaken courses, the grade attained in the last attempt should be taken in the case of credit transfer with grade being carried over. Students applying for credit transfer for a course taken in other institutions are required to declare that the course grade used for claiming credit transfer was attained in the last attempt of the course in their previous studies. If a student fails in the last attempt of a retaken course, no credit transfer should be granted, despite the fact that the student may have attained a pass grade for the course in the earlier attempts.

13.11 Students will not be granted credit transfer for a course which they have attempted and failed in their current study.

14. LEAVE OF ABSENCE

Periods of time during which a student is on an approved leave of absence from the University shall not be included in the calculation of time limitations for stipends. When granting a leave of absence to a student, whose tuition is funded through the state or University, his/her right for an educational grant will be retained. Funding and tuition fees will be paused for the period of the leave of absence, except for funding of stipends, which are established by the procedures of the paying state stipend to the students who have been granted a leave on medical grounds. The funding and tuition fees will be resumed after the end of a leave of absence.
A leave of absence will not be considered for approval in the following cases:

1) If the application is submitted during the examination period;
2) If a student has been scheduled for dismissal in the light of poor academic performance, inadequate progress toward degree, or for disciplinary reasons.

If a student has an outstanding “Incomplete” at the time he or she is granted leave of absence, the period for completion of that “Incomplete” may be extended for the period of the leave of absence with the written approval of the faculty member who granted the “Incomplete” and the Dean.

A student who requests a leave of absence shall submit an application form provided by the Office of the Registrar. A leave of absence may be granted by the Dean, the Vice President for Student Affairs, and the Vice Provost for Academic Affairs. The student’s leave of absence will become effective upon the Provost’s signature of the order, which shall indicate the dates of beginning and termination of the leave of absence and its grounds. Copy of the order is given to the student, along with a document stating their academic status at the time of leaving and the conditions they will be under upon their return from leave of absence. If the student was enrolled in classes prior to the approval of the leave of absence, no grades will be awarded for the interrupted semester and all courses will be marked with a “Withdrawal” (“W”). The grant of the a leave of absence will be recorded on the student’s transcript.

14.1 Leave of Absence - Medical.

Students may request for leave of absence when extraordinary circumstances such as illness or injury prevent the student from continuing classes and incompletes or other arrangements with the instructors are not possible. Medical leave of absence policy covers both physical and mental health conditions, including pregnancy and maternity.
A leave of absence can be granted to a student on the grounds of a medical certificate confirmed by a qualified medical officers consulting commission created in accordance with legislation of the Republic of Kazakhstan for a period from 6 to 12 months, except that in the case of tuberculosis a leave may be granted for a period of 1 to 2 years and in the case of maternity a leave of absence may be granted for a period of up to 2 years.
A second leave of absence on medical grounds shall not be granted to a student. A student may request a leave of absence on medical grounds by submitting an application to the Department of Student Affairs for validation, along with an original

medical certificate issued by the Medical Authority. When returning from a leave of absence granted on medical grounds a student shall submit an application to the Office of the Registrar no less than 20 working days prior to beginning of the academic period they wish to return, and in cases other than pregnancy/maternity leave, he/she will submit a medical certificate of an appropriate Medical Authority approving the student's return to the University. Students returning from pregnancy/maternity leave shall submit birth certificate of the child or other relevant document(s).

14.2 Leave of Absence - Immediate Family Member.

Students may be granted for leave of absence based on change in social or economic status affecting an immediate family member (immediate member means a parent, spouse, dependent child, sibling, or grandparent). In order to grant a leave of absence based on circumstances of an immediate family member, the University may request to present evidence of a direct impact on the student's ability to continue with his or her program of study. If requested, such evidence shall be submitted to the Dean, who shall review and forward copies of such documentation to the Vice President for Student Affairs and International Cooperation and the Vice Provost for Academic Affairs. When returning from a leave on non-medical grounds a student shall submit an application to the Office of the Registrar not less than 45 days prior to the beginning of the semester in which they wish to return.

14.3 Leave of Absence - Other.

A student may be granted a leave of absence from the University for a period of up to one year for reasons other than a medical condition or event affecting an immediate family member if the following conditions met:

1) No leave of absence may be granted under this section for any undergraduate student prior to the completion of the first year of his or her studies;
2) No leave of absence may be granted under this section for any student who is currently on probation, and has had Category B disciplinary actions;
3) No leave of absence may be granted under this section for any student who is behind in credit hours;
4) A leave of absence under this section shall be granted only to a student with high academic performance GPA 3.0 and above;
5) A leave of absence under this section will be granted only on a determination by the Dean that such leave will not be detrimental to the student's ability to complete the program.

To apply for a leave of absence under this section, a student is required to submit documentation demonstrating the purpose of the leave and the activities in which he or she expects to participate during the leave period. In the event that a proposed leave includes a period of employment with a company, the supporting documentation submitted in advance must include a letter of invitation from the employing company and a copy of the corporate registration or other documentation of the company's operations. When returning from a leave on non-medical grounds a student shall submit an application to the Office of the Registrar not less than 45 days prior to the beginning of the semester in which they wish to return. At the end of the

leave period, the student will be required to submit a report detailing his or her activities during the leave period to the Dean and a letter from a supervisor or equivalent individual(s) attesting to the accuracy of the student's report and evaluating the student's performance during the leave period. In the event the student's activities during the period of leave include employment, he or she is required to submit relevant documentation demonstrating uninterrupted employment for the prescribed period. Violation of the terms of this section will be treated as non-academic misconduct under the University's Student Code of Conduct and Disciplinary Procedures.

15. PRINCIPLES OF ASSESSMENT

15.1 Assessment of learning and assessment for learning are both important for assuring the quality of student learning. Assessment of learning is to evaluate whether students have achieved the intended learning outcomes of the courses that they have taken and have attained the overall learning outcomes of the academic program at the end of their study at a standard appropriate to the award. Appropriate methods of assessment that align with the intended learning outcomes will be designed for this purpose. The assessment methods will also enable teachers to differentiate students' different levels of performance within courses. Assessment for learning is to engage students in productive learning activities through purposefully designed assessment tasks.

15.2 Assessment will also serve as feedback to students. The assessment criteria and standards will be made explicit to students before the start of the assessment to facilitate student learning, and feedback provided will link to the criteria and standards. Timely feedback will be provided to students so that they are aware of their progress and attainment for the purpose of improvement.

15.3 The course results based on the assessments are examined by the Exam Board at the end of each semester. The Exam Board will review, discuss and finalize progression and completion.

16. ASSESSMENT METHODS

16.1 Students' performance in a course can be assessed at the discretion of the course coordinator by a variety of assessment activities, including examinations, tests, assignments, projects, laboratory work, field exercises, presentations and other forms of classroom participation. Assessment activities which involve group work should include some individual components therein, i.e. the contribution made by each student in a group effort shall be determined and assessed separately, and this can result in different grades being awarded to students in the same group.

16.2 The course learning outcomes, assessment activities, and the weighting of each activity in the overall course grade will be clearly stated in the course specifications. The course learning outcomes should be assessed by appropriate assessment activities, in line with the outcome-based approach.

16.3 At the beginning of each semester, the course coordinator will inform students of the details of the methods of assessments to be used within the assessment framework as specified in the course specifications.

16.4 Students who did not participate in assessment activities will be awarded zero mark. When there are extenuating circumstances, the students must provide documentary evidence and apply for excuse absence (refer to Section 12). Depending on the circumstances, the course instructor may for cases of approved excused absence:

1) Set a new date (or deadline) for the students to retake or submit the missed assessment activity;

2) Decide on alternative means to compensate for the missed assessment activity.

Applications for excuse absence so that students can participate in missed assessment activity will not be accepted 7 calendar days after the original assessment activity date.

16.5 Course instructors have the right not to accept and/or deduct marks for late submission of assessment elements. These course policies should be stated in the course specifications. At the beginning of each semester, the course coordinator must inform students of the course policies.

17. COURSE RESULTS

17.1 Course instructors, in respect of the course they teach, have sole responsibilities for marking and grading students' coursework and examinations scripts. Assessment elements (including final examinations) will be graded by a clear marking scheme (set by the course instructor) which is non-negotiable. Timely feedback of assessment will be given to students as soon as possible (e.g. not later than a month), and in any case, before the final examination/assessment. In this regard, course instructors will be accountable to the Head of Department, to ensure that all forms of assessment, including the students' coursework and examination scripts, are correctly marked and graded where appropriate. Course instructors will avoid administrative errors at all times, and submit the grades to the Office of the Registrar according to the schedule set in the academic calendar. To ensure consistency and uniformity for a common course taught by different course instructors, meetings can be arranged amongst them before the examination papers are set or before the marking is done.

17.2 Course grades should be reviewed and finalized by the Department before being formally released to students and submitted to the Exam Board.

18. BOARD OF EXAMINERS

18.1 The authority for approving the overall results of students rests with the Exam Board. The Exam Board will meet at the end of each semester (except for Summer Term - students who are eligible to graduate after the completion of Summer Term courses will be processed in the beginning of the fall semester). The Exam Board is responsible for making:

(i) A decision on the classification of awards to be granted to each student on completion of the program;

(ii) A decision on progression, academic probation, and dismissal cases; and

(iii) A decision on cases with extenuating circumstance.

18.2 These decisions are made by the Exam Board at the end of each semester in the light of the standard of student achievement appropriate to the award to which the program is designed to lead, the aims of the program, the students' performance on the program in previous years, the general assessment regulations of the University, the specific program regulations, and good practice established in the University and elsewhere.

18.3 The Exam Board will not attempt to change the grades for any student in any course nor condone failures.

18.4 Students shall be formally notified of decisions affecting them after the Exam Board meeting except for those whose cases require endorsement by the Provost Office.

19. PROGRESSION / ACADEMIC PROBATION / DISMISSAL

19.1 The Exam Board shall, at the end of each semester (except for Summer Term - students who are eligible to graduate after the completion of Summer Term courses will be processed in the beginning of the fall semester), determine whether each student is

(i) Eligible for progression towards an award; or

(ii) Eligible for an award; or

(iii) Required to be dismissed from the program.

19.2 At the conclusion of every semester, each student's Grade Point Average (GPA) (see Section 23) and rate of progress toward degree are calculated by the Office of the Registrar and academic standing is determined for students seeking Bachelor degrees according to the following criteria:

1) Good Academic Standing – A student having a Cumulative Grade Point Average (CGPA) of 2.0 or above and a GPA in the current semester of 2.0 or above is considered to be in good academic standing;

2) Academic warning – A student will receive notice of academic warning if his/her academic performance is deemed to be unsatisfactory. A student may receive an academic warning after the mid-semester status reports, which are required from all course instructors in all courses to help identify and assist students who may need additional guidance (Mid-semester grading will be based on Satisfactory (S) – i.e. A student who is at a minimum C or above with excellent attendance; or Non Satisfactory (NS) – i.e. Any student who is at a C- or below with attendance problems, and other problems that may keep the student from successfully completing the courses. Notification of academic warning will be sent by the Office of the Registrar to the student, the School's Vice Dean of Academic Affairs and the student's advisor. A student will be advised to limit their social activities and may not be considered for NU sponsored travel.

3) Academic probation – A student who fails to maintain Good Academic Standing based on GPA will be placed on Academic Probation. At the end of one semester of academic probation, students are subject to dismissal from NU if they have not achieved the necessary conditions to return to Good Academic Standing. In exceptional cases, the Dean may recommend to extend academic probation for a second semester based on evidence of improvement, overall academic progress, the student's potential to return to Good Academic Standing and eventually to graduate on time. The recommendations must be submitted to the Vice Provost for Academic Affairs indicating the grounds for the recommendation. The final decision on extension of the academic probation for another semester is made by the Vice Provost for Academic Affairs. Under no circumstances may a student be on academic probation more than two consecutive semesters or for more than three semesters in total.

19.3 Grades received during Summer Term may also affect a student's academic standing.

19.4 The Dean will receive a probation report at the end of each semester from the Office of the Registrar. Students will receive notification from the Office of the Registrar informing them of any change in their academic standing

19.5 Students are required to remain for four years of study as an undergraduate student to ensure they graduate pursuant to graduation requirements as specified in the internal regulations of NU.

19.6 NU expects students to complete their degree requirements within four years (subject to the Policy on Fifth Year Study and other internal regulations of NU). To complete a degree in four years, students must average 30 ECTS per semester (including transfer credits and summer courses). Any students who falls 30 or more ECTS credits behind this rate of completion will be subject to dismissal from NU. The Office of the Registrar shall submit a list of students who are 30 or more ECTS credits behind satisfactory progress toward satisfactory progress toward a degree to the Dean, who shall make a recommendation to the Provost. The total credits are tallied by counting all credits earned from coursework as well as credits transferred into NU. Attempted credits are calculated by tallying the credits for every course on a student's transcript including transfer credit, graded courses, and courses that were graded AW, W, F, or I.

19.7 Students may be considered for the fifth year of study if they are unable to meet graduation requirements by the end of the last semester of their final year and are expected to be able to complete their degree with one additional year of study. At the end of the spring semester, as soon as is practicable after the receipt of final grades, the Office of the Registrar will send each School a list of the fourth year students who will not satisfy the requirements for graduation. The Vice Dean for Academic Affairs or equivalent in each School, in consultation with academic advisors and Department Chairs, will complete a form indicating the specific courses in which the student is to be enrolled during his or her fifth year. This form must be submitted to the Office of the Registrar by the stipulated deadline. The Office of the Registrar shall send a letter to the student's parent informing them that the student is eligible for a fifth year of study at cost, identifying the list of courses in which the student will be required to enroll during a fifth year of study, and indicating the current cost per credit of fifth year study at the University. The letter will contain an acceptance form. Upon timely return of the acceptance form the student will be enrolled as a fifth year student in the specific courses indicated in the letter. When the student is enrolled, the Office of the Registrar shall forward a copy of the letter and the acceptance form to the Bursar's Office. The Bursar's Office shall generate a billing statement and payment contract which will be send to the student. The Bursar's Office shall be responsible for the execution and registration of the contract. When the contract is executed, the Bursar's Office will send it to the Office of the Registrar for inclusion in the student's permanent file. A student enrolled into a fifth year will receive an academic schedule for each semester of the fifth year based on the list of required courses identified in the letter from the Office of the Registrar. The fifth year student is not allowed to

change this schedule, drop or add courses, or withdraw from this set schedule. All academic requirements for graduation must be completed within the fall and spring semester of the fifth year. A sixth year will not be considered under any circumstances. If a student has not completed their program of study by May of the fifth year, they will not graduate from the University or receive a diploma. They will receive a letter of attendance on approved letterhead. The school will ensure that each fifth year student meets regularly with their academic advisor. During their fifth year of study, fifth year student may be provided with accommodation on campus, depending on availability. Fifth year students will be charged an accommodation fee if they choose to live on campus.

20. APPEAL OF GRADES

All students have the right to appeal any grade that they have received that they believe is in error. The error must be based on one of the following criteria:

1) Error in calculation
2) Error in application of the class grade policy as presented in the course specifications
3) Incorrect entry of the grade into the database
4) Incomplete marking of an assessment

In the case of an exam, a student must first consult with the course instructor as soon as the grade is available and announced to the students. The student should review his or her corrected, graded final exam in the presence of a faculty within the stipulated period set by the course coordinator. No viewing is allowed after the stipulated period. If any error is found, the student should complete a “Grade appeal” form and submit it to the course coordinator. The School will set the official deadline for the appeal process. Late appeals will not be accepted.

Upon receipt of the “Grade appeal” form, the course coordinator can accept or deny the request. If there is insufficient ground for the grade appeal, the instructor can deny the request. However, if a student’s grade has been assigned incorrectly due to technical or procedural error, or miscalculation of grade, the course coordinator should complete a “Grade change” form from the Office of the Registrar. This form must be signed by the course instructor and the Dean. No grades can be changed after a degree has been granted.

If a student is dissatisfied with the outcome from the course coordinator, he or she may appeal to the Dean or Vice Dean, who shall consult with the course coordinator before making a decision. The decision of the Dean or Vice Dean shall be final. All grade changes must be resolved by the end of the first week of the next semester.

21. RETAKING OF COURSES

21.1 Any student who receives a grade that would prevent academic progress in his or her program of study may enroll to retake that course. The total number of times a student may retake a course is limited to three retake attempts. Students are not permitted to retake a course if it has already been passed for the purpose of improving the awarded grade.

21.2 All retake attempts will remain in the student record and on the transcript, and will be counted to semester's GPA, semester CPGA, semester's earned credits, semester's attempted credits and total attempted credits. Only the last retake will be counted in the final CGPA and total earned credits.

21.3 The summer term is short and the instructors of courses if offered can decide on the course policy, mode of delivery, and assessment requirements. If retake courses are offered in the summer term, a student cannot participate in more than two retake courses.

22. EXCEPTIONAL CIRCUMSTANCES

Absence from an assessment component

22.1.1 Students who are absent without permission from any form of assessment or who do not submit coursework for assessment will be awarded a mark of zero for that assessment unless the course instructor determines that there are extenuating circumstances. When there are extenuating circumstances, it is the student responsibility to provide documentary evidence in accordance to established University and School procedures and inform the course instructors as soon as possible prior to the assignment of the final grades. Depending on the circumstances, the instructor may set a new date for the students to resubmit or retake the missed assessments (refer to Section 16).

22.1.2 All medical documents must be verified by the NU doctors and endorsed by the Department of Student Affairs.

22.1.3 Any student who cannot take the examination as scheduled is required to submit his/her application for late assessment in writing to the Head of Department offering the course, within five working days from the date of the examination, together with any supporting documents. Decisions of applications for late assessment and the means for such late assessments shall be made by the Head of Department after consultation with the course coordinator.

Assessment to be completed (Incomplete grade)

22.2 When a student has completed a substantial portion of the requirements for a course but, due to extenuating circumstances, is unable to complete all requirements, the course instructor may assign a temporary grade of "Incomplete". An "Incomplete" grade can be given only on the basis of a written prior agreement between the student and the instructor and approved by the Head of Department and the Dean. The agreement will describe the additional work that is expected and the terms under which it is to be completed. The date for completion of work is to be determined by the course instructor, but all work is to be completed no later than the end of the following semester (including summer semester if appropriate)

22.3 When the work or examination that is required under an "Incomplete" agreement is completed, the course instructor shall request a change of the "I" grade to the appropriate grade for the course, at which time the grade of "I" will be removed from the student's transcript.

22.4 An "I" grade can also be applied to a student who cannot take part in a final examination in a course because of personal health problems, or that of immediate family. A new deadline will be set by the course instructor for the completion of the final examination.

22.5 An "I" has no grade points and is not included in the calculation of GPA.

22.6 A grade of Incomplete that is not completed by the end of the subsequent semester automatically reverts to the grade indicated in the agreement between the course instructor and the student. If no grade is indicated in the agreement and the instructor does not submit a change of grade request, the "Incomplete" grade will revert to an "F". In no case shall a student be granted a degree while there are unresolved Incompletes in the student's record.

Withdrawal

22.7 Withdrawal from courses will be permitted up to the date indicated in the Academic Calendar for the year in which the withdrawal occurs. A student will not be allowed to withdraw from a course in which he/she had taken a grade of "W" in a previous semester.

22.8 A withdrawal from a course is effective upon the student's submission of a completed Withdrawal Form to the Office of the Registrar.

22.9 A student who takes a Leave of Absence during a semester will automatically be withdrawn from all courses.

Other particular circumstances

22.10 A student's particular circumstances may influence the procedures for assessment but not the standard of performance expected in assessment.

23. GRADING

23.1 Assessment grades shall be awarded on a criterion-referenced basis. The following Common Grading Scale is applied to all NU undergraduate programs:

Letter grade	***%***	***Quality Point***	***Explanation***
A	95-100	4	Excellent, exceeds the highest standards in the assignment of course
A-	90-94.9	3.67	Excellent, meets the highest standards for the assignment or course
B+	85-89.9	3.33	Very good, meets the high standards for the assignment or course
B	80-84.9	3.00	Good, meets most of the standards for the assignment or course
B-	75-79.9	2.67	More than adequate; shows some reasonable command of the material
C+	70-74.9	2.33	Acceptable; meets basic standards for the assignment or course
C	65-69.9	2.00	Acceptable; meets some of the basic standards for the assignment or course
C-	60-64.9	1.67	Acceptable; while falling short of meeting basic standards in several areas
D+	55-59.9	1.33	Minimally acceptable; falling short of meeting many basic standards
D	50-54.9	1.00	Minimally acceptable; lowest passing grade
F	0-49.9	0	Failing; very poor performance

'F" is a course failure grade, whilst all others ('D' to 'A') are course passing grades. No credit will be earned if a course is failed.

Semester GPA

23.2 At the end of each semester, a semester Grade Point Average (GPA) will be computed based on the grade point of all the courses taken in the semester. For each course, the grade point is determined by multiplying the number of credits with the numeric quality point based on the obtained grade for that course. The sum of the grade points is then divided by the total credits for all the courses taken in the semester as follows:

$$\text{GPA} = \frac{\sum_{n} \text{Course Credit Value} \times \text{Course Quality Point}}{\sum_{n} \text{Course Credit Value}}$$

where *n* = number of courses (inclusive of failed courses) taken by the student in the semester.

In addition, the following courses will be excluded from the semester GPA calculation:

(i) Transferred courses

(ii) Incomplete courses

(iii) Withdrawn courses

Figure 1: example of the semester GPA calculation

Courses	**Credits (ECTS)**	**Letter Grade**	**Quality Point**	**Credit value multiply by Quality Point**
Course 1	8	A	4.00	8X4=32
Course 2	6	B+	3.33	6X3.33=19.98
Course 3	6	C-	1.67	6X1.67=10.02
Course 4	6	F	0	6X0=0
Course 5	6	B	3.00	6X3=18.00
	Total = 32			Total = 80
Semester GPA =				80/32 = 2.5

23.3 GPA's will be calculated for each Semester including the Summer Term. This Semester GPA will be used to determine students' eligibility to progress to the next Semester alongside with the 'cumulative GPA'. The Semester GPA calculated for the Summer Term will also be used for this purpose

Annual GPA

23.4 At the end of each academic year, an annual Grade Point Average (GPA) will be computed based on the grade point of all the courses taken in the academic year (excluding the summer term). For each course, the grade point is determined by multiplying the number of credits with the numeric quality point based on the obtained grade for that course. The sum of the grade points is then divided by the total credits for all the courses taken in the academic year.

In addition, the following courses will be excluded from the yearly GPA calculation:

(i) Transferred courses

(ii) Incomplete courses

(iii) Withdrawn courses

23.5 GPA's will be calculated for each academic year excluding the Summer Term. This annual GPA will be used to determine Dean's list. Students who have taken at least 60 ECTS and obtained an annual GPA of greater or equal to 3.8 based on the fall and spring semesters grades in the academic year and did not have any misconduct will be recommended for the Dean's lists, which are commendations to undergraduate students of excellence.

Cumulative GPA

23.6 At the end of every semester, a Cumulative Grade Point Average (CGPA) will be computed based on the grade point of all the courses taken from the start of the program in residence at the University (including the summer term). For each course, the grade point is determined by multiplying the number of credits with the numeric quality point based on the obtained grade for that course. The total cumulative grade points are then divided by the total graded credits for all the courses taken from the start of the program in residence at the University.

23.7 For courses which have been retaken, only the grade point obtained in the final attempt will be included in the CGPA calculation. The CGPA is an indicator of overall performance at graduation, and is capped at 4.0.

Administrative Grades

23.8 The following University-wide administrative grade notations apply to all undergraduate programs:

Grades	Comments
P/F	A grade of P (pass) or F (Fail) may be reported for students who are permitted to take a course on a P/F grading basis rather than receiving a letter grade. Classes may only be taken on a P/F basis with the approval of the course instructor and the Dean. A "P" will not be used in calculating the student's GPA or CGPA; an "F" grade will be used in calculating the GPA and CGPA. The pass is equivalent to a C- or above
AU	Audited courses are recorded on the transcript with the notation "AU". Audited courses are not included in the calculation of the GPA, attempted credit, or earned credit. The grade "AU" is automatic. The course instructor cannot assign any other grade. Audited courses do not receive credit, cannot be counted towards graduation requirements, do not satisfy prerequisites and cannot be transferred.
I	Incomplete
IP	This grade is assigned at the end of the first term of a year-long class if the student has made adequate progress up to that point. It will be changed to reflect the class grade for both semesters of study at the end of the year.
W	Withdrawal
AW	Administrative Withdrawal. This grade indicates that a student has been ordered withdrawn from a course based on: • Disciplinary grounds, following the procedures and standards specified in the internal regulations of NU • Non-payment of tuition where appropriate following the procedures and standards specified in the internal regulations of NU
AD	Administrative Drop – An administrative drop occurs when a student has failed to attend the first week of any class for which they have completed registration and appear on the class roster. This process is initiated by the appropriate School to which the course belongs

24. GRADUATION REQUIREMENTS FOR BEng(HONS) IN MECHANICAL AND AEROSPACE ENGINEERING PROGRAM

All students qualifying for a 4-year Full-time Undergraduate Degree offered from fall 2018 onward must meet the following specific graduation requirements of their chosen program of study:

(i) Complete successfully a minimum of 248 ECTS composed of courses as specified in the program curriculum;

(ii) Obtain at least a C- grade for the Capstone Project;

(iii) Earn a CGPA of 2.00 or above at graduation.

24.1 It is the student's responsibility to ensure that all requirements for graduation are fulfilled in a timely fashion. The student should consult his/her academic advisor to determine whether the requirements have been met and, if not, what the student must do to meet the requirement.

24.2 The Office of the Registrar will send the list of students who meet graduation requirements, including their CGPA's and completed courses, to the Dean, who will approve each individual student and then t=return the list to the Office of the Registrar.

24.3 The Registrar will review all information, based on the recommendation of the Dean, and verify the list of students for graduation.

24.4 The list of recommended and verified students will be submitted to the Provost for final approval.

25. AWARD CLASSIFICATION

25.1 An undergraduate student is eligible for honors designation and will receive "red" diplomas, if he/she meets one of the following criteria:

1) his/her completed academic record equals to 4.00 CGPA. Such student qualifies for the category "Distinction";
2) his/her completed academic record equals to 3.90 CGPA and above (CGPA at graduation >= 3.90) calculated after excluding student(s) eligible for the category "Distinction". Such student qualifies for the category "Summa Cum Laude";
3) his/her completed academic record equals to 3.80 CGPA and above (CGPA at graduation >= 3.80) calculated after excluding student(s) eligible for the category "Distinction" and "Summa Cum Laude". Such student qualifies for the category "Magna Cum Laude";

25.2 Any courses passed after the graduation requirement has been met will <u>not</u> be taken into account in the grade point calculation for award classification.

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26. END-OF-SEMESTER AND FINAL EXAMINATIONS

End-of-Semester Period

26.1 The End-of-Semester period is a time of reduced social and extracurricular activity, starting with the last week of classes and continuing through the final examination period. In this period, students concentrate on academic work and prepare for the final examinations.

26.2 The following rules govern the conduct of classes during the End-of-Semester period:

1) During this time course instructors should neither make extraordinary assignments nor announce additional course meetings to "catch-up" in course presentations that have fallen behind. Course instructors may choose to conduct optional review sessions and to suggest other activities that might seem appropriate for students preparing for final examinations. Review sessions should be scheduled for optimal attendance, and a serious effort should be made by course instructors to accommodate students who are unable to attend a scheduled review session.

2) No graded homework assignments, mandatory quizzes, or examinations should be given during the last week of classes except:

   a) in classes, where graded homework assignments or quizzes are routine parts of the instruction process, or

   b) in classes with laboratories, where the final examination will not test the laboratory component. In such a case, the laboratory sessions during the week preceding examination period may be used o examine students on that aspect of the course

   c) Take-home examinations, given in place of the officially scheduled in-class examination, may be distributed in the week preceding the final examination period

   d) During the End-of-Semester period, no course instructor may schedule any extracurricular musical, dramatic, or athletic events involving compulsory student participation, nor may students be asked to attend any meetings of committees

Final Examinations

26.3 No other coursework, including laboratory or studio work, will be due during the final examination period unless it is assigned in advance and in lieu of the course's final examination.

26.4 All scheduled final examinations, or equivalent final graded exercises, are held at the end of the semester during NU's official final examination period. Final papers or other assignments that are assigned in lieu of a final examination will be due during the NU's final examination period.

26.5 The final exam schedule is generated by the Office of the Registrar. The date, time and venue of the final exam should not be changed. No student shall be required to take more than two scheduled final examinations that take place within a single calendar day. Students who find conflicts in their final examinations should seek to resolve these with the course instructors involved at the time the final examination schedule is posted. Course instructors are encouraged to be accommodating whenever possible. If a course instructor refuses to accommodate a conflict in a situation where a student is scheduled for more than two final examinations on the same calendar day, the student may appeal to the Dean.

26.6 On the day of the final exam, a student who is sick or has extenuating conditions that can affect the performance may apply for deferred assessment and should not sit for the exam. Once he/she sits for the exam, the student cannot appeal the grade based on medical and extenuating condition grounds (refer to Sections 20 and 22).

26.7 Students with a disability, dyslexia or other diseases can apply for special assessment arrangements in their final exams. Notification of special requirements must be made by the student to the course instructor at least three working days prior to the final exam. If the student did not apply for special assessment arrangements and sit for the exam, they cannot appeal the grade based on medical or extenuating condition grounds (refer to Sections 20 and 22).

26.8 Any student shall be permitted to review his or her corrected, graded final examination in the presence of a faculty or staff member within the stipulated period set by the course coordinator. If any error is found, the student should appeal (refer to Section 20).

Student Examination Conduct

26.9 Students are expected to arrive at the examination room on time.

26.10 Student will be required to present a current NU student identity card when entering an examination hall, and to display this card on their desks during the examination.

26.11 All rules concerning the administration of the examination will be explained to the students before the start of the examination. Students are required to observe all instructions given by examiners, supervisors, proctors, or other officials responsible for the conduct of the examinations.

26.12 The following rules apply to all examinations:

1) Talking to anyone other than the proctor in the examination room is not permitted.
2) The presence of any illegal items (unless permitted by the examination) will be grounds for charges of academic misconduct and immediate expulsion from the examination, and a grade of “F” on that examination. These items include but are not limited to cell phones or any text messaging devices.
3) Students must stop working at the end of the time allowed for the examination. Continuing to work on the examination after the allowed time is considered cheating.

26.13 Communicating answers to other students is as serious as receiving answers. Students who assist others are subjects to disciplinary actions and penalties.

27. ACADEMIC MISCONDUCT

27.1 All academic misconduct will be processed in accordance to the NU Student Code of Conduct and Disciplinary Procedures.

27.2 All disciplinary actions against students' misconducts will be recorded in students' records.

27.3 Students who have committed disciplinary offences (covering both academic and non-academic related matters) will be put on 'disciplinary probation'. The student will lose the stipend during the 'disciplinary probation'.

27.4 Students with two academic misconducts will be recommended for dismissal.

27.5 Students with records of academic misconduct will not be considered for University funded activities including student trips and overseas summer mobility programs.

27.6 The University reserves the right to withhold the issuance of any certificate of study to a student who has unsettled matters with the University, or who is subject to disciplinary action.

28. COURSE SPECIFICATIONS

28.1 Course titles

Level 1 courses
ENG 100 Introduction to Engineering
ENG 101 Programming for Engineers
MATH 161 Calculus I
PHYS 161 Physics I for Scientists and Engineers
HST 100 History of Kazakhstan
ENG 102 Engineering Materials I
PHYS 162 Physics II for Scientists and Engineers
MATH 162 Calculus II
SHSS 150 Rhetoric & Composition
KAZ 121 Kazakh I

Level 2 courses
MAE 200 Structural Mechanics I
MAE 201 Computer Aided Design
ENG 200 Engineering Mathematics (Differential Equations & Linear Algebra)
CEE 201 Environmental Chemistry
SHSS 210 Technical Writing
MAE 206 Engineering Dynamics I
MAE 205 Materials and Manufacturing I
ENG 201 Applied Statistics
ENG 202 Numerical Methods in Engineering
PHIL Ethics (selection among three courses)

Level 3 courses
MAE 300 Fluid Mechanics I
MAE 301 Engineering Thermodynamics
MAE 302 Machine Elements Design
MAE 303 Control Systems
GSB Fundamentals of Entrepreneurship and Management
MAE 305 Fluid Mechanics II
MAE 350 Structural Mechanics II
MAE 307 Engineering Dynamics II
MAE 306 Computer Aided Engineering
MAE 351 Vehicle Propulsion Systems
ECON 323 Managerial Economics
ENG 300 Interdisciplinary Project

Level 4 courses
MAE 400 Heat Transfer
MAE 401 Mechanical Systems Design
MAE 450 Heating Ventilating & Air-Conditioning
MAE 451 Oscillations of Mechanical Systems
MAE 452 Computer Aided Geometric Design
ENG 400 Capstone Project
KAZ 264 Kazakh II (Language and ethnicity)
MAE 453 Fire Engineering
MAE 454 Aerodynamics
MAE 455 Flight Mechanics
MAE 456 Materials and Manufacturing II
MAE 457 Feasibility Analysis of Clean Energy Technologies
MAE 458 Fundamentals of Multi-Body Dynamics
MAE 459 Advanced Control Systems and Industrial Automation
MAE 460 Advanced Topics in Computational Fluid Dynamics
MAE 461 Advanced Heat Transfer

28.2 LEVEL 1 courses

Core course	
Course code & title:	**ENG 100 Introduction to Engineering**
Semester:	1
Teaching Area:	General Professional Skills
Prerequisites:	
Course Description	
This course introduces students to the foundation and fundamental principles required to become analytical, detail-oriented, and productive engineers. The students will also gain an overview of what engineers do and of the various areas of specialization. Important topics for the engineering profession such as research in engineering, communications, and safety are also introduced. Additionally, students will work together in interdisciplinary groups to research, design, fabricate, test, and deploy a complete engineering project. Through lectures, laboratory practicum and project work, the students will become familiar with the following topics: - Overview of the Engineering Discipline - Engineering Communications - Research Skills - Occupational Health & Safety - Drafting and 3D Modelling - Fundamental Dimensions and Units - Manufacturing (3D Printing and/or others) - Material & Chemical Properties - Hydraulics and Fluids management - Programming - AC/DC circuits	
Course Aims	
1) To develop problem solving skills using analytical and hands-on approaches 2) To develop critical thinking, communication, and research skills 3) To introduce students to the significance of safety and occupational health in the engineering profession 4) To develop collaborative team skills and demonstrate professional responsibility	
Course Learning Outcomes	
1) Explain many of the different specializations of the engineering profession. Be in a position to apply basic research skills in engineering. 2) Program electronic components (e.g., microcontrollers such as Arduino Uno, Raspberry Pi) for sensor components, controllers, and actuators for an engineering system 3) Design & Visualize engineering components & systems using 3D CAD modelling software 4) Describe & Apply manufacturing processes for engineering components (e.g. via 3D printing). 5) Explain & Use hydraulics and fluid mechanics properties for fluid processes. Design, Assemble and Test engineering systems 6) Explain various safety issues typical for an engineering environment & Apply safety precautions as required. 7) Apply hands-on approaches to troubleshooting electrical/mechanical/civil/chemical engineering systems. Devise effective teamwork practices for problem solving	

Core course	
Course code & title:	**ENG 101 Programming for Engineers**
Semester:	1
Teaching Area:	General Professional Skills
Prerequisites:	

Course Description

This is an introductory course for programming essential for Engineering undergraduate study. The module would focus on the development of programming skills that can be directly applied to solve engineering problems where the computer is part of the system or is used to model a physical or logical system. This module introduces programming as a tool for solving engineering problems through C and Java programming languages. This is an introductory course providing foundational programming to Chemical, Mechanical, Civil and Electrical Engineers. Topics covered include: -Introduction to computers and programming -Variables in C, assignment statements, and arithmetic expressions -Input-output operations and functions -Operators: rules of operator precedence -Flow of Control, if-else, switch, while, for, do -Structured programming -Arrays & Pointers -Dynamic Memory Allocation -Elementary programming in Java -Methods in Java -Methods and Arrays in Java -Objects and Classes

Course Aims

1) To provide foundational knowledge and practice required to apply programming in solving Engineering problems.
2) To illustrate how the programming concepts presented in the lectures and labs are applied in project.
3) To demonstrate how the need to accommodate different practically motivated trade-offs can lead to alternative implementations.

Course Learning Outcomes

1) Develop programming solutions to open ended engineering problems.
2) Infer alternate solutions to programming problems.
3) Develop software specifically using C and Java programming languages.
4) Apply knowledge of programming to solve practically relevant engineering problems.
5) Use the object-oriented concepts to write optimal and efficient codes.

Core course	
Course code & title:	**MATH 161 Calculus I**
Semester:	1
Teaching Area:	General Professional Skills
Prerequisites:	

Course Description

This course covers limits and continuity as well as differentiation and integration of polynomial, rational, trigonometric, logarithmic, exponential, and algebraic function. The application areas include slope, velocity, extrema, area, and volume.

Course Aims

1) Computing limits.
2) Use limits to compute derivatives.
3) Use derivatives to understand graphs of functions.
4) Use derivatives to solve applied problems.
5) Evaluate integrals.
6) Use integrals to solve applied problems.

Course Learning Outcomes

1) Use both the limit definition and rules of differentiation to differentiate functions.
2) Sketch the graph of a function using asymptotes, critical points, the derivative test for increasing/decreasing functions, and concavity.
3) Apply differentiation to solve applied max/min problems.
4) Apply differentiation to solve related rates problems.
5) Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
6) Apply integration to compute arc lengths, and areas between two curves.
7) Use L'Hospital's rule to evaluate certain indefinite forms.

Core course	
Course code & title:	**PHYS 161 Physics I for Scientists and Engineers**
Semester:	1
Teaching Area:	General Professional Skills
Prerequisites:	

Course Description

This is an introductory calculus-based course covering Mechanics, Mechanical Waves and Thermodynamics. The students will learn to identify fundamental laws of mechanics and thermodynamics in everyday phenomena and to apply these laws to solving basic physics problems and to describing laboratory experiments.

Course Aims

1) Foster scientific creativity through variety of engaging lectures/discussions coupled with
2) improving problem-solving skills with exercises involving analytical and conceptual physics problems as well as encouraging and
3) developing team-based collaborative skills physics laboratory experiments by introducing the fundamental principles, methods and engineering applications of mechanics, waves, and thermodynamics. This course is designed for freshman students who have good preparation in physics and mathematics and who will pursue research and development careers in various areas of physical science and engineering. In addition, this course
4) provides practical knowledge they will need to complete intermediate and advanced undergraduate physics courses.

Course Learning Outcomes

1) Think critically and scientifically by applying physics concepts, including from other classes.
2) The student will gain knowledge and develop the skills to understand, set-up and solve qualitatively physics problems for the basic topics.
3) The student will learn the appropriate mathematical techniques and concepts to obtain quantitative solutions to problems in topics listed above.
4) The student will improve his/her communicating skills related to this course via the reading the textbook and additional materials, doing homework problems, writing laboratory reports, and doing optional in-class presentation.
5) The student will collect and analyze data and/or information from external sources.
6) The student will prepare coherent reports based on the accepted standards presented in class.
7) The student will meet the deadlines developing effective learning habits and discipline necessary to promote life-long learning.

Core course	
Course code & title:	**HST 100 History of Kazakhstan**
Semester:	1
Teaching Area:	Other
Prerequisites:	

Course Description

This course is a history of the territories which today make up Kazakhstan, from the Mongol conquests to the collapse of the USSR. The course combines a thematic approach with a chronological structure. We will examine two interrelated aspects of the history of the lands that today make up Kazakhstan. Firstly, we will analyze how authority was asserted, recognized, and challenged over the past few centuries. How did modern states emerge? What were the limits of state control over society and culture? What role did religious and national identities play in bringing political communities together and in tearing them apart? Who paid the costs of political and economic modernization? Secondly, we will study the usage of land and other natural resources. How did people assert the right to use land? What tensions did land usage and the exploitation of natural resources cause? What were the economic and environmental effects of land usage?

Course Aims

1) Students will acquire an understanding of the relationship between political authority, natural resources, and social and cultural change in territories of modern-day Kazakhstan from a historical perspective
2) Students will learn to search for information, to weigh evidence, and to draw conclusions about key social, cultural, and political issues in history
3) Students will learn to work with primary sources
4) Students will learn to understand historical scholarly texts
5) Students will learn to express their own arguments in a clear and convincing manner

Course Learning Outcomes

1) Knowledge: 1) Knowledge of the basic moments in Kazakhstani history from the post-Mongol period onwards, with a particular focus on the themes of authority and land usage 2) Basic understanding of key historiographical debates relating to the study of Kazakhstan 3) Understanding and ability to deploy key concepts relating to the study of Kazakhstani history, including 'nation' and 'class'
2) Academic: 1) Ability to analyze a range of primary sources chosen by the instructor, paying particular attention to their context, genre, and authorship 2) Ability to identify the question, thesis, and methods of a scholarly work in the field of history with the instructor's guidance 3) Appreciation of the diversity of scholarly approaches to the study of the past 4) Ability to extract and systematize information from selected primary and secondary sources 5) Ability to formulate a thesis and to structure an analytical in-class essay in response to an essay question provided by the instructor 6) Ability to lead a group discussion on a historical topic 7) Ability to take selective notes on expert presentations, seminars, and readings
3) Other: 1) Ability to collaborate with peers in source leadership and in other classwork 2) Ability to moderate discussion in a medium-sized group 3) Ability to intervene in class in front of a medium audience of peers 4) Self-discipline and self-motivation

Core course	
Course code & title:	**ENG 102 Engineering Materials I**
Semester:	2
Teaching Area:	Materials & Manufacturing
Prerequisites:	

Course Description

The module covers the fundamentals of materials science and engineering. These include the understanding of the material structure from the atomic to micro to macro levels. The effects of the structure and the processing techniques on the material properties will be discussed. These concepts will be illustrated using metals to allow students to utilize the knowledge for materials selection in common engineering applications.

Course Aims

1) To build a deep understanding of the interconnections between microstructure, processing, and properties of materials and the implications on large-scale engineering applications
2) To enhance the ability of students to connect atomic level behavior of materials with their mechanical properties
3) Familiarize the students with materials characterization techniques, incl. tools for microstructural observations and mechanical characterization

Course Learning Outcomes

1) Explain the influences of microscopic structure and defects on material properties, including dislocation and strengthening mechanisms
2) Understand the applications and processing of common engineering materials including metals and their alloys
3) Conduct appropriate tests to determine given mechanical properties using both destructive and non-destructive techniques.
4) Assess and describe the mechanisms leading to failure when provided with a failure example with an unknown cause.

Core course	
Course code & title:	**PHYS 162 Physics II for Scientists and Engineers**
Semester:	2
Teaching Area:	General Professional Skills
Prerequisites:	Physics I for Scientists and Engineers

Course Description

This is an introductory calculus-based course covering Electricity, Magnetism, and elements of Optics. The students will learn to identify fundamental laws in everyday electromagnetic phenomena and to apply these laws to solving basic physics problems and to describing laboratory experiments.

Course Aims

1) Foster scientific creativity through variety of engaging lectures/discussions coupled with
2) improving problem-solving skills with exercises involving analytical and conceptual physics problems as well as encouraging and
3) developing team-based collaborative skills physics laboratory experiments by introducing the fundamental principles, methods and engineering applications of mechanics, waves, and thermodynamics. This course is designed for freshman students who have good preparation in physics and mathematics and who will pursue research and development careers in various areas of physical science and engineering. In addition, this course
4) provides practical knowledge they will need to complete intermediate and advanced undergraduate physics courses.

Course Learning Outcomes

1) Think critically and scientifically by applying physics concepts, including from other classes.
2) The student will gain knowledge and develop the skills to understand, set-up and solve qualitatively physics problems for the basic topics.
3) The student will learn the appropriate mathematical techniques and concepts to obtain quantitative solutions to problems in topics listed above.
4) The student will improve his/her communicating skills related to this course via the reading the textbook and additional materials, doing homework problems, writing laboratory reports, and doing optional in-class presentation.
5) The student will collect and analyze data and/or information from external sources.
6) The student will prepare coherent reports based on the accepted standards presented in class.
7) The student will meet the deadlines developing effective learning habits and discipline necessary to promote life-long learning.

Core course	
Course code & title:	**MATH 162 Calculus II**
Semester:	2
Teaching Area:	General Professional Skills
Prerequisites:	Calculus I
Course Description	
This course covers transcendental functions, advanced integration techniques, improper integrals, area and arc length in polar coordinates, infinite series, power series and Taylor's theorem	
Course Aims	
1) focus on applications, 2) focus on techniques of integration, 3) focus on sequences and series, especially power series 4) focus on parametric and polar curves	
Course Learning Outcomes	
1) Integrate functions whose antiderivative is given by elementary functions. 2) Use integrals in a variety of area and volume computations. 3) Solve first order differential equations by separation of variables or the method of integrating factors 4) Analyze the convergence of series which are either absolutely convergent or alternating 5) Know the most usual Maclaurin series expansions and their intervals of convergence, together with how to derive them. 6) Work with curves in parametric form, especially polar coordinates. 7) Identify types of conic from their equation in cartesian or polar coordinates.	

Core course	
Course code & title:	**SHSS 150 Rhetoric & Composition**
Semester:	2
Teaching Area:	Other
Prerequisites:	

Course Description

This course familiarizes students with the skills and process involved in writing an academic research paper. With a focus on the steps of the writing process, students will complete two major research papers, while practicing skills in summarizing, paraphrasing, and citation. In addition to the mechanics of writing, the course emphasizes the development of critical thinking skills through reading, response, and discussion. Another goal of the course is to increase students' oral communication skills through both class discussion and presentations. Finally, SHSS 150 focuses on helping students develop an original and distinctive writing voice, one that allows synthesis of personal experience, opinion, and reading.

Course Aims

1) Teach students the skills and process involved in writing an academic research paper.
2) Develop students' critical thinking skills through reading, response, and discussion.
3) Increase students' oral communication skills through both class discussion and presentation.

Course Learning Outcomes

1) Accurately paraphrase short passages while writing a concise summary of an article or book chapter.
2) Critically and thoughtfully engage with academic texts through class discussions, writing summaries and responses, and through oral presentations.
3) Write a logical, well-organized, and coherent research essay of 5-7 pages with correct citations (minimum of five sources) and sophisticated vocabulary.

Core course	
Course code & title:	**KAZ 121 Kazakh I**
Semester:	2
Teaching Area:	Other
Prerequisites:	

Course Description

Students are offered a selection of courses in Kazakh language based on their language-knowledge level. The following description covers: Upper Intermediate Kazakh. In this course, students will develop or continue to develop advanced linguistic competencies in four areas: listening, reading, writing, and speaking. They will work with materials for level B2 and learn to give opinions on different topics, analyze the text, compare statistical data, and write an essay. Hence, they will learn vocabulary and grammar appropriately each theme. Furthermore, they will additionally learn new terms demonstrating Kazakh culture in this course.

Course Aims

1) to develop students' communicative skills through speaking, reading, listening and writing activities;
2) to teach to support conversations in social, cultural and educational spheres spontaneously;
3) to teach to employ lexical and grammatical patterns relevantly in everyday life;
4) to teach to review critically, analyze and synthesize information developing cognitive skills;
5) to develop making own judgement in planning, problem solving, and making a decision in different social and cultural situations.

Course Learning Outcomes

1) discuss issues on topics included in the syllabus, give detailed answers and provide an opinion on the topics;
2) formulate main idea and report on the texts for upper-intermediate level;
3) synthesize info and arguments from a number of sources;
4) critically analyze and evaluate papers for general public with consideration of principles of unity, coherence, tone, persona, purpose, methods;
5) follow the discussion on matters related to their field and understand in detail the points given prominence by the speaker;
6) make a descriptive and comparative report/diagram/chart;
7) argue with good grammatical control without much sign of having to restrict what they want to say;
8) make well-structured project presentation with introduction, main body, conclusion and reference;
9) make own judgement in planning, problem solving and make a decision in different social and cultural situations;

28.3 LEVEL 2 courses

Core course	
Course code & title:	**MAE 200 Structural Mechanics I**
Semester:	3
Teaching Area:	Materials & Manufacturing
Prerequisites:	

Course Description

The subject of structural mechanics aims to study forces acting on rigid bodies at rest. Time will be spent finding free body diagrams. Finding resultant forces for a variety of force systems and structure. As well as finding the reacting forces at the boundary conditions, due to forces acting on bodies. From the analysis of forces the stresses present within the structure will analyzed. Students shall develop critical thinking skills to be able to find to develop an analysis that leads a suitable solution(s) to structural (statics) real life problems using force and stress analysis.

Course Aims

1) Create Free Body of structure such as bars, trusses, beams, for example
2) Modelling of structures and forces applied
3) Modelling of linear elastic behavior
4) Modelling of various states of stress/strain: Tension, compression, shear, and torsion, bending.
5) Application of tensors to Mohr's circles, Tresca and Von Mises stress (including hydrostatic stress)

Course Learning Outcomes

1) Identify the forces applied to a structure and sketch the Free Body Diagram
2) Calculate the forces at the support (reaction forces)
3) Calculate the forces and stress acting on bars (trusses) and beams.
4) Calculate the deformation (deflection, elongation etc.) of structural elements

Core course	
Course code & title:	**MAE 201 Computer Aided Design**
Semester:	3
Teaching Area:	Design & Analysis
Prerequisites:	

Course Description

Modern engineers must be able to sketch a technical drawing both by hand and in a CAD software package, like SolidWorks, in accordance with requirements defined in international standards (e.g., ISO, ANSI). At the same time, it is essential to develop skills in spatial visualization of objects and 3D modeling of parts and assemblies. Computer Aided Design is a core course for 2nd-year students with the main focus on the fundamentals of engineering design: visualization, sketching, drawing, modeling, prototyping, assembling, and testing. Students will work on a semester project in teams of 3-4 students.

Course Aims

1) To introduce engineering design methodology.
2) To gain familiarity with the standards and conventions of engineering design graphics.
3) To develop spatial visualization and reasoning skills.
4) To use geometric modeling software as a design and visualization tool.
5) To develop sketching skills using pencil and paper, instruments, digital tablets.

Course Learning Outcomes

1) Produce engineering drawings according to engineering standards (e.g., ISO, ANSI).
2) Create 3D computer models of machinery parts and assemblies utilizing SolidWorks Academic Edition.
3) Perform geometric operations on 3D models with the aim of supporting engineering computations and analysis (e.g., model views, animations)
4) Utilize CAD functionality to generate drawings and reports for engineering solutions documentation.

Core course	
Course code & title:	**ENG 200 Engineering Mathematics (Differential Equations & Linear Algebra)**
Semester:	3
Teaching Area:	General Professional Skills
Prerequisites:	Calculus II
Course Description	
1. Differential equations of first- and second-order 2. Series solution of differential equations 3. Laplace transforms and its application to the solution of initial value problems 4. Some of the important special functions. 5. Linear algebra applications	
Course Aims	
1) Solve, using analytic means, a range of differential equations which arise most often in the various engineering disciplines. 2) Use computer algebra systems, numerical and statistical software packages in the solution of real-world engineering problems. 3) Apply linear algebra to a range of engineering-based problems.	
Course Learning Outcomes	
1) Solve a large class of first- and second-order differential equations analytically using standard techniques. 2) Model simple physical situations encountered in engineering using first- and second-order differential equations. 3) Use Laplace transform techniques to solve first- and second-order initial value problems. 4) Recognize and work with a number of the higher transcendental functions of mathematics. 5) Solve more difficult second-order linear differential equations using series solutions. 6) Find general solutions to linear algebraic equation systems. 7) Use Mathematica for both calculus and linear algebraic applications.	

Core course	
Course code & title:	**CEE 201 Environmental Chemistry**
Semester:	3
Teaching Area:	General Professional Skills
Prerequisites:	

Course Description

The module is essential for an undergraduate Civil Engineering program, since it is a prerequisite for further courses related to environmental engineering area, i.e. environmental engineering, water and wastewater treatment processes, electives. This course will give the students fundamental knowledge on environmental chemistry. It will include chemistry principles, cycles of chemicals in environment, reactions, kinetics, equilibria, electrochemistry, chemistry of environmental processes.

Course Aims

1) To provide students with the skills and knowledge needed to understand environmental chemistry and related chemical processes.
2) To enable students to be aware of environmental issues in the world.
3) To stimulate interest in, and care for, the environment.

Course Learning Outcomes

1) Apply knowledge on chemistry theories, laws, and definitions
2) Interpret scientific vocabulary and terminology
3) Be aware of the existing scientific techniques related to the discipline
4) Explain environmental processes

Core course	
Course code & title:	**SHSS 210 Technical Writing**
Semester:	3
Teaching Area:	Other
Prerequisites:	

Course Description

This course presents students with practical information about communicating in different kinds of workplace environments and professional and technical discourse communities. This course highlights the key characteristics of technical writing and emphasizes the importance of planning, drafting, and revising texts. Students will analyze and produce common technical writing genres, and react to rhetorical situations each genre presents, including issues of audience, organization, visual design, style, and the production of texts.

Course Aims

1) Recognize the use of rhetorical and stylistic elements necessary for the successful practice of scientific and technical communication
2) Work individually and collaboratively to research, analyze, and write about public debates surrounding science and technology
3) Practice the ethical use of sources and appropriate citation conventions
4) Refine writing style for clarity, concision, coherence, and emphasis
5) Work with peers to provide written and oral feedback of student work

Course Learning Outcomes

1) Identify and understand the structures and functions of the primary genres of technical writing
2) Analyze and adapt to the constraints of specific rhetorical situations, including audiences, purposes, modality, and use
3) Integrate tables, figures, and other images into documents
4) Produce and present technical documents, including research reports, that are accessible to non-specialist audiences and demonstrate the ethical use of sources and appropriate citation conventions

Core course	
Course code & title:	**MAE 206 Engineering Dynamics I**
Semester:	4
Teaching Area:	System Dynamics & Control
Prerequisites:	Structural Mechanics I

Course Description

This module consists of application of Newton's Laws to equilibrium of particle and rigid body and reactions developed internally and externally due to application of the loads, stress and strain diagram, and study of simple mechanical planar motion of a particle through consideration of forces, work, energy and momentum and its conservation using different coordinate systems.

Course Aims

1) To advance the existing knowledge of the students on particle dynamics, to dynamics of rigid bodies in two and three dimensions, with main focus on planar systems.
2) To provide to students the necessary background for being able to continue their studies with modules on applied dynamics in the context of machine and industrial applications and advanced 3D multibody dynamics.

Course Learning Outcomes

1) Model and analyze the kinematics of systems of rigid bodies.
2) Model and analyze dynamic interactions of rigid bodies.
3) Apply the principle of work and energy for rigid bodies in complex motion.
4) Apply the principle of impulse and momentum for rigid bodies in complex motion.
5) Model and analyze three-dimensional rigid body systems (introduction).

Core course	
Course code & title:	**MAE 205 Materials and Manufacturing I**
Semester:	4
Teaching Area:	Materials & Manufacturing
Prerequisites:	

Course Description

This course aims to extend the fundamental understanding of the structure - property relationship of materials introduced in Engineering Materials course. It primarily intends to introduce the students to a wide variety of materials and relevant theories. This course covers not only ferrous & non-ferrous materials but also three other major categories of non-metallic materials that are encountered by engineers in the real world, namely ceramics, polymers, and composite. It also assists the students to develop the idea of production processes required for various materials. In addition, this course demonstrates the capability of different types of heat treatment processes such as annealing, normalizing, quenching, tempering, surface modification methods to improvise material properties further.

Course Aims

1) Introduce students to a wide variety of materials and theories outlining ferrous & non-ferrous materials, metals, composites, and ceramics.
2) Provide students with knowledge on the fundamentals of the various different surface technologies available.
3) Provide students with knowledge & certain practical aspects on material removal processes.
4) Introduction to the principles of manufacturing processes; related machinery and equipment; common aspects of manufacturing, including metrology and quality assurance

Course Learning Outcomes

1) Identify wide variety of application specific materials by correlating their material properties and characteristics with the requirements.
2) Explain the theory pertaining to ferrous and non-ferrous materials.
3) Design and apply heat treatments processes and phase diagram to develop materials with certain properties.
4) Evaluate traditional manufacturing processes and related quality control techniques.
5) Employ manual turning and milling machine to produce part product.

Core course	
Course code & title:	**ENG 201 Applied Statistics**
Semester:	4
Teaching Area:	General Professional Skills
Prerequisites:	Calculus II

Course Description

This course provides an introduction to basic probability theory and statistics. Topics include sample spaces, events, classical and axiomatic definition of probability, conditional probability, independence, expectation and conditional expectation, variance, distributions of discrete and continuous random variables, joint distributions, central limit theorem, descriptive statistics, confidence interval estimation, and hypothesis testing.

Course Aims

1) To introduce basic probability theory and techniques of descriptive statistics
2) To introduce important continuous and discrete random variables
3) To introduce basics of inferential statistics
4) To develop computing skills using software such as MATLAB and/or R for basic statistical analysis

Course Learning Outcomes

1) Describe various interpretations of probability and the difference between discrete random variables
2) List important continuous and discrete distributions.
3) Compute descriptive statistics and summarize a dataset
4) Compute confidence intervals and conduct hypothesis tests
5) Use software for basic statistical analysis.

Core course	
Course code & title:	**ENG 202 Numerical Methods in Engineering**
Semester:	4
Teaching Area:	General Professional Skills
Prerequisites:	Engineering Mathematics (Differential Equations & Linear Algebra)

Course Description

This course will introduce students to various numerical techniques currently used by practicing engineers and to give them a sound underpinning knowledge of the workings of these techniques. How computer programs aid in the use of numerical methods will also be demonstrated.

Course Aims

1) What a numerical method is.
2) Give an understanding of the reasons for using numerical methods.
3) Integrate linear algebra techniques when appropriate for a particular numerical method.
4) Show how numerical methods can be applied correctly to various areas of approximate mathematics and in particular to the solution of ordinary differential equations (ODEs) and partial differential equations (PDEs).
5) Use existing knowledge of computer programming to help in finding solutions using numerical methods.

Course Learning Outcomes

1) Demonstrate knowledge and understanding of numerical methods to solve systems of linear equations,
2) Demonstrate knowledge and understanding of numerical methods to interpolate and to compute quadratures,
3) Demonstrate knowledge and understanding of numerical methods to solve ordinary differential equations,
4) Demonstrate knowledge and understanding of numerical methods to solve simple partial differential equations,
5) Analyze a mathematical problem and determine which numerical technique to use to solve it,
6) Show logic in coding a mathematical problem in algorithmic form, and,
7) Incorporate MATLAB and Mathematica into numerical solutions.

Core course	
Course code & title:	**PHIL Ethics (selection among three courses)**
Semester:	4
Teaching Area:	General Professional Skills
Prerequisites:	
Course Description	
Students should pick one of the following offered courses: 1. PHIL 210: Ethics 2. PHIL 211: Practical Ethics 3. PHIL 212: Ethical Reasoning	
Course Aims	
Course Learning Outcomes	

28.4 LEVEL 3 courses

Core course	
Course code & title:	**MAE 300 Fluid Mechanics I**
Semester:	5
Teaching Area:	Thermofluids & Energy Applications & Aerospace Engineering
Prerequisites:	Physics I for Scientists and Engineers
Course Description	
This course will cover the basic concepts, techniques and principles underlying the statics and dynamics of fluids: - Fundamental concepts: Definition of a fluid, control volume and differential analysis, kinematics of fluid motion, stress and strain rate, viscosity, Newtonian fluid. - Fluid in equilibrium: Fluid statics, variation of pressure with depth, forces on immersed surfaces. - Dimensional analysis and similitude: Nature of dimensional analysis, Buckingham's PI theorem, arrangement of dimensionless group, Reynolds number, Laminar and Turbulent Flow. - Conservation laws in control volume form: continuity, momentum equation for steady flow, first law of thermodynamics (relation to Bernoulli's equation), applications. - Viscous flow: Poiseuille and Couette flow, internal flow with losses: major and minor losses, friction factor.	
Course Aims	
1) Gain a full understanding of the basic concepts, techniques and principles underlying the statics and dynamics of fluids. 2) Apply the above to solve fluid flow problems, in particular, fluids-related engineering problems.	
Course Learning Outcomes	
1) Identify the properties of a fluid and classify fluids in categories based on their stress-strain relationship. Calculate the stress/strain of a Newtonian fluid. 2) Use dimensional analysis to obtain the dimensionless groups associated with a physical problem and apply similarity to relate the conditions of the prototype with its model. 3) Calculate the pressure variation in manometers, tubes, containers etc. and compute the force on an immersed surface due to the presence of a static fluid. 4) Compute the forces and velocities in a moving fluid using conservation laws in control volume form (continuity, momentum equation), for steady flow. 5) Differentiate between streamline vs pathline, and streamfunction vs velocity potential, and apply Bernoulli's equation along a streamline. 6) Calculate the viscous losses associated with a pipe network hence estimate the necessary pressure/power to drive the flow. 7) Determine the velocity profile of some basic flows, both viscous and inviscid.	

Core course	
Course code & title:	**MAE 301 Engineering Thermodynamics**
Semester:	5
Teaching Area:	Thermofluids & Energy Applications & Aerospace Engineering
Prerequisites:	

Course Description

This course builds on, and develops from, an introduction to the essential theoretical basis of engineering theoretical basis of engineering thermodynamics and its application to a range of problems of relevance to practical engineering. The course aims to equip the student with basic tools and methodologies for carrying out thermodynamic analyses of engineering systems. Key topic areas include: Second Law of Thermodynamics applied to heat engines and refrigeration systems; common practical heat engine and refrigeration cycles; and, fundamentals of combustion.

Course Aims

1) To provide a fundamental understanding of the Second Law of Thermodynamics and associated application to a wide range of systems.
2) To give the ability to analyze the work and heat interactions associated with a prescribed process path.
3) To give the ability to evaluate entropy changes in a wide range of processes and determine reversibility and irreversibility of a process.
4) To give the ability to evaluate energy changes in a wide range of processes and be familiar with the concepts of Availability and Exergy.
5) To provide an ability to carry out thermodynamic analyses of common cycles found in thermodynamics.
6) To provide familiarity with the concepts and use of psychrometry.
7) To provide familiarity with basic concepts of combustion of fuels.

Course Learning Outcomes

1) Apply understanding of the nature and operating principles of energy flows to systems encountered in engineering.
2) Describe and apply basic thermodynamic principles and laws of physics to analyzing and predicting performance of idealized forms of thermodynamic systems.
3) Describe and assess benefits of improvements to thermodynamic systems.
4) Relate idealized thermodynamic system models to corresponding real systems.

Core course	
Course code & title:	**MAE 302 Machine Elements Design**
Semester:	5
Teaching Area:	Design & Analysis
Prerequisites:	Materials and Manufacturing I

Course Description

This module consists of application of previously studied principles of materials science and mechanics to the design of mechanical machine elements. This module will build the understanding of how machines and their mechanical elements work and how to design them to achieve desired properties and behaviors. It will contribute to the development of critical thinking and understanding of the cause-effect relationships involved in machine design and will set the groundwork for creative mechanical systems design.

Course Aims

1) The module aims to impart the necessary knowledge and skills for mechanical engineering students to analyze and design machine elements and simple machines.

Course Learning Outcomes

1) Perform system identification and synaptic network graph representations; Identification of elements and interfaces
2) Perform dimensional, geometric and functional modelling and tolerancing
3) Explain basic principles and technology of various machine elements
4) Model mechanical failure (incl. yielding, fracture, fatigue, creep) and elastic compliance
5) Perform tribological modelling of interfaces (friction and rolling resistance) and modelling of elastic material hysteresis
6) Perform machine element design calculations using combined analytical and numerical methods

Core course	
Course code & title:	**MAE 303 Control Systems**
Semester:	5
Teaching Area:	System Dynamics & Control
Prerequisites:	

Course Description

This course reviews various types of control systems, deals with system response analysis in frequency domain, state space representation for non-linear system, and classical controller design by hand and by MATLAB software. It also elaborates State space analysis and design. Finally, it deals with the project-based problems drawn from mechatronics and mechanical systems.

Course Aims

1) To provide a solid background for the understanding of classical controller, its analysis and design techniques.
2) Develop hardware and software packages.

Course Learning Outcomes

1) Identify various types of control systems and its underlying theory
2) Analyze stability, system response and transient behavior of dynamic systems
3) Design classical controller such as PID controller
4) Derive block diagram, transfer functions, and state space description
5) Design root locus by hand and by MATLAB software

Core course	
Course code & title:	**GSB Fundamentals of Entrepreneurship and Management**
Semester:	5
Teaching Area:	General Professional Skills
Prerequisites:	

Course Description

This course introduces students to the fundamentals of entrepreneurship. It covers topics including opportunity identification, idea generation, building business models and plans, to presenting ideas. We will discuss the role of entrepreneurial activity in Kazakhstan's economy. The course is a guide to high-growth entrepreneurship, combining theoretical frameworks with cases and practice-oriented exercises.

Course Aims

1) Student understands the fundamental concepts of entrepreneurship and the entrepreneurial process
2) Student can describe and distinguish the types of entrepreneurship, the financial sources for startups, and modes of business networking.
3) Student applies entrepreneurship concepts individually and working in teams to cover the development of ideas into business plans.

Course Learning Outcomes

1) Comprehend basic concepts of the entrepreneurial process.
2) Comprehend basic tools for the analysis of the entrepreneurial process.
3) Apply those concepts as part of a working team in the development, reporting and presentation of a business plan.

Core course	
Course code & title:	**MAE 305 Fluid Mechanics II**
Semester:	6
Teaching Area:	Thermofluids & Energy Applications & Aerospace Engineering
Prerequisites:	Fluid Mechanics I

Course Description

The module includes the fundamental concepts, principles and theories of external flows, boundary layers and compressible flows. Furthermore, it will discuss how to apply the concepts, principles, and theories in fluid mechanics to design and analyze the performance of turbomachinery.

Course Aims

1) Analysis of laminar, transitional, and turbulent boundary layers in particular and external flows over objects in general;
2) Study of compressible flows;
3) Application of fluid mechanics for the design and analysis of turbomachinery.

Course Learning Outcomes

1) Characterize external fluid flows and various boundary layers over objects;
2) Calculate the drag and lift forces over various bodies;
3) Analyze compressible flows and calculate flow field parameters with and without shocks;
4) Apply the concepts, principles and theories learnt in fluid mechanics to design and analyze turbomachinery

Elective course	
Course code & title:	**MAE 350 Structural Mechanics II**
Semester:	6
Teaching Area:	Materials & Manufacturing
Prerequisites:	Structural Mechanics I

Course Description

The subject of structural mechanics II aims to study general principles of the strength calculations of the general mechanical structures as thin-walled rods, thick-walled pipes, fast-rotating and uneven heated discs, plates, and shells. Numerical modeling of the structures will be done using commercial software such as MATLAB. Students shall develop critical thinking skills to be able to assess the validity of the analytical and numerical results

Course Aims

1) To give students a clear understanding of the principles of calculating the strength and rigidity.
2) To discuss the basic principles of calculating thin-walled rods, thick-walled pipes, fast-rotating and uneven heated discs, plates, and shells.
3) Give students a general understanding of the numerical methods for calculating these structures.

Course Learning Outcomes

1) classify the structures subject to strength / rigidity calculation;
2) construct mechanical models of structures subject to calculation;
3) perform calculation for strength and / or rigidity;
4) Use computer programs (for example, MATLAB) to perform strength and rigidity calculations of mechanical structures.

Core course	
Course code & title:	**MAE 307 Engineering Dynamics II**
Semester:	6
Teaching Area:	System Dynamics & Control
Prerequisites:	Engineering Dynamics I

Course Description

The module consists of analysis of machines and mechanisms operation with application of statics and dynamics principles. Application of these principles with analysis of operation of mechanisms provides background for design of machine elements.

Course Aims

1) The module aims to impart the necessary knowledge and skills for mechanical engineering students to apply dynamics analysis in the design of mechanisms and machines. Students should be able to design linkages and calculate their position, velocity, and acceleration as well as the forces involved in their motion. Due to the presence of shaking forces (and balancing) in linkages an introduction to vibration will be done.

Course Learning Outcomes

1) Analyze and synthesize mechanisms and machines.
2) Design viable mechanism solutions to real, unstructured engineering problems.
3) Identify, formulate, solve, and analyze simple vibration problems.
4) Apply knowledge for analysis of simple machine elements experimentally.

Core course	
Course code & title:	**MAE 306 Computer Aided Engineering**
Semester:	6
Teaching Area:	Design & Analysis
Prerequisites:	Computer Aided Design Numerical Methods in Engineering

Course Description

The course will describe the general underlying principles and the techniques used in computer aided analysis software tools. It will include mathematical modelling along with numerical methods & techniques. The course is aiming to introduce the fundamentals of the Finite and Boundary Element methods (FEM / BEM) and guide students in the development and usage of such methods in the engineering profession. Focus will be given in solving specific engineering problems ranging from solid mechanics, to heat transfer and fluid flows using both student developed and commercial analysis software packages.

Course Aims

1) Describe the mathematical formulation of the finite and boundary element methods and how to apply it to basic (linear) ordinary and partial differential equations.
2) Develop the required mathematical skills regarding the mathematical formulation and applications of FEM and BEM
3) Implement the finite and/or boundary element method (using coding environments, such as MATLAB, FEniCS or equivalent) and solve a specific engineering problem
4) Present the coupling between boundary elements and finite element methods.
5) Apply the aforementioned methods and operations in analyzing engineering problems (elastic, thermal, fluid-flow and electrostatics) in modern CAE/CAA software packages (ANSYS, COMSOL and/or others).

Course Learning Outcomes

1) Identify and be able to use mathematical objects, formulations and concepts required in FEM and BEM.
2) Analyze engineering problems with the help of FEM and BEM and assess their output.
3) Select the more suitable method and/or approach for a given problem (based on its type [linear/non-linear/shell-like etc.], required accuracy and preprocessing effort)
4) Develop and use software tools implementing the aforementioned methods in practical real-world engineering problems.

Elective course	
Course code & title:	**MAE 351 Vehicle Propulsion Systems**
Semester:	6
Teaching Area:	Aerospace Engineering
Prerequisites:	

Course Description

The following will be included in this elective module: 1. Fuel consumption and drivability models of the most important vehicle propulsion systems, which are IC engines, electric motors, short range energy storages, batteries and fuel cells, drive trains and vehicles, etc. 2. Mathematical optimization methods (parameter and control), including computer aided tools (e.g. CFD, FEA). 3. Several examples of novel power train systems (hybrid electric vehicles, fuel cell vehicles, etc.) and their optimization. A major case study of optimization of a novel vehicle propulsion system.

Course Aims

1) Introduction of the most important concepts of mathematical system optimization using vehicle propulsion problems as examples.
2) Presentation of several model classes of propulsion systems and components.
3) Application of modern system optimization and control tools to vehicle propulsion systems.

Course Learning Outcomes

1) understand the structure of conventional propulsion systems;
2) understand the structure of new propulsion systems;
3) explain, analyze, and evaluate the working principles of conventional propulsion systems;
4) explain, analyze, and evaluate the working principles of new propulsion systems;
5) perform system optimization and controller design for vehicles;
6) Describe (quantitatively) propulsion systems

Core course	
Course code & title:	**ECON 323 Managerial Economics**
Semester:	6
Teaching Area:	General Professional Skills
Prerequisites:	

Course Description

The goal of this course is to learn how to apply microeconomic principles and quantitative tools to managerial decisions. It covers issues like demand analysis, production and cost analysis, and pricing strategy. By doing so, this course helps students develop strategies and tools for solving a wide variety of issues and problems that managers face. Students who successfully complete this course are expected to make an accurate evaluation of external business environment and create value within various organizational settings.

Course Aims

1) Learn how to apply microeconomic principles and quantitative tools to managerial decisions.
2) Develop strategies and tools for solving a wide variety of issues and problems that managers face.

Course Learning Outcomes

1) Make an accurate evaluation of external business environment
2) Create value within various organizational settings.

Elective course	
Course code & title:	**ENG 300 Interdisciplinary Project**
Semester:	6
Teaching Area:	General Professional Skills
Prerequisites:	

Course Description

In this course students work in interdisciplinary teams toward a holistic approach to design projects; including problem definition, design proposal, implementation, and critical evaluation. The course explores design research and practice within social and economic contexts; including the ethical, cultural, and environmental impacts of design decisions, intellectual property considerations, and aspects of appropriate professional conduct. The course will focus on tools and skill sets that are particularly important for succeeding in a design project, including planning, teamwork, project management, and design reporting. Where possible, it is expected that the projects will include an industrial partner, who will provide realistic industrial problems and support them with necessary guidance and resources. This course requires students form and work in groups of 5 or more in size.

Course Aims

1) Extensively analyzing project tasks, activities and deliverables with project planning and management skills working on an interdisciplinary engineering problem
2) Evaluating research, presentation and implementation skills related to the project
3) Creating new knowledge and skills continuing on the experience gained from earlier years working in a group.

Course Learning Outcomes

1) to apply the knowledge acquired in earlier courses in the study of a complex design problem;
2) to identify the requirements, which have to be fulfilled by possible solutions ('designs') to solve the earlier identified design problem;
3) to develop solutions for a complex design problem. These solutions should be well argued, if the data allow, also quantified and applicable in practice (by the final customer, if available);
4) to present and defend team results;
5) to collaborate and cooperate in such a way that the project goals are fulfilled;
6) to effectively manage a project.

28.5 LEVEL 4 courses

Core course	
Course code & title:	**MAE 400 Heat Transfer**
Semester:	7
Teaching Area:	Thermofluids & Energy Applications
Prerequisites:	Fluid Mechanics I Engineering Thermodynamics

Course Description

The course covers the heat transfer phenomena including conduction, convection, and radiation. Boiling and condensation, and heat exchangers are treated as well. By learning the basis of all these phenomena and techniques, the students will develop advance knowledge and understanding of heat transfer.

Course Aims

1) The module will assist students to gain an understanding of heat transfer concepts and their applications. Students will explore the principles of heat transfer process, numerical analysis of heat transfer and their influence on systems in everyday life. Students will also develop an appreciation of the design principles of thermo-fluid systems. Students will apply the knowledge to analyze existing thermo-fluid systems and to contribute to new designs.
2) Explain the basic heat transfer concepts such as heat transfer mechanisms, heat conduction, heat convection and heat radiation equations.
3) Solve numeric problems by applying the fundamental principles of heat transfer
4) Analyze laboratory experimental data and synthesize these results with your knowledge in order to communicate your ideas and conclusions in the form of a laboratory report.
5) Analyze the heat transfer mechanisms of existing thermo-fluid systems and processes and contribute to new designs.
6) Understand and explain the role of thermodynamics and heat transfer science in building a sustainable society

Course Learning Outcomes

1) Define the heat transfer mechanisms
2) Recognize steady and unsteady conduction heat transfer problems and perform calculations to determine the heat transfer in both conditions.
3) Analyze heat convection problems and perform calculations to determine heat transfer in both laminar and turbulent conditions
4) Describe the phenomenon of boiling and condensation and perform basic calculations.
5) Describe and perform calculations of most common types of heat exchangers
6) Analyze and solve radiation problems in different configurations of emitting conditions and geometries

Core course	
Course code & title:	**MAE 401 Mechanical Systems Design**
Semester:	7
Teaching Area:	Design & Analysis
Prerequisites:	Machine Elements Design

Course Description

This module consists of application of previously studied principles of machine elements design to design complex mechanical systems and machines and develop relevant technology. This module will build the understanding how mechanical systems and machines work and how to create them in order to achieve given desired properties and behaviors within given contexts and requirements. It will contribute to development of competencies related to the systematic analysis and synthesis, creativity and decision-making and to the understanding of real-life mechanical systems.

Course Aims

1) The module aims to impart the necessary knowledge and skills for mechanical engineering students to design mechanical systems.

Course Learning Outcomes

1) Apply systems design methodology to create abstractable/ specifiable system models in the space of ideas, using idea representations and values of ideas; Identification of the design object, context and requirements and of pDOFs and dDOFs
2) Perform systems modelling (multiphysics) based on SN-methodology
3) Model the design process and its subprocesses, planning and monitoring (incl. reviews and stage gates, creativity, and systematic human interactions), the technology development process (incl. TRL) and apply systematic innovation methodology
4) Explain and measure quality and apply total quality management
5) Perform multi-parametric multi-objective evaluation and optimization (Pareto optimality) and related parametric studies
6) Apply taught methods to the design of challenging mechanical systems and technology development in realistic projects and role-play

Elective course	
Course code & title:	**MAE 450 Heating Ventilating & Air-Conditioning**
Semester:	7
Teaching Area:	Thermofluids & Energy Applications
Prerequisites:	

Course Description

Heating, ventilating, and air conditioning of indoor environment are mandatory in modern society. It provides human comfort and enhances human health. These two factors lead to the increase in safety and productivity. Moreover, controlled environment for various public and health care buildings including hospital and data centers is necessary. The topics includes air-conditioning systems, moist air properties and conditioning processes, comfort and health, heat transmission, solar radiation, heating, and cooling loads & air diffusion.

Course Aims

1) This HVAC course aims to equip the students with the knowledge in the research and practice in indoor environment heating, ventilating, and air conditioning.

Course Learning Outcomes

1) Relate the scientific theory and principles which govern heating, ventilating, and air conditioning of indoor environment;
2) Apply the theory and principles to the design and selection of the engineering systems;
3) Conduct research in the contemporary issues related to HVAC; and,
4) Publish research findings in quality journal.

Elective course	
Course code & title:	**MAE 451 Oscillations of Mechanical Systems**
Semester:	7
Teaching Area:	System Dynamics & Control
Prerequisites:	Structural Mechanics I

Course Description

This is an elective module to mechanical engineering program and includes the most important corresponding methods and techniques that are typically used in engineering and industrial applications.

Course Aims

1) Develop a dynamic model of various mechanical systems
2) Constitute the equation of motion of mechanical systems with an arbitrary number of degrees of freedom.
3) Solve obtained differential equations of motion and determine natural frequencies and mode shapes.
4) To analyze the dynamic model and use the results for improvement of the mechanical system.

Course Learning Outcomes

1) Understand the principles of dynamic simulation of mechanical systems
2) Use analytical and numerical methods for solving the equations of motion
3) Use a dynamic system analysis for the design of reliable and durable mechanical systems.

Elective course	
Course code & title:	**MAE 452 Computer Aided Geometric Design**
Semester:	7
Teaching Area:	Design & Analysis
Prerequisites:	Computer Aided Design

Course Description

CAGD, which stands for Computer Aided Geometric Design, is the discipline concerned with the computational and geometric aspects of free-form curves, surfaces, and volumes as they are used, for example, in CAD/CAM (Computer Aided Design / Computer Aided Manufacture), scientific visualization and computer graphics. It's safe to say that CAD revolutionized modern day engineering. CAD allows for the easier development of products and product management integration and CAGD is its main pillar. Having thorough knowledge of the internal mathematical representations and modelling is a significant asset for every engineer that is willing to be involved in engineering projects

Course Aims

1) Present in detail geometrical transformations including affine and projective transformations.
2) Provide the basic definitions and differential geometry elements aiming in the definition of curvature & torsion for parametric curves & surfaces.
3) Discuss the need and requirements for free-form curves & surfaces.
4) Present in detail all basic forms of parametric curve & surface representations used in modern Computer Aided Design (CAD) software packages: a. Bezier, B-Spline and NURBS representations will be covered along with the corresponding evaluation algorithms and geometrical operations: Representation's bases definitions, Curve & Surface point evaluations (de Casteljau & de Boor-Cox algorithms), Curve's & surface's derivatives, Curve Subdivision, Degree elevation & reduction, knot insertion a.o.
5) Present the basic methods for representing solids with modern CAD software packages. Discuss Boolean operations used in CSG (constructive solid geometry) and present the solid's Boundary Representation (BRep).
6) Apply the aforementioned methods and operations in designing free-form models in modern CAD software packages.
7) Apply methods and visualization aids for the assessment of curves' and surfaces' smoothness and overall quality

Course Learning Outcomes

1) Understand the underlying principles and the techniques used in common geometrical transformations applied in CAD software packages.
2) Understand and be able to use all the common curve & surface representations along with their common evaluation algorithms.
3) Design curves and surfaces under given shape constraints.
4) Generate 3D models of engineering components under given continuity and other geometrical constraints.
5) Be able to assess the quality and fairness of curves and surfaces.
6) Be able to 2D and 3D parametric models that are appropriate for employment in shape optimization procedures.
7) Demonstrate critical reasoning with respect to the validity and fidelity of their designed models.

Core course

Course code & title:	**ENG 400 Capstone Project**
Semester:	7 & 8
Teaching Area:	General Professional Skills
Prerequisites:	

Course Description

The capstone project is the culminating experience of the student's engineering program and provides students with the opportunity to apply and integrate their knowledge and skills gained from earlier years. This is achieved in a context of a year-long and substantial engineering project related to the student's discipline area. Students will take the responsibility to organize, plan and carry-out the various tasks required for successful completion of the project. Wherever possible, projects will be sourced from industry partners. Projects may be undertaken by individual students or in small teams. At the completion of the unit, students will hand over their project deliverables and present project outcomes in a report as well as end-of-semester oral presentation and defense.

Course Aims

1) Extensively analyzing project tasks, activities and deliverables with project planning and management skills working on a complex engineering problem
2) Evaluating research, presentation and implementation skills related to the project
3) Creating new knowledge and skills continuing on the experience gained from earlier years working on a complex engineering problem.

Course Learning Outcomes

1) Evaluate and perform survey to propose an open design or research problem;
2) Extensively criticize and apply Engineering research methods to evaluate feasibility of a diverse set of solutions.
3) Design, interpret, and invent to meet design specifications of a real-life engineering problem;
4) Effectively develop and construct project implementation plans;
5) Produce and develop a well written capstone project report and project presentation;
6) Prove ability to communicate effectively with all stakeholders in an ethical and professional manner and confidently defend ideas and proposals to the project client and university audiences.

Core course	
Course code & title:	**KAZ 264 Kazakh II (Language and ethnicity)**
Semester:	7
Teaching Area:	Other
Prerequisites:	Kazakh I

Course Description

Developed for the "C1" level, this course is intended for studying an ethnos through language units preserved in its vocabulary. During this course, the students will study and analyze ethnocultural lexis (words, word combinations, fixed phrases, proverbs, historical texts). By means of these analysis, they will learn about perceptions, psychology, character, and preferences of the Kazakh people. The students are going to identify and analyze extralinguistic factors that have influenced the formation of national cultural lexis. As a result, they will have learned that the national lexis can provide information about the nation and also the ways to analyze it. Besides, the knowledge of identifying national cultural peculiarities that the students are going to gain in this course can be used in their study of other languages. As course materials, the students are going to read oral literature and ethnographic texts and work with ethnolinguistic, etymology and dialect dictionaries.

Course Aims

1) To consider the connection between language and ethnos from the scientific perspective.
2) To consider the ethnocultural lexis as a tool to study the national values and traditions, stages of historical development.
3) To critically examine the linguistic knowledge, to analyze the language assimilation processes on the basis of substratum, superstratum, adstrat systems.
4) To show the richness of the national lexis in connection with society, history and socium.
5) To expand the understanding of the Kazakh nation by means of language cultural heritage.

Course Learning Outcomes

1) To develop and use the norms of intellectual language competences through understanding the connection between the language and national mentality and culture.
2) To use the national perceptions and knowledge for personal development, preparation of qualitative proposals and effective decision-making.
3) To be skilled to use interlanguage communication principles as a tool of development business responsibility.
4) To learn using the national values as a source of information and creative source of development the business responsibility.
5) To develop skills in analyzing deeper national cultural layers of the Kazakh language, using it in different social and cultural situations.

Elective course	
Course code & title:	**MAE 453 Fire Engineering**
Semester:	8
Teaching Area:	Thermofluids & Energy Applications
Prerequisites:	Engineering Thermodynamics Fluid Mechanics II

Course Description

The Fire Engineering course covers the basics and engineering applications of fire science, compartment fire and the fundamentals of fire suppression, smoke control in buildings and firefighting systems in buildings. In addition, the students are expected to learn how to perform CFD fire modeling using PyroSim and/or open source tools

Course Aims

1) The Fire Engineering course aims to provide a general understanding of the principles of enclosure fire dynamics, their applications to building fires and smoke analysis, as well as the basic design methods for fire-fighting systems.

Course Learning Outcomes

1) The students are expected to acquire a general understanding of the principles of enclosure fire dynamics, skills, and techniques for their applications to building fires and smoke analysis, as well as the basic design methods for fire-fighting systems;
2) The students will be expected to understand the limitations found in fire modeling and to learn to use CFD software and properly interpret results from fire simulations for fire engineering applications. The software may include PyroSim, and/or ANSYS-CFX/Fluent, and/or OpenFOAM or other similar tools.

Elective course	
Course code & title:	**MAE 454 Aerodynamics**
Semester:	8
Teaching Area:	Aerospace Engineering
Prerequisites:	Fluid Mechanics II

Course Description

This course aims to introduce the concepts, principles, techniques, and theories for the analysis of air flow over moving objects, including a review of the historical development of aerodynamics and aerospace engineering. The application of aerodynamics to the design of engineering components and systems is emphasized. There are four main components in the course: 1) inviscid aerodynamics including potential flows; 2) viscous aerodynamics including laminar and turbulent boundary layers; 3) aerodynamics of airfoils and wings; 4) supersonic and hypersonic airfoil theories.

Course Aims

1) Familiarization of students with the basic principles of the concepts, principles, techniques, and theory for the analysis of aerodynamics.
2) Development of various relevant skills and competences through the application of aerodynamics to the design of engineering components and systems
3) Familiarization and development of Computational Fluid Dynamics (CFD) models associated to aerodynamics engineering applications.

Course Learning Outcomes

1) by the end of the course the student will be expected to be able to understand the concepts, principles, techniques and theories for a) inviscid aerodynamics; b) viscous aerodynamics; c) aerodynamics of airfoils and wings; d) supersonic/hypersonic airfoil theories.
2) they will also be expected to acquire the necessary skills and techniques to apply aerodynamics for engineering design.
3) The students will be expected to understand the limitations found in numerical solutions, as compared to analytical solutions, and the ways to tackle them in an engineering manner.
4) The students will be expected to learn to use and properly interpret results out of commercial CFD software, with emphasis on the use of a commercial software (e.g., ANSYS-CFX/Fluent, OpenFOAM or similar) to solve engineering problems.

Elective course	
Course code & title:	**MAE 455 Flight Mechanics**
Semester:	8
Teaching Area:	Aerospace Engineering
Prerequisites:	Engineering Thermodynamics Fluid Mechanics II
Course Description	
This course covers airplane's performance during take-off, rate of climb, turning and level flight and landing as well as its range and endurance. Topics include standard atmosphere, basic aerodynamics, aerodynamic shapes, elements of airplane performance and stability and control. Astronautics and hypersonic vehicles will also be briefly introduced.	
Course Aims	
1) This course aims to provide an understanding of airplane design and its flight performance.	
Course Learning Outcomes	
1) Understand airplane flight conditions and stability. 2) Analyze airplane flight performance in various conditions. 3) Relate the various physical elements and environmental parameters which govern the design and performance of airplane. 4) Appreciate space flight and hypersonic vehicles.	

Elective course	
Course code & title:	**MAE 456 Materials and Manufacturing II**
Semester:	8
Teaching Area:	Materials & Manufacturing
Prerequisites:	

Course Description

This course is designed to provide students with an overview of a wide variety of manufacturing processes (additive, forming & subtractive) and system including assembly. It will also provide the insight of fundamental principle behind the manufacturing processes and their influence on quality, cost as well as flexibility. Other important aspect such as process economy, automation of process, lean concept of manufacturing and micro-fabrication techniques will be also covered under this course. This course includes project work which requires student to generate G coding and fabricate part product using computer numerical controlled (CNC), machine

Course Aims

1) Providing students with an overview of a wide variety of manufacturing processes and their applications as well as related operations and tools.
2) Exposing students to the fundamental principles behind the processes with the intent of providing a working knowledge of a broad range of manufacturing processes.
3) Providing students with the basic principles and methods utilized in the joining and welding technology of engineering materials.
4) Providing students, the knowledge related to economic aspect of metal cutting.
5) Familiarizing students with the knowledge of CNC Coding and fabrication of 3D part using CNC machine.
6) Familiarizing students with the aspects of manufacturing automation and quality concepts.

Course Learning Outcomes

1) Acquire knowledge of various methods of manufacturing processes and understanding the applications of these processes in real life.
2) Evaluate the economic analysis of metal cutting technology.
3) Employ CNC machines to fabricate the designed parts and be able to perform CNC coding, simulation using software
4) Safely conduct manufacturing experiments, analyze, and interpret the results and errors and formulate conclusions as part of a team work
5) Explain different types of joining processes and the principles guiding the operations.

Elective course	
Course code & title:	**MAE 457 Feasibility Analysis of Clean Energy Technologies**
Semester:	8
Teaching Area:	Thermofluids & Energy Applications
Prerequisites:	

Course Description

This is a fourth-year elective module in the Mechanical Engineering program which gives the student an introduction to the preparation of techno-economic feasibility studies of clean energy technologies; i.e., technologies based on energy efficiency measures and renewable energy sources. Additionally, environmental impact is assessed by the quantification of reduction in CO2 emissions obtained when using clean energy technologies instead of conventional technologies. Special emphasis is paid to analysis of real case studies, for which the outcome is thoroughly known and for hypothetic and academic case studies of engineering interest, as much as possible. Moreover, the student has the opportunity of interacting with specialized software such as RETScreenTM in the Laboratory to enhance her/his capabilities in setting up and analyzing the feasibility of simple and complex clean energy technology systems.

Course Aims

1) Review the current status of the worldwide energy consumption and its environmental impact.
2) Introduce the methodology and tools for the economic and technical feasibility analysis of engineering projects with focus on clean energy technologies.
3) Introduce the technologies and practice of energy efficiency in residential, commercial, and industrial applications. Analysis of case studies using specialized software.
4) Introduce the technologies for power and heat generation and transport based on: Cogeneration, Solar PV, Solar Water Heating, Wind Power and Mini-Hydros. Analysis of case studies using specialized software.

Course Learning Outcomes

1) Analyze data sources of generation and consumption of energy (e.g., IEA, EIA, etc.).
2) Review of legal aspects associated to the implementation of clean energy technologies.
3) Combine technical, economic, financial, and atmospheric emissions concepts to analyze viability of energetic problems, including sensitivity and risk analyses.
4) Use of specialized tools to assess complex clean energy technology systems.
5) Work and communicate effectively in multi-task teams.

Elective course	
Course code & title:	**MAE 458 Fundamentals of Multi-Body Dynamics**
Semester:	8
Teaching Area:	System Dynamics & Control
Prerequisites:	Engineering Dynamics II

Course Description

The module aims to further advance the knowledge of the students in modeling and analyzing rigid body dynamic systems by introducing them to multi-body interactions in the three dimensions. It will give the students the ability to tackle problems involving complex real-world systems upon the completion of their studies. Both classical versus modern approaches will let critical thinking regarding modeling efficiency and equation complexity evolve.

Course Aims

1) To advance the existing knowledge of the students on rigid body kinematics and dynamics by shifting from planar two or three body systems to three dimensional multibody systems.
2) To further develop the students' knowledge on mass distribution and moments of inertia by introducing inertia dyadic and calculations involving complex three-dimensional geometric bodies.

Course Learning Outcomes

1) Model and analyze the kinematics of systems of rigid bodies in the three dimensions.
2) Model and analyze dynamic interactions of rigid bodies in the three dimensions.
3) Compare different methods in analyzing system kinematics and dynamics.
4) Model and analyze three-dimensional rigid body systems (introduction).
5) Gain an intuition into the behavior of multi-body system behavior by solving the equations of motions.

Elective course	
Course code & title:	**MAE 459 Advanced Control Systems and Industrial Automation**
Semester:	8
Teaching Area:	System Dynamics & Control
Prerequisites:	Control Systems

Course Description

The first part of the course reviews the classical control systems, advanced classical control method, state space representation, optimal controller design, and robust controller design. Furthermore, it deals with model problems drawn from mechatronics and mechanical systems. The second part of the course begins with the definition of industrial automation, an overview of the Factory Automation, Programmable Logic Controllers (PLCs), PLC hardware components, PLC programming using Ladder logic, industrial sensors, and actuators. Automation based on Hydraulic, Pneumatic and Numerical controls is also included.

Course Aims

1) To provide a solid background for the understanding of modern control system concepts, analysis, and design techniques,
2) To provide a solid background for the understanding of modern industrial automation systems, their applications, analysis, and design techniques,
3) Develop hardware and software packages.

Course Learning Outcomes

1) Derive mathematical models of physical systems in state-space representation.
2) Examine a system for stability, controllability, and observability.
3) Design and analyze controllers, based on the modern control approach using various methods according to the specified criteria.
4) Evaluate and compare the performance of the designed modern control system.
5) Define as well as classify industrial automation and the underlying theory.
6) Use Programmable logic controllers in real-life projects.
7) Design autonomous systems based on PLC.
8) Develop skills in MATLAB / Simulink and use it as tool in the design and evaluation processes.

Elective course	
Course code & title:	**MAE 460 Advanced Topics in Computational Fluid Dynamics**
Semester:	8
Teaching Area:	Design & Analysis
Prerequisites:	Fluid Mechanics I Numerical Methods in Engineering

Course Description

This module reviews and deepens the skills of the student in fluid mechanics, heat transfer and numerical methods to a level that is required in engineering applications. Special emphasis will be paid to examples during lectures, and problem-solving skill development during tutorials, based on real-life engineering problems, as much as possible. From the very beginning of the module, the student will be required to implement common algorithms related to the solution of differential equations appearing in fluid mechanics and heat transfer problems, using tools like C++, MATLAB, or MS Excel. After the first quarter of the semester, students will start interacting with CFD software such as ANSYS-CFX, ANSYS-Fluent, OpenFOAM or similar with the aim of enhancing their capabilities in solving engineering problems in fluid mechanics and heat transfer.

Course Aims

1) Review fundamental governing differential equations in incompressible fluid dynamics and energy conservation, both in Vector and Cartesian-tensor notation.
2) Introduce the concept of turbulence modelling and most popular methods used in engineering applications.
3) Introduce concept of Computational Fluid Dynamics (CFD) and learn computational hardware & software and space-time discretization schemes generally associated to it by programming own small codes and by using commercial software widely used for engineering applications.

Course Learning Outcomes

1) Be familiar with fluid dynamics equations in both vector and Cartesian-tensor notation and with common algorithms and methods used to solve them numerically, to the extent of being capable to read and understand engineering articles on CFD.
2) Build and solve approximate solutions to differential equations using common algorithms and methods.
3) Understand the limitations found in numerical solutions, as compared to analytical solutions, and the ways to tackle them in an engineering manner.
4) Learn to use and properly interpret results out of commercial CFD software, with emphasis on the use of a commercial software (e.g., ANSYS-CFX/Fluent, OpenFOAM or similar) to solve engineering problems.
5) Communicate in written and verbal manner the engineering results obtained via CFD.

Elective course	
Course code & title:	**MAE 461 Advanced Heat Transfer**
Semester:	8
Teaching Area:	Thermofluids & Energy Applications
Prerequisites:	Heat Transfer

Course Description

The course explores advanced concept of Heat Transfer. Advanced examples using basic concepts will be used as a review. Then, phenomena such as convective and radiative heat transfer, heat exchangers, two-phases boiling, and condensation flows will be studied in detail to provide operational-level knowledge on heat transfer. The concept of mass transfer will be introduced and investigated in detail.

Course Aims

1) Review of fundamentals of Heat Transfer
2) Introduction to advanced concepts in convection and radiation
3) Deep analysis of Heat Exchangers
4) Introduction to 2-phase flow boiling and condensation
5) Mass transfer and applications

Course Learning Outcomes

1) Understand all the basic concepts of Heat Transfer with applications
2) Perform advanced problems in Heat and Mass Transfer with complex geometries and physic phenomenon
3) Develop a project involving devices and close to daily-life, industry, or research issues
4) Communicate appropriately the results of their project through a report and presentation