NAZARBAYEV UNIVERSITY
SCHOOL OF ENGINEERING AND DIGITAL SCIENCES

Department of Electrical and Computer Engineering

Program Handbook

Master of Science in Electrical and Computer Engineering

Academic year 2019-2020 & onwards

Welcome Note

Dear students,

On behalf of the Department of Electrical and Computer Engineering, it is my pleasure to welcome you to Nazarbayev University and the Master of Science in Electrical and Computer Engineering program. I wish you all, the greatest success and thank you for making NU your choice of postgraduate studies.

There are several reasons for students choosing to continue on to a postgraduate level of studies. Many do so for career advancement, while others do so for self-gratification. Whatever your reason, our diverse and experienced staffs at Nazarbayev University will provide you with first-rate education and research knowledge. Just as you pride yourselves on the high quality of professional work that we know you are capable of, we pride ourselves on the continuing success and reputation of our programs. As such, our department has aligned the courses you are about to undertake with the recommendation of higher education accrediting bodies and both local and international engineering companies to meet research expectations.
Your Master's degree program will run over 4 semesters (2 years) where you are required to complete 120 ECTS credits. A master thesis begins in the 3rd semester (1st semester of the 2nd year) and completes in the final semester of the Master's course where you will be asked to demonstrate your familiarity with the current literature in the field; defend your thesis proposal; analyze and evaluate results; support your findings in a scholarly manner according to disciplinary norms and finally, defend your thesis work. Along these lines, it is recommended that you begin to plan and interact with your supervisors of choice early in the program so that you'll be able to discuss your research topic, arrange supervised meetings, and receive guidance to successfully complete your thesis on-time.

Wishing you a successful endeavor in your Master of Science program!

Yours Sincerely,

Prof. Almas Shintemirov

Head of Department (ECE)

Contents

Program Overview

The Master of Science in Electrical and Computer Engineering (MSc-ECE) degree program is a specialized degree program offered by School of Engineering and Digital Sciences at Nazarbayev University (NU). Students are required to complete 120 ECTS credits, in 4 semesters, which satisfies requirements stipulated by the Bologna Process and the European Credit Transfer and Accumulation System (ECTS) for Master's Degrees. The program is focusing on research and has been designed to provide advanced skills and a detailed knowledge base at the graduate level for individuals working in academia, industry, or research settings in Kazakhstan or throughout the world.

The MSc ECE provides a comprehensive technological and scientific preparation for engineers in the area of Electrical and Computer Engineering in four different main majors, ***1) Devices and Circuits, 2) Power Engineering and Control Systems, 3) Signal Processing and Communication Systems, 4) Computer Engineering*** in perfect alignment with today´s technological challenges. A set of mandatory core courses guarantees competence in advanced mathematics, the 4 (four) key areas of the program, classic and novel research methods and effective oral and written communication in the science and technology domain.

By delivering an MSc at an international standard level, we are offering our master's students future opportunities in terms of PhD and positions in research centers, locally or abroad.

Aims and Objectives

The mission of the School of Engineering and Digital Sciences at Nazarbayev University is to contribute to the development of Kazakhstan in terms of:

- Educating students with engineering expertise to lead organizations and provide innovative solutions for complex technical issues of enterprises.
- Conducting innovative and pioneering basics of applied research that evolve the body of knowledge in Engineering through interdisciplinary collaboration with other schools and research centers at Nazarbayev University and leading universities worldwide.
- Advancing the professional development in engineering through our service to the professional community and providing lifelong learning opportunities for practitioners.

The M.Sc. (ECE) program aims to reflect the mission of the School of Engineering and Digital Sciences and accomplishes this by pursuing the following objectives:

1) Extend the knowledge and skills in advanced Electrical and Computer Engineering analysis and design, particularly in using latest modelling and analysis techniques;
2) Develop solutions to Electrical and Computer Engineering problems using in-depth knowledge and innovative ideas and techniques necessary for specialist engineers;
3) Develop skills to conduct high quality research in the field of Electrical and Computer Engineering;
4) Provide awareness of the challenges in the profession and integrate engineering and non-engineering topics for leading organizations.

Graduate Attributes

The MSc-ECE program immerses the student within a scientific and technological ecosystem to favor their professional growth according to NU Graduate Attributes, which are very well aligned with the vision and mission of NU. These attributes are listed as:

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 communicators across languages and cultures;
6) Be cultured and tolerant citizens of the world;
7) Demonstrate high personal integrity;
8) Be prepared to take a leading role in the development of their country.

The MSc program delivers these attributes by providing the students opportunities to be involved in: (a) working on individual and group assignments; (b) team-building exercises for developing decision-making skills; (c) designing tasks for developing creativity; (d) delivering and attending project-research presentations to polish their communication skills; and (e) engaging on group discussions among students and faculty in order to develop personal integrity and cultural tolerance. The same attributes are also addressed by the program learning outcomes that follow.

Program Learning Outcomes

On successful completion of the program, graduates will be able to:

1) Analyze and design Electrical and Computer Engineering systems;
2) Apply advanced Electrical and Computer Engineering concepts to support policy making, development and management of Kazakhstan;
3) Review, analyze, and interpret the body of scientific literature and innovations in Electrical and Computer Engineering area;
4) Produce quality research by addressing global issues in Electrical and Computer Engineering with highest professional and ethical standards;
5) Evaluate and communicate their novel ideas and research findings to specialist and non-specialist audiences clearly and unambiguously.

Program's Learning Outcomes alignment to NU Graduate attributes is summarized in the following table:

		Program Learning Outcomes				
		1	2	3	4	5
NU Graduate Attributes	1	☑	☑	☑	☑	☑
	2	☑	☑	☑	☑	☑
	3		☑			
	4		☑	☑	☑	
	5					☑
	6				☑	
	7	☑	☑	☑	☑	☑
	8	☑	☑		☑	☑

Program Duration

The nominal MSc program duration is **two years**, while the maximum allowable duration can be extended up to **two and half years** (excluding leave of absence and deferment of admission; see "*ACADEMIC POLICIES AND PROCEDURES FOR GRADUATE PROGRAMS OF THE AUTONOMOUS ORGANIZATION OF EDUCATION 'NAZARBAYEV UNIVERSITY'*" for further details).

Assessment

Assessment is aligned with the learning outcomes of the program and of those of each course. Course assessment tasks are performed during and at the end of each course. Types of assessment vary form successful completion of integrated coursework, assignments, and project work to evaluation of performance of case studies, interviews, and deliverance of presentations.

The following table summarizes assessment and evaluation points for all stages of the MSc program:

Stage of Program	***Significance***	***Possible Results***	***Evaluation Point***
ADMISSION TO PROGRAM	Initial Evaluation	Admission Admission with Conditional Status, Subject to Satisfactory Completion of Conditions Rejection	***Key Evaluation Point*** Admission is handled on a case-by-case basis by evaluating the student's undergraduate curriculum, English proficiency and letters of recommendation among other documents and interview (only for shortlisted candidates)
COURSEWORK	Determination of Student Competence in Fundamentals of Discipline	Continue in Program Continue on Probation Dismissed from Program	***Continuous Evaluation*** The coursework component for the Master of Science is assessed by the module instructor. It is enforced that all faculties provide a module descriptor to students at the start of the course outlining the weight of each assessment.
DEGREE CANDIDACY	Demonstration of Student's Mastery of Content Knowledge and Skills in the Discipline	Pass and Continue in Program Required to Re-Take Some Courses Dismissed from Program	***Key Evaluation Point***
COMPLETION OF THESIS PROJECT	Demonstration of Student's Mastery of Content Knowledge and Skills Needed to Graduate	Pass Recommend Changes with or without re-defense Fail and dismissal from Program	***Key Evaluation Point***

Coursework Assessment methods by course & correspondence to Program Learning outcomes are summarized in the following table:

Where Addressed (Courses)	Program Learning Outcomes					*How addressed** *(L&T Methods)*
	1	2	3	4	5	
Technical Communication			☑		☑	1. Lectures 2. Workshops 3. Individual and Group Presentations 4. Individual and Group Projects 5. Paper writing and presentation. 6. Exams Flipping/Blending Learning in which on-line and in-class lessons are combined resulting in an effective technique to improve the process of learning.
Advanced Applied Mathematics	☑					
Research Methods and Ethics			☑		☑	
Research Seminar (MECE)	☑		☑	☑	☑	
MSc Thesis I(MECE)	☑	☑	☑	☑	☑	
MSc Thesis II(MECE)	☑	☑	☑	☑	☑	
Advanced Data Structures and Algorithms	☑		☑		☑	
Embedded Systems and Applications	☑	☑	☑		☑	
Probability and Statistics for Electrical and Computer Engineers	☑	☑	☑	☑	☑	
System Modelling and Control	☑	☑			☑	
Advanced Electromagnetics	☑	☑	☑		☑	
Modern Control Theory	☑	☑	☑		☑	
Advanced Photonics	☑	☑	☑		☑	
Industrial and Commercial Power Systems	☑	☑	☑			
Computer Communication Networks	☑		☑			
Advanced Power System Protection	☑	☑	☑		☑	
Parallel Computer Architecture	☑	☑	☑		☑	
Optical Communication	☑	☑	☑		☑	
Advanced Topics in Mixed Signal Circuit Design	☑	☑	☑		☑	
Advanced Power Electronics	☑	☑	☑		☑	
Wireless Communications	☑	☑	☑		☑	
Computer and Network Security	☑	☑	☑		☑	
Security of E-Systems and Networks	☑	☑	☑		☑	
Renewable Energy	☑	☑	☑			
RF Circuits	☑		☑			
Communication Systems	☑	☑	☑			
Semiconductor Devices	☑	☑	☑			
Advanced Microprocessor Systems	☑	☑	☑		☑	
Wireless Sensor Networks	☑	☑	☑		☑	
Internet of Things	☑	☑	☑		☑	
Pattern Recognition	☑	☑	☑		☑	
Adaptive Signal Processing	☑	☑	☑		☑	

MASTER OF SCIENCE - PROGRAM

Course-type key

Program Core courses
Program Elective courses

SEMESTER 1	FALL: 2021	August 06 – December 14
TYPE	**COURSE CODE & TITLE**	**ECTS**
Program Core	**MECE 606 - EMBEDDED SYSTEMS AND APPLICATIONS**	6
	MSC 602, ADVANCED APPLIED MATHEMATICS	6
	MECE603 - ADVANCED DATA STRUCTURES AND ALGORITHMS	6
	MECE 724 – SYSTEM MODELLING AND CONTROL	6
	MECE 605 - PROBABILITY AND STATISTICS FOR ELECTRICAL AND COMPUTER ENGINEERS	6

SEMESTER 2	SPRING: 2022	January 8 – May 17
TYPE	**COURSE CODE & TITLE**	**ECTS**
Program Core	**MSC 600, RESEARCH METHODS AND ETHICS**	6
	MECE 600, RESEARCH SEMINAR	6
	MSC 601, TECHNICAL COMMUNICATION	6
Elective	Elective 1 (Pick on From Electives Pool)	6
Elective	Elective 2 (Pick on From Electives Pool)	6

SEMESTER 3	FALL: 2022	TBA
TYPE	**COURSE CODE & TITLE**	**ECTS**
Program core	**MECE601, MASTER THESIS I**	24
Elective	**ELECTIVE 3 (PICK ON FROM ELECTIVES POOL)**	6

SEMESTER 4	SPRING: 2023	TBA
TYPE	**COURSE CODE & TITLE**	**ECTS**
Program core	**MECE 602, MASTER THESIS II**	24
Elective	**ELECTIVE 4 (PICK ON FROM ELECTIVES POOL)**	6

Academic Policies and Procedures

All academic policies and procedures that are not explicitly covered in this handbook are conformant with the corresponding items described in "*SCHOOL OF ENGINEERING AND DIGITAL SCIENCES MASTERS STUDENT HANDBOOK",* which covers School of Engineering and Digital Sciences Master Programs, and the "*ACADEMIC POLICIES AND PROCEDURES FOR GRADUATE PROGRAMS OF THE AUTONOMOUS ORGANIZATION OF EDUCATION "NAZARBAYEV UNIVERSITY" (APP-Graduate Programs-NU)"*, which covers all graduate programs in Nazarbayev University. These policies and procedures include, among others, the following:

1. Admissions
2. Registration
3. Credits (Requirements, awarding & transfers)
4. Grading issues such as: administrative grades, grade appeals
5. Course re-takes
6. Degree withdrawals
7. Academic code of behavior
8. Leaves of absence, including medical reasons, immediate family member issues and others
9. Dismissal & voluntary withdrawal.

Every student participating in the MSc-ECE program is expected to have read and understood all the policies, rules, procedures, and guidelines described in this program specific handbook, school's MSc handbook and the general APP for graduate programs in NU.

Grading System

Graded courses

Letter Grade	Grade Points	Percentage
A	4.00	95-100%
A-	3.67	90-94.9%
B+	3.33	85-89.9%
B	3.00	80-84.9%
B-	2.67	75-79.9%
C+	2.33	70-74.9%
C	2.00	65-69.9%
C-	1.67	60-64.9%
D+	1.33	55-59.9%
D	1.00	50-54.9%
F	0.00	0-49.9%

Non-graded (PASS/FAIL) courses

In the case of a non-graded course, the following assessment percentages apply

Description	Percentage
Pass	59% or Above
Fail	Below 59%

Program Completion Requirements

Satisfactory completion of the MSc program requires that the student progress through a number of distinct stages, each of which is characterized by a key evaluation point (See Appendix). The necessary stages are:

1) Satisfactory application to the program;
2) Completing all required coursework in the program (72 ECTS);
3) Satisfactory completion of the master thesis (48 ECTS);
4) Satisfactory achievement of minimum GPA for continuation through semesters and graduation (Candidacy).

Continuation / normal progress

To continue in the MSc-ECE graduate program at SEDS, NU, a student must maintain a minimum CGPA of no less than a **B- (2.67 on a 4-point scale)** after each grading period and conform to all program rules and policies to maintain normal progress toward degree. A student who fails to satisfy the continuation requirement for the program is subject to dismissal.

Appealing against grades

If a student believes that she or he has received an unfair or erroneous grade, the student may appeal. The following are cases for appeal:

1) In the case of an examination. The student must first consult with the instructor within 5 working days of her or his receipt of the contested grade (this time may be extended in the event that the instructor can be shown to have been unavailable during the period following the student's receipt of the grade in question). The Instructor must respond within the next 5 working days. In the event that the student is still dissatisfied, she or he may appeal to the Dean of the School (or the Dean's designee) within 5 working days. The Dean (or her or his designee) shall consult with the Instructor before making any decision. The decision of the Dean (or her or his designee) shall be final;

2) In the case of a Final Course Grade. The student must first consult with the instructor within 5 working days of her or his receipt of the contested grade (this time may be extended in the event that the instructor can be shown to have been unavailable during the period following the student's receipt of the grade in question). The date to be used for appeals of Final Course Grades is the date published in the Academic Calendar. The Instructor must respond within the next 5 working days (that time may be extended in the event the instructor is shown to have been unavailable during the period following the student's receipt of their final grade). In the event that the student still believes that the grade is incorrect, or the Instructor has not replied within 15 days, the student may appeal to the Dean of the School (or the Dean's designee) within 5 days. The Dean (or her or his designee) shall consult with the Instructor before making any decision. The decision of the Dean (or her or his designee) shall be final.

Plagiarism

In any coursework or thesis assessment, unacknowledged copying or plagiarism is not acceptable. Plagiarism can result in extremely serious academic actions including cancellation of any or all results, suspension from the program, or even expulsion. Plagiarism means using the work of others in preparing an assignment and presenting it as your own without explicitly acknowledging – or referencing – where it came from. Plagiarism can also mean not acknowledging the full extent of indebtedness to a

source. Work can be plagiarized from many sources including books, articles, the internet, and other media. Plagiarism can also occur unconsciously or inadvertently. Direct copying is definitely plagiarism. Paraphrasing of another's work without acknowledgment is also plagiarism. Submitting someone else's work or ideas without attribution is not evidence of your own grasp of the material and cannot earn you marks.

Nazarbayev University's policy on plagiarism sets out student responsibilities in regard to copying. Students are responsible for ensuring that:

- They are familiar with the expected conventions of authorship and the appropriate use and acknowledgement of all forms of intellectual material relevant to their discipline.
- The work submitted for assessment is their own.
- They take all reasonable steps to ensure their work cannot be accessed by others who might seek to submit it, in whole or in part, as their own.

Whenever you refer to another person's research or ideas -either by directly quoting or by paraphrasing them-, you must acknowledge your source by proper referencing. Turnitin is a useful web-based originality checking service that can help in assessing the originality of one's submitted work. More information on Turnitin can be found in Appendix I and service's web site (http://turnitin.com/).

Description of Courses

***Note: In future, minor changes in courses and/or program, subject to approval by SEDS Teaching and Learning Committee, may not be reflected in this document, however, these would be reflected in the corresponding Course Specification Forms.**

Program Core Courses

MSC 600, Research Methods and Ethics

This course addresses the primary need for graduate students to undertake formal training that will help them in understanding how to conduct their research. The course will develop student's understanding of research plan and engender skills enhancement for reading, interpreting, writing, and presenting key ideas. The course will also instill an understanding of a variety of research methods and ethics and implement appropriate strategies in lecture and workshop settings.

CLOs

By the end of this course, students will be able to:

1. Discuss the research process, research methodology, research methods, and research ethics;
2. Effectively use modern technology to plan and manage research projects;
3. Effectively apply the research methodology and appropriate research methods to formulate and validate engineering research problems;
4. Critically analyze and evaluate research findings;
5. Effectively employ appropriate communication techniques to summarize, document and present the research results to both specialists or non-specialists;
6. Develop the skills to maintain good working relations in a research team environment.

MSC 601, Technical Communication

This graduate level course combines the application of rhetorical analysis to stylistic conventions of writing in engineering, with a focus on clarity, conciseness, and coherence. Students will employ process writing to produce genre specific writing familiar to Engineers, including research reports scientific papers designed for specific audiences. This course also trains students to deliver effective and appealing professional and scientific presentations, with attention to best practices in the use of technical English and oral communication.

CLOs

By the end of this course, students will be able to:

1. Understand technical communication along a continuum, identifying appropriate writing and speaking strategies for intra-disciplinary, inter-disciplinary, business and public audiences;
2. Determine audience needs and expectations as they pertain to writing and presentation in engineering genres;
3. Organize and prepare coherent and effective scientific texts and presentations for academic, professional, and public audiences;
4. Communicate effectively and efficiently the process of developing, implementing, and evaluating research;
5. Refine writing style for clarity, concision, coherence, and emphasis;
6. Practice the ethical use of sources and appropriate citation conventions;
7. Work with peers to provide written and oral feedback of student work.

MSC 602, Advanced Applied Mathematics

This course reviews and deepens the advanced analytical and numerical methods to solve ODEs and PDEs. The whole course will be supported by a mathematical software package capable to perform symbolical calculations.

The module is designed for graduate students to cover their research needs concerning mathematical modeling via analytical, semi-analytical or numerical techniques.

CLOs

By the end of this course, students will be able to:

1. Apply appropriate methods of solution for a given mathematical problem concerning modeling with ODEs and PDEs;
2. Design computer programs to solve semi-analytically or numerically engineering problems that require modeling with ODES and PDEs;
3. Justify analytical or numerical results for advanced mathematical models of engineering field.

MECE 600, Research Seminar

This course enables students to gain and apply basic research knowledge and skills to select their research projects in Electrical and Computer Engineering by attending a series of expert presentations and by assessing, preparing and presenting his or her own preliminary research ideas. The course develops the following knowledge and skills:

1. Identifying the area of research interest;
2. Surveying of state of the art for the area of interest;
3. Identifying the research topic and associated issues;
4. Understanding of the social, cultural, global, and environmental issues associated with chosen research topic;
5. Writing a research paper based on the literature survey under the supervision of a faculty member;
6. Presentation of a seminar and being assessed by a panel.

CLOs

By the end of this course, students will be able to:

1. Explore potential areas of research and select his/her research area;
2. Clearly identify the research topic and research issues;
3. Identify the social, environmental and economic issues related to the research topic.

MECE 601, Master Thesis I

This course intends to give students the opportunity to develop the research proposal. The course develops the following knowledge and skills:

1. Preparation of a thorough and comprehensive literature review to support the research proposal;
2. Formulation of the research hypothesis;
3. Developing and justifying the methods to conduct the research.

CLOs

By the end of this course, students will be able to:

1. Conduct a comprehensive literature review to support the research proposal;
2. Formulate the research hypothesis;
3. Develop and outline the research methods;
4. Independently apply research methods and techniques to perform experimentation/simulation;
5. Effectively present the progress of the research.

MECE 602, Master Thesis II

This course intends to give students the opportunity to fully implement the research proposal and bring it to a conclusion. The course develops the following knowledge and skills:

1. Planning and conducting, independently, research at an advanced level;
2. Critically analyzing research results;
3. Effectively presenting their results to a wide audience;
4. Effectively compiling their results in the form of an authoritative thesis.

CLOs

By the end of this course, students will be able to:

1. Independently conduct and complete a research project at an advanced level;
2. Critically analyze and discuss obtained research results in accordance with applicable norms of research ethics;
3. Communicate effectively the research results and findings to a wide audience;
4. Generate an authoritative thesis based on their results and findings.

MECE603: Advanced Data Structures and Algorithms

The course provides a survey of computer algorithms, examines fundamental techniques in algorithm design and analysis, and develops problem-solving skills required in all programs of study involving computer science. Topics include advanced data structures, recursion and mathematical induction, algorithm analysis and computational complexity, sorting and searching, design paradigms (divide and conquer, greedy heuristic, dynamic programming, amortized analysis), and graph algorithms. Advanced topics are selected from areas like randomized algorithms, information retrieval, string and pattern matching, and computational geometry. A final project is required form each student.

CLOs

By the end of this course, students will be able to:

1. Analyze algorithms to determine worst-case complexity in terms of time and space requirements;
2. Design algorithms to meet functional requirements as well as target complexity bounds in terms of time and space complexity;
3. Develop data structure techniques for various aspects of programming;
4. Implement algorithms to assess their actual performance com-pared to expectations from analysis;
5. Design and implement an algorithm and data structure project and present results in class with proper documentation and presentation.

MECE606: Embedded Systems and Applications

This course provides the practical understanding of microcontrollers in the design and implementation of embedded systems for engineering applications using open hardware and software by considering modern industry standard specifications and design issues. In this course, the students will learn the formal specification models along with system level requirements for implementing embedded systems and get exposed to a range of practical hardware-software co-design and mapping issues. The students will gain an understanding of the design trade-off of real-time systems working on the constraints of low power, computational speed, and low memory requirements. The design verification methods required for embedded system design will be introduced. Students will work on introductory projects and labs covering example engineering applications related to (1) Devices, and Circuits, (2) Power Systems and Control Engineering, (3) Signal Processing and Communication Systems, and (4) Computer Engineering. These areas can cover a range of topics such as cyber-physical systems, smart homes, communications systems, consumer electronics, automotive systems, energy management and conservation, power systems, smart grids, and robotics. Laboratory assessment will be by program demonstration, code review, re-ports, and practical skills testing.

CLOs

By the end of this course, students will be able to:

1. Describe the internal architecture of an embedded system, including, processors, counters, timers, ports, and memory;
2. Identify the issues in designing and building a microcontroller system;
3. Evaluate hardware timing issues and conduct real-time programming;

4. Program, build and test a microcontroller system;
5. Design and implement embedded systems through hand-on-experience on engineering applications in a lab setting.

MECE605: Statistics and Probability for Electrical and Computer Engineers

The main goal of this course is to provide a mathematical introduction to the theory of stochastic processes. Topics covered in this module include:
1. Overview of Probability and Random Variables: axioms of probability theory; conditional probability; density, distribution and characteristic functions; random vectors and random sequences;
2. Introduction of Stochastic Processes: Definitions; processes with independent increment, Markov and Martingale processes; stationarity and its properties; frequently used processes, systems with random input; ergodicity;
3. Power Spectra and Orthogonal Expansions: Autocorrelation function and power spectral density; power spectrum analysis for linear time-invariant systems; Fourier series and Karhunen–Loève expansions of processes; expansion of stationary processes using innovation process;
4. Bandlimited and Discrete-time Processes: Definition of bandlimited processes and their properties; sampling theorem for stochastic processes; probability functions, moments and power spectra of discrete-time processes; i.i.d. white noise, AR, MA and ARMA models;
5. Introduction to Estimation Theory: Minimum mean-squared error (MMSE) and linear MMSE criteria; Orthogonality principle and its applications; causal and non-causal Wiener filters and their applications.

CLOs

By the end of this course, students will be able to:
1. Determine the statistical properties of unidimensional and multi-dimensional random variable;
2. Discuss the mathematical methods of analyzing stochastic processes;
3. Compare different forms of stationary and ergodicity in random processes;
4. Evaluate statistical quantities such as autocorrelation function and power spectral density of the stochastic processes and ex-plain the key characteristics of these quantities;
5. Estimate the response of a system to a random input using statistical techniques;
6. Design bandlimited and discrete-time stochastic processes for realistic systems.

MECE 724: System Modeling and Control

This course introduces students to recently developed and advanced techniques for solving modeling and control problems. The course presents theory and methodology for analysis and modeling of systems and signals, and methods for design and synthesis of feedback controllers. The emphasis of the course will be on mathematical foundations and numerical methods for system modeling from physical properties, identification, and advanced control of dynamical systems. In particular, it explores state space representation, dynamical modeling from Lagrange equations, model validation, model approximation, Kalman filtering, real-time system identification. The course also discovers control techniques such as state-feedback controller, output feedback controller, state observer, stabilizing controllers, automatic Tuning, gain scheduling, and auto-calibration.

CLOs

Upon successful completion of this course, students will be able to:
1. Obtain mathematical models for dynamical systems.
2. Use state space approach to model dynamical systems.
3. Design closed loop feedback controllers in time-domain based on state space approach.
4. Analyze stability of dynamical systems
5. Apply system identification techniques to identify and estimate system parameters.

6. Formulate solutions based on adaptive control techniques.
7. Analyze and design Model Predictive Controller for linear systems.

Program Elective Courses

1) Area: Devices and Circuits:

Advanced Electromagnetics
Semiconductor Devices
Advanced Topics in Mixed Signal Circuit Design
Advanced Photonics
RF Circuits
Pattern Recognition

2) Area: Power and Control Engineering:

Modern Control Theory
Industrial and Commercial Power Systems
Advanced Power System Protection
Advanced Power Electronics
Renewable Energy
Pattern Recognition

3) Area: Signal Processing and Communication Systems:

Adaptive Signal Processing
Wireless Communications
Optical Communication
Wireless Sensor Networks
Communication Systems
Internet of Things
Pattern Recognition

4) Area: Computer Engineering:

Computer Communication Networks
Parallel and Advanced Computer Architecture
Computer and Network Security
Advanced Microprocessor Systems
Security of E-Systems and Networks
Internet of Things
Pattern Recognition

MECE708: Advanced Electromagnetics

This course presents advanced analytical techniques for formulating and solving problems in applied electromagnetics. A number of techniques are presented including basic electromagnetic theorems, Green's functions, spectral domain representations, electric and magnetic field integral equations, and approximate boundary conditions. Applications of these methods are also presented in the areas of radiation, radiowave propagation in stratified media, and scattering. The mathematical techniques required, particularly those not found in other courses, are included in this course.

CLOs

By the end of this course, students will be able to:
1. Develop an advanced understanding of electrodynamics;
2. Acquire a mathematical toolset in vector calculus, integral trans-forms, and solutions of differential equations;
3. Be able to solve electrodynamics problems in slab, cylindrical and spherical geometry;
4. Understand how to discretize problems and solve problems by computation;
5. Understand, evaluate and describe the theories, concepts and principles of the current knowledge for the chosen topic;
6. Master appropriate analytical, theoretical and/or practical techniques to further their understanding and skills in the chosen topic.

MECE715: Modern Control Theory

This course reviews the classical control systems, system modelling, time and frequency domain analyses, feedback characteristics, stability analysis, state space representation, sampled data control systems, z-transform and pulse transfer function, stability analysis of the sampled data control systems, fuzzy control systems, neural network based controllers.

CLOs

By the end of this course, students will be able to:
1. Formulate mathematical and analytical models of physical systems using state-space representations;
2. Evaluate for stability, controllability and observability using systems approach;
3. Design controllers based on heuristics and meta-heuristics.
4. Compare the performance of modern control system using practical examples;
5. Develop skills in the design and evaluation processes using MATLAB / Simulink.

MECE703: Advanced Photonics

The course provides advanced topics of optics and photonics, with the aim of giving a complete vision of photonics to use in engineering and systems. The course describes some important aspects of optics and photonics components along with their applications, describing both the main devices and the main formulation of light propagation and interaction with matter. The course will touch the following topics: Classical formulation of light-matter interaction; Semi-classical theory of light-matter interaction; Introduction of quantum theory of interaction of radiation field with matter; Advanced lasers; Wave-equation description of nonlinear optical interactions; Model of refractive index intensity dependence; Non-linear optics application; Non-linear fiber optics; Soliton propagation; Ultrafast optics; Scattering theory; Stimulated Brillouin and stimulated Rayleigh scattering; Stimulated Raman scattering; Applications, Raman amplification, Raman spectroscopy and microscopy. Numerical method in nonlinear optics.

CLOs

By the end of this course, students will be able to:
1. Elaborate on advanced optical theories using problems in modern engineering;
2. Explain concepts of advanced photonics by practical case studies;
3. Justify technical, communication and human skills to solve current photonics related engineering problem;
4. Analyze photonics system by hands-on activity;
5. Design advanced photonics devices and systems by completing a group activity.

MECE700: Industrial and Commercial Power Systems

The course aims to provide the student with the fundamentals of electrical industrial and commercial power systems: design, demand calculation, maintenance, load calculation, management and operation. In specific, it provides practical and essential knowledge for designing the electrical distribution infrastructure in large commercial buildings and industrial sites. Particular emphasis is on compliance with current practices and regulations within Eurasia. The course also touches on some aspects of utilization. Regulatory aspects; switch-board design; underground cabling systems; designing neutral system in industrial and commercial structure, surge protection; lightning rod system design and calculation; electrical lighting systems; industrial heating; energy efficiency and energy management; power factor correction; power quality and the effects of voltage and current harmonics; escalator and lift traffic analysis; transformer loading and over-load in industrial and commercial sites; and introduction to the smart grid will be discussed in this course. This is an essential course for power engineers which are planning to work in industry or doing re-search in smart grid field in distribution system.

CLOs

By the end of this course, students will be able to:
1. Criticize electrical industrial and commercial distribution systems and their technical requirement through practical case-studies;
2. Choose the relevant standards, rules and regulations effective in industrial sites and commercial buildings using industrial examples;
3. Design distribution substation, and transformer selection using relevant tools;
4. Evaluate the power factor and explain compensation techniques with available standards;
5. Improve power quality in industrial and commercial network using advanced techniques;
6. Discuss insulation test techniques, and choose suitable electrical components and cable sizing using realistic conditions.

MECE718: Computer Communication Networks

This course studies integrated network architecture of service, control signaling, performance evaluation, and management. Examples of high-speed LAN/WAN, next generation Internet and mobile wireless network, ATM Systems and Networks, and PANs will be given and analyzed. Each student is required to prepare and present a term paper and a final project.

CLOs

By the end of this course, students will be able to:
1. Design and analyze computer networks protocols and architectures;
2. Investigate the performance of computer communications net-works using simulation tools and analytic analysis;
3. Have the opportunity to present term papers and final project in class in order to enhance technical communications and writing in subject matter;
4. Familiarize with recent advances and trends in this field.

MECE701: Advanced Power System Protection

This course deals with fundamentals to advances in the field of power systems protection and relaying. In particular, it covers the types of faults and their calculation using symmetrical components methods; industrial voltage and current transformers; transmission and distribution line protection - over-current, directional, distance, out-of-step protection; primary and backup protection zones, discrimination of relay time and current settings, Digital relaying: Microprocessor based relays,

Phasor measuring units and Wide Area monitoring Systems (WAMs), fault detection and isolation procedures, power system restoration and self-healing systems".

CLOs

By the end of this course, students will be able to:
1. Minimize the new protection challenges posed by the active distribution systems and integrated power systems by applying advanced protection techniques;
2. Explain the working principles of solid-state relays and their capabilities over conventional relays using a range of case-studies;
3. Select modern protection schemes tools to safeguard the power system operation;
4. Design new protection schemes through a practical study.

MECE719: Parallel Computer Architecture

The course covers traditional parallel architecture topics—such as programming models and communication and synchronization issues in message passing and shared-memory architectures—as well as a variety of recent and/or advanced ones such as datacenters and heterogeneous architectures. Topics like multicore systems, interconnection networks and algorithms, cache coherence, victor processors, pipelining, multiprocessor systems will be covered. The course features a semester-long course project in order to introduce the students to research in the fields of parallel computer architecture and systems, and advances in the state of the art in parallel computer design and performance evaluation.

CLOs

By the end of this course, students will be able to:
1. Explain major components of a parallel computer system;
2. Assess and compare various parallel computer architectures and paradigms;
3. Investigate recent advances in parallel architectures and processing;
4. Conduct literature review on a topic in parallel systems and pre-pare a project to solve a problem.

MECE704: Optical Communication

Optical Communication course provides an in-depth overview of fiber-optic communications for high bit-rate/high-throughput. The course provides a description of fiber-optic communication network and devices, and performance calculations. The effect of attenuation, dispersion, and non-linear effects is quantified. Protocols for 10-100 Gbit/s data communication over long-haul links are discussed.

CLOs

By the end of this course, students will be able to:
1. Discuss the impact of modulation, detection, propagation, and polarization using realistic case studies;
2. Assess performance of single-span systems limited by attenuation;
3. Compare performance of multi-span systems with optical amplifiers;
4. Evaluate the effect of dispersion and its interaction with non-linear effects;
5. Adapt the concepts of the course in practical optical communication systems;
6. Explain concepts and equations for advanced applications in optical networks.

MECE705: Advanced Topics in Mixed Signal Circuit Design

The main goal of this course is to provide an in depth understanding of design issues in analog and digital integrated circuits. Topics covered in this module include:
1. Mixed-mode design flow; Top-down and bottom-up, constraint-driven design methodologies; Design reuse (IPs);

2. High-level design and optimization, Behavioral modeling and simulation; Macro-modeling algorithms;
3. Multilevel and mixed-domain simulation; AHDL macro models;
4. Computer-aided design considerations for mixed-signal coupling; Functional verification;
5. Floor planning and physical implementation; Layout tools for analog ICs and mixed-signal SoCs;
6. Specific simulation methods for mixed-mode integrated circuits.

CLOs

By the end of this course, students will be able to:
1. Evaluate the top-down design methodology and the steps involved in the design based on a typical mixed-signal IC design flow;
2. Discuss their knowledge in circuit modeling and simulation techniques (architectural, behavioral, circuit or device level) to construct the mixed-signal circuit blocks;
3. Implement the top-down methodology and the design reuse (IPs);
4. Design a mixed-signal IC from system specifications to the final layout using different EDA tools.

MECE702: Advanced Power Electronics

The general purpose of the module is to have the students exposed to modern DC-DC (Switched Capacitor and Flying Capacitor) and DC-AC (Neutral Point Clamped, Flying Capacitor, Cascade H-bridge) power converter topologies, their operation principles, methods of analysis and computer simulation.

CLOs

By the end of this course, students will be able to:
1. Explain the types and topologies of power electronic converters and analyze their operation;
2. Assess performance of power electronic converters in terms of voltage and current ripples and harmonic distortions;
3. Select power converter components based on electromagnetic stress and losses;
4. Plan computer simulation and physical results interpretation of various power electronic converters steady-state operation;
5. Survey different methods of power converters regulation using available industry standards.

MECE706: Wireless Communications

Communication systems & technical challenges; Channel modelling (propagation, channel statistics, channel measurements); Modulation & information theory; Antennas (diversity, MIMO, smart); Multiple access schemes; Cooperative & cognitive radio.

CLOs

By the end of this course, students will be able to:
1. Explain the pathlosss models and how it can be useful in mobile communication systems;
2. Discuss co-channel interference and shadow margin and its importance on the performance analysis of mobile communication systems;
3. Criticize all the steps of Handoff process using various mathematical tools;
4. Determine various channel modelling by different case-studies;
5. Compare Mobile-to-Mobile wireless techniques using practical examples;
6. Survey state of the art wireless communication techniques.

MECE710: Computer and Network Security

This course deals with the key concepts of vulnerabilities, attacks, threats, security measures and mechanisms in computer systems and networks. It will present the essential concepts of cybersecurity technolgy and their applications. Topics include applied cryptography, authentication, digital signatures, digital certificates and network security protocols such as

IPSec, SSL, TLS and SET. Students will also learn necessary knowledge about security mechanisms such as firewall, VPN and network intrusion detection systems. Examples and case studies will be covered. A term paper and final project will be required from each student.

CLOs

By the end of this course, students will be able to:
1. Investigate in depth major fundamental concepts of computer and network security;
2. Be able to apply problem solving methods to deal with challenges and make decisions using sound engineering procedures;
3. Familiarize with the analysis and design of cybersecurity proto-cols;
4. Design and analyze security protocols using simulation tools.

MECE711: Security of E-Systems and Networks

This course covers the fundamental techniques in security of E-based Systems. E-based systems are ubiquitous in the modern world with applications spanning e-commerce, e-government, e-services, Virtual Private Networks (VPNs), health care, among others. This course deals with the fundamental concepts and tools of security of e-based systems and computer networks and their range of applications. Among the topics to be covered in this course include: authentication of users, system integrity, confidentiality of communication, availability of business service, non-repudiation of transactions, public key cryptosystems, authentication and digital signature, e-security tools such as Public Key Infrastructure (PKI) systems, biometric-based security systems, wire-less network security, trust management systems in communication networks, intrusion detection systems, protecting against malware and computer network security risk management. Examples and case stud-ies will be given. A term paper and a final project are required from each student.

CLOs

By the end of this course, students will be able to:
1. Investigate e-business, e-commerce, e-commerce and e-government systems including protocols, architectures, trends, challenges and performance aspects;
2. Analyze security schemes of e-based systems and networks;
3. Access, analyze and compare various e-based system technologies;
4. Evaluate performance of the related architectures and protocols using available widely used simulation tools.

MSC700: Renewable Energy

The ever-increasing demand of power, heating and cooling associated to global population and economic growth, parallel to anthropogenic global warming and fast depletion of fossil fuels, creates an imperative need to incorporate a much larger share of clean and renewable energy. The Renewable Energy Systems course introduces graduate students to the principles of energy conversion, storage, technologies and economy associated to the use of renewable energy sources.
The course presents a global overview of renewable energy sources with a focus on solar and wind energy sources, covering various aspects of the modeling, design and analysis of solar power and heating, and on-shore/off-shore wind power systems, including their economic and environmental impact analyses.

CLOs

By the end of this course, students will be able to:
1. Recognize the construction and operational principles of different renewable energy plants and analyze their functioning;
2. Assess the interaction of wind and turbine rotor for wind turbine performance evaluation and assess solar energy harnessing for efficient thermal and power conversion;

3. Identify the factors governing the siting of PV power plants and wind farms for a wide range of sites and clients;
4. Design systems comprising of generators, controllers and energy storage components in solar and wind power plants.

MECE707: RF Circuits

This course presents advanced topics on RF and mm-wave circuits. Frequency synthesizers, transmitter linearization techniques (e.g. polar circuits), MIMO and phase array circuits, power D/As.

CLOs

By the end of this course, students will be able to:
1. Investigate principles of Integer and Frac-N Frequency Synthesizers;
2. Learn beamforming techniques such as MIMO and phase array circuits;
3. Use concepts of power D/As for ultra wideband transmission circuits (e.g. Software Definer Radio);
4. Apply power amplifier linearization concepts in real circuits.

MECE714: Communication Systems

This course involves the detection of signals, the prediction and filtering of random processes, the design and analysis of communication systems, the analysis of protocols for communication networks, and statistical processing of images. Specific topics include the use of signal processing and error correction coding, and modulation techniques for both data transmission and digital magnetic recording, the use of spread spectrum techniques for wireless communications, and the design and analysis of multi-user communication networks. Additional areas of re-search include time series analysis, adaptive filtering, sampling design, and wavelet theory. Applications are made to such fields as communications, radar, sonar, oceanography, holography, and image processing. Both theoretical and practical aspects of information processing are studied.

CLOs

By the end of this course, students will be able to:
1. Thorough insight in the theory, design and analysis of communication systems;
2. Learn use of signal processing and error correction coding, and modulation techniques for both data transmission and digital magnetic recording;
3. Identify applications of communication systems in different fields;
4. Critical assessment of articles from scientific literature discussing time series analysis, adaptive filtering, sampling design, and wavelet theory in applications of communication systems.

MECE709: Semiconductor Devices

The course is an introduction to semiconductor fundamentals and applications to the electronic devices. Course creates the background in the physics of the compound semiconductor-based electronic devices and also prepare students to advanced courses in solid state and quantum electronics. The course provides an opportunity for students to continue education in undertaking advanced study and research in the vari-ety of different branches of semiconductor device applications. Topics include the background solid state and semiconductor physics, and basic principles of electronic devices operation.

CLOs

By the end of this course, students will be able to:
1. Thorough insight in the working principles of the building blocks (diodes, metal semiconductor, and metal-insulator-semiconductor structures) of semiconductor devices: equilibrium, DC, AC, and large signal behavior;

2. Insight in the operation (equilibrium, DC, AC, and large signal) of the basic semiconductor devices: the MOSFET and the bipolar transistor including modern structures;
3. Recognize the most important process steps used in semiconductor device technology;
4. Analyse semiconductor devices: drawing band diagrams, assessing IV, CV characteristics, and switching behavior, comparing competing semiconductor devices;
5. Critical assessment of articles from scientific literature discussing semiconductor devices.

MECE713: Advanced Microprocessor Systems

The course deals with advanced microprocessor systems; embedded control; processor core; system-on-chip; power-aware design; media processors; DSP; crypto processors; network processors; trusted processor architectures; and architecture simulation. Both design and programming aspects will be covered. A final project is required from each student.

CLOs

By the end of this course, students will be able to:
1. Assess and investigate recent advances in microprocessor and embedded systems;
2. Familiarize with special processors such as DSP; media processors; DSP; and crypto processors;
3. Design and program advanced microprocessor and embedded system;
4. Criticize weaknesses and evaluate strengths of each system.

MECE720: Wireless Sensor Networks

This course deals with principles of wireless sensor networks (WSNs), architecture, protocols, and performance. Topics include: Wireless technology for distributed sensor networks, clustering techniques in WSNs, routing in WSNs, WSNs security, industrial WSNs protocols, WSNs design, implementation and management and performance evaluation of WSNs including simulation analysis. Trends and challenges of WSNs will be covered. A term paper and final programming/design project are required.

CLOs

By the end of this course, students will be able to:
1. Investigate the architectures, protocols, applications and performance of WSNs;
2. Familiarize with the challenges to design WSNs, especially their limited resources;
3. Select right topology for the right applications of WSNs;
4. Experience how to simulate WSNs in order to predict or tune their performance.

MECE707: Internet of Things

This course provides a core grounding in how science and technology have developed to enable the Internet of Things (IoT) – in a way appropriate for any learner. For those interested in developing further hands-on expertise in designing and developing for the Internet of Things, this course will provide a context to the discoveries and con-verging technologies that will springboard the next round of innovations. Topics covered in this course module include:
-Automation systems: Introduction, networks for automation applications: HART, CAN, PROFIBUS, Industrial Ethernet
-Capillary networking: Challenges for wireless capillary net-working. Systems addressing these challenges: IEEE 802.15.4, Wireless HART, Low Power Bluetooth, Lower Power WiFi
-Internet of Things (IoT): Introduction of IoT, Integration of constrained node networks into the IPv6 world, 6LoWPAN, ROLL RPL: Routing protocol for heterogeneous low-power and lossy networks, CoRE CoAP: HTTP-like application layer protocol over UDP
-Markov Chains and Basics of Queuing Theory

CLOs

By the end of the course, students will be able to:
1. Analyze the fundamental challenges with respect to Machine-to-machine (M2M) and Internet of Things (IoT) of future networks using different case-studies
2. Survey the current state-of-the-art IoT systems and their technical features through review of scientific articles
3. Compile open problems and their possible solutions using experimental and theoretical techniques.
4. Justify systems approach to design through a class project(s).

MECE709: Pattern Recognition

Pattern recognition is the science of assigning an observation to a set of pre-specified categories. The aim of this module is to introduce fundamental concepts used in design and implementation of pattern recognition methods. After a brief review of probability theory, we will cover important and classical families of classification rules, error estimation, and dimensionality reduction techniques. Our discussion on classical methods is then followed by a set of modern shrink-age-based techniques for performing classification and regression on very large sparse data matrices.
The topics include:
Classification Rules: Bayes Decision Rule, Classification, Parametric Classification Rules, Nonparametric Rules, Perceptron, Support vector Machines, Neural networks, Decision Trees, Discrete Classification
Error Estimation: Hold-out, Resubstitution, Cross-validation, Boot-strap
Dimensionality Reduction: Filter-based feature selection, Wrapper-based feature selection and various search strategies, PCA, Multidi-mensional scaling
Shrinkage-based techniques: LASSO, Elastic-net

CLOs

By the end of the course, students will be able to:
1. Test theory of pattern recognition by explaining an engineering application.
2. Explain applications of pattern recognition by practical case studies.
3. Interpret data analysis with classifiers by completing hands-on activities.
4. Survey application of engineering principles by completing practical experiments.
5. Develop systems thinking, temporal reasoning and quantitative skills by completing a project activities.

MECE716: Adaptive Signal Processing

The objective of this course is to provide the mathematical framework for an understanding of adaptive statistical signal processing. The basic tools of vector spaces, optimization theory, and discrete-time stochastic processes are reviewed and applied to the methods of Wiener filtering and least-squares filtering. Various types of adaptive filters will be introduced and their properties will be studied, specifically convergence, tracking, robustness and computational complexity. Applications will mainly be addressed through student projects.

CLOs

By the end of this course, students will be able to:
1. Distinguish concepts of stochastic process and optimization theory using a range of mathematical techniques;
2. Interpret standard adaptive signal processing algorithms using practical case-studies;
3. Integrate knowledge of stochastic process in filter design;
4. Design a stochastic filter for a practical problem under realistic conditions.

Master Thesis Guidelines

The guidelines presented herein form a manual designed to provide you with a quick reference for planning, preparation, and compilation of your thesis manuscript. In this manual, explanations of form and style, as well as a wide range of suggestions and advice, are offered for serving this goal. It is among the aims of this document to clarify the rules and explain possible options in areas where decisions about form and layout are at your discretion.
Finally, it is important that you read the entire manual **before** you begin preparing your manuscript so that you understand the format and purposes behind the rules.

Aims and Objectives

The Master's thesis constitutes a piece of applied research and in this context, your primary goal is to analyze, solve and present your research findings for an existing problem relevant to your field of study. This process should be based on existing scientific and engineering knowledge and follow the principles of responsible research conduct. Hence, you are not expected to conduct basic research and/or produce new knowledge, although this is not prohibited.

The **topic** of your thesis should be related to the advanced studies of the degree program and should be decided in agreement with your thesis supervisor through the preparation and presentation of your Thesis Agreement to the MSc program coordinator for approval.

The primary focus of your research project is usually expressed in terms of **aims** and **objectives**. Your aims should comprise aspirations and/or intentions defined in broad terms which essentially describe what you are hoping to achieve. These aims set out what you are targeting to deliver at the end of the project. Objectives, on the other hand, are specific statements that define measurable outcomes and comprise specific goals and steps that must be followed for achieving your aims. Your objectives must be:

Specific; provide precise descriptions of what you are going to do.
Measurable; be able to provide concrete evidence when reaching a goal.
Achievable; avoid setting infeasible goals.
Realistic; plan your steps and goals based on the available resources (time, lab equipment, skills etc.).
Timely delivered; create a timetable, know when each stage needs to be completed, allow extra time for unexpected delays

Thesis components and contents

Thesis components

Your thesis may have up to three components: a core thesis, essential supporting material, and non-essential supplementary material.

Core Thesis. The core thesis must be a self-contained, narrative description of the argument, methods, and evidence used in your thesis project. Despite the ability to present evidence more directly and with greater sophistication using mixed media, the core thesis must provide an accessible textual description of the whole project.

The core thesis must stand alone and be printable on paper, meeting the formatting requirements described in these guidelines. The electronic version of the thesis must be provided in the most stable and universal format available—currently Portable Document Format (PDF) for textual materials. These files may also include embedded visual images.

Essential Supporting Material. Essential supporting material is defined as mixed media content that cannot be integrated into the core thesis, i.e., material that cannot be adequately expressed as text. Your thesis committee is responsible for deciding whether this material is essential to the thesis. Essential supporting material does not include the actual project data. Supporting material is essential if it is necessary for the actual argument of the thesis and cannot be integrated into a traditional textual narrative. Essential supporting material must be submitted in the most stable and least risky format consistent with its representation.

Non-essential Supplementary Material. Supplementary material includes any supporting content that is useful for understanding the thesis but is not essential to the argument. This might include, for example, electronic files of the works analyzed in the thesis or additional support for the argument (simulations, samples of experimental situations, etc.). Supplementary material is to be submitted in the most stable and most accessible format.

Core thesis/manuscript contents

This Master's program includes courses presenting and explaining research methodologies and reporting methods, however, you should always keep the following in mind when conducting research and compiling your thesis manuscript:

- Always include a pertinent literature review. The literature review aims in describing the existing and established theory and research in your thesis area and, hence, providing a context for your work. Reference all sources mentioned in the review and give full citation in thesis' Reference List.
- Explain the methods used in researching and developing your work. It is highly important to explain what research methods you used to acquire data and/or information and full present the conducted work.
- Discuss with your thesis supervisor the extent and level of detail required; different levels of research depth will obviously require different levels of detail.
- Clearly present your findings. Describe what have been discovered through your research. Give all results, as long as they are products of your research activities. Include tables, graphs, illustrations etc., so that it is easier for the reader to understand your results.
- Always include a discussion of your findings. Use a discursive and evaluative writing approach and fully present your interpretations and judgements of the results your research shows. Contextualize your ideas in relation to other theories and with other similar research, particularly in reference to the works mentioned in your literature review.

Stages and Procedures

Actions described in Stages 1 & 2 need to be completed within the first eight weeks of the program's 2nd semester, i.e., by the end of February 2019. During the 2nd semester the student has the opportunity, after discussion with his/her current supervisor, to change the topic and/or the supervising committee. After the end of the 2nd semester no changes are allowed.

STAGE 1: Identify Thesis Supervisors (supervisory committee)

1) Students must select their potential MSc thesis supervisors (Lead- & Co-supervisors) within the first 8 weeks of the Program's second semester and inform the MSc Program Coordinator, who is going to initiate the required approval of your supervisory committee by the departmental MSc Program Committee. Both supervisors must be from the department. In exceptional cases, with the approval of the Department MSc Committee, HoD and Dean, it will be accepted to have the Co-Supervisor external to the Department in which the student is enrolled. But, with no exception, the Lead Supervisor must be a faculty of the Department of the student. In the case of having an external member as Co-Supervisor, that member will act as internal to the effects of evaluation of the Master Thesis. Furthermore, an external examiner needs to be assigned to each student, who will not be part of the student supervisory committee but will be involved in the approval of the final MSc thesis report and the evaluation of the MSc. Thesis defense. The external examiner must be external to your department and can be an academic from another NU department, university or, alternatively, an expert from the industry holding an appropriate academic degree and specializing in your thesis' scientific field. Department's MSc committee will choose the External Examiner from a list of supervisor-proposed candidates. In all stages, all involved individuals and bodies are responsible for identifying and declaring potential or perceived conflict of interest among involved parties and following the rules and guidelines mentioned in Appendix VI.

Constructive supervision is a significant component aiming in the success of your thesis work and requires the vivid interaction between you and your supervisors. However, you should never forget that it is you, the student, who is carrying out the work and it's your motivation, academic knowledge, and interest central in making the supervision process work.

Your supervisory committee comprises academic professionals that will help you track appropriate research sources and support your research and the compilation of your thesis work. Your supervisor may also refer you to other experts (either internal or external to the university) who may have specialized knowledge in the specific topic of your thesis. Your Lead Supervisor is responsible for ensuring that the Master's thesis meets the goals and requirements set by the School of Engineering and Digital Sciences. Your supervisory committee will be able to predict common pitfalls and protect you from them while at the same time provide you with advice helping you meet your thesis' objectives. However, keep in mind that it is required by you to be the dynamic party in the interaction with your supervisors. Discussion and critical argumentation are key features that should be present in your meetings. Supervision is not a monologue, and neither the supervisors nor the student should restrain themselves from asking the other party for clarification of claims. Mutually challenging dialogues can help you in delivering a successful result.

STAGE 2: Selection of topic

Supervisors are in position to suggest appropriate MSc thesis' topics. These may stem from research work being conducted at the school/department or may arise from material covered during your coursework. Furthermore, thesis' topics may be also related to work carried out in the context of research projects involving industrial partners. The topic of the thesis is decided in discussions between you and your chosen supervisors; however, the final choice is always made by you. In this regard, it is customary for interested department faculty members to announce topics and/or areas of interest in helping you choose your thesis topic.

Furthermore, during your first supervised meetings you should spend some time discussing, in addition to academic matters, all practical matters that may arise during your work:

- Do you need all-round supervision? Have you got prior experience in using equipment or software required in the proposed topic? Will you be able to use them?
- When can you meet with your supervisor? How often? Can you set up regular meeting intervals or do you prefer an on-demand approach? Keep in mind that supervisors are bound to offer at least 12 hours of supervision for a 48-credit master thesis.
- How ambitious are you? Are you thinking of later applying for a funded PhD position?

Finally, a *Supervision Agreement* form, found in Appendix II, must be filed in, signed, and submitted to the MSc Coordinator for review and approval by MSc Committee and Head of Department by the end of the second semester. The Supervision Agreement must state the proposed thesis title, supervisors, start date, and intended submission date.

STAGE 3: Submission of your thesis proposal

When you and your supervisor come to an agreement for an appropriate thesis topic, you are required to submit a thesis proposal/candidature within the first four (4) weeks of the Program's 3rd semester. This proposal will be presented with the aid of a short report and defended orally in front of an academic panel, comprising your two supervisors and a third faculty from the Department of Electrical and Computer Engineering appointed by the MSc ECE Committee and approved by the Head of Department. This panel will decide on the appropriateness of your proposed thesis topic and the scientific concreteness of the methodologies you are aiming to apply. Your research/thesis topic proposal should clearly address the following items:

- Outline of the problem/area of application
    - Explain why you think it is worth investigating
    - Set your ideas into a theoretical/academic context
- Aims and Objectives
    - Describe what you are aiming to achieve
    - Present the steps and approaches you will employ for reaching your goals
- Methodology
    - Explain what methods you intend to use when researching and developing your work
    - Use a descriptive writing approach corresponding to the detail required for the panel's comprehension of your approach.
- Scope and constraints
    - Set clearly your scope and anticipated constraints:
        - Your selected topic may be vast with numerous applications and thus, you might want to limit your work in a particular area of application
        - You may not be able to conduct some research due to constraints on time, cost, or availability of resources
- Discuss requirements on resources
    - Do you need any special lab equipment?
    - Is literature review possible with library's resources?
    - Are any materials and/or consumables required in your research?
- Propose a draft timetable for your thesis

The panel may accept your proposal or provide you with feedback and change suggestions that will help you meet the required academic standards for starting your thesis. If the proposal is deemed unacceptable you will have a second chance to revise and present your modified proposal within four weeks. If

your proposal is not accepted for a second time, you will be recommended for dismissal from the program[1].

Your thesis proposal should be obviously discussed during the preliminary meetings with your supervisory committee. Your Lead Supervisor will usually provide pertinent literature and/or additional resources to accelerate your initial work. Finding suitable and reliable information may prove challenging, but there are many ways including library books, databases, international sources, articles, journals, reviews, and a lot more.

STAGE 4: Carrying out research and preparation of your thesis manuscript

Once your proposal has been officially approved, the actual work may begin. It is crucial that you are always well-prepared in meetings with your supervisor. In this context, it is a good practice to always keep minutes of your meetings and circulate agendas with clearly outlined discussion points and expected results prior to your meetings. This makes it easier for the supervisor to focus on significant issues, leading to a better response for you. If you feel that you may have misunderstood a concept, or you are not certain of the steps required for performing a particular task, ask your supervisor for clarifications or further guidance. The supervisors should always guide you with advices on the topics and tasks you should put emphasis on and at the same time turn you away of meaningless tasks that may waste your time.

Try to establish a communication channel that suits both you and your supervisors. Emailing is an easy, asynchronous way of communication that overcomes time and place barriers. Furthermore, since it is primarily based on writing, it requires a certain amount of prior thinking and planning that helps you avoid getting 'off-track' as it may be the case when speaking. However, emails are cumbersome when lengthy and lack the directness of a real meeting. So, it is important to balance the ways of communication based on your needs and supervisor's availability.

Try to follow the work schedule as close as possible and report unexpected delays or difficulties to your supervisor. This does not mean that whenever you are faced with a difficulty, you will turn to your supervisor for doing the work for you. It essentially means that after putting reasonable effort on accomplishing a specific result which is still elusive, you should turn to your supervisor for additional guidance.

Finally, you must keep in mind that writing a thesis cannot happen in one go. You should, as soon as possible, keep track of your work, make notes and sketches, write intermediate reports so that when your work has approached a certain maturity level, you'll be able to compile, with the aid of this material, a successful thesis' manuscript. **In this regard a progress report is required to be submitted by you to the MSc Coordinator as a proof of progress by the end of the 3rd semester. This progress report should include as a minimum requirement a complete literature review and must be approved by your supervisor.**

STAGE 5: Thesis submission & Defense of your work

Before submitting your manuscript, your supervisor will check it thoroughly and give you feedback on corrections and changes that need to be made. Usually, thesis's revision may take up to 1-2 weeks, and an appropriate amount of time should be also reserved for making corrections.

[1]Failing of MSc thesis or dismissal from program are subject to regular appeal process and rules established in the program handbook and guidelines

When you have prepared the revised document, you submit to your supervisory committee and external examiner for evaluation. Keep also in mind that you should aim at meticulously following your supervisor's comment and corrections so that a series of multiple revisions can be avoided. When your supervisory committee & the external examiner approve the final document, your Lead supervisor will fill the required form and you will get permission to submit your final thesis report for evaluation.

The overall grade for your degree is calculated as the credit-weighted average of all course grades. Additionally, a SUCCESSFUL submission and defense of your thesis is required to be considered for graduation; see §Thesis Grading below for the employed scheme in your thesis evaluation.

Thesis submission process involves the following steps:

- **Thesis report submission (in electronic format).**
- **Thesis oral defense in front of the examination committee.**
- **Thesis revision, if required.**
- **Submission of final version of your report (Thesis manuscript).**
- **Thesis mark appeal, if any. The appeal should be submitted to the MSc ECE committee, which is responsible for the Thesis evaluation process.**

The exact deadlines for each submission process step will be announced every year in due time. Commonly, the submission and examination process begin about 1.5 months before the end of the program's 4th (last) semester and may end few days after the end of the semester.

If your supervisory committee does not approve your thesis for defense or you fail the defense, you may continue to work on your thesis during the immediate summer semester and defend the amended thesis in the summer term before the beginning of the following fall semester. You will not receive a scholarship and you may need to cover the tuition and other fees by yourself during the summer term.

You may also request the Dean's permission to extend your MSc program for the following Fall semester if needed to complete the program requirements. The student's academic supervisor must endorse the request. During this period, you will not receive a scholarship and you may need to cover the tuition and other fees by yourself. If you cannot present and/or defend your thesis during this last semester, you will be recommended for dismissal from the program[2].

In any case, re-examination of the MSc thesis may be permitted only once, with the approval of the Dean of School of Engineering and Digital Sciences.

Thesis Assessment Criteria

The grade assigned depends on the level to which the following criteria have been met:

Manuscript Grading (MSc Thesis Manuscript)

Maximum MSc Thesis Manuscript score: **100**

- ***Presentation of the research problem and thesis' objectives (10%)***
  - Is the research problem clearly specified and contextualized?
  - Are the research questions and hypotheses clearly formulated?
  - Does the thesis capture the relevance, rationale, and objectives of the proposed research?
- ***Literature and technology review (15%)***
  - Does the thesis include a comprehensive review and critical discussion of the relevant literature and/or technological developments?

[2] Failing of MSc thesis or dismissal from program are subject to regular appeal process and rules established in the program handbook and guidelines

- Is there a description on how the conducted research positions itself within the generic context of works which have been published in the area?
- Is the relevant background theory covered? Are the presentation, discussion and explanation provided, adequate? Has the theory been contextualized appropriately within the framework of the research problem being investigated?
- Have the latest theoretical developments in the area been presented and described?
- Does the student demonstrate a systematic understanding of the relevant background material and knowledge?

- ***Methodology, design and implementation (35%)***
  - Are the adopted methodologies and/or design approaches clearly justified and described?
  - Is the implementation well explained?
  - Is there a clear identification of any limitations, assumptions and constraints which affect the application of the employed methodology, design approach and implementation?
- ***Testing, results, analysis, evaluation concluding remarks & future work (30%)***
  - Are the test procedures sound and objective?
  - Do the proposed tests address the research problem being investigated?
  - Are the test conditions, assumptions, constraints, and limitations clearly identified?
  - Are the results clearly presented, analyzed objectively and critically evaluated?
  - Do the concluding remarks summarize the work done? Are there suggestions for any future development and/or enhancements?
- ***Structure and presentation of thesis (10%)***
  - Are the thesis contents well structured, focused, and easy to follow?
  - Are the student's contributions and assumptions clearly communicated to the reader?
  - Is it in compliance with the given guidelines?
  - Is it clearly presented and organized? Is the grammar and usage of English of an appropriate level?

Oral Presentation Grading (MSc Thesis Defense)

Maximum MSc Thesis Defense score (presentation + technical content) **100**

PRESENTATION SCORE: *(Maximum presentation score: 50)*

- ***Speech & Style*** *(10p.)*
  - Clear and easily understood. Correct use of terms.
  - Easy-to-understand sequence. Professional appearance. Use of good English.
- ***Structure of the Presentation*** *(10p.)*
  - Logical sequence, good flow. Supporting body of literature mentioned.
  - Development of topics described clearly. Smooth progression from topic to topic.
  - Key points & challenges sufficiently highlighted.
- ***Layout of Visual Aids*** *(10p.)*
  - Clear power point slides, uncluttered. Concise & precise slides.
  - Use of good English. Good use of charts, tables, diagrams, etc.
- ***Questions & Answers*** *(20p.)*
  - Clearly understood the question.
  - Concise answer responding to the point of the question.

TECHNICAL CONTENT SCORE: *(Maximum technical content score: 50)*

- ***Introduction*** *(10p.)*
  - Problem statement & project objectives. Coverage of all main points of the project.
  - Literature review and conclusions. Relevance to the need of industry, society etc.
- ***Technical Competency*** *(30p.)*
  - Viability of the design concept. Justification of the approach
  - Design methodology. Practical Implications.
  - Quality of the concept presentation. Interpretation of the achieved results.

- Use of relevant tools/equipment/software. Costs and efficiency considerations.

- ***Conclusions, Future Work & Professional ethics*** *(10p.)*
  - Conclusions: advantages and disadvantages.
  - Level of the project objectives achievement.
  - Future work and possible improvements.
  - Consideration in design and solution. Applicability to real-life situations.
  - Compliance with good practices and standards.

Thesis Grading

The MSc. Thesis must be compiled in a report (manuscript) according to the specification provided herein and defended in front of MSc. Examination Thesis committee, which comprises your two supervisors and your external examiner. The MSc. Thesis manuscript and MSc Defense Oral presentation will be evaluated using the assessment criteria and weighting presented in the previous section, Thesis Assessment Criteria and Oral Presentation Assessment Criteria, respectively. The Thesis manuscript evaluation (M) contributes 70% to your final thesis evaluation while the remaining 30% comes for your Oral presentation (O).

Thesis is not graded with a letter scale as in the case of other MSc courses, but a SUCCESSFUL / UNSUCCESSFUL attribution is utilized. For a successful completion of your thesis, you are required to achieve an overall supervisory committee evaluation greater or equal to 75%. The examination committee members' evaluations contribute to your MSc thesis result as follows:

1. External examiner's (EE_M and EE_O) evaluations are weighted with a 30% weight, and
2. Lead and Co-Supervisor's evaluations (S1_M, S1_O & S2_M, S2_O) are weighted with a 35% weight each

Hence, your final thesis evaluation (FE) is calculated as follows:
FE = 0.3 O + 0.7 M,
where O = (0.3 EE_O + 0.35 S1_O + 0.35 S2_O) and M = (0.3 EE_M + 0.35 S1_M + 0.35 S2_M)
If FE is greater or equal to 75%, your thesis manuscript & defense is considered SUCCESSFUL, otherwise it will be considered UNSUCCESSFUL.

In case of a difference larger than 25% between evaluation marks given by External and average of Internal Examiners, the Department MSc Committee will decide the final evaluation of the thesis. The percentage difference will be calculated using the following relation:

$$\text{Percentage Difference} = \frac{|V_i - V_e|}{\frac{(V_i + V_e)}{2}} \times 100,$$

where V_i is the average evaluation of the internal members and V_e the evaluation of the external member.

Manuscript Structure & Formatting

Detailed description of manuscript's structure along with specific guidelines for the document's styling can be found in Appendix III – Manuscript Format Specifications.

Referencing

Whenever writing a piece of academic work, you are required to acknowledge the sources of data and information that you have used. This permits you to:

- prove that your work has a substantial factual basis;
- offer your readers the means to identify and retrieve the references for their own use;
- acknowledge the creators/authors of material/methods you have used/employed in your own research work
- support the research methodology and approaches you have used to reach your conclusions.

You can use any established engineering citation methodology to reference any material used in your work. For more information on ASME[3]'s referring style and alternative approaches see Appendix IV – Referencing style.

Always keep in mind that referencing is divided into two key components:

1. *In-text references* where references might be numbered in the order of appearance, as in [1] or using the author's name and date of publication as in (James et al., 2002);
2. *A reference list* displayed at the end of the piece of work which provides full details of all references cited in-text. The references can be ordered as they appear in text or in alphabetical order according to the selected style. In any case, the identification mark for each item in the list must coincide with the in-text reference used.

[3] THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Appendices

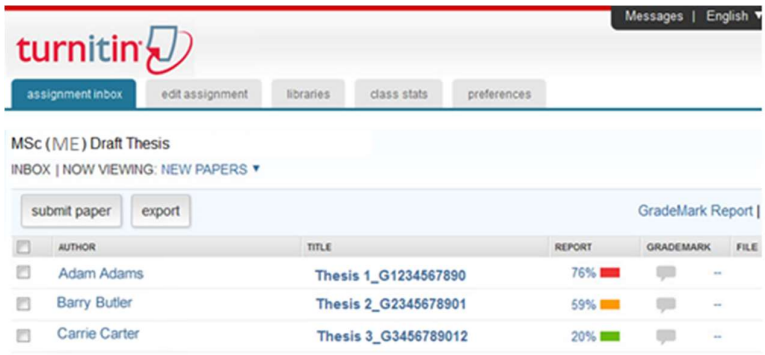
Appendix I - Turnitin

Turnitin is a web-based originality checking service that is used by many universities worldwide to prevent plagiarism. When a student's work is submitted to Turnitin it is matched against millions of internet pages, electronic journals, books, and a database of all previously and concurrently submitted assignments. Turnitin then generates an originality report providing a summary of matching or similar text found in the submitted work. Turnitin can be used to check sources that have been correctly acknowledged and cited.

The higher the percentage indicated on the originality report, the greater the amount of text copied. The similarity percentage index ranges from 0% to 100% and is specified by distinct Colors:

- **Blue** (No matching words)
- **Green** (1 - 24% similarity index)
- **Yellow** (25 – 49% similarity index)
- **Orange** (50 – 74% similarity index)
- **Red** (75 – 100% similarity index)

Acceptable ranges for plagiarism using Turnitin is ideally below 20%. The figure below illustrates a sample originality report.



Appendix II – Supervision Agreement Form

MSc Thesis-Supervision Agreement Form
School of Engineering and Digital Sciences, Nazarbayev University

NAZARBAYEV UNIVERSITY

Department of Electrical and Computer Engineering
53 Kabanbay Batyr Ave. Nur-Sultan, Kazakhstan, 010000
Tel. No: +7 (7172) 70 64 23, 70 65 43, 70 65 99
E-mail address: seng@nu.edu.kz
Web-page: seng.nu.edu.kz

Student Name and ID	Name: ID:		
Program	**Master of Science in Electrical and Computer Engineering(MSc-ECE)**		
Lead Supervisor	Name: Institute / School / Department: Address:		
Co-supervisor	Name: Institute / School / Department: Address:		
External Examiner	Name: Institute / School / Department: Address:		
Proposed thesis title			
Starting date		Intended date of thesis submission	

RIGHTS AND OBLIGATIONS IN THE SUPERVISORY RELATIONSHIP

- The supervisor and the student should, at the outset of the supervisory relationship, discuss and agree on the format of supervision, the expected progress, and the intended date of thesis submission.
- The supervisor and the student should observe the regulations and instructions governing the supervision of the master thesis.
- Regulations and instructions regarding conflict of interest (as described in Appendix VI of MSc ECE handbook) in supervision and assignment of external examiners should be observed by the student, the supervisor, and the MSc ECE committee.

Student

- The student should be well-prepared for meetings with supervisors.
- The student should provide sufficient notice to the supervisors if he/she is not able to attend a scheduled meeting.
- When there are serious problems in supervision, the student should immediately bring this to the attention of the Master's Program Coordinator or Head of Department.
- In case the thesis cannot be completed within the period of the agreement, the student must apply for an extension of the supervision agreement.

Supervisors

- The supervisors should be familiar with and follow the ethical guidelines of supervisors at Nazarbayev University. He/she should also ensure that students are aware of the guidelines.
- The supervisors should ensure that the first meeting with the student takes place shortly after having been assigned, in which the supervisors should discuss with and inform the student about how the supervision is to be organized.
- The supervisors should offer the student at least 12 hours of supervision for a 48-credit master thesis, distributed evenly throughout the supervision period.

- The supervisors should be well prepared for the meetings with the student.
- The supervisors should discuss with the student as well as evaluate the plan, the methodology and execution of the proposed research. He/she should assist the student in planning the research with a view to completing it within the normal period of study.
- The supervisors are expected to read and give detailed comments on the draft of the thesis chapters at least once, but the supervisors will exercise their own judgment in how far it is necessary to give detailed comments on revised chapters and the completed thesis.
- The supervisors may, if appropriate, carry out part of the supervision in small research seminars.
- The supervisors should, through the meetings with the student, monitor the progress of the student's work and evaluate the progress in relation to the planned schedule.
- The supervisors should give sufficient notice to the student if he/she needs to re-schedule a meeting.

Modification or Termination of Supervision Agreement

- Changes can be made to the supervision agreement (i.e. changing the research topic) when both the student and lead supervisor agree.
- Changes to the supervisor and/or co-supervisor and/or research topic can only happen before the end of the program's 2nd semester.
- When the supervisor is to be absent for an extended period of time in the course of the supervisory relationship, the department should, in consultation with the student, determine how the supervision can be organized during this period.
- In case the department considers that the student is not acting according to the supervision agreement, he/she should be notified in writing.
- If the supervisory relationship is not deemed, by the student or the supervisor, to be working satisfactorily, for academic or other reasons, either side may request to be released from the supervisory relationship. A new supervisor should then be arranged.
- The student may be considered as not acting according to the supervision agreement in cases when:
  (a) the student fails to submit the master thesis within the semester which the thesis is due for submission and has not been given approval for an extension and a new submission date.
  (b) the student has not contacted the supervisor for one semester. In such a case, the research can be taken up by other students.
  (c) the allocated hours of supervision have been used up, and the student has no approved plan for submission of thesis.
- The supervision agreement ends when the student:
  (a) submits the master thesis
  (b) is considered as not acting according to the agreement and has been notified of it in writing, and has not received approval for a new plan for submission
  (c) forfeits or gives up the right to his/her place in the master program concerned.

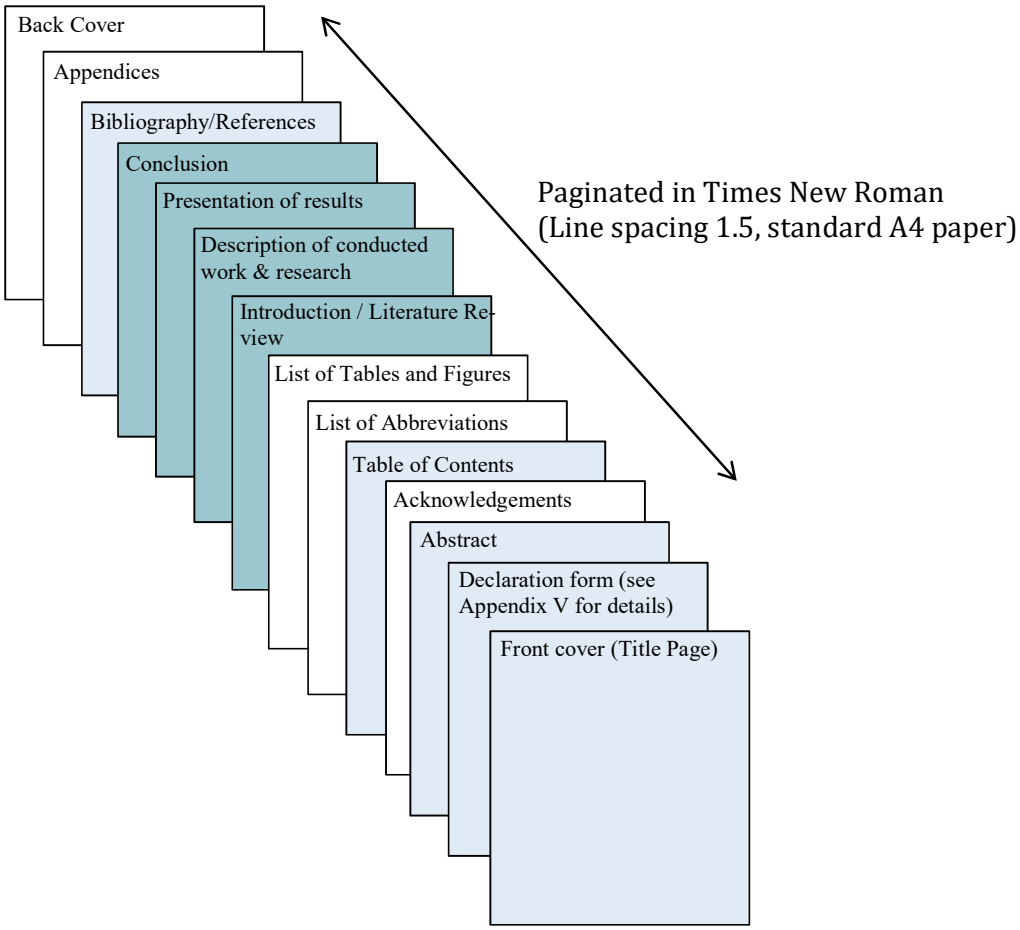
Student	Date	Signature
Lead Supervisor	Date	Signature
Co-supervisor	Date	Signature
Master's Program Coordinator	Date	Signature
Head of Department	Date	Signature
Dean of School	Date	Signature

(Dean's approval is required only for the exceptional case where a supervisor or co-supervisor is external to the department)

Appendix III – Manuscript Format Specifications

1. **Style Requirements**
    - The thesis must be written in English language. Quotations in languages other than English may be included; however, the quotations' translation should be also included.
    - An abstract of the thesis, not exceeding **500** words, should be part of the preliminary material.
    - Supplementary materials, such as questionnaires, large data sets, or copies of photographs, may be placed into appendices. The appendices must be consecutively paginated with the text. The paper quality and margins of the appendices must conform to the standards for the rest of the thesis.
2. **General Thesis Format Requirements**
    - The MSc. Thesis format will be strictly according to the specifications described in this handbook and needs to be limited to **100** pages excluding appendices.
    - The font type will be Times New Roman, in black and size 12 point with the exceptions noted in the detailed guidelines below. The text line-spacing will be double. Lengthy quotations, footnotes, and bibliographies may be single-spaced.
    - Your thesis should be divided into chapters. A chapter should be divided into sections and subsections. Sections and subsections of chapters are to be identified by numbers. Chapters use 1st level numbering, i.e., Chapter 1, 2, 3 etc. chapter sections use 2nd level numbering, i.e., C.1, C.2 where C is the number of the corresponding chapter; e.g., the 3rd section in the 2nd chapter should be numbered as 2.3. Subsections use 3rd level numbering and their numbers are preceded by the chapter and section number, e.g., 2.1.4, 2.1.5 etc. Numbering should be used up to subsections.
    - Computer-generated figures, graphs and other diagrams are acceptable. Each diagram should be numerated, include a caption, and should not be divided between two pages.
    - Tables may be used either in the text or in appendices. All tables should include a numerated header (caption) and named rows and columns.
    - All mathematical and/or chemical equations and relations are considered as text and numbered using a chapter numbering scheme; see above. Detailed, lengthy derivations and mathematical proofs should be placed in Appendices.
    - Page headers or decorative borders should not be used.
    - The text should be justified. The beginning of the first line of text of each paragraph should be indented to **1.25 cm**.
    - The page margins for the text will begin at least **2.5cm** from all sides.
    - The second and subsequent pages should be numbered in Arabic figures in the middle of the top of each page.

3. Detailed Guidelines & Examples
Order of manuscript elements and chapters



Required elements/chapters

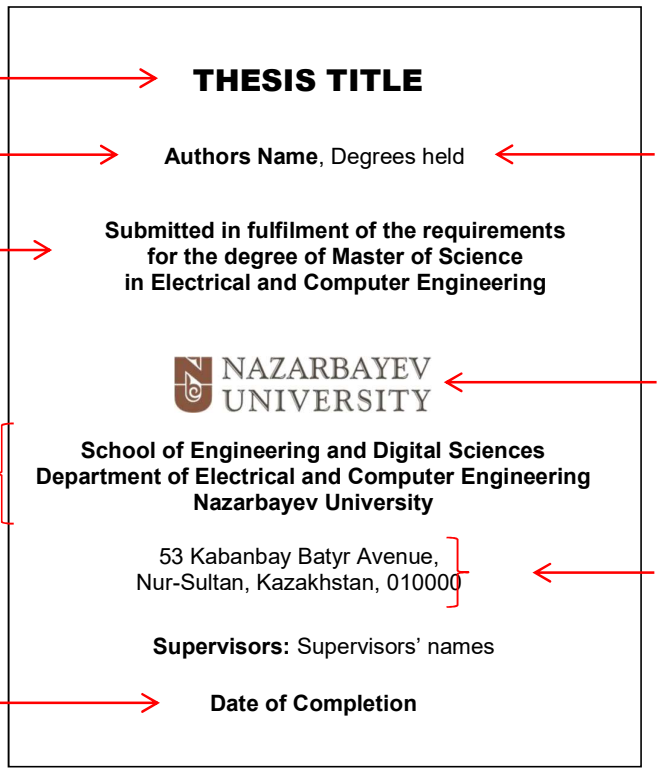
Optional elements

Required chapters (Additional chapters may also be present)

NOTE: All text should by typed using Times New Roman font face. If your word-processing software does not support Times New Roman, substitute with a font face that closely resembles it.

Pagination: All pages must be numbered; page numbers must be displayed on all pages, except the title page. Numbering should be placed in the middle of the top or bottom of each page

Front Cover



Times New Roman (Bold), Size 16

Times New Roman (Bold), Size 15 Enter your name

Times New Roman (Bold), Size 15

Times New Roman, Size 15 Degrees currently attained (i.e. B. Eng)

Authorized University logo

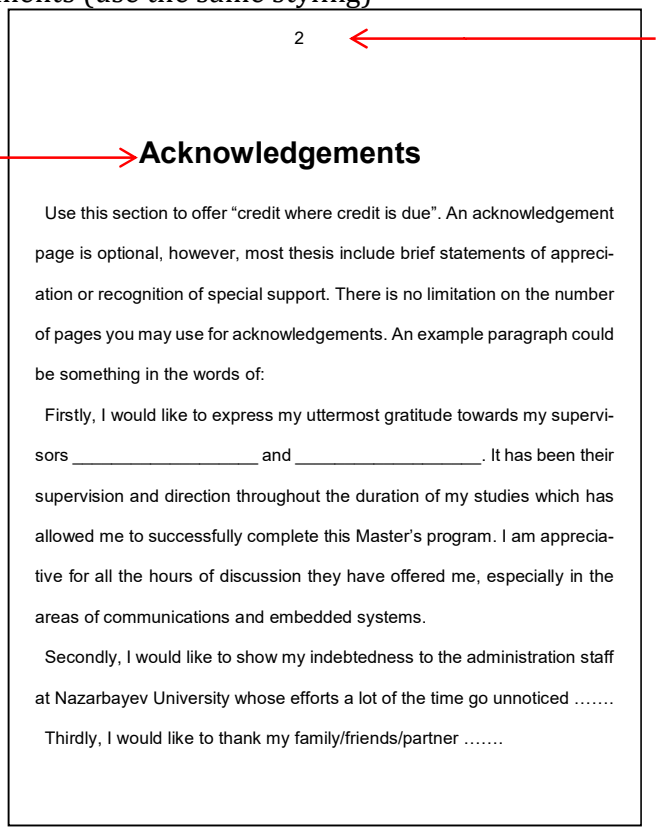
Times New Roman (Bold), Size 15 School, Department, and University Name

Times New Roman, Size 15 Institution Address

Times New Roman (Bold), Size 15 Date of thesis completion (e.g., December 2016)

Insert the declaration form (see Appendix V) as an unnumbered separate page following the cover page.

Abstract & Acknowledgements (use the same styling)

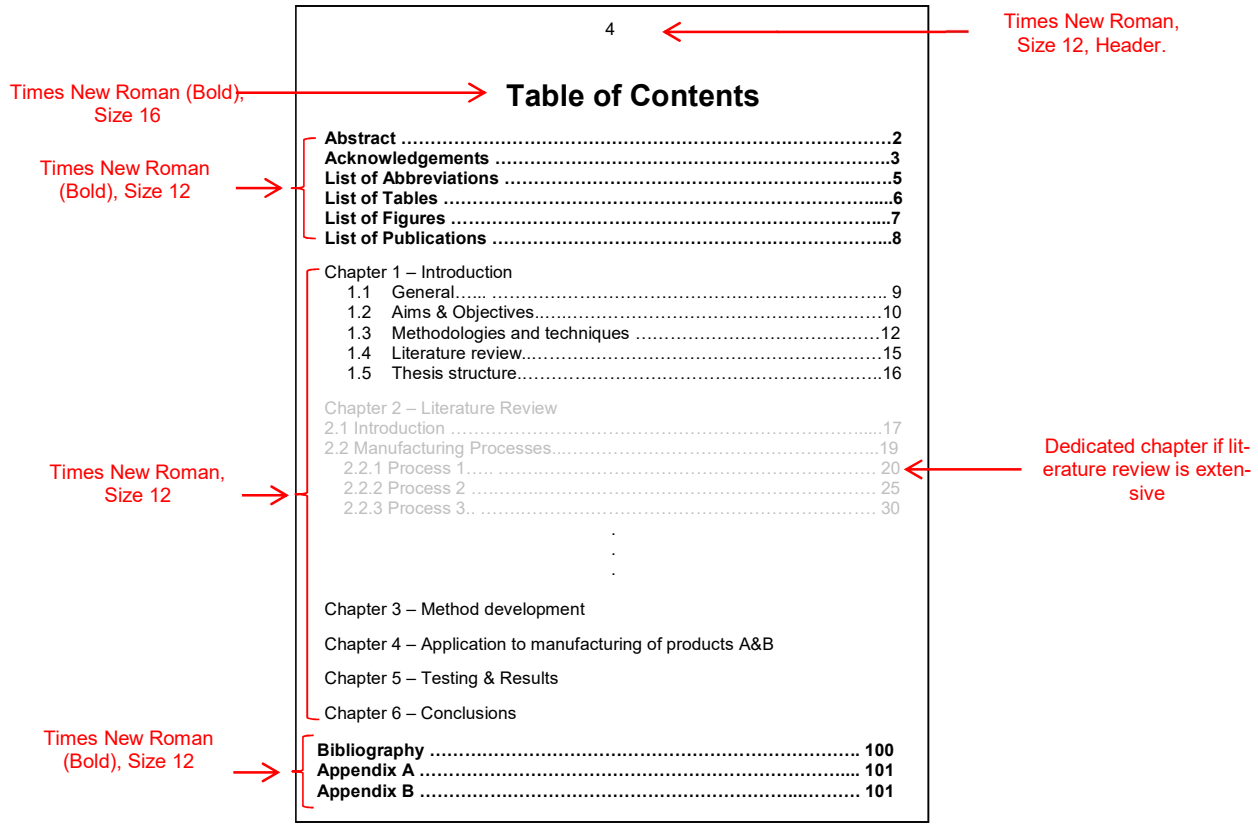


Times New Roman, Size 12, (Alternatively you may print the page numbers at the bottom of the page)

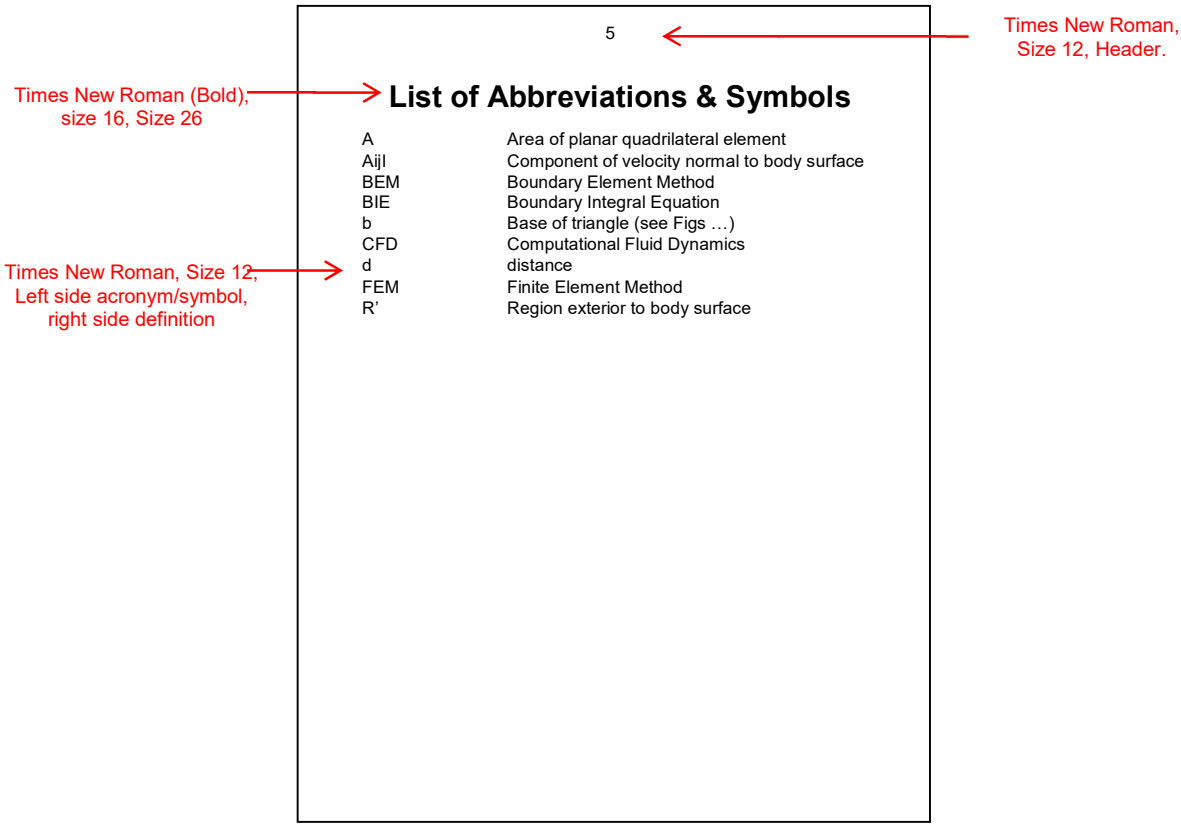
Times New Roman (Bold), Size 16

Times New Roman, Size 12 (If a new page is needed due to many acknowledgments the text will commence at the top of the next page under the header).

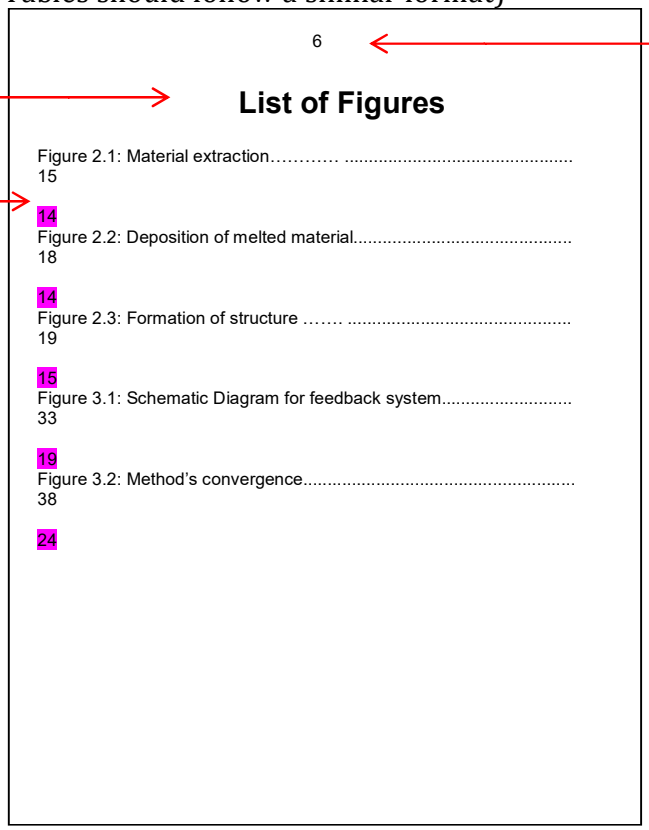
Table of Contents



List of Abbreviations



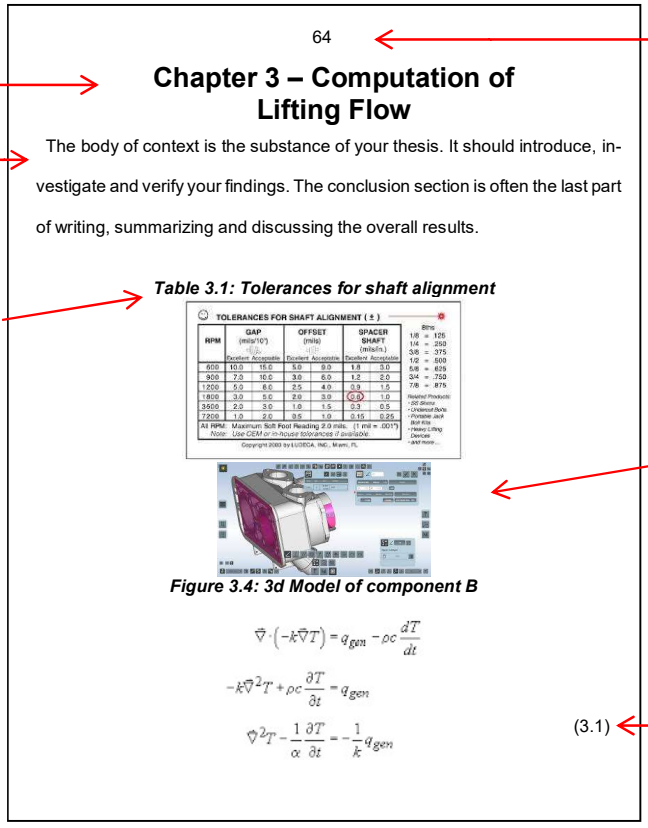
List of Figures (List of Tables should follow a similar format)



6

List of Figures

Chapters



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Chapter 3 – Computation of Lifting Flow

The body of context is the substance of your thesis. It should introduce, investigate and verify your findings. The conclusion section is often the last part of writing, summarizing and discussing the overall results.

Table 3.1: Tolerances for shaft alignment

Figure 3.4: 3d Model of component B

$$\vec{\nabla}\cdot\left(-k\vec{\nabla}T\right) = q_{gen} - \rho c\frac{dT}{dt}$$

$$-k\vec{\nabla}^2 T + \rho c\frac{\partial T}{\partial t} = q_{gen}$$

$$\nabla^2 T - \frac{1}{\alpha}\frac{\partial T}{\partial t} = -\frac{1}{k}q_{gen} \quad (3.1)$$

Bibliography/References

Times New Roman, Size 12, Header.

Times New Roman (Bold), Size 16

Bibliography/References

[1] Aftosmis MJ, Melton JE and Berger MJ. Adaptation and surface modeling for Cartesian mesh methods. AIAA Paper, Collection of Technical Papers. Pt. 2 (A95-36501 09-34) 95-1725. In 12th AIAA Computational Fluid Dynamics Conference and Open forum, San Diego, 1995.

[2] Aiso H. Admissibility of difference approximations for scalar conservation laws. *Hiroshima Math. Journal* 1993; **23**: 15–61.

[3] Allmaras S. Analysis of a local matrix preconditioner for the 2-D Navier–Stokes equations. AIAA Paper 93-3330. In AIAA 11th Computational Fluid Dynamics Conference, Orlando, 1993.

[4] Allmaras S. Analysis of semi-implicit preconditioners for multigrid solution of the 2-D Navier–Stokes equations. AIAA Paper 95-1651. In AIAA 12th Computational Fluid Dynamics Conference, San Diego, 1995.

[5] Allmaras S. Algebraic smoothing analysis of multigrid methods for the 2-D compressible Navier–Stokes equations. AIAA Paper 97-1954. In AIAA 13th Computational Fluid Dynamics Conference, Snowmass, 1997.

[6] Alonso JJ and Jameson A. Fully-implicit time-marching aeroelastic solutions. AIAA Paper 94-0056. In AIAA 32nd Aerospace Sciences Meeting, Reno, 1994.

[7] Alonso JJ, Martinelli L and Jameson A. Multigrid unsteady Navier–Stokes calculations with aeroelastic applications. AIAA Paper 95-0048. In AIAA 33rd Aerospace Sciences Meeting, Reno, 1995.

[8] Anderson WK, Thomas JL and Whitfield DL. Multigrid acceleration of the flux split Euler equations. AIAA Paper 86-0274. In AIAA 24th Aerospace Sciences Meeting, Reno, 1986.

[9] Anderson WK and Venkatakrishnan V. Aerodynamic design and optimization on unstructured grids with a continuous adjoint formulation. AIAA Paper 97-0643. In AIAA 35th Aerospace Sciences Meeting, Reno, 1997.

[10] Anderson BK, Thomas JL and Van Leer B. A comparison of flux vector splittings for the Euler equations. AIAA Paper 85-0122. In AIAA 23rd Aerospace Sciences Meeting, Reno, 1985.

Times New Roman, Size 11, Conform to the referencing section of this handbook.

Appendices

Times New Roman, Size 12, Header.

Times New Roman (Bold), Size 16

Appendices

Times New Roman, Size 12.

Appendices are not necessarily part of every thesis. Appendices may be used for supplementary illustrative material, original data, computer programs, and other material not necessarily appropriate for inclusion within the body text of the thesis.

Times New Roman (Bold, underlined), Size 14

Appendix A

Figure A.1 Shape optimization in additive manufacturing

Appendix B

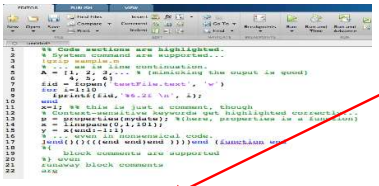

Figure B.1 Code excerpt

Times New Roman (Bold, Italic), Size 12, Note: use appendix letters in numbering figure captions, i.e. A.1, A.2, B.1.

Appendix IV –Referencing style

ASME Referencing style

Text Citation. Within the text, references should be cited in numerical order according to their order of appearance. The numbered reference citation should be enclosed in brackets.

Example
It was shown by Prusa [1] that the width of the plume decreases under these conditions.

In the case of two citations, the numbers should be separated by a comma [1, 2]. In the case of more than two reference citations, the numbers should be separated by a dash [5-7].

List of References. References to original sources for cited material should be listed together at the end of the paper; footnotes should not be used for this purpose. References should be arranged in numerical order according to their order of appearance within the text.
(1) Reference to journal articles and papers in serial publications should include:
· last name of each author followed by their initials
· year of publication
· full title of the cited article in quotes, title capitalization
· full name of the publication in which it appears
· volume number (if any) in boldface (Do not include the abbreviation, "Vol.")
· issue number (if any) in parentheses (Do not include the abbreviation, “No.”)
· inclusive page numbers of the cited article (include “pp.”)
(2) Reference to textbooks and monographs should include:
· last name of each author followed by their initials
· year of publication
· full title of the publication in italics
· publisher
· city of publication
· inclusive page numbers of the work being cited (include “pp.”)
· chapter number (if any) at the end of the citation following the abbreviation, “Chap.”
(3) Reference to individual conference papers, papers in compiled conference proECEdings, or any other collection of works by numerous authors should include:
· last name of each author followed by their initials
· year of publication
· full title of the cited paper in quotes, title capitalization
· individual paper number (if any)
· full title of the publication in italics
· initials followed by last name of editors (if any), followed by the abbreviation, “eds.”
· publisher
· city of publication
· volume number (if any) in boldface if a single number, include, “Vol.” if part of larger identifier (e.g., “PVP-Vol. 254”)
· inclusive page numbers of the work being cited (include “pp.”)
(4) Reference to theses and technical reports should include:

· last name of each author followed by their initials
· year of publication
· full title in quotes, title capitalization
· report number (if any)
· publisher or institution name, city

Sample References

[1] Ning, X., and Lovell, M. R., 2002, "On the Sliding Friction Characteristics of Unidirectional Continuous FRP Composites," ASME J. Tribol., 124(1), pp. 5-13.
[2] Barnes, M., 2001, "Stresses in Solenoids," J. Appl. Phys., 48(5), pp. 2000–2008.
[3] Jones, J., 2000, Contact Mechanics, Cambridge University Press, Cambridge, UK, Chap. 6.
[4] Lee, Y., Korpela, S. A., and Horne, R. N., 1982, "Structure of Multi-Cellular Natural Convection in a Tall Vertical Annulus," Proc. 7th International Heat Transfer Conference, U. Grigul et al., eds., Hemisphere, Washington, DC, 2, pp. 221–226.
[5] Hashish, M., 2000, "600 MPa Waterjet Technology Development," High Pressure Technology, PVP-Vol. 406, pp. 135-140.
[6] Watson, D. W., 1997, "Thermodynamic Analysis," ASME Paper No. 97-GT-288.
[7] Tung, C. Y., 1982, "Evaporative Heat Transfer in the Contact Line of a Mixture," Ph.D. thesis, Rensselaer Polytechnic Institute, Troy, NY.
[8] Kwon, O. K., and Pletcher, R. H., 1981, "Prediction of the Incompressible Flow Over A Rearward-Facing Step," Technical Report No. HTL-26, CFD-4, Iowa State Univ., Ames, IA.
[9] Smith, R., 2002, "Conformal Lubricated Contact of Cylindrical Surfaces Involved in a Non-Steady Motion," Ph.D. thesis, http://www.cas.phys.unm.edu/rsmith/homepage.html

Other referencing styles

You can use any established referencing style as long as you make sure that all referencing uses a single style. Elsevier journals offer the following referencing services and styles (the following example style refers to the journal of Computer Aided Design (CAD)):

Elsevier References

Citation in text: Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list but may be mentioned in the text. If these references are included in the reference list, they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication.

Web references: As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading, if desired, or can be included in the reference list.

References in a special issue: Please ensure that the words 'this issue' are added to any references in the list (and any citations in the text) to other articles in the same Special Issue.

Reference management software: Most Elsevier journals have a standard template available in key reference management packages. This covers packages using the Citation Style Language, such as Mendeley (http://www.mendeley.com/features/reference-manager) and also others like EndNote (http://www.endnote.com/support/enstyles.asp) and Reference Manager (http://refman.com/downloads/styles). Using plug-ins to word processing packages which are available from the above sites, authors only need to select the appropriate journal template when preparing their article and the list of references and citations to these will be formatted according to the journal style as described in this Guide. The process of including templates in these packages is constantly ongoing. If the journal you are looking for does not have a template available yet, please see the list of sample references and citations provided in this Guide to help you format these according to the journal style.

If you manage your research with Mendeley Desktop, you can easily install the reference style for this journal by clicking the link below: http://open.mendeley.com/use-citation-style/computer-aided-design when preparing your manuscript. You will then be able to select this style using the Mendeley plugins for Microsoft Word or LibreOffice. For more information about the Citation Style Language, visit http://citationstyles.org.

Reference style guidelines:

Text: Indicate references by number(s) in square brackets in line with the text. The actual authors can be referred to, but the reference number(s) must always be given.

List: Number the references (numbers in square brackets) in the list in the order in which they appear in the text.

Examples:

Reference to a journal publication:

[1] Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. J Sci Commun 2010;163:51–9.

Reference to a book:

[2] Strunk Jr W, White EB. The elements of style. 4th ed. New York: Longman; 2000.

Reference to a chapter in an edited book:

[3] Mettam GR, Adams LB. How to prepare an electronic version of your article. In: Jones BS, Smith RZ, editors. Introduction to the electronic age, New York: E-Publishing Inc; 2009, p. 281–304.

Note shortened form for last page number. e.g., 51–9, and that for more than 6 authors the first 6 should be listed followed by 'et al.' For further details you are referred to 'Uniform Requirements for Manuscripts submitted to Biomedical Journals' (J Am Med Assoc 1997;277:927–34) (see also http://www.nlm.nih.gov/bsd/uniform_requirements.html).

Journal abbreviations source

Journal names should be abbreviated according to the List of Title Word Abbreviations: http://www.issn.org/services/online-services/access-to-the-ltwa/.

Appendix V –Declaration Form

The signed declaration form that follows should be first page after your report's cover sheet

DECLARATION

I hereby, declare that this manuscript, entitled "*title of thesis"*, is the result of my own work except for quotations and citations which have been duly acknowledged.
I also declare that, to the best of my knowledge and belief, it has not been previously or concurrently submitted, in whole or in part, for any other degree or diploma at Nazarbayev University or any other national or international institution.

(signature of author)

Name:
Date:

Appendix VI –Conflict of Interest

Definitions:

Conflict of interest - refers to a conflict between official University duties and private interests and personal relationships, where the private interests or personal relationships could improperly influence the way in which a person carries out their official duties.

Perceived conflict of interest - where a reasonable person might perceive that such improper influence as described above could exist.

Personal relationships - relationships with individuals or people that extend outside of the University or University duties, or a relationship where a reasonable person might perceive that there could be some bias, either positive or negative, resulting from that relationship. These include relationships with:

1. immediate family, e.g. spouse or partner, parents, children, step-children, etc.;
2. close relatives, e.g. aunts, uncles, cousins, nephews, nieces etc.;
3. rivals, e.g. competitors or persons with whom one has a history of serious conflict or enmity; and
4. all other relationships that could introduce bias in carrying out official duties.

Private interests - refers to any interests that involve potential gain or loss (financial or non-financial) for an individual or for any other person or organization that individual may wish to benefit (e.g. family, friends, associates) or disadvantage (e.g. competitors, rivals).

Rules and Guidelines:

1. All individuals are responsible for identifying, declaring, and managing conflicts of interest that apply to them.
2. Conflicts of interest may affect or have the appearance to affect sound and professional judgement adversely. Conflicts of interest or perceived conflicts of interest must be declared and managed to ensure integrity and transparency.
3. Staff members, students and other individuals who are charged with carrying out University activities and functions have a responsibility to declare and manage conflicts of interest as they arise. When declared, the conflict of interest should be avoided. Where this is not possible, action must be undertaken to ensure that the conflict (or perceived conflict) is managed in a transparent and appropriate manner.
4. Supervisors, chairs of committees/panels/groups and other responsible parties are accountable for ensuring that declared conflicts of interest, real or perceived, are evaluated and managed appropriately.
5. Declarations of conflict of interest should be made by individuals in writing to the relevant supervisor, chair of a committee/panel/group, other relevant person, or body as soon as the conflict is identified. Where circumstances prevent an immediate written declaration (e.g. conflict arises during a meeting), a verbal declaration should be lodged and, if possible, formally noted (e.g. in minutes of the meeting).

6. Where a supervisor, chair of a committee/panel/group, other relevant person or body becomes aware of a conflict of interest (or perceived conflict of interest) that has not been declared they should discuss the matter with the individual and take appropriate actions.
7. The best way in which to handle a conflict of interest is to avoid it. Where it is not possible to avoid a conflict of interest, the MSc ECE committee, the Head of Department, the School's Vice-Dean should be responsible for assessing the risk and taking appropriate actions.