UNIVERSITY OF NOVI SAD
FACULTY OF TECHNOLOGY
NOVI SAD

DOCUMENTATION FOR ACCREDITATION OF

STUDY PROGRAMME FOR

MASTER ACADEMIC STUDIES

MATERIAL AND ENERGY FLOW MANAGEMENT

Content:

INTRODUCTION

Title of study programme	Material and energy flow management
Independent higher education institution performing study programme	University of Novi Sad
Higher education institution performing study programme	Faculty of Technology Novi Sad
Professional -scientific field	Technical – technological sciences
Scientific, professional or artistic filed	Technological engineering
Type of studies	Master academic studies
Scope of the studies expressed in ECTS credits	60 ECTS
Academic title	Master engineer in technology
Length of studies	1 academic year
Year when the realisation of study programme started	-
Year when the realisation of study programme will start (if the programme is new)	2015/2016.
Number of students studying due to this study programme	-
Planned number of students that will enrol at this study programme	16
Date when the programme is accepted by the appropriate institution (quote which)	28/11/2014, Teaching Board of the Faculty of Technology in Novi Sad
Language in which the study programme is conducted	English
Year when the programme is accredited	-
Web address where study programme data can be found	http://tf.uns.ac.rs

Standard 1. The structure of study programme

Description of the structure and content of study programme with the teaching methods

1.1. Study programme has the following elements:

a) Name of study programme: Material and energy flow management
Aims of study programme: Education and training of master engineers in technology in the scientific field - Technological engineering for material and energy flow management in industry and flows concerning industry, in order to be prepared for adequate designing, organisation, control and independent problem solving arising during production process in chemical, oil-petrochemical, food and pharmaceutical industry. The aim of the study programme is also training of students for technological systems management taking into account technological, economic, ecological and social aspects as well as for the application of original and scientifically relevant researches that contribute to the development of new and improvement of the present industrial processes in order to increase energy efficiency, waste flows reduction, environmental protection and the application of zero emission concept in accordance with the legislations and standards of the Republic of Serbia and European Union. (Aims are presented in standard 3 in detail)

b) Type of studies and outcome of studying process: Master engineer in technology.
Implementation of professional, scientific and research activities in the education of human resources for the performance of professional duties in the field of Technological engineering in the scientific field Technological engineering with the title Master engineer in technology. (Competences are presented in standard 4 in detail)

c) Professional, academic i.e. scientific name: After finishing of studies, professional i.e. academic title Master engineer in technology is gained.

d) Conditions for the enrolment at study programme: At master academic studies Material and energy flow management may enrol a person who has completed his undergraduate studies in the field of the same or related field of study programmes for which he applies, achieving at least 240 ECTS credits. Expert Committees appointed by the Teaching Board of the Faculty give an opinion on the possible need for additional programme content that students must master in cases where curriculum of undergraduate studies are not entirely appropriate. Persons who have acquired higher education to the regulations applicable before the entry into force of the Law on Higher Education are eligible to enrol at master academic studies according to the conditions and in the manner prescribed by the Regulations on registration of students at study programmes of the Faculty of Technology in Novi Sad. The order of candidates for admission shall be determined on the basis of general average grade achieved at the undergraduate level and length of study at the undergraduate level. (Requirements for admission are presented in detail in the standard 7.)

e) List of compulsory and elective study areas i.e. subjects with framework content :
At master academic studies Material and energy flow management, there are four compulsory subjects, four electives from a list of eight elective courses, mandatory internships and study research. In Tables 5.1 and 5.3 there is a list of compulsory and elective subjects with ECTS credits, the number of hours of lectures, practical classes and

other forms of teaching. The choice of electives must be made at enrolment. In Appendix 5.2 there is a list of subjects.

f) Modes of the study performance, time required for the study: The studies are conducted in the framework of lectures, auditory and computational practice classes, preparation of project assignments, seminar papers, professional practice and final paper. Total duration of the master academic studies Material and energy flow management is one year (two semesters).

g) Credit value of each subject: Each subject values a certain number of ECTS credits. Credit value of each subject is given in **Table 5.1**

h) Credit value of final paper: at the specialist academic studies it values 10 ECTS credits.

i) Pre-conditions for enrolment of specific subjects or groups of subjects: given in the specification of each subject.

j) Method of selecting subjects from other study programmes: Subjects are selected from the list of elective subjects of the study programme Material and energy flow management.

k) Conditions for transfer from other study programmes within the same or related field of study: There is no possibility for transfer from other study programmes within the same or related field of study, since there is none of them at the higher education institution.

1.2. Scope of the studies: Master academic studies Material and energy flow management value 60 ECTS credits.

Appendix 1.1 Web site of the Faculty of Technology Novi Sad: http://tf.uns.ac.rs

Standard 2. The purpose of study programme

The study programme material and energy flow management emphasizes the profundity of academic knowledge, abilities and skills in the field of technology engineering acquired at the undergraduate level. This study programme enables students to acquire technical and managerial skills necessary for successful work in the field energy efficiency increasing, reduction of energy consumption, waste flows, environmental protection and application of zero emission concept in the field of technology engineering. Study programme material and energy flow management provides an opportunity for students to independently or in a team, by using modern software packages, deepen their knowledge, improve existing and introduce new methods, and acquire necessary skills, regarding technological, economic and social aspects in designing, production, data analysis, marketing, management and implementation of industrial process control. By its concept and structure, the study programme is fully in line with the objectives of the Faculty of Technology in Novi Sad, as a higher education institution. By realizing this kind of concept and structure of study programme, Master engineers in technology are educated, possessing socially justified and useful competencies in European and worldwide frameworks.

Appendix 1.1 Web site of the Faculty of Technology Novi Sad: http://tf.uns.ac.rs

Standard 3. The aims of study programme

Study programme material and energy flow management is based on general engineering, ecological-economic and social principles in industrial production by following world trends of improvement and application of the latest scientific and technological achievements, both in production and in industrial management and environmental protection. Also, the student acquires knowledge of the applicable national and international legislation in the field of material and energy flow management, with the aim of achieving sustainable development and accordance of the constant need for increasing the capacity of the industry with the necessary emphasis on the environmental protection. The student also acquires scientific knowledge on the relationships between economy and wider community, which is of great importance due to the connection of material and energy flows to all spheres of society.

Appendix 1.1 – Web site of the Faculty of Technology Novi Sad: http://tf.uns.ac.rs

Standard 4. The competences of graduate students

Mastering the study program for master academic studies Material and energy flow management should enable graduate students - Master engineer in technology, to acquire the following competences:

- Ability to solve problems in the field of material and energy flow management in industry and related systems industry-environment, taking into account technological, environmental, economic and social aspects.
- Ability to consider relevant parameters for a given technological process and their impact on the values essential for the production capacity increase, reducing investment and maintenance costs reduction, by improving the energy efficiency of the process and reducing negative impacts on the environment.
- Design and simulation of the appropriate process models, by the application of modern software packages, as well as defining material and energy balances, increasing

profitability in the existing plants, by monitoring, controlling and optimizing the process parameters.

- Management of all waste flows (material and energy flow), in order to realize zero emission concept, taking into account the standards / principles of industrial ecology.
- Management of all aspects of minimizing the risk of chemical accidents and disasters, forecasting the potential risks related to different technological methods by the application of the appropriate models.
- Monitoring of energy efficiency of technological and related systems as well as the ability to develop energy efficiency indicators and the interpretation of their mutual influence.
- Writing and running of the projects, important for the sustainable development of local, regional and national communities, taking into account the interdependence of industry, ecology, ecosystem, management and socio-economic environment.
- Effective monitoring and adoption of innovations and results of researches in the field of technological engineering and a clear and unambiguous way of transferring the conclusions, knowledge and concluding strategies to expert and general public;
- Planning, organizing and preparing of relevant technical reports and reports on the results of the work, as well as their oral presentation and submission in printed and / or electronic form.
- Communication with other technical professions and engineering profiles, allowing the possibility for efficient team work.

Appendix 4.1 – Diploma supplement

Standard 5. Curriculum

The curriculum of master academic studies Material and energy flow management was formed to meet the objectives of the study programme. In order to meet the individual preferences of students, the curriculum of study programme includes four elective blocks, each of them consisting of two electives. All subjects are one-semester courses and have the value of the appropriate number of ECTS credits. The order of subject teaching in the study programme is organized in that way, that the knowledge needed for the following subjects are acquired in the previously taught courses. Upon completion of master academic studies, a student acquires 60 ECTS credits. The curriculum is defined by a description of each subject that contains the name, type of subject, year and semester of the studies, the number of ECTS credits, the name of the teacher, the course aims and expected outcomes of knowledge and competence, the pre-conditions for attending the course, course content, recommended literature, teaching methods, assessment and evaluation method and other relevant information. An integral part of the curriculum is a professional practice for a period of 180 classes, which is realized in the relevant scientific-research institutions, organizations for carrying out innovative activities, in companies, public institutions etc. As a part of the study programme material and energy flow management, it is included a study and research work for 60 classes during the second semester of master academic studies. A student completes his/her studies by conducting master thesis which consists of theoretical and methodological preparation, necessary for a complete understanding of the field, in which the master thesis is realized, elaboration and defence of the thesis.

Table 5.1 Timetable of subjects per semesters and years of study for study programme of second level of studies

Table 5.2 Specification of study-research work
Table 5.2A Specification of professional practice
Table 5.2Б Specification of master thesis
Table 5.3 Elective courses at study programme Material and energy flow management
Report 1. Report on the structure of study programme

Appendix 5.1 – Timetable
Appendix 5.2 – Book of subjects
Appendix 5.3 – Decision of Teaching Board of the Faculty of Technology on the acceptance of the study programmes and decision of the Senate on approval of study programmes of the Faculty of Technology in Novi Sad.

Standard 6: Quality, modernity and international accordance of study programme

Study programme material and energy flow management of master academic studies is in accordance with modern scientific developments and comparable to similar programmes at foreign institutions of higher education. The concept of the study programme has provided the compatibility/compliance of the best experiences of education in our country and successful study programmes from European faculties in the field of technological engineering. Study programme material and energy flow management of master academic studies is similar and comparable to accredited study programmes from the following institutions :

1. Trier University of Applied Sciences,
   Institute for Applied Material Flow Management, Birkenfeld, Germany
   International Material Flow Management
   http://www.umwelt-campus.de/ucb/index.php?id=8292&L=1

2. Duke University, Durham, North Carolina, USA
   Master of Environmental Management (MEM)
   http://nicholas.duke.edu/programs/mem

3. Yale School of Forestry & Environmental Studies, New Haven, Connecticut, USA
   Master of Environmental Management (MEM)
   http://environment.yale.edu/academics/degrees/mem/

Study programme material and energy flow management is formally and structurally aligned with the established subject-specific standards for accreditation. The content of this study programme is realized in accordance with European recommendations and standards: an ECTS credit system is introduced, European cooperation and mobility of students and staff is stimulated, comparable criteria and methodologies are introduced, as well as a system of easily recognizable and comparable diploma through Diploma Supplement.

The principle of one-semester subjects and access to further studies is respected. The study programme is aligned with European standards in terms of students' enrolment, study duration, mode of examination and assessment of students, acquiring appropriate ECTS credits, graduation and ways of studying.

Appendix 6.1,2,3 - Data on, at least three accredited foreign programmes, which the programme is aligned with, is given in the description of the standard.

Standard 7: Students' enrolment

The Faculty of Technology, in accordance with the social needs and its own financial, human and technical-technological resources, enrols at master academic studies of study programme Material and energy flow management, certain number of students with budgetary financing and self-financing. At master academic studies Material and energy flow management may enrol a person who has completed his undergraduate studies in the field of the same or related field of study programs for which applies, achieving at least 240 ECTS credits. Expert Committees appointed by the Teaching Board of the Faculty give an opinion on the possible need for additional programme content that students must master in cases where curriculum of undergraduate studies are not entirely appropriate. Persons who have acquired higher education to the regulations applicable before the entry into force of the Law on Higher Education are eligible to enrol at master academic studies according to the conditions and in the manner prescribed by the Regulations on registration of students at study programmes of Faculty of Technology in Novi Sad (**Appendix 7.3**). The order of candidates for admission shall be determined on the basis of general average grade achieved at the undergraduate level and length of study at the undergraduate level. The Faculty makes the list of applied candidates, which makes the unique list of the University of Novi Sad. The right of entry to the master academic studies Material and energy flow management is acquired by the candidate who is ranked at the final list within the anticipated number of students for admission.

Table 7.1 Review of the number of students enrolled at the study programme Material and energy flow management in the academic year 2014/15.

Appendix 7.1 – Competition for enrolment at master academic studies
Appendix 7.2 – Resolution on the appointment of the Committee for students' admission
Appendix 7.3 - Regulations on registration of students at study programmes of Faculty of Technology in Novi Sad

Standard 8: Evaluation and advancement of students

The students' final grade in each of the subjects within the study programme material and energy flow management is formed by continuous monitoring of their work, achieved results and students' engagement during the academic year and at the final exam.
A student overcomes the study programme by taking exams, thereby acquiring a certain number of ECTS credits, in accordance with the plan of the study program. Every single subject in the programme has a certain number of ECTS credits that a student realizes when successfully passes the exam. The number of ECTS credits is determined on the basis of student's workload in mastering certain subjects and by applying a unique methodology of the Faculty of Technology for all study programmes. The performance of students in mastering a particular subject is monitored continuously during classes and it is expressed in points. The maximum number of points that a student can realize in each subject is 100.

A student acquires points in the subject by filling in the pre-exam requirements and passing the exam. The minimum number of points that a student can earn by completing pre-exam requirements during teaching process is 35 and the maximum is 70. The overall success of students in the subject is expressed by a grade form 5 (failed) to 10

(excellent). A student's grade is the result of the total number of points that a student has gained by completing pre-exam requirements and passing the exams, according to the quality of the acquired knowledge and skills.
Pre-exam requirements consist of: presence at lectures, preparation of seminar papers, home works, projects and tests. Additional requirements for the examination are defined separately for each subject. The progress of students during their education is defined by Rules of studies and Regulations on grading system and examinations at the Faculty of Technology in Novi Sad (**Appendix 8.2.**).

Table 8.1 Statistical data on the progress of students in the study programme

Appendix 8.1 – is given in Appendix 5.2 (Book of subjects)
Appendix 8.2 – Rules of studies at the Faculty of Technology in Novi Sad and Regulations on grading system and examinations

Standard 9: Teaching staff

For the realization of the study programme material and energy flow management, it is provided the teaching staff with the necessary professional and academic qualifications and competence as well as experience in pedagogical and educational work. The required number of teachers for the realization of the study programme is 3.17. The total number of teachers in the study programme is higher than required to cover the total number of lecture classes in this study programme. Out of the total number of teachers, 66.67% are permanently employed, full time employees at the Faculty. The percentage of the lecture classes that 100% working time teachers hold is 76.08%. The group size for lectures is up to 16 students. All data on teachers and associates are available to the public on the website of the Faculty of Technology (http://tf.uns.ac.rs). Special attention within the study programme is devoted to professional improvement, promotion and development of the teaching staff in order to improve their knowledge and apply positive experiences in the classroom.

Table 9.0 All data on teaching staff at the institution and the study programme (the list is formed when filling in data in electronic form, the institution is obliged to fill in into this table all the information required).

Table 9.1 Scientific, artistic and professional qualifications of teachers and teaching requirements
Table 9.2 List of teachers involved in the study programme
Table 9.3 Cumulative overview of the number of teachers regarding the fields and major scientific or artistic fields involved in the study programme
Table 9.4 List of associates involved in the study programme

Report 2 Number of teachers due to the needs of the study programme needs
Report 3 Number of associates due to the needs of the study programme needs

Report. Report on the parameters of the study programme (this report follows the filling in of data in electronic form)

Appendix 9.1 - Photocopies of employment registers (in electronic form)
Appendix 9.2 - Regulation on the method and procedure of acquiring the title and employment of teaching staff, associates and researchers at the Faculty of Technology in Novi Sad
Appendix 9.3 - Contracts on teachers' involvement with part-time engagement
Appendix 9.4 - Consent of higher education institution on the teachers' engagement at another higher education institution
Appendix 9.5 – Book of teachers
Appendix 9.6 - Evidence about the public availability of teachers' and associates' data: **Web site of the Faculty of Technology Novi Sad:** http://tf.uns.ac.rs **and the Faculty of Technical Sciences:** http://ftn.uns.ac.rs

Standard 10: Organizational and material funds

In order to perform the study programme are provided appropriate human, spatial, technical-technological, library and other resources are provided, that are adequate to the character of the study programme and the anticipated number of students. The total size of the institution is 7687.43 m^2. The Faculty per student possesses 5.1 m^2 of gross area (5.1 m^2> 4 m^2). Each student has 1.07 places. Students have access to two computer classrooms with 31 computers. The library, which is located within the building of the Faculty of Technology, has 106318 library units. All courses within the study programme are covered by the appropriate textbooks. The Faculty reading room is available to students every day from 7-24 hours.
For the realization of the study programme, the resources from the companies are also used (**Appendix 10.3**).

Table 10.1 List of rooms with the size in m^2 in the institution where the teaching process is performed at the study programme
Table 10.2 List of equipment for carrying out of the study programme
Table 10.3 List of library units relevant to the study programme
Table 10.4 List of textbooks available to students at the study programme
Table 10.5 Coverage of compulsory subjects (books, practice books, workbooks...), which are located in the library or can be bought.

Appendix 10.1 - Extract from the library inventory
Appendix 10.2 - Statement on computer equipment
Appendix 10.3 – Cooperation agreements

Standard 11: Quality control
The first steps in quality control at the Faculty date back to 2001, when the first external evaluation of the Faculty was performed by the European University Association's (EUA) representatives. That year, the Faculty conducted the first major survey of students of all academic programmes and levels of study, made its own SWOT analysis and made the first report on self-evaluation. The commission for quality control and self-evaluation was formed in 2004 (Self-evaluation May 2012, **Appendix 11.1**). The Faculty was involved in the TEMPUS project *Implementing Quality Assurance in Serbian Universities*, in which it was gained valuable experience in ensuring the quality of teaching, scientific research, management of the Faculty and the like. One of the regular activities of the Teaching Board of the Faculty is the analysis of the results obtained by regular surveys of students and teachers and decision making. **Table 11. 1** List of the committee members for quality control
Appendix 11.1 - Report on the results of self-assessment of the Faculty of Technology **Appendix 11.2** – The strategy of quality assurance at the Faculty of Technology in Novi Sad, Self-assessment and evaluation of the quality of work at the Faculty of Technology in Novi Sad, the Regulation on ensuring the quality of teaching process and related activities at the Faculty of Technology, Decision on the adoption of the Regulation on ensuring the quality of teaching process and related activities at the Faculty of Technology **Appendix 11.3** - Regulations on the publishing activities of the Faculty of Technology in Novi Sad **Appendix 11.4** - Extract from the Statute of the Faculty of Technology in Novi Sad - Article 136 - Quality System

Standard 12: Distance-learning studies
Distance-learning studies are not provided within this study programme.