Josip Juraj Strossmayer University of Osijek

Mechanical Engineering Faculty in Slavonski Brod

STUDY PROGRAMME

UNDERGRADUATE STUDY: MECHANICAL ENGINEERING

CONTENTS

1. UNDERGRADUATE STUDY PROGRAMME

1.1. Introduction

Mechanical engineering, belonging to a technical field, contains disciplines which include all phases and processes in a product service life: from idea, design and construction, technology and tools development, production planning and managing, providing services, assembling, carrying out testing, putting in operation, providing maintenance during life cycle to recycling or ecological disposal of waste at the end of the technical or economic service life.

The application of modern computer techniques, tools and systems has broadened the professional skills and employment opportunities of mechanical engineers: Computer Aided Design (CAD) systems are used in all industrial branches and for various products; Numeric Control (NC) and Computer Numeric Control (CNC) machines are more and more found in the wood, textile and food processing industries, while maintenance of equipment, production lines and appliances plays an important role even in hospitals, hotels, road, railway, waterway and air traffic, as well as in the industries which had previously never been interested in mechanical engineers (i.e. processing, building, power, chemical, food, agricultural industries).

The broadened opportunities of mechanical engineers have also put additional demands on their education: it is becoming necessary to gain basic knowledge of processes and methodologies to understand and define the processes of change in the chain of activities from idea to the finished product, its exploitation and recycling. These methodologies are founded both on modern theoretical models and procedures and information technology support and in particular on the application of artificial intelligence (genetic algorithms, neural networks, and expert systems).

There is a growing need for the mechanical engineers. There have been no unemployed young mechanical engineers in the last few years. The demands and needs of the industry have increased so that the students started obtaining grants even in the first years of their study. The reasons for this can be found in the following facts:

- Development of our economy and the increasing needs to appear and remain present at the international markets require new knowledge and skills,

- Entrepreneurial needs (private sector) for the skilled technical workforce, able to technically communicate with the developed manufacturing systems in the European Union, are becoming more and more explicit,

- Small and medium enterprise owners are looking for the young and competent managers to organise modern production and offer services competitive on the international markets.

The programme offers courses necessary to satisfy the requirements of modern manufacturing (new technologies, computer aided manufacturing logistics, information technologies, methods of product development and design, materials engineering). They will provide knowledge and skills necessary for the development of our production companies in order to meet the terms, prices and quality of products and services able to compete internationally.

A comparison with similar programmes in the European Union and the world is given by degree programmes:

- Aristotle University of Thessaloniki, Department of Mechanical Engineering, Gr54006 Greece
- Chalmers University of Technology (Chalmers tekniska högskola), Göteborg, Sweden, Mechanical Engineering (Maskinteknik) (Programme code: TMASA)
- Istanbul Technical University, Dept. of Mechanical Eng. Gümüssuyu TR-34439, Istanbul, Turkey
- Mechanical Engineering, Scotland, Cardiff
- Technical University of Denmark (Danmarks Tekniske Universitet), Lyngby, Denmark, MEK – Department of Mechanical Engineering (Institute for Mekanik, Energy of Konstruktion)
- The Faculty of Mechanical Engineering – Budapest University of Technology and Economics, Bertalan L. u. 2.; H-1521 Budapest, Hungary
- The University of Limerick, College of Engineering, Ireland
- Universidad Carlos III De Madrid, Spain, Technical Industrial Engineering (Mechanics)
- University of Aveiro, Engenharia Mecânica, Campus Santiago – 3810, Aveiro, Portugal
- University of Ljubljana, Faculty of Mechanical Engineering, Mechanical Engineering (Univerza v Ljubljani, Fakulteta za strojništvo)
- University of Maribor, Faculty of Mechanical Engineering, Mechanical Engineering (Univerza v Mariboru, Fakulteta za strojništvo)
- University of Strathclyde, Glasgow, Scotland
- University of Twente (Universiteit Twente), Enschede, Netherlands, Faculty of Engineering Technology – Mechanical Engineering
- University of West Bohemia, Pilsen, Czech Republic, Faculty of Mechanical Engineering (Fakulta strojní Západočeské university)

The past experience confirms the legitimacy of introducing the new subjects which provide the knowledge and skills necessary in developed production companies today. The interest of students to attend lectures has increased when we introduced the subjects based on the new manufacturing or information technologies: Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), Computer Aided Engineering (CAE), and methods: Rapid Prototyping, Finite Element Method, Manufacturing Resources Planning (MRP II), Just in Time (JIT) methods of production management and Condition Based Maintenance.

2. GENERAL INFORMATION

2.1. Title of the study

The title of the study programme is **Mechanical Engineering**

2.2. Responsible for the study

Responsible for the study is the Faculty of Mechanical Engineering in Slavonski Brod of the Josip Juraj Strossmayer University in Osijek.

The study is carried out at the Faculty of Mechanical Engineering in Slavonski Brod. The lecturers from other Faculties within the Josip Juraj Strossmayer University in Osijek are also engaged.

2.3. Duration of the undergraduate study programme

The duration of the study is 6 semesters.

Before the lectures begin, the students can take courses in mathematics and physics (30 hours) to make it easier for them to understand the first year courses; or introduction of mechanical engineering (15 hours) courses to acquire some basic technical knowledge.

In the first year (1st and 2nd semester) the students take the core subjects (mathematics, mechanics, materials and electrical engineering) necessary for the understanding of professional courses; courses in technical drawing and computer graphics and computer applications for the use of software systems and programs in professional courses, as well as the elective one, i.e. the technical language (English and German) is required to enable them the use of the foreign technical literature.

In the second year (3rd and 4th semester), the students are provided with the basic knowledge and skills necessary for independent learning and mastering the technical expertise for their own profession (mathematics, materials, structural elements, production methods, strength of materials, thermodynamics and maintenance).

In the third year (5th and 6th semester), the students take joint specialized courses necessary for the engineers of production engineering to solve problems in manufacturing and service enterprises (fluid mechanics, programming CNC machines, manufacturing machines, manufacturing processes III, heat treatment, tools and appliances, automation, production planning and management, quantitative methods and theories and techniques of measurement).

In addition to these joint courses for graduates of engineering, through elective courses (computer applications, pneumatic and hydraulic systems, probability and statistics, and product assembly), the students are preparing for their orientation to the graduate study.

Through compulsory and elective courses and a final project in the 6th semester, the students gain the necessary width of education for practical work in the manufacturing and service companies.

2.4. Undergraduate study admission requirements

The graduates of high school education programs and of the four-year vocational education programs can enrol the undergraduate engineering program based on:
- Recognizing excellence in high school and grade on the state graduation or
- Results of national competitions.

The candidates who are enrolled on the basis of recognizing excellence in high school and the state graduation results are enrolled based on the following ranking list:
- Grades in high school (average of all grades) to 40% of the total score (max 400 points).
- Results (grades) of the state graduation:
  - Croatian Language (Level B) to 5% of the total score (max 50 points),
  - Mathematics (Level B) to 35% of the total score (max 350 points),
  - Foreign Language (Level B) to 5% of the total score (max 50 points).
- Passed state graduation elective subject Physics (not compulsory) can bring up to 15% of the total score (max 150 points).

The candidates who enrol based on the results of national competitions in Mathematics and Physics (from 1st to 4th grade of high school), with placement from 1st to 3rd place, may enrol directly.

2.5. Competences and employment opportunities

Some of the employment opportunities are:

- Product and component designer with the application of CAD system,

- Technologies designer for conventional manufacturing processes and NC and CNC machines programming,

- Designing tools and appliances

- Organisation of production and manufacturing logistics,

- Management of workshops, services, assembly and repair building-sites,

- Quality control and laboratory testing jobs,

- Jobs connected with the maintenance of equipment and machinery,

- Material supply and selection jobs,

- Inventory management and shipping jobs.

The undergraduate student (with achieved 180 ECTS credits) may proceed (with the adequate grade point average) the graduate study in the program of graduate studies at the Faculty of Mechanical Engineering in Slavonski Brod.

2.6. Academic title

A student must earn at least 180 ECTS points (including a degree project) to obtain a Bachelor's degree in Mechanical Engineering (BEng in Mechanical Engineering).

3. DESCRIPTION OF THE UNDERGRADUATE STUDY PROGRAMME

Based on the past experience of the students' interests and the economy, a survey conducted with 70 managers, opinions of engineers from the practice, about the importance of practice for completion of products, and comparisons with similar programs at universities in the developed countries, the curriculum (for the undergraduate study at the Faculty of Mechanical Engineering in Slavonski Brod) has been developed

3.1. The list of compulsory and elective subjects of undergraduate study

During six semesters of the university undergraduate studies in Mechanical Engineering, general technical and engineering skills are acquired.

Semester I

Course	L	E	ECTS	S	Exam	Code number
Mathematics I	3	3	7	M	*	P 101
Materials I	2	2	5	M	*	P 103
Mechanics I	3	3	7	M	*	P 102
Technical Drawing and Computer Graphics	3	3	8	M	**	P 104
Physical and Health Education I	0	2	1	M	**	P 106
Technical Foreign Language I	1	1	2	O	**	
	12	*14*	*30*		*3*	

Technical Foreign Language I	L	E	ECTS	S	Code number
Technical English Language I	1	1	2	O	P 307
Technical German Language I	1	1	2	O	P 308

Preparatory courses	L	E	ECTS	Code number
Physics	2	0	P	P 111
Mathematics	1	1	P	P 109
Introduction of Mechanical Engineering	1	0	P	P 110

Interpreter abbreviation:
L – Lectures, E – Exercises, S – Status (M – Mandatory, O – Optional, P – Preparatory course)
* Oral or written exam; ** Knowledge verification (program, seminary, colloquy, test)

Semester II

Course	L	E	ECTS	S	Exam	Code number
Electrical Engineering	2	2	5	M	*	P 304
Materials Testing and Properties	2	1	3	M	*	P 608
Mathematics II	3	3	7	M	*	P 201
Mechanics II	3	3	6	M	*	P 202
Computer Aided Preparation and Production	2	3	6	M	**	P 205
Physical and Health Education II	0	2	1	M	**	P 206
Technical Foreign Language II	1	1	2	O	**	
	13	*15*	*30*		*4*	

Technical Foreign Language II	L	E	ECTS	S	Code number
Technical English Language II	1	1	2	O	P 408
Technical German Language II	1	1	2	O	P 409

Semester III

Course	P	V	ECTS	S	Ispit	Šifra
Strength of Materials	2	2	5	M	*	P 203
Design Elements I	3	2	5	M	*	P 302
Mathematics III	2	2	5	M	*	P 301
Materials II	2	2	5	M	*	P 204
Manufacturing Procedures I	4	2	7	M	*	P 303
Physical and Health Education III	0	2	1	M	**	P 306
Technical Foreign Language III	1	1	2	O	**	
	14	*13*	*30*		*5*	

Technical Foreign Language III	L	E	ECTS	S	Code number
Technical English Language III	1	1	2	O	P 506
Technical German Language III	1	1	2	O	P 507

Semester IV

Course	L	E	ECTS	S	Exam	Code number
Design Elements II	2	2	5	M	*	P 401
Maintenance	2	2	5	M	*	P 721
Manufacturing Procedures II	4	2	7	M	*	P 403
Thermodynamics	3	3	7	M	*	P 305
Physical and Health Education IV	0	2	1	M		P 407
Industrial practice [1]	0	5	5	M		
	11	*16*	*30*		*4*	

[1] Industrial practice (1 month)

Interpreter abbreviation:
L – Lectures, E – Exercises, S – Status (M – Mandatory, O – Optional, P – Preparatory course)
* Oral or written exam; ** Knowledge verification (program, seminary, colloquy, test)

Semester V

Course	L	E	ECTS	S	Exam	Code number
Automation	2	2	5	M	*	P 404
Quantitative Methods	2	2	5	M	*	P 605
Fluid Mechanics	3	2	6	M	*	P 501
Machine Tools	2	1	4	M	*	P 504
Manufacturing Procedures III	4	2	7	M	*	P 503
Optional courses	2	1	3	O	**	
	15	*10*	*30*		*5*	

Optional courses	L	E	ECTS	S	Code number
Products Assemblage	2	1	3	O	D 791
Pneumatic and Hydraulic Systems	2	1	3	O	P 610
Computer Programs	2	1	3	O	D 1025
University optional course	2	1	3	O	P 505
Probability and Statistics	2	1	3	O	P 513

Semester VI

Course	L	E	ECTS	S	Exam	Code number
Tools and Devices I	2	1	3	M	*	P 602
Production and Operations Management	3	3	6	M	*	P 502
Programming of CNC Machines and Robots	2	2	4	M	*	P 603
Theory and Technique of Measurements	2	1	3	M	*	P 512
Heat Treatment	2	2	4	M	*	P 754
Final project	0	5	10	M	**	P 720
	11	*14*	*30*		*5*	

Interpreter abbreviation:

L – Lectures, E – Exercises, S – Status (M – Mandatory, O – Optional, P – Preparatory course)

* Oral or written exam; ** Knowledge verification (program, seminary, colloquy, test)

3.2. Description of subjects

A detailed description of each subject is given in this section.

The credit value is given with each subject. ECTS points are defined in the following way: Total number of hours of study workload which forms one ECTS point is determined on the basis of the total number of required working hours for each subject. Therefore the total student workload includes the total time it took for the successful completion of the programme.

Time structure:	Total time %
lectures	20 - 35
seminars	20 – 35
fieldwork	0 – 10
exercises	20 – 35
laboratory work	0 – 10
teaching material study	10 – 15
elaboration of programs	0 - 30
data processing	0 – 10
independent study	20 – 35
study excursions	0 - 10
term paper writing	0 – 10
technical literature reading and studying	10 – 30
exams	0 – 10

The percentage of student workload in defining the total number of ECTS points by subjects varies depending on the subject and amounts to a maximum of 35%.

For 1 credit point, the student workload for teaching material mastering is 27 hours.

P 101 Mathematics I

Brief contents:

Vectors. Quantities. Geometrical Definition of Vector. Basic Operations: Multiplying a Vector by a Scalar, Addition of Vectors. Vectors in a Coordinate System. Scalar Product. Vector Product. Triple Mixed Product. Concept of Vector Space.

Analitic geometry in space. Line. Plane. Line and Plane.

Systems of linear equations. Gauss' s Elimination Method. Gauss-Jordan' s Elimination Method.

Functions. Real Function of a Real Variable. Basic Elementary Functions. Polynomials. Rational Functions. Power Functions. Exponential and Logarithmic Functions. Hyperbolic and Area Functions.Trigonometric and Arcus Functions. Elementary Functions.

Limit and continuity. Limit. Continuity. Properties. Asymptotes.

Derivatives. Concept of Derivative and Velocity. Table of Basic Derivatives. Properties. Derivative of Composite Function. Tangent and Normal. Lagrange' s Formula. Differential. Derivative of Function Represented Parametrically. Derivative of Implicit Function. Derivatives and Differentials of Higher Orders. L' Hospital – Bernoulli' s Rule for Indeterminate Forms. Taylor ' s Formula. Extrema. Curvature. Investigating Functions and Their Graphs.

Sequences and series. Concept of Sequence. Convergent and Divergent Sequence. Properties of Convergent Sequences. Concept of Series. Convergent and Divergent Series. Criteria for Convergence and Divergence of Series. Taylor ' s Series.

Teaching methods and the ways of knowledge assessment:

Lectures, written and oral exercises.

Mandatory literature for study and for exam:

1. D. Jukić, R. Scitovski: Matematika I, Osijek 2000.
2. K. Šeper: Vektori i matrice, Osijek 1998.
3. B.P. Demidovič: Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Danjar, Zagreb 1995.

Exam's type:

Written and oral, at the end of the course.

P 102 Mechanics I

Brief contents:

Familiarizing students with the basic facts of theoretical and practical mechanics – statics. Defining the basic principles and laws of mechanics. Define the basic principles and laws of mechanics. Explaining balance conditions for solid objects, particularly supporting objects. Explaining the internal forces and the ways to define them. Define the concept of gravity and second moment of area.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises. Auditory exercises in groups of up to 30 students. Individual solving of problems under instructor supervision. Weekly homework and solving short oral defense before the teacher of each task. Out of 12, 7 of homework should be positive, otherwise defended the case be re-listen.

Mandatory literature for study and for exam:

1. Matejiček, F.; Semenski, D.; Vnučec, Z.: Uvod u Statiku sa zbirkom zadataka, Strojarski fakultet, Slavonski Brod, 2009. ISBN 978-953-6048-49-6
2. Matejiček, F.; Vnučec, Z.: Elektronički udžbenik MZT RH – 2002-027, Zagreb, 2003: http://www.sfsb.hr/ksk/statika (Dio: Statika)

Additional list of recommended literature:

1. Inženjerski priručnik IP1, Temelji inženjerskih znanja, Školska knjiga, Zagreb, 1996.

Exam's type:

Determination of final grade (85-100 points – excellent, 59 points – fair):
(a) 5 quizzes 10 points (8 points – exempt from taking final exam);
(b) 4 preliminary exams 60 points;
(c) 5 mandatory homeworks 24 points;
(d) regular class attendance 6 points (minimum (a)+(b)+(c)+(d) 59 points - exempt from taking final exam);
(e) written exam – if condition (a)+(b)+(c)+(d), is not satisfied, otherwise minimal requirements is (59-a-c-d) points,
(f) oral exam - if condition (a) is not satisfied.

P 103 Materials I

Brief contents:

Introduction to materials crystallography, metallography, crystallization process, alloy lattice, diffusion etc.
Introduction to mechanical properties of materials: tensile test, hardness and impact tests.
Introduction to Fe–C phase diagrams. Metastable Fe-C phase diagram, stable Fe-C phase diagram. Primary and secondary crystallisation for characteristic carbon Contentss. Mechanical properties in dependence of the structure at particular carbon Contentss.
Introduction to heat treatment basics: heat treatment parameters, change in Fe-C phase diagram due to higher cooling rates, Upton's diagram, austenite, transformation and properties of martensite, application of the Fe-C phase diagram and Upton's diagram for steel quenching. Concept of steel quenching and hardenability, influence on steel properties.
Purpose of alloying, peculiarities in behaviour of typical alloyed steels and carbide influence.
Introduction to mechanical, chemical and other properties of polymeric materials.
Plastomers, elastomers, duromers.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises: auditory and laboratory
Preliminary exam I, II, III, IV during the teaching session.

Mandatory literature for study and for exam:

1. Novosel, M.; Krumes, D.: Željezni materijali (metalografske osnove i tehnička primjena željeznih ljevova), Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 1997.
2. Novosel, M.; Krumes, D.: Željezni materijali II dio Konstrukcijski čelici, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 1995.

Additional list of recommended literature:

1. Riehle, M; Simmchen, E.: Grundlagen der Werkstoftechnik DVFG, Stuttgart, 1997.
2. Schumann: Metallographie, VED DVFG, Leipzig, 1986.
3. Smith, T.: The Science of Engineering Materials, Prentice Hall Inc, 1987.

Exam's type:

Written and oral

P 104 Technical Drawing and Computer Graphics

Brief contents:

Introduction to the technical standards, 3D view, projection methods, orthogonal projections, sections, auxiliary views, dimensioning and rules for providing technical documentation. Application of computers in computer-aided drafting and providing technical documentation. Acquiring knowledge of the indispensable for the engineering communication by technical drawings.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises with individual problem solving. Solving general problems in the field of technical drawing with faculty guidance and help. Using computers in the field of computer graphics and making technical drawings. Practice problems, preliminary exams, creating drawings using computers.

Mandatory literature for study and for exam:

1. Opalić, M.; Kljajin, M., Sebastijanović, S.: Tehničko crtanje, 2. izdanje, Sveučilišta u Osijeku i Zagrebu, Čakovec, 2007.
2. Kljajin, M.; Opalić, M.: Inženjerska grafika, Sveučilište J. J. Strossmayera u Osijeku, Strojarski fakultet u Slavonskom Brodu, 2010.

Additional list of recommended literature:

1. Kljajin, M.: Vježbenica iz tehničkog crtanja, SF, Slavonski Brod, 1995. (interno izdanje)
2. Herold, Z.: Inženjerska grafika, Inženjerski priručnik, Školska knjiga, Zagreb, 1994.
3. Horvatić-Baldasar, K.; Babić, I.: Nacrtna geometrija, Sand d.o.o., Zagreb 2001.
4. Duhovnik, J.; Kljajin, M.; Opalić, M.: Inženirska grafika, Univeza v Ljubljani, Fakulteta za strojništvo, Ljubljana, 2009.

Exam's type:

Written, design exercises and project presentation.

P 106 Physical and Health Education
(the same for 206, 306, 407)

Brief contents:

Health and proper physical development are a base and prerequisite for all human activities, therefore this cultural-educational area is especially important in a cultural-educational process for regular development of all anthropological characteristics of students. The parts this area consists of all add to and have a strong impact on the development of positive hereditary traits of an individual.

Physical and health culture programme is realized through:

1. Basic programme activities compulsory for all students, except for students with health problems for whom a special activity programme, based on the type of the health problem, is organised.

2. Facultative programmes are not compulsory for all students but only for those who in addition to the core programme express a special interest in specific activities of physical training.

3. Elective activities are carried out in an organised way in sports clubs for students interested in a particular sport. Special task of these clubs is the organization of summer and winter vacations for students.

Teaching methods and the ways of knowledge assessment:

Students can choose from the following kineziologic activities (basic programme):

1. monostructural movements : athletics

2. polystructural movements : basketball, volleyball, handball, soccer (male students), tennis, badmington etc.

3. complex movements: competitive gymnastics

Elective activities: mountaineering, winter excursions, skiing.

Mandatory literature for study and for exam:

1. Milanović, D., Jukić, I., Čustonja, Z., Šimek, S. (2006). Kvaliteta rada u sportu. Findak, V. (ur.) Zbornik radova 15. ljetne škole kineziologa Republike Hrvatske ' Kvaliteta rada u područjima edukacije, sporta i sportske rekreacije '. Rovinj, 20-24.06.2006., 35-47.
2. Mraković, M. (1992). Uvod u sistematsku kineziologiju, Fakultet za fizičku kulturu, Sveučilišta u Zagrebu.
3. Findak, V., Prskalo, I. (2004). Kineziološki leksikon za učitelje. Petrinja: Visoka učiteljska škola.

Additional list of recommended literature:

1. Mišigoj-Duraković M. (2007). Kinantropologija-biološki aspekti tjelesnog vježbanja. Kineziološki fakultet Sveučilišta u Zagrebu.
2. Findak, V., Prskalo, I. (2003). Kineziološko gledište o suvremenoj odgojnoj i obrazovnoj problematici. U Zborniku: Odgoj i obrazovanje u razvitku hrvatskog društva, Hrvatski pedagoško-književni zbor, Zagreb, str.143-149.

Exam's type:

There are no exams but compulsory attendance is necessary to obtain the signature.

P 109 Mathematics

Brief contents:

Algebra. Numerical Operations with Common Numbers. Numerical Operations with Concrete Numbers.
Trigonometry. Trigonometry of Right Triangle. Trigonometric Equations. Geometry. Area of the Parallelogram. Area of the Triangle. Area of the Circle. Volume of the Prism and ylinder. Volume of the Pyramid and Cone. Volume of the Sphere. Functions. Linear Function. Quadratic Function. Exponential Function. Logarithmic Function.

Teaching methods and the ways of knowledge assessment:

Lectures and Exercises.

Mandatory literature for study and for exam:

1. Dakić, B.; Elezović, N.: Matematika 3 udžbenik i zbirka zadataka za 3. razred gimnazije, Element, Zagreb 2002.
2. Dakić, B.; Elezović, N.: Matematika 4 udžbenik i zbirka zadataka za 4. razred gimnazije, Element, Zagreb 2002.

Exam's type:

Written and oral.

P 110 Introduction of Mechanical Engineering

Brief contents:

Modern archeology and anthropology confirms that the first human artifact stone blade was made in history. It is therefore necessary methodically show through retrospective history of technology and technical inventions with the aim of introducing students closer to the meaning of the legality of the development of techniques of individual elements through a system of machines. Through this course, at the very beginning of the study, the goal is for students to approach and show the complexity and multidisciplinary study of engineering, areas of engineering in society, the impact of technology on social and economic development. Inform students with the basic methodological approach to the study of mechanical engineering, in order to facilitate understanding of certain students depending on the current trends and technology as applied science. The analysis of technical systems approach and clarify the relationship of technical and other sciences. Factors that influence the development of technology. Relations of production and development techniques. Technical and technological progress and the limits of development. Directions for further development of techniques and tasks in society. Through this course, students will draw attention to the basic principles of methodology of teaching higher education, as a pedagogical and systematically organized form of communication between teacher-students to satisfy the principle outcomes of this level of education, but also the adoption of universal human and social values.

Teaching methods and the ways of knowledge assessment:

Lectures. Analysis of a program. Discusions on topics related to the profession in synergy with the wider social community. Communication workshops to encourage student involvement in the issue of the affirmative and the negation group. Avoiding the frontal in comunication with students and encourage work in groups with the intention of the creative involvement of students in the teaching work. Seminar is the final part of the course, and it is presented an individual written essay based on individual student selected topics.

Mandatory literature for study and for exam:
1. Čatić, I.: Tehnika, temelj kulture – zagovor hrvatske budućnosti, Graphis, Zagreb, 2003.
2. Zbornik: Filozofija i tehnika, Hrvatsko filozofsko društvo, Zagreb, 2003.
3. Winston, B.: Media Technolgy and Society: From the Telegraph to the Internet, Routledge, London, 2003.

Additional list of recommended literature:

1. Arnold, Gehlen : Duša u tehničkom dobu, AGM, Zagreb, 2004.
2. Rapo, V.: Ženski ručni rad u školama kontinentalne Hrvatske, Hrvatski školski muzej, Zagreb, 2003.
3. Rapo, V.: Muški ručni rad u pučkim, građanskim i učiteljskim školama kontinentalne Hrvatske, Hrvatski školski muzej, Zagreb, 2004.
4. Burger, H.: Filozofija tehnike, Naprijed, Zagreb, 1989.
5. Bazala, V.: Pregled povijesti znanosti, ŠK, Zagreb, 1980.
6. Dadić, Ž.: Povijest ideja i metoda u matematici i fizici, Školska knjiga, Zagreb, 1992.

Exam's type:

During the teaching activity in the discussion and group work in kretivnom participating students the possibilities of evaluation of student activities, a seminar with the default task in the form of essays, which replaces the production of the written examination, there was a complete evaluation. The oral examination is used if a student in the previous phase of evaluation is not satisfied with the achievements and / or if the student has not made as directed the seminar task as an essay.

P 111 Physics

Brief contents:

The course spreads and consolidates the physics knowledge of the students. The special attention is given to the developing of the qualitative engineering sense for the physical quantities, states and processes, to help students in the easier and deeper understanding of the professional courses. On the beginning of the course, special attention is given to the understanding and applications of scalar/vector physical quantities (nature, units, numerical values and additional information). Following four parts of the course from mechanics (kinematics, statics, dynamics and fluid mechanics) and thermodynamics include discussions – core qualitative analysis as well as quantitative estimates of the physical states and processes, the series of simple and complex examples of the mechanical engineering systems. In that way, the students with finished high school get to know mechanical engineering better, and the students that finished vocational schools consolidates their knowledge of physics. Remaining two parts of the course – substance structure (atoms and molecules) and structure of the matter (solids, liquids and gases), are devoted to the system microanalysis without which are impossible the deeper understanding of the macro methods of the materials, fluid mechanics, thermodynamics and other mechanical engineering courses.

Teaching methods and the ways of knowledge assessment:

Lectures: Discussions about important topics from selected parts of physics, using slides from: Physics – grounds for discussion (http://brod.sfsb.hr/~zkolumb/fizika/). Students are stimulated to take parts in discussions. Optional seminar paper. Continual assessment.
Exercises: –

Mandatory literature for study and for exam:

1. Z. Kolumbić, D. Kozak: Fizika– podloge za diskusiju (e-udžbenik dostupan na poveznici: http://www.sfsb.hr/~zkolum/Fizika/)

Additional list of recommended literature:

1. Hering E., Martin R., Stohrer M.: Physik für Ingenieure, 10th Edition; 1017 s; Springer, 2007; 3540210369
2. Eichler J.: Physik – Grundlagen für das Ingenieurstudium – kurz und praegnant, 3. Auflage; 351 s; Springer, 2007; 3834802239
3. Ohanian H.C., Markert J.T.: Physics for Engineers and Scientists, Third Edition; Volume One, Part 1a; 255 p; Norton & Company, 2007; 0393974227.
4. Ohanian H.C., Markert J.T.: Physics for Engineers and Scientists, Third Edition; Volume One, Part 1b; 265 p; Norton & Company, 2007; 0393112071

Exam's type:

Optional exam – validation of (a) activity during lectures and (b) Seminar paper.

P 201 Mathematics II

Brief contents:

Integrals. Indefinite Integral. Table of Basic Integrals. Methods of Integration. Integrals of Rational Functions. Integrals of Some Irrational Functions. Integrals of Tri gonom etric Functions. Definite Integral. Newton - Leibniz ' es Formula. Applications of Definite Integral. Improper Integrals.

Differential F, quations. Basic Notions. Field of Directions. Orthogonal Trajectories.First - Order Diffcrential Equations: Equation with Variables Separable, Hoinogeneous Equalion, Linear Equation, Bernoulli' s Equation.Second - Order Differential Equation with Constant Coefficients. Variation of Constants. Reducing the Order. System of Differential Equations.

Teaching methods and the ways of knowledge assessment:

Lectures. Exercises.

Mandatory literature for study and for exam:

1. Z. Pavić: Matematika za inženjere (udžbenik sa zbirkom zadataka u pripremi, E-sadržaji Strojarskog fakulteta)
2. B. P. Demidovič: Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Danjar, Zagreb 1995.
3. A. Borzan i drugi: Riješeni zadaci iz više matematike-Svezak III, Školska knjiga, S Zagreb 1991.

Exam's type:

Written and oral.

P 202 Mechanics II

Brief contents:

Familiarizing students with the basic facts of theoretical and practical mechanics – kinematics and kinetics. Defining the basic principles and laws of motion. Explaining the meaning of trajectory and position of an object, as well as its speed and acceleration and the equations governing motion. Explaining movement of solid objects in a straight line as well as more complex movement. Explaining the kinetics of an object and a system of objects and solid objects: the terms for work, force, inertial moment, rotational moment, potential and kinetic energy. Defining the term for inertial moment of a solid object. Explaining straight line and circular motion of a solid object under the influence of forces and moments. The goal is to encourage students to develop a methodical approach to solving general multi-body movement problems.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises. Auditory exercises in groups of up to 30 students. Individual solving of problems under instructor supervision. Weekly homework and solving short oral defense before the teacher of each task. Out of 12, 7 of homework should be positive, otherwise defended the case be re-listen..

Mandatory literature for study and for exam:

1. Matejiček, F.; Semenski, D.; Vnučec, Z.: Uvod u Statiku sa zbirkom zadataka, Strojarski fakultet, Slavonski Brod, 2009. ISBN 978-953-6048-49-6
2. Matejiček, F.: Kinematika sa zbirkom zadataka, Strojarski fakultet, Slavonski Brod, 2009. ISBN 978-953-6048-47-2
3. Matejiček, F.: Kinetika sa zbirkom zadataka, Strojarski fakultet, Slavonski Brod, 2010. ISBN 978-953-6048-55-7
4. Matejiček, F.; Vnučec, Z.: Elektronički udžbenik MZT RH – 2002-027, Zagreb, 2003: http://www.sfsb.hr/ksk/statika (Dio: Kinematika i dio: Kinetika)

Additional list of recommended literature:

1. Inženjerski priručnik IP1, Temelji inženjerskih znanja, Školska knjiga, Zagreb, 1996.

Exam's type:

Determination of final grade (85-100 points – excellent, 59 points – fair):
(a) 5 quizzes 10 points (8 points – exempt from taking final exam);
(b) 4 preliminary exams 60 points;
(c) 5 mandatory homeworks 24 points;
(d) regular class attendance 6 points (minimum (a)+(b)+(c)+(d) 59 points - exempt from taking final exam);
(e) written exam – if condition (a)+(b)+(c)+(d), is not satisfied, otherwise minimal requirements is (59-a-c-d) points,
(f) oral exam - if condition (a) is not satisfied.

P 203 Strength of Materials

Brief contents:

This course is a foundation to many advanced techniques that allow engineers to design structures, predict failures and understand the physical properties of materials. "Strength of materials" gives the student basic tools for stress, strain and strength analysis. Mechanics of deformable bodies: definitions of stress/strain components, stress and strain transformations, principal stresses, Mohr's circle for stress and strain, classification of material behavior, generalized Hooke's law, elastic constants. Stress concentrations. Engineering applications to: uniaxial loaded members and simple structures, torsion of circular rods and tubes, bending and shear stresses in prismatic beams, deflection of beams, curved beams. Thermal stresses. Statically indeterminate problems. Strain energy, yield theories, combined bending and torsion loads of beams. Buckling of columns. Introduction to experimental stress analyses: strain gauges method and method of photo-elasticity. The aim of the course is to skill the students to be able to solve solely simple problems of the strength of constructions elements.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises with individual problem solving. Students helped by instructor solve problems in class-room. Several problems are assigned for work at home and their grades form the basis for deciding upon the final grade in exercises of this course. The course includes demonstration use of equipment and results of experimental stress analyses

Mandatory literature for study and for exam:

1. Alfirević, I.: Nauka o čvrstoći I, Tehnička knjiga, Zagreb 1995.
2. Alfirević, I.: Nauka o čvrstoći, str. 479-570, Inženjerski priručnik, IP1 Temelji inženjerskih znanja, Školska knjiga, Zagreb 1996.
3. Vnučec, Z.: Vježbenica iz Čvrstoće (zadaci za vježbe i pitanja za usmeni ispit), SF-Slavonski Brod, Slavonski Brod 2004.

Additional list of recommended literature:

1. Vnučec, Z.: Vježbenica ispitnih zadataka (podržanih programima na računalu) iz Čvrstoće, SF-Slavonski Brod, Slavonski Brod 2004.
2. Šimić, V.: Otpornost materijala I, Školska knjiga, Zagreb 1992.
3. Brnić, J.: Nauka o čvrstoći, Školska knjiga, Zagreb 1991.
4. Cheng, Fa-Hwa.: Statics and Strength of Materials, Glencoe/McGraw-Hill, New York 1998.
5. Solecki, R., Jay Conant, R.: Advanced Mechanics of Materials, Oxford University Press, New York and Oxford, 2003.

Exam's type:

Written and oral exam (achievements of the students should be checked successively by 6 colloquiums in the written form).

P 204 Materials II

Brief contents:

Introduction to systematization of iron materials. Selection of materials. Casting (steel, gray, white, nodular, etc.) Structural steels: general structural steels, boiler sheets, steels for carburizing, steels for quenching and tempering, steels for nitriding, steels resistant to wear, spring steels, steels resistant to corrosion and aggressive media. Tool steels. Properties of tool materials. Introduction to the basics of heat treatment, influences of annealing, austenitizing, quenching and tempering on the properties of steel. Introduction to the basics of systematization of non-iron materials (non-ferrous metals with alloys and other materials). Bearing materials. Properties of bearing alloys. Composite materials, properties and use (structure, corrosion and tribology).

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises. Auditory exercises and laboratory.
Preliminary exam I, II, III during the teaching session.

Mandatory literature for study and for exam:

1. Novosel, M.; Krumes, D.: Željezni materijali (metalografske osnove i tehnička primjena željeznih ljevova), Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 1997.
2. Novosel, M.; Krumes, D.: Željezni materijali II dio Konstrukcijski čelici, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 1995.
3. Marušić, V.: Tribologija u teoriji i praksi, Strojarski fakultet, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 2008.

Additional list of recommended literature:

1. Smith, T.: The Science of Engineering Materials, Prentice Hall Inc., 1987.
2. Studemann: Wärmebehandlung von Stahl, Gusseisen und Nichteisenmetalle, Carl Hanser Verlag, München, 1984.
3. Vitez, I.; Kladarić, I.; Marković, R.: Europske norme za nove sustave označivanja čelika, Tehnički vjesnik 10, (2003), 1, 49-61.

Exam's type:

Written and oral.

P 205 Computer Aided Preparation and Production

Brief contents:

Computer system. Computer system elements (hardware, software, orgware, lifeware, dataware, netware). Components of computer. Communication. Division of computers. Computer work methods and modalities. Data organisation and management. Data safety and security. Algorithm features. Algorithm steps. Flow charts. Flow charts symbols. Basic algorithm structures. Algorithmic definition of technical problems and computer support in functions and activities of production preparation. Significance of modern information technologies and possibility of applying in preparation and production process.

Teaching methods and the ways of knowledge assessment:

Lectures. Exercises: laboratory (Microsoft Excel, Microsoft Word, Microsoft PowerPoint, electronic catalogue for tool selection, CAM system, chosen information system modules).

Mandatory literature for study and for exam:

1. Majdandžić, N.: Primjena računala, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 1996.
2. Microsoft Hrvatska d.o.o. http://www.microsoft.com/hr/hr/default.aspx

Additional list of recommended literature:

1. Langer, M.: Excel za Windows 2003; Miš d.o.o., Zagreb, 2004.
2. Gookin, D.: Word 2003 za neupućene; Mikro knjiga Beograd, 2004.
3. Maštruko, O.: Windows XP od početnika do gurua, Sysprint d.o.o., Zagreb, 2003.
4. Galić, D.: Office XP - sve što želite i ne želite znati, Sysprint d.o.o., Zagreb, 2002.
5. Majdandžić, N.: Računalom integrirana proizvodnja, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 1997.
6. Rehq J. A.; Kraebber H. W.: Computer Aided Manufacturing, Prentice Hall, 2004.
7. Zhang, H.; Alting, L.: Computerized Manufacturing Process Planning, Chapman &Hall, London, Glasgow, New York, Tokyo, Melbourne, Madras, 1994.

Exam῾s type:

Written exam.

P 301 Mathematics III

Brief contents:

Vector analysis. Scalar and Vector Fields. Level Surfaces and Vector Curves. Differential Vector Calculus. Directional Derivative. Gradient. Divergence. Curl. Nabla and Delta Calculus**.** Integral Vector Calculus. Line Integral. Directional Circulation Density and Curl. Surface Integral. Total Flux Density and Divergence. Integral Formulae. Potentials.

Numerical analysis: Errors. Solving Equations: Iteration Method, Tangent Method, Secant Method. Interpolation Polynomial: Lagrange Polynomial, Newton Polynomial, Spline Polynomial. Solving Integrals: Trapezoidal Rule, Simpson's Rule. Solving Differential Equations.

Teaching methods and ways of knowledge assessment:

Lectures. Auditory exercises.

Mandatory literature for study and for exam:

1. Šeper, K., Pavić, Z.: Vektorska analiza, Vodič i zadaci, Građevinski fakultet Sveučilišta u Osijeku 1997 (E-sadržaji Strojarskog fakulteta)

Exam's type:

Written and oral.

P 302 Design Elements I

Brief contents:

Introduction to mechanical elements and their classification. Analysis of dynamic toughness during design and dimensioning of machine elements. Safety factors. Standardization and tolerances. Shapes of rigid and flexible couplings, as well as joint elements. Tubular lines, joint elements and regulation of medium flow.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises with individual problem solving from selected chapters. Solving practical problems with faculty guidance and help with creating the program.

Mandatory literature for study and for exam:

1. Decker, K. H., Elementi strojeva, Golden marketing - Tehnička knjiga, Zagreb 2006.
2. Kljajin, M.: Elementi strojeva I (podloge za vježbe), Stezni, zavareni i vijčani spoj (P1), SF, Slavonski Brod, 2001. (interno izdanje)
3. Kljajin, M.: Elementi strojeva I (podloge za vježbe), Ručna dizalica (P2), SF, Slavonski Brod, 2001. (interno izdanje)

Additional list of recommended literature:

1. Shigley, J. E.; Mischke, C. R.; Budynas, R.: Mechanical Engineering Design, Seventh Edition, 7th Edition, ISBN: 0-07-292193-5, McGraw-Hill High Education, 2003.
2. Shigley, J. E.; Mischke, C. R.; Brown, T. H.: Standard Handbook of Machine Design, Third Edition, ISBN: 0-07-144164-6, McGraw-Hill High Education, 2004.
3. Cvirn, Ž.; Herold, Z.: Elementi konstrukcija, FSB-Zagreb 2000.

Exam's type:

Written and oral exam (written exam is in two parts: theoretical + numerical), theoretical requirement can be completed by passing the 1st and 2nd preliminary exam.

P 303 Manufacturing Procedures I

Brief contents:

Acquainting of students with fundamentals of foundry engineering and metal casting procedures. Acquainting with fundamental technological possibilities of metal shaping by casting and with simulation methods for defining parameters of manufacturing procedure. In the course moulding techniques, metal melting and castings defects will be presented.

Review and systematization of manufacturing procedures in the contemporary industrial production. Acquainting of students with fundamentals of polymer materials science and with polymers processing into final products.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises: auditory, visits to foundries, laboratory, design.
During the teaching session tests are provided to assess the knowledge.

Mandatory literature for study and for exam:

1. Ivan Budić: Osnove tehnologije kalupljenja, Jednokratni kalupi I dio, II izmijenjeno i dopunjeno izdanje, Strojarsku fakultet, Slavonski Brod, 2010.
2. Ivan Budić, Zoran Bonačić-Mandinić: Osnove tehnologije kalupljenja, Jednokratni kalupi II dio, Strojarsku fakultet, Slavonski Brod, 2004.
3. Ivan Budić: Posebni ljevački postupci, I dio, Strojarsku fakultet, Slavonski Brod, 2006.
4. Ivan Budić: Posebni ljevački postupci, II dio, Strojarsku fakultet, Slavonski Brod, 2009.
5. Raos, Pero; Šercer, Mladen. Teorijske osnove proizvodnje polimernih proizvoda. Slavonski Brod: Strojarski fakultet u Slavonskom Brodu Sveučilišta u Osijeku i Fakultet strojarstva i brodogradnje Sveučilišta u Zagrebu 2010.

Additional list of recommended literature:

1. I. Katavić, *Ljevarstvo*, Tehnički fakultet Sveučilišta, Rijeka, 2001.,
2. ASM Metal Handbook, Melting and Casting, vol. 5 B, ASM, Metals Park, Ohio, 1972.
3. Čatić, Igor. Proizvodnja polimernih tvorevina. Zagreb: Društvo plastičara i gumaraca, 2006.

Exam's type:

Written and oral exam.

P 304 Electrical Engineering

Brief contents:

Introduction to the basic laws of electrical engineering and electronics in the following areas: electrostatics, magnetism, analysis of DC circuits, analysis of AC circuits, power transformers, introduction to electronics. The course also gives description of basic measurement and calculation methods to determine basic electrical quantities, an overview of applied basic elements of circuits, electronic components and technology for the production of electronic elements and circuits. Basic components and simple electronic circuits are analyzed with a comparison of analog and digital electronics.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises: auditory exercises, laboratory exercises
During the teaching session: two written tests for inspection of knowledge.

Mandatory literature for study and for exam:

1. V. Pinter: Osnove elektrotehnike 1 i 2, Tehnička knjiga, Zagreb, 1975.
2. M. Essert, Z. Valter: Osnove elektrotehnike, Sveučilište u Zagrebu, 1990.
3. J.Grilec, D.Zorc: Osnove elektronike, Školska knjiga, Zagreb, 1993.,

Additional list of recommended literature:

1. M. Essert, G. Sečak, B. Skalicki: Vježbe iz elektrotehnike, Sveučilište u Zagrebu, 1980.
2. Z. Valter, A. Vidić: Upute za laboratorijske vježbe iz elektrotehnike.
3. A.S.Sedra, K.C.Smith: Microelectronic Circuits, Saunders College Publ. 1991.,
4. T.L.Floyd: Electronic devices, Charles E.Merrill Publ.Comp.,1984.

Exam's type:

Seminar, written and oral exam.

P 305 Thermodynamics

Brief contents:

The basic definitions. Thermal state. Properties. System Energy. Equilibrium and non-equilibrium processes. The mass conservation law.
The first law of thermodynamics for closed and steady open systems.
The ideal gases and ideal non-compressible matter. The thermal equation of the ideal gas. Polytropic change state in closed systems. (Work, heat and change of internal energy.) Polytropic change state in open systems. (Power, heat rate flow, and change of enthalpy. Cycles. Clockwise (heat engines) and counter clockwise (refrigerators and heat pumps). Carnot, Otto and Diesel cycle as an ideal gas cycles. The second law of thermodynamics. Reversible and irreversible processes in closed and open systems. The lost of available work. Real gases (vapors.) Evaporation. The characteristic reversible processes with vapor in closed and open systems. The vapor cycles. Carnot and Rankine cycles. Refrigeration cycles. Vapor compression refrigeneration cycles.
Basis of heat transfer: conduction, convection and radiation. Steady state heat conduction: plane wall and cylinder. Convection heat transfer. Forced and natural convection. The basis of heat transfer during boiling and condensation. Radiation, black body, real surfaces. Net radiation heat transfer: nearly surfaces; two surface enclosure. Heat exchangers (recuperators). Non - dimensional calculation of parallel and counter flow heat exchangers.

Teaching methods and the ways of knowledge assessment:

Lectures. Exercises. During the teaching session tests are provided to assess the knowledge.

Mandatory literature for study and for exam:

1. Galović, A: Termodinamika I, FSB, Zagreb, 2007.
2. Galović, A.: Termodinamika II, FSB, Zagreb, 2007.
3. http://www.sfsb.hr/~mzivic/TERMvjezbe.html, M.Živić: Termodinamika-vježbe, riješeni zadaci

Additional list of recommended literature:

1. Halasz, B.: Zbirka zadataka iz uvoda u termodinamiku, FSB Zagreb, 2009.
2. Cengel, Y.A; Boles, M.A.: Thermodynamics, An Engineering Approach with Student Resources DVD, McGraw Hills, 2010.
3. Incropera, F.; DeWitt, D.; Bergman, T.L.;Lavine,A.S.: Introduction to Heat Transfer, John Wiley and Sons, 2007.
4. http://www.sfsb.hr/test/index.html, TEST –The Expert System for Thermodynamics

Exam's type:

Written and oral.

P 307 Technical English Language I

Brief contents:

The main aim is to develop strategies which will enable the students to understand technical texts and extract the necessary information, acquire the terminology, recognise the language structures, translate write summaries.

Technical texts dealing with various engineering subjects are analysed: Engineering, General Principles of Dynamics, Energy, Hydroelectric and Solar Power Generation, Thermodynamics – Energy Conversion, Fluid Mechanics.

There is no progression in terms of the difficulties of language structures and they are dealt with as they appear in a text. Still, particular attention is given to the categories characteristic of the register of technical English: passive and participle constructions, modals, compounds, tenses, word formation, etc.

Teaching methods and the ways of knowledge assessment:

The given tasks are fulfilled through exercises in rhetorical analysis, vocabulary and phraseology expansion and development of the skills necessary for defining, classifying, listing, describing, translating, logically interpreting of compounds, summary writing.

Mandatory literature for study and for exam:

1. Hercezi – Skalicki, M.: 'Reading Technical English for Academic Purposes', Školska knjiga, Zagreb, 1993.
2. Harding, K. & Taylor, L.: 'International Express – Intermediate (New Edition)', Oxford University Press, 2005.

Additional list of recommended literature:

1. Master, P.: 'English Grammar and Technical Writing', Office of English Language Programs of the U.S. Department of State, Washington, DC, 2004.
2. Bujas, Ž.: 'Veliki englesko – hrvatski rječnik', Nakladni zavod Globus, Zagreb, 1999.
3. Bujas, Ž: 'Veliki hrvatsko-engleski rječnik', Nakladni zavod Globus, Zagreb, 1999.
4. Šetina, S.: 'Englesko-hrvatski rječnik općeg i proizvodnog strojarstva', Strojarski fakultet Slavonski Brod, 1999.
5. Cebalo, R.: 'RJEČNIK strojarskih tehnologija', vlastito izdanje, Zagreb, 1998.
6. Lambert, V. & Murray, E.: 'Everyday Technical English', Longman, 2003.

Exam's type:

Written (at the end of the course).

P 308 Technical German Language I

Brief contents:

The main aim is to develop strategies which will enable the students to understand technical texts and extract the necessary information, acquire the terminology, recognise the language structures, translate, write summaries.

Technical texts dealing with various engineering subjects are analysed: Grundlagen technischer Systeme, technisches Grundwissen, Materie und die Funktionsklassen der Sachsysteme, Energie, Information, etc.

There is no progression in terms of the difficulties of language structures and they are dealt with as they appear in a text. Still, particular attention is given to the categories characteristic of the register of technical German: passive and participle constructions, modals, compounds, tenses, word formation, etc.

Teaching methods and the ways of knowledge assessment:

The given tasks are fulfilled through exercises in rhetorical analysis, vocabulary and phraseology expansion and development of the skills necessary for defining, classifying, listing, describing, translating, logically interpreting of compounds, summary writing.

Mandatory literature for study and for exam:

1. Štambuk, Z., Marinić, D.: 'Deutsch und Technik: Materie, Energie, Information', Školska knjiga, Zagreb, 1993.
2. Rosandić, Ž.: 'Izbor tekstova za njemački jezik', SF, Slavonski Brod, 2009. (interno izdanje)
3. Uroić, M., Hurm, A.: 'Njemačko-hrvatski rječnik', Školska knjiga, Zagreb, 1994.

Additional list of recommended literature:

1. Medić, I.: 'Kleine deutsche Grammatik', Školska knjiga, Zagreb, 1992.
2. Muljević, V.: 'Elektrotehnički rječnik (njemačko – hrvatski)', Školska knjiga, Zagreb, 1996.
3. Cebalo, R.: 'RJEČNIK strojarskih tehnologija', vlastito izdanje, Zagreb, 1998.
4. Leitner, H: 'Njemačko – hrvatski rječnik', Školska knjiga, Zagreb, 1998.

Exam's type:

Written (at the end of the course).

P 401 Design Elements II

Brief contents:

Introduction to characteristics, dimensioning methods, and design of machine elements for the transfer of power and rotational motion. Classification of power and motion transfer systems. Shafts and axles. Sliding and roller bearings. Couplings. Belt drive using flat belts. Belt drive using v-belts. Friction drive. Cylindrical gears, cone gears, screw gears. Worm gears. Chains and sprockets. Elements for the transfer of power and rotational motion.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises with individual problem solving from selected chapters. Solving practical problems with faculty guidance and help with creating the program.

Mandatory literature for study and for exam:

1. Decker, K. H., Elementi strojeva, Golden marketing - Tehnička knjiga, Zagreb 2006.
2. Oberšmit, E.: Ozubljenja i zupčanici, SNL, Zagreb 1982.
3. Kljajin, M.: Elementi strojeva II (podloge za vježbe), Vratilo (P3), SF, Slavonski Brod, 2003. (interno izdanje)
4. Kljajin, M.: Elementi strojeva II (podloge za vježbe), Lamelna spojka (P4), SF, Slavonski Brod, 2003. (interno izdanje)
5. Kljajin, M.: Elementi strojeva II (podloga za vježbe), Reduktor (P5), SF, Slavonski Brod, 2004. (interno izdanje)

Additional list of recommended literature:

1. Shigley, J. E.; Mischke, C. R.; Budynas, R.: Mechanical Engineering Design, Seventh Edition, 7th Edition, ISBN: 0-07-292193-5, McGraw-Hill High Education, 2003.
2. Shigley, J. E.; Mischke, C. R.; Brown, T. H.: Standard Handbook of Machine Design, Third Edition, ISBN: 0-07-144164-6, McGraw-Hill High Education, 2004.
3. Cvirn, Ž.; Herold, Z.: Elementi konstrukcija, FSB-Zagreb 2000.

Exam's type:

Written and oral exam (written exam is in two parts: theoretical + numerical), theoretical requirement can be completed by passing the 1st and 2nd preliminary exam.

P 403 Manufacturing Procedures II

Brief contents:

Fundamentals of metal forming. Metal forming advantages. Approach to metal forming. Division of metal forming. Formability of material – generally. Malleability. Deformability. Ability of material for deep drawing. Plasticity of material. Deformability of material. Experimental defining deformability of material. Elastic and plastic deformations. Influence of plastic deformation on changing in structure and of the material properties. Recristalization. State of stress. Stress state and distribution of stress. General equations. Methods of plastomechanics. Force production methods. Volume constancy. Logarithmic deformation. Velocities. Homogeneous forming. Principle of flow. Flow conditions for 1D, 2D and 3D state of stress. Friction. Plastic flow stress. Ideal deformation work. Elemental plasticity theory: upsetting, broaching, deep drawing, bending, extruding and rolling. Material heating.

Examination and systematization of machining and its application.
Introducing students with theoretical thesis in machining, cutting tools, forces and cutting resistances, heat treatment processes in machining and accuracy of machining.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises: auditory exercises, laboratory classes. During the teaching session tests are provided to assess the knowledge.

Mandatory literature for study and for exam:

1. Grizelj, B.: "Alati i naprave", Strojarski fakultet Slavonski Brod 2004.
2. Grizelj, B.: "Oblikovanje metala deformiranjem", Strojarski fakultet Slavonski Brod 2002.
3. Grizelj, Branko; Seuček, Ivan, "Rezni alati : noževi, glodala". Slavonski Brod : Strojarski fakultet u Slavonskom Brodu(sveucilisni udzbenik), 2007.
4. Grizelj, Branko, "Strojevi za oblikovanje metala deformiranjem". Slavonski Brod : Strojarski fakultet u Slavonskom Brodu(sveucilisni udzbenik), 2007.
5. Grizelj, Branko, "Oblikovanje lima deformiranjem", Slavonski Brod : Strojarski fakultet u Slavonskom Brodu, 2009 (knjiga).
6. Šavar, Š. : Obrada metala odvajanjem čestica I , pojedina poglavlja, Sveučilišna naklada Liber, Zagreb 1991.
7. Cebalo, R.. : Obrada odvajanjem čestica – podsjetnik za ispit, Zagreb 2000.

Additional list of recommended literature:

1. Povrzanović, A.: "Obrada metala deformiranjem", Fakultet strojarstva i brodogradnje Zagreb, 1996.
2. Hribar, J.: "Plastična obrada metala", Fakultet strojarstva i brodogradnje Zagreb, 1975.
3. Musafija, B.: "Obrada metala plastičnom deformacijom", Svjetlost Sarajevo, 1988.
4. Lange, K.: "Umformtechnik" Band I-IV, Spring Verlag, 1989-1993.
5. Fritz, H.; Schulze, G.: "Fertigungstechnik", VDI VERLAG, 1995.
6. Math, M.: "Uvod u tehnologiju oblikovanja deformiranjem", Fakultet strojarstva i brodogradnje, Zagreb, 1999.
7. Amstead, B.H.; Ostwald, P.F.; Begeman, M.L.: Manufacturing processes, VII ed., John Wiley & Sons, New York, 1979.

Exam's type:

Written and oral.

P 404 Automation

Brief contents:

Modern means of production automation: computers, robots. System and its characteristics. Systems according to process control, examples. Analysis and synthesis of the systems. System stability, stability criterion. Mathematical model of the process: thermal and mechanical process. Analysis in time domain, standard types of input changes, basic dynamic elements. Frequency domain analysis. Complex domain analysis, transfer function, block algebra. Automation elements: sensors, actuators and regulators. Basics of PLC programming.

Teaching methods and the ways of knowledge assessment:
Lectures.
Exercises: auditory, laboratory.

Mandatory literature for study and for exam:

1. T.Šurina: Automatska regulacija, Školska knjiga, Zagreb, 1981.
2. V. Kecman: Osnove automatike, zadaci iz automatske regulacije, Školska knjiga, Zagreb, 1988.
3. N. Perić, I. Petrović: Računalno upravljanje sustavima - predavanja, Fakultet strojarstva i računarstva, Mostar, 2005.
   http://act.rasip.fer.hr/materijali/17/CCS_SKRIPTA_Naslovna_Stranica.pdf
   http://act.rasip.fer.hr/materijali/17/CCS_SKRIPTA_AU.pdf (18.03.2010.)
4. Handouts na predavanjima.

Additional list of recommended literature:

1. N. Perić, I. Petrović: Automatizacija postrojenja i procesa. Skripta, FER, 2005.
2. R. Žanetić: Vođenje procesa u proizvodnji (Skripta za internu upotrebu), Kemijsko-tehnološki fakultet u Splitu, Sveučilišta u Splitu, Split, 2006.
   www.ktf-split.hr/~zanetic/vodjenje.doc (18.03.2010.)
3. Juraj Božičević: Temelji automatike I i II, Školska knjiga Zagreb, 1980.

Exam's type:

Written and oral exam.

P 408 Technical English Language II

Brief contents:

The main aim is to develop strategies which will enable the students to understand technical texts and extract the necessary information, acquire the terminology, recognise the language structures, translate write summaries.

Technical texts dealing with various engineering subjects are analysed: Engineering Materials, Material Processing, Welding, Bearings, Tribology.

There is no progression in terms of the difficulties of language structures and they are dealt with as they appear in a text. Still, particular attention is given to the categories characteristic of the register of technical English: passive and participle constructions, modals, compounds, tenses, word formation, etc.

Teaching methods and the ways of knowledge assessment:

The given tasks are fulfilled through exercises in rhetorical analysis, vocabulary and phraseology expansion and development of the skills necessary for defining, classifying, listing, describing, translating, logically interpreting of compounds, summary writing.

Mandatory literature for study and for exam:

1. Hercezi – Skalicki, M.: 'Reading Technical English for Academic Purposes', Školska knjiga, Zagreb, 1993.
2. Harding, K. & Taylor, L.: 'International Express – Intermediate (New Edition)', Oxford University Press, 2005.

Additional list of recommended literature:

1. Master, P.: 'English Grammar and Technical Writing', Office of English Language Programs of the U.S. Department of State, Washington, DC, 2004.
2. Bujas, Ž.: 'Veliki englesko – hrvatski rječnik', Nakladni zavod Globus, Zagreb, 1999.
3. Bujas, Ž: 'Veliki hrvatsko-engleski rječnik', Nakladni zavod Globus, Zagreb, 1999.
4. Šetina, S.: 'Englesko-hrvatski rječnik općeg i proizvodnog strojarstva', Strojarski fakultet Slavonski Brod, 1999.
5. Cebalo, R.: 'RJEČNIK strojarskih tehnologija', vlastito izdanje, Zagreb, 1998.
6. Lambert, V. & Murray, E.: 'Everyday Technical English', Longman, 2003.

Exam's type:

Written (at the end of the course).

P 409 Technical German Language II

Brief contents:

The main aim is to develop strategies which will enable the students to understand technical texts and extract the necessary information, acquire the terminology, recognise the language structures, translate, write summaries.

Technical texts dealing with various engineering subjects are analysed: Grundlagen technischer Systeme, Technisches Grundwissen, Materie und die Funktionsklassen der Sachsysteme, Energie, Information, etc.

There is no progression in terms of the difficulties of language structures and they are dealt with as they appear in a text. Still, particular attention is given to the categories characteristic of the register of technical German: passive and participle constructions, modals, compounds, tenses, word formation, etc.

Teaching methods and the ways of knowledge assessment:

The given tasks are fulfilled through exercises in rhetorical analysis, vocabulary and phraseology expansion and development of the skills necessary for defining, classifying, listing, describing, translating, logically interpreting of compounds, summary writing.

Mandatory literature for study and for exam:

1. Štambuk, Z., Marinić, D.: 'Deutsch und Technik: Materie, Energie, Information', Školska knjiga, Zagreb, 1993.
2. Rosandić, Ž.: 'Izbor tekstova za njemački jezik', SF, Slavonski Brod, 2009. (interno izdanje)
3. Uroić, M., Hurm, A.: 'Njemačko-hrvatski rječnik', Školska knjiga, Zagreb, 1994.

Additional list of recommended literature:

1. Medić, I.: 'Kleine deutsche Grammatik', Školska knjiga, Zagreb, 1992.
2. Muljević, V.: 'Elektrotehnički rječnik (njemačko – hrvatski)', Školska knjiga, Zagreb, 1996.
3. Cebalo, R.: 'RJEČNIK strojarskih tehnologija', vlastito izdanje, Zagreb, 1998.
4. Leitner, H: 'Njemačko – hrvatski rječnik', Školska knjiga, Zagreb, 1998.

Exam's type:

Written (at the end of the course).

P 501 Fluid Mechanics

Brief contents:

Properties of fluids. Real and ideal fluids. Viscosity. Determination of viscous force. Viscometer. Equation of jet trajectory. Forces in a fluid. Equation of motion of fluid particle. Compressibility of liquids. Criterions of incompressibility of flow. Equilibrium of fluid particle. Fluid statics in a gravitational field. Pascal's principle. Measurement of pressure. Manometers. Differential manometers. Hydraulic press. Barometers. Hydrostatic force on a plane surface. Hydrostatic force on a curved surface. Buoyant force. Measurement of density. Kinematics of fluid flow. Lagrangian and Eulerian descriptions of motion. Material derivative. Path lines and stream lines. Bernoulli's equation. Velocity measurement. Pitot and Prandtl-Pitot tube. Venturi tube. Siphon. Time for reservoir discharge. Fluid dynamics. Integral forms of basic laws of physics: Conservation of mass, Momentum principle. Moment of momentum, Conversation of energy. Basic laws for onedimensional flow. Modified Bernoulli equation. Graphical presentation of Bernoulli equation. Cavitation. Dimensional analysis of circulation about a body. drag Dimensional analysis of flow in closed conduits (Darcy-Weisbach equation). Hydraulic calculation of pipelines. Frictional losses. Minor losses. Energetic characteristics of hydraulic machines. Calculation of pressure drop, discharge and diameter of pipe. Calculation of friction in noncircular conduits.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises: auditory, laboratory
During the teaching session tests are provided to assess the knowledge.

Mandatory literature for study and for exam:

1. Virag, Z.: Mehanika fluida-odabrana poglavlja, primjeri i zadaci, FSB Zagreb, 2002.
2. http://www.sfsb.hr/~mzivic/MehFvjezbe.html, M. Živić: predavanja i vježbe iz Mehanike fluida

Additional list of recommended literature:

1. Fancev, M.: Mehanika fluida, članak u Tehničkoj enciklopediji br. 8, 1982.
2. Cengel, Y., A.; Cimbala, J., M: Fluid Mechanics (with Student Resources DVD), Fundamentals and Application, Mc Graw Hill, 2009.

Exam's type:

Written and oral.

P 502 Production and Operations Management

Brief contents:

Basic terms, information and documentation flow in the manufacturing company. The importance of production preparation in different types of manufacturing companies. Tasks and activities of the production preparation. Construction preparation of production. Construction documentation. Technological preparation of production. Description of the technological process. Factors that affect the technological process and approaches to the process planning. Raw material selection. Operations sequencing. Machine and machine tools selection. Determination of the base surfaces. Machining parameters selection. Time calculation. Technological documentation. Tools preparation. Materials preparation. Determining the economic production quantity and the cost of the product.

Basic terms, state of art and trends in production management. Production functions in business system. Production management. Planning and planning methods (line charts, net diagrams, operational research methods…). Production types and modalities. Operative preparation. Launching. Scheduling. Scheduling models and methods. Priority. Resources and capacities. Calculation of capacities. Monitoring and controlling. Models of warehouse management system in single, serial and continuous production.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises: auditory and laboratory exercises, seminar papers (design of technological processes).

Mandatory literature for study and for exam:

1. Majdandžić, N.; Lujić, R.; Matičević, G.; Šimunović, G.; Majdandžić, I.: Upravljanje proizvodnjom, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 2001.
2. Majdandžić, N.; Čuljak, S.: Priprema proizvodnje I, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 1991.

Additional list of recommended literature:

1. Gačnik, V; Vodenik, F.: Projektiranje tehnoloških procesa-optimizacija režima i vremena obrade, Tehnička knjiga Zagreb, 1990.
2. Jurković, M.; Tufekčić, Dž.: Tehnološki procesi – projektiranje i modeliranje, Univerzitet u Tuzli, Tuzla, 2000.
3. Buchmeister, B.; Polajnar, A.: Priprava proizvodnje za delo v praksi, Fakulteta za strojništvo Maribor, Maribor 2000.
4. Scallan, P.: Process Planning: The design/manufacture interface, Butterworth-Heinemann, 2003.
5. Mikac, T.; Blažević, D.: Planiranje i upravljanje proizvodnjom, Tehnički fakultet, Zavod za industrijsko inženjerstvo i management, Katedra za organizaciju i operacijski management, Rijeka, 2007.
6. Polajner, A.; Buchneiter, B.; Leber, M.: Organizacija proizvodnje, Univerza v Mariboru, Fakultet za strojništvo,2002.
7. Plajner, A.; Buchneiter, B.; Leber, M.; Pandža, K.; Kalpič, B.; Rojs, T.; Vujica-Herzog, N.; Palčič, I.; Fulder, T.; Meža, P.: Menadžment proizvodnih sistemov, Univerza v Mariboru, Fakultet za strojništvo,2004.
8. Roger, G. Schroeder: Upravljanje proizvodnjom – Odlučivanje u funkciji proizvodnje, Četvrto izdanje, Mate d.o.o, Zagreb, 1999.
9. Vila, A.; Leicher, Z.: Planiranje proizvodnje i kontrola rokova. Informator, Zagreb, 1976.

Exam's type:
Written and oral.

P 503 Manufacturing Procedures III

Brief contents:

Students will be introduced into basics of production process of materials joining by welding and to basics of structures surface protection. Welding technology is very important process in manufacturing of complex products. Often, this joining process is irreplaceable, especially in manufacturing of products that operate at extremely high or low exploitation temperatures, which are exposed to aggressive media or to influence of dynamic stress in service. Course covers theoretical and practical basics of welding technology, equipment for welding, influencing variables and possible failures at welding.

Students will be also introduced to surface protection technology which is on disposal to engineers for corrosion protection and damages reduction. The aim of course is a detail approach to presentation and analysis of corrosion damage problems on mechanical and other structures and to finding out theoretical and practical solutions for materials protection.

Teaching methods and the ways of knowledge assessment:

Lectures. Auditorium, laboratory and industrial exercises. Completing of written forms (templates) for exercise.

Mandatory literature for study and for exam:

1. Lukačević,Z. Zavarivanje, Strojarski fakultet u Slavonskom Brodu, 1998.
2. Samardžić,I. i dr. Analiza tehnologičnosti zavarenih konstrukcija, digitalni udžbenik, http://www.sfsb.hr/kth/zavar/index.html
3. I. Esih, Z. Dugi: Tehnologija zaštite od korozije I i II, Zagreb, 1990.
4. I. Esih, Osnove površinske zaštite, Zagreb 2003.

Additional list of recommended literature:

1. Zbornici radova 1. – 5 međunarodnog znanstveno-stručnog savjetovanja o tehnologiji zavarivanja, izdavač Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2001, 2003., 2005., 2007. i 2009.
2. Znanstveno stručni časopis Zavarivanje i zbornici radova sa znanstveno stručnih skupova, Hrvatsko društvo za tehniku zavarivanja, Zagreb.
3. Kralj, S., Andrić, Š.: Osnove zavarivačkih i srodnih postupaka, Sveučilište u Zagrebu, 1992., ISBN 86-7819-043-4
4. Zbornik radova « EUROCORR2003» Budapest, Hungary, 2003
5. Meden, G.; Pavletić, A.; Pavletić, D.: Osnove zavarivanja, Rijeka, Tehnički fakultet u Rijeci, 2000.

Exam's type:

Written and oral.

P 504 Machine Tools

Brief contents:

Types and classification of machine tools: machines for chip removal processes, machines for plastic deformation and other machines in production. Introduction of students with technological aspects and performances of machine tools. Acquainting with knowledge about the possibilities of machining on classic (conventional) and non-conventional machines in order to improve productivity and economics of machining. Introduction of students with special–purpose machines and production lines and their modules: working, feeding and supplementary devices as well as devices for workpiece handling.

Teaching methods and the ways of knowledge assessment:

Lectures. Exercises (auditory exercises, laboratory excercises), Introduction with machine tools and devices in machinery and demonstration of application of machining procedures in Laboratory (workshop) During the teaching session tests are provided to assess the theory and numerical examples.

Mandatory literature for study and for exam:

1. Grizelj, B.: "Alati i naprave", Strojarski fakultet Slavonski Brod 2004.
2. Grizelj, B.: "Oblikovanje metala deformiranjem", Strojarski fakultet Slavonski Brod 2002.
3. Grizelj, Branko; Seuček, Ivan, "Rezni alati : noževi, glodala". Slavonski Brod : Strojarski fakultet u Slavonskom Brodu(sveucilisni udzbenik), 2007.
4. Grizelj, Branko, "Strojevi za oblikovanje metala deformiranjem". Slavonski Brod : Strojarski fakultet u Slavonskom Brodu(sveucilisni udzbenik), 2007.
5. Grizelj, Branko, "Oblikovanje lima deformiranjem", Slavonski Brod : Strojarski fakultet u Slavonskom Brodu, 2009 (knjiga).
6. R. Cebalo: Alatni strojevi i obradni sustavi, Vedograf, Zagreb 1999.
7. R. Cebalo :Obradni strojevi – II : zadaci. Zagreb : Vlastito izdanje, 1998.

Additional list of recommended literature:

1. R. Zdenković, Atlas alatnih strojeva, Sveučilišna naklada Liber, Zagreb, 1991.
2. R. Cebalo: Obradni sustavi, Vedograf, Zagreb 2000.
3. B.H. Amstead; P.F. Ostwald; M.L. Begeman, Manufacturing processes, VII ed., John Wiley & Sons, New York, 1979

Exam's type:

Written and oral (written, oral, semester project presentation, semester project proposal).

P 506 Technical English Language III

Brief contents:

The main aim is to develop strategies which will enable the students to understand technical texts and extract the necessary information, acquire the terminology, recognise the language structures, translate write summaries.

Technical texts dealing with various engineering subjects are analysed: Electrical and Electronic Engineering, Computers, Electronics and Automation, Engine Fundamentals, Production Management, Ergonomics.

There is no progression in terms of the difficulties of language structures and they are dealt with as they appear in a text. Still, particular attention is given to the categories characteristic of the register of technical English: passive and participle constructions, modals, compounds, tenses, word formation, etc.

Teaching methods and the ways of knowledge assessment:

The given tasks are fulfilled through exercises in rhetorical analysis, vocabulary and phraseology expansion and development of the skills necessary for defining, classifying, listing, describing, translating, logically interpreting of compounds, summary writing.

Mandatory literature for study and for exam:

1. Hercezi – Skalicki, M.: 'Reading Technical English for Academic Purposes', Školska knjiga, Zagreb, 1993.
2. Harding, K. & Taylor, L.: 'International Express – Intermediate (New Edition)', Oxford University Press, 2005.

Additional list of recommended literature:

1. Master, P.: 'English Grammar and Technical Writing', Office of English Language Programs of the U.S. Department of State, Washington, DC, 2004.
2. Bujas, Ž.: 'Veliki englesko – hrvatski rječnik', Nakladni zavod Globus, Zagreb, 1999.
3. Bujas, Ž: 'Veliki hrvatsko-engleski rječnik', Nakladni zavod Globus, Zagreb, 1999.
4. Šetina, S.: 'Englesko-hrvatski rječnik općeg i proizvodnog strojarstva', Strojarski fakultet Slavonski Brod, 1999.
5. Cebalo, R.: 'RJEČNIK strojarskih tehnologija', vlastito izdanje, Zagreb, 1998.
6. Lambert, V. & Murray, E.: 'Everyday Technical English', Longman, 2003.

Exam's type:

Written (at the end of the course).

P 507 Technical German Language III

Brief contents:

The main aim is to develop strategies which will enable the students to understand technical texts and extract the necessary information, acquire the terminology, recognise the language structures, translate, write summaries.

Technical texts dealing with various engineering subjects are analysed: Grundlagen technischer Systeme, Technisches Grundwissen, Materie und die Funktionsklassen der Sachsysteme, Energie, Information, etc.

There is no progression in terms of the difficulties of language structures and they are dealt with as they appear in a text. Still, particular attention is given to the categories characteristic of the register of technical German: passive and participle constructions, modals, compounds, tenses, word formation, etc.

Teaching methods and the ways of knowledge assessment:

The given tasks are fulfilled through exercises in rhetorical analysis, vocabulary and phraseology expansion and development of the skills necessary for defining, classifying, listing, describing, translating, logically interpreting of compounds, summary writing.

Mandatory literature for study and for exam:

1. Štambuk, Z., Marinić, D.: 'Deutsch und Technik: Materie, Energie, Information', Školska knjiga, Zagreb, 1993.
2. Rosandić, Ž.: 'Izbor tekstova za njemački jezik', SF, Slavonski Brod, 2009. (interno izdanje)
3. Uroić, M., Hurm, A.: 'Njemačko-hrvatski rječnik', Školska knjiga, Zagreb, 1994.

Additional list of recommended literature:

1. Medić, I.: 'Kleine deutsche Grammatik', Školska knjiga, Zagreb, 1992.
2. Muljević, V.: 'Elektrotehnički rječnik (njemačko – hrvatski)', Školska knjiga, Zagreb, 1996.
3. Cebalo, R.: 'RJEČNIK strojarskih tehnologija', vlastito izdanje, Zagreb, 1998.
4. Leitner, H: 'Njemačko – hrvatski rječnik', Školska knjiga, Zagreb, 1998.

Exam's type:

Written (at the end of the course).

P 512 Theory and Technique of Measurements

Brief contents:

The students are introduced to the fundamentals of technical measurements and the methodology of calculation of measuring uncertianty. Units of SI system and theoretical basis for measurement of physical quantities. Measurements at industrial processes: design of the measuring instruments and handling, reading and acquisition of measurement data, statistical analysis of obtained measurement data. Croatian standards and guidelines for technical measurements. Writing of technical reports for performed measurement. Inspection and measurement plans.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises. Measurement of selected product. Calculation of measurement uncertainty type A. During laboratory and practical classes students are acquainted with basic instrumentations applied to measurement of mechanical quantities. Laboratory work includes: measurement of macrogeometric deviation of surface (flatness, roundness, cylindricality); measurement of microgeometric deviations of surface (roughness of surface); angularity measurement. Introduction to type of thermometers, dilatation thermometers, electrical thermometers,thermoelements. Introduction to various types of manometers, liquid manometers, mechanical manometers. Calibration of manometer.

Mandatory literature for study and for exam:

1. Vnučec, Z.: Repetitorij 1 iz Teorije i tehnike mjerenja, 1. dio: Uvod u tehnička mjerenja, interno izdanje, Strojarski fakultet, Slavonski Brod, 2004.
2. Maglić, L.: Repetitorij 1 iz Teorije i tehnike mjerenja, 2. dio: Mjerenje temperature, interno izdanje, Strojarski fakultet, Slavonski Brod, 2004.
3. Živić, M.: Repetitorij 1 iz Teorije i tehnike mjerenja, 3. dio: Mjerenje tlaka, interno izdanje, Strojarski fakultet, Slavonski Brod, 2004.
4. Maglić, L.: Repetitorij 2 iz Teorije i tehnike mjerenja: Mjerenje oblika i dimenzija, interno izdanje, Strojarski fakultet, Slavonski Brod, 2004.
5. Vnučec, Z.: Repetitorij 3 iz Teorije i tehnike mjerenja: Mjerenje mehaničkih veličina električnim putem, interno izdanje, Strojarski fakultet, Slavonski Brod, 2004.

Additional list of recommended literature:

1. ...: Inženjerski priručnik - 1. knjiga: Temeljni pojmovi, poglavlje 11: Mjeriteljstvo, str. 951-1042, Školska knjiga, Zagreb 1996.
2. Bego, V.: Mjerenja u elektrotehnici, Tehnička knjiga, Zagreb 1991.

Exam's type:

Continuous assessment with two partial written exams.

P 513 Probability and Statistics

Brief contents:

Combinatorics. Combinatorics – Meaning and Basic Principle. Variations, Permutations and Combinations.

Probability. Random Experiment. Algebra of Events. Probability of Event. Basic Rules of Probability. Random Variables. Expectation; Variance and Moments. Discrete Random Variables: Binomial Variable, Poisson Variable, Hypergeometric Variable. Continuous Random Variables: Uniform Variable, Exponential Variable, Normal Variable. Multidimensional Random Variables. Expectation, Variance and Moments.

Statistics. Empiric Distributions. Population. Arithmetic Mean, Variance and Moments. Statistic Estimate. Estimate of Parameters. Intervals of Confidence of the Expectation and Variance. Adjustments. Parametric Test. Nonparametric Test. Test Statistic Hypothesis.

Teaching methods and the ways of knowledge assessment:

Lectures. Written and oral exercises.

Mandatory literature for study and for exam:

1. I. Pavlić: Statistička teorija i primjena, Tehnička knjiga, Zagreb 1988.
2. M. Ilijašević, Ž. Pauše: Riješeni primjeri i zadaci iz vjerojatnosti i statistike, Zagreb 1990.

Exam's type:

Written and oral.

P 602 Tools and Devices I

Brief contents:

Introducing students into tools and devices. Classification of tools and devices. Tools and devices designer tasks. Basics for parts design. Basics for tools and devices design.
Punchers.
Punching, insection, paring, calibration. Fine plate working. Plate working tool drawing with materials, machining quality and heat treatment. Phase of plate working. Stress. Plate working force and deformation work. Reducing force of plate working. Gap. Tool tolerance and production tool tolerance. Rational utilization of material. Tools material. Mechanical locking. Elements for taking off work parts. Bordering plate. Scrolling plate. Alignment plate. Centre of tool. Tools for plate working and bending. Tools for plate working and deep drawing.
Devices.
Devices introduction. Devices influence on increase in production. Devices purpose. Elements and mechanisms for tightening parts. Calculation and construction of tightening. Calculation and construction of tightening by cam. Calculation and construction tightening by Archimedes coil. Calculation and construction tightening by lever. Calculation and construction tightening by pin. Calculation and construction tightening by elastic bush. Defining part location in devices. Surface shape for tightening parts. Parts base. Errors at defining tightening location. Analysis of base errors. Devices economy. Devices automation.
Cutting tools for machining.
Cutting tools. Cutting tools types. Cutting angles. Geometrical tool shape. Rounded cutter. Phase. Cutter construction and calculation. Milling cutter. Construction and distribution of milling cutter. Calculations of milling cutter. Drill. Construction and classification of drills. Calculations of drill. Other cutting tools.
Tool stability. Optimal production. Cutting tool materials. Marking plates from sintered metal. Cutting tool purpose. Index of good cutting and tool blunting. Tool sharpening. Economic tool manufacture.
Other tools and devices.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises: Programme drawing.

Mandatory literature for study and for exam:

1. Grizelj, B.: "Alati i naprave", Strojarski fakultet Slavonski Brod 2004.
2. Grizelj, B.: "Oblikovanje metala deformiranjem", Strojarski fakultet Slavonski Brod 2002.
3. Grizelj, Branko; Seuček, Ivan, "Rezni alati : noževi, glodala". Slavonski Brod : Strojarski fakultet u Slavonskom Brodu(sveucilisni udzbenik), 2007.
4. Grizelj, Branko, "Strojevi za oblikovanje metala deformiranjem". Slavonski Brod : Strojarski fakultet u Slavonskom Brodu(sveucilisni udzbenik), 2007.
5. Grizelj, Branko, "Oblikovanje lima deformiranjem", Slavonski Brod : Strojarski fakultet u Slavonskom Brodu, 2009 (knjiga).

Additional list of recommended literature:

1. Rebec, B.; Margić, S.: "Štance I dio", Fakultet strojarstva i brodogradnje Zagreb, 1990.
2. Rebec, B.; Margić, S.: "Štance II dio", Fakultet strojarstva i brodogradnje Zagreb, 1990.
3. Rebec, B.: "Naprave", Fakultet strojarstva i brodogradnje Zagreb, 1990.
4. Rebec, B.: "Rezni alati" Fakultet strojarstva i brodogradnje Zagreb, 1990.

5. Musafija, B.: "Obrada metala plastičnom deformacijom", Svjetlost, Sarajevo 1988.
6. Popović, B: "Proizvodne tehnologije", Beograd 1990.

Exam's type:

Written and oral.

P 603 Programming of CNC Machines and Robots

Brief contents:

Teach students about CNC machine and robot construction attributes explain drivers, measure systems and control units. Programming languages will be presented and basic skills and knowledge necessary for programming of CNC machines and robots will be given.

The contents and jobs of manual programming of specific control units up to computer aided manufacturing (CAM) approach will be shown. Technology (cutting parameters, tools, operation sequencing etc.) according to drawings (geometry, quality, heat treatment etc.) and raw material selection will be defined. Program structure, commands (G and M code), coordinate systems, characteristic points and program development will be explained.

Robot system; robot control, programming and implementation in manufacturing will be given. Students will teach basic skills and knowledge of robot programming.

Teaching methods and the ways of knowledge assessment:

Lectures. Exercises. Programme drawing (auditory exercises, laboratory classes). Work in the laboratory on educational machines. Work with available control units of CNC machines. On the basis of assigned tasks make integral seminar paper, prepare the machine and produce the given work-pieces.

Laboratory work on educational robotic system. Getting acquainted with the interface and through exercises enable solving of particular problems for the educational robotic system.

Mandatory literature for study and for exam:

1. Tufekčić, Dž.; Jurković,M. i dr.: Programiranje na CNC mašinama, Univerzitet u Tuzli, Tuzla, BiH, 2001.

Additional list of recommended literature:

1. EMCO WinNC Sinumerik 810/820, Software description, EMCO Maier G.m.b.H., Hallein, Austria, 2000.
2. CNC Programme package – EMCO PC Mill 125, EMCO Maier G.m.b.H., Hallein, Austria, 2000.
3. Abramović, M.; Cvjetičanin, M. i dr.: Tehnologija obrade na numerički upravljanim tokarilicama, Školska knjiga, Zagreb, 1987.
4. Kief, H.B.: NC/CNC Handbuch, Carl Hanser Verlag, Munchen, Njemačka, 1993.
5. Balic, J.: Contribution to Integrated Manufacturing, DAAAM Manufacturing technology, Vienna, Austria, 1999.
6. SCORBOT – ER 4u -User Manual, Intelitek Inc., Manchester, USA, 2001.
7. SCORBASE - User Manual, Intelitek Inc., Manchester, USA, 2001.
8. Šurina, T; Crneković, M: Industrijski roboti, Školska knjiga, Zagreb, 1990.
9. Kovačić,Z i dr.: Osnove robotike, Graphis, Zagreb, 2002.

Exam's type:

Written, oral and seminar work.

P 605 Quantitative Methods

Brief contents:

The course includes selected chapters and methods of operational research and related optimization quantitative models. A brief introduction to statistically designed experiments and empirical quantitative models also has been given in the course.

The course focuses on linear programming and special cases, the methods and techniques of problem solving as well as uses of linear programming (optimal production program, transportation problem, assignment problem, cutting stock problem, mixture problem, business association …). There is a great emphasis on the computer support to solve optimization quantitative models and to get empirical quantitative models.

Teaching methods and the ways of knowledge assessment:

Lectures (theoretical basis illustrated by examples).

Exercises: auditory exercises – formulation and solving of simple optimization quantitative models using different techniques; laboratory exercises – computer supported solving of optimization quantitative models and developing of empirical models from the data of experiments.

Mandatory literature for study and for exam:

1. Kalpić, Damir; Mornar, Vedran: Operacijska istraživanja. Zagreb; Zeus, 1996.
2. Postavljena predavanja nastavnika kao nastavni tekst na web stranici: http://www.sfsb.hr//~ksimun

Additional list of recommended literature:

1. Šakić, Nikola; Štefanić, Nedeljko: Metode optimiranja proizvodnje. Inženjerski priručnik 4, Treći svezak Organizacija proizvodnje. Zagreb; Školska knjiga, 2002, str. 345-397.
2. Barković, Dražen: Operacijska istraživanja. Osijek; Ekonomski fakultet, 2001.
3. Ban, Željko; Matuško, Jadranko; Petrović, Ivan: Primjena programskog sustava MATLAB za rješavanje tehničkih problema. Zagreb; Graphis, 2010.

Exam ̓s type:

Written and oral.

P 608 Materials Testing and Properties

Brief contents:

Introduction to testing and some important properties of materials. Types of testing and importance of materials with special emphasis on mechanical, tehnological and tribological testing for determination of their properties. The testing is fundamental for selection, use and processing of materials. Static methods of testing mechanical properties: tensile, compression, bending, shear and torsion at room, elevated and lower temperatures. Static protracted testing: creep and relaxation of materials. Dynamic methods of material testing: impact (Charpy pendulum), fracture toughness and fatigue. Methods of hardness testing: static (Brinell, Vickers, Rockwell) and dynamic (Poldy, Baumann, Shore). Machines and devices for the mentioned materials testing. Hardness testing. Testing of some important technological material properties by: bending, compression, drawing, alternating bending, testing of tubes and welded joints. Standards for materials testing and designation of steels. Testing of tribological properties of materials.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises. Auditory exercises and laboratory classes.
Preliminary exam I, II, semester project during the teaching session.

Mandatory literature for study and for exam:

1. Vitez, I.: Ispitivanje mehaničkih svojstava materijala, Strojarski fakultet, Sveučilište u Osijeku, Slavonski Brod, 2006.
2. Marušić, V.: Tribologija u teoriji i praksi, Strojarski fakultet, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 2008.

Additional list of recommended literature:

1. Filetin, T.: Svojstva i karakteristike materijala – Katalog opisa, Hrvatsko društvo za materijale i tribologiju, Zagreb, 1994.
2. Mladen Franz: Mehanička svojstva materijala, FSB, Zagreb, 1998.
3. Blumenauer, H.: Werkstoffprüfung, WEB Verlag, 4. Auflage, Leipzig, 1987.

Exam's type:

Written and oral.

P 610 Pneumatic and Hydraulic Systems

Brief contents:

Introduction to the basics of control systems. Students will gain fundamental knowledge regarding pneumatic, hydraulic, and electrical elements, as well as their incorporation into more complex control systems. The main goal is to enable students to independently solve problems related to automation in manufacturing.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises. Solving simple practical and general problems.

Mandatory literature for study and for exam:

1. Nikolić, G.: Pneumatika i hidraulika: 1. dio – Pneumatika, Pelago, 2002, 953-160173-9
2. Šestan, A.: Uljna hidraulika i pneumatika. Pomorski fakultet, Rijeka, 2003.
3. Nikolić, G.; Novaković, J.: Pneumatika i hidraulika: 2 dio - Hidraulika, Školske novine, Zagreb, 2003.

Additional list of recommended literature:

1. Nikolić, G.: Pneumatsko upravljanje, skripta FSB – 1990.
2. Publikacije i literatura proizvođača (npr. FESTO, WESTINGHOUSE, BOSCH itd.)

Exam's type:

Continuous assessment (assigned program, theoretical test questions, preliminary exams).

P 721 Maintenance

Brief contents:

Basic characteristics of modern technical systems maintenance so as to provide higher reliability and availability will be explained. According to the life cycle attributes and organisation goals of technical systems, the maintenance strategy will be set. Theoretical approaches to technical system reliability, inventory management of spare parts and materials will be shown. Basic maintenance technology and organisation structure for particular models and strategies will be presented as well. The necessity for providing a good information system to achieve better maintenance results will be demonstrated. Information on application and implementation of modern information technologies in maintenance information system will be given.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises. Programme drawing (auditory exercises, laboratory classes).

Mandatory literature for study and for exam:

1. Majdandžić, N. Strategije održavanja i informacijski sustavi održavanja, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 1999.

Additional list of recommended literature:

1. Dhillon, B.S.: Engineering Maintenance – A Modern Approach, CRC Press, USA, 2002.
2. Sebastijanović, S.: Osnove održavanja strojarskih konstrukcija, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2002.
3. Rao, B.K.N.: Handbook of Condition Monitoring, Elseviar Advanced Technology, Oxford, UK, 1996.
4. Barron, R.: Engineering condition monitoring – Practice, methods and applications, University of Strathclyde, Addison Wesley Longman, Essex, UK, 1996.

Exam's type:

Written and oral.

P 754 Heat Treatment

Brief contents:

Introduction to heat treatment. Relation between the required characteristics on drawing - technological documentation and heat treatment equipment. Determination of austenitizing parameters. Types of furnace heating. Annealing methods. Clasical quenching treatment. Step quenching. Immersion hardening. Flame hardening. Induction hardening. Laser heat treatment. Selection of steel (based on hardenability). Thermochemical treatment of metal surfaces. Carburizing methods. Pack, salt bath and gas carburizing. Measurement of depth and hardness of carburizing layers. Nitriding. Nitrocarburizing (Tenifer treatment). Carbonitriding. Sulf-Inuz treatment. Ion nitriding and boriding. Heat treatment of tool steels, annealing, quenching. Influence of tempering temperature on the properties of materials. Protective gas atmospheres. Oxidation – reduction. Water gas reaction. Decarburisation – carburisation. Exothermic protective atmospheres. MONO gas. Endothermic protective atmospheres. Nitrogen based synthetic protection atmospheres. Heat treatment in vacuum. Advantages and disadvantages of protective atmospheres. Parts cooling methods. Equipment for vacuum heat treatment.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises. Auditory exercises and laboratory classes.
Preliminary exam I, II during the teaching session.

Mandatory literature for study and for exam:

1. Krumes, D.: Toplinska obradba, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 2000.
2. Krumes, D.: Površinske toplinske obrade i inženjerstvo površina, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 2004.

Additional list of recommended literature:

1. Novosel, M.; Cajner, F.; Krumes, D.: Alatni materijali, Sveučilište u Osijeku, Strojarski fakultet, Slavonski Brod, 1996.
2. Stupnišek, M.; Cajner, F.: Osnove toplinske obradbe metala, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje, Zagreb, 1996.

Exam's type:

Written and oral.

D 791 Products Assemblage

Brief contents:

Acquainting of students with activities of products assemblage in workshop and on site. The subject comprises activities connected with products assemblage from line production, small series and single product fabrication in workshop conditions as well as with the assemblage of huge products like bridges, cylindrical and spherical containers etc. in on site conditions. Basic principles used in products assemblage are explained on examples from practice. Potential difficulties and approaches to production process advancement are also discussed regarding products assemblage activities in workshop and on site conditions.

Teaching methods and the ways of knowledge assessment:

Lectures.
Exercises: auditory, on site

Mandatory literature for study and for exam:

1. I.Veža, Projektiranje proizvodnih procesa, FESB, Split, 1998.
2. B.Vranješ, B.Jerbić, Z.Kunica, Projektiranje proizvodnih sustava, Organizacija proizvodnje, sv.3., Biblioteka inženjerski priručnik 4/III, ISBN 953-0-31682-8, 73-130, Školska knjiga, Zagreb, 2002.
3. http://www.sfsb.hr/kth/zavar/index.html

Additional list of recommended literature:

1. J.T. Black, *The design of the factory with a future*, McGraw-Hill, New York1991.
2. http://ocw.mit.edu/OcwWeb/Mechanical-Engineering/2-875Mechanical-Assembly-and-Its-Role-in-Product-DevelopmentFall2002/Calendar/index.htm
3. Hyung Suck Cho, "Mechanical Assembly", Mechanical Engineering Handbook, CRC Press, USA, 1998.
4. Zbornik radova stručnog seminara: Visokoučinski postupci zavarivanja. Izdavač: HDTZ, Zagreb, 2002.
5. Zbornik radova 2. međunarodnog znanstveno stručnog savjetovanja "Specijalni postupci i zavareni proizvodi u tehnici zavarivanja. DTZ Slav. Brod, 2003.

Exam's type:

Seminar work.

D 1025 Computer Programs

Brief contents:

Introduction of specific computer programs and computer environments present in the engineering business. Working in computer networks. Applications for teamwork: communication, calendars, document management, evaluation and voting. Basics of office programming, creating macro commands and scripting languages. Practical applications of virtual computers. Programs for data protection. Overview of user tools.

Teaching methods and the ways of knowledge assessment:

Lectures and exercises. Auditory and laboratory exercises on computers with the continuous monitoring and evaluation.

Mandatory literature for study and for exam:

1. Gilbert Held, S. Ravi Jagannathan. Practical Network Design Techniques, Second Edition: A Complete Guide For WANs and LANs. CRC Press, Boca Raton, 2004.
2. M. Katherine Brown, Brenda Huettner, Char James-Tanny. Managing virtual teams: getting the most from wikis, blogs, and other. Wordware Publishing, Inc. Plano, 2007.
3. James Edward Smith, Ravi Nair. Virtual machines: versatile platforms for systems and processes. Elsevier Inc, San Francisco, 2005.

Additional list of recommended literature:

1. David C. Jacobs, Joel Yudken. The internet, organizational change, and labor: the challenge of virtualization. Routledge, 2003.
2. Patrick McBride. Secure Internet practices: best practices for securing systems in the Internet and e-Business age. CRC Press, Boca Raton, 2002.

Exam's type:

Pass the tests of knowledge (program, seminars, colloquia, test).