DESCRIPTION OF THE COURSE

Name of the course: **Application of computer technologies for the design of mechanical engineering products**	Code: **MpME01**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 30 hours CW - yes	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Eng. Iliya Chetrokov, PhD (FME), tel.: 659 611, e-mail: chetrokov@tu-plovdiv.bg
Assist. Prof. Eng. Nikolay Paytakov, (FME), tel.: 659 590, email: npaytakov@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

PURPOSE OF THE COURSE: The aims are to upgrade and improve the knowledge and skills of students in the use of modern computer-aided tools (software and hardware) for the design of machine-building and instrument-making products.

DESCRIPTION OF THE COURSE: The main topics are related to the design of details and products with complex geometry, from sheet material, of welded structures; of tooling, etc., applying techniques for 3-D modelling of parts: composed of many bodies; by cross sections and complex trajectories; by using library components; by surface and hybrid modelling; by working with configurations, related dimensions, equations and parametric tables; as well as some advanced techniques for working in the context of the assembly.

PREREQUISITES: knowledge of the disciplines from the bachelor's degree of MU specialty: 1. Fundamentals of construction and CAD - I and II part. 2. Resistance of materials - I and II part. 3. Machine elements - I and II part. 4. Design methodology.

TEACHING METHODS: The classes are using slideshows. The laboratory exercises are conducted at computer workstations in the CAD laboratory, and protocols are developed and defended.

METHOD OF TESTING AND EVALUATION: Written and practical exam (test).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Русимов В., Борисов И., Димитров Н., Ангелов П., SolidWorks – Моделиране и чертежи, ТехноЛогика ЕАД, София, 2019 г. 2. Каравасилев О., Велин Недялков, Антон Нанчев, Михаил Кожухаров, Ана Сапунджиева, SolidWorks – Базово моделиране и чертежи, ТехноЛогика ЕООД, София, 2008 г. 3. Каравасилев О., Велин Недялков, Антон Нанчев, Михаил Кожухаров, Ана Сапунджиева, SolidWorks – Разширени възможности, ТехноЛогика ЕООД, София, 2008 г.

DESCRIPTION OF THE COURSE

Name of the course: **Metrological assurance in mechanical engineering**	Code: **MpME02**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 30 hours CW - yes	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Eng. Pavlinka Kacarova, PhD (FME), tel.: 659 636, e-mail: p.kacarova@tu-plovdiv.bg
Assist. Prof. Eng. Kliment Georgiev, PhD, (FME), tel.: 659 636, email: k.georgiev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

PURPOSE OF THE COURSE: The course "Metrological assurance in mechanical engineering " aims to acquaint students with the basic requirements for metrological assurance of measuring tools used in various industries. As well as with the principle of operation of different types of control activity related to inspections, attestation and examination of the means of control. The requirements to them according to the normative documents, laws and standard procedures. The laboratory exercises aim at the students to acquire practical knowledge and skills for performing these metrological procedures, as well as to be able to do metrological assurance in various productions of mechanical engineering.

DESCRIPTION OF THE COURSE: The course covers a wide range of regulatory requirements related to the conduct of various procedures in metrological assurance. The principles of application of different types of metrological inspections in different measuring instruments are studied. A connection is made between the metrological assurance and the quality management systems. The diagnostics and the preventive maintenance of the different means of control.

PREREQUISITES: Prerequisites: Physics, Mathematics, ME, Materials Science, MIT and KUK.

TEACHING METHODS: Lectures, laboratory work with protocols with written report and individual defense.

METHOD OF TESTING AND EVALUATION: Exam. The final grade is formed by two components: - bearing 70% of the exam question and another 30%. - from the assessment received in defense of LE.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Lecture notes from the lead lecturer. 2. Димитров,Вълева и др.,Ръководство за лаб.упражнения по основи на метрологията и техническите измервания,София,Техника 3.Радев. Хр. Метрология и измервателна техника,справочник Том 1 , 2, Първо издание; Софтрейд , 2012г.

DESCRIPTION OF THE COURSE

Name of the course: **Computer analysis and simulation in mechanical engineering**	Code: **MpME03**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 30 hours	Number of credits: **4**
Course project (CP)	Code: **MpME08**	Number of credits: **2**

LECTURER(S):
Assoc. Prof. Eng. Iliya Chetrokov, PhD (FME), tel.: 659 611, e-mail: chetrokov@tu-plovdiv.bg
Assist. Prof. Eng. Penko Mitev, PhD, (FME), tel.: 659 590, email: penkomitev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

PURPOSE OF THE COURSE: The aim of this course is to acquaint the students with the basic terminology, concepts and principles of working with CAD/CAE systems for computer analysis and simulation, applied in the mechanical engineering and production.

DESCRIPTION OF THE COURSE: The basic concepts related to Computer Analysis and Simulation in the design of various parts, assemblies and machines are considered. The main stages in research and optimization of the designed products with the help of CAE systems are considered. Prerequisites: Knowledge of engineering graphics, machine elements, resistance of materials, mechanics, theory of machines and mechanisms, design methodology is required.

PREREQUISITES: Knowledge of engineering graphics, machine elements, resistance of materials, mechanics, theory of machines and mechanisms, design methodology is required.

TEACHING METHODS: Lectures, delivered using technical means, through which the structure of the lecture, some definitions and the most essential knowledge, drawings, dependencies, graphs and formulas are projected on the screen. A methodological guide has been prepared for each of the exercises. Students perform the exercise independently under the guidance of the teacher. They have the opportunity to study the theoretical part on their own in advance and prepare for the exercise.

METHOD OF ASSESSMENT: The assessment of the laboratory exercises is formed on the basis of ongoing control. A written examination is conducted according to an approved unified system for testing and assessment.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: Алямовский А., Solid Works/COSMOSWorks "ДМК Пресс" 2004 1. Джонов Ц., Петров М., Методично ръководство за решаване на задачи по метода на крайните елементи (Cosmos/M 1.71) Част 1, АМІ 1999 2. Максимов Й., Компютърни методи за инженерен анализ, УИ "В. Априлов", Габрово 1999 3. Ташев М., COSMOSWorks – обучение с примери, част I. ТУ София, Филиал Пловдив, Пловдив. ISBN-13:978-954-8779-85-2. 4. Paul Kurowski Engineering Analysis with COSMOSWorks Professional 2008 5. Paul Kurowski Engineering Analysis with SolidWorks Simulation 2009 6. Paul Kurowski Engineering Analysis with SolidWorks Simulation 2010 7. Paul Kurowski Engineering Analysis with SolidWorks Simulation 2011 8. John R. Steffen Analysis of Machine Elements using SolidWorks Simulation 2010 9. Алямовский А. А. SolidWorks Simulation. Инженерный анализ для профессионалов: задачи, методы, рекомендации. – М.: ДМК Пресс, 2015. – 562 с.: ил. ISBN 978-5- 97060-140-2 10. Randy Shih Introduction to Finite Element Analysis Using SolidWorks Simulation 2010 11.

Ташев М. COSMOS Works - обучение с примери, Ръководство за лабораторни упражнения по дисциплината „Компютърни методи за оптимизация на машиностроителни конструкции” I-част, ISBN 978-954-8779-85-2, ТУ - Филиал Пловдив, 2006г 12. Ташев М., Ст. Николов, COSMOS Works - обучение с примери, Ръководство за лабораторни упражнения по дисциплината „Компютърни методи за оптимизация на машиностроителни конструкции” II-част, ISBN 978-954-8779-90-6, ТУ - Филиал Пловдив, 2007г. 13. Ташев М., П. Йорданов, Инженерен Анализ с метод на крайните елементи ISBN978-954-490-350-3 2012г. 14. Ташев М., Инженерен Анализ с CAE системи в машиностроенето ISBN-978-619- 90128-5-7 2014г. 15. Ташев М., Инженерен Анализ с CAE системи ISBN-978-619-90128-8-8 2015г. 16. Ташев М., Инженерен Анализ с CAE системи (допълнено) 2017г.

DESCRIPTION OF THE COURSE

Name of the course: **Reliability of industrial systems**	Code: **MpME04**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 30 hours	Number of credits: **4**
Course project (CP)	Code: **MpME08**	Number of credits: **2**

LECTURER(S):
Assoc. Prof. Eng. Silviya Salapateva, PhD (FME), tel.: 659 613, e-mail: sisisal@tu-plovdiv.bg
Assist. Prof. Eng. Nikolay Paytakov, (FME), tel.: 659 590, email: npaiyakov@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The students must be able to obtain the necessary knowledge but also able to develop general and specific type of approaches, methods and techniques, needed for analysis, evaluation and decision making in the field of reliability and fault diagnosis of machines and mechanical devices.

DESCRIPTION OF THE COURSE: Introduction to reliability engineering, reliability characteristics of machines and mechanical devices. Reliability modelling and modular design – systems reliability models, block diagram analysis, Fault Tree Analysis (FTA), Petri nets, state-space analysis (Markov analysis). Reliability in design – quality function deployment (QFD), Failure modes, effects and critically analysis (FMECA). Reliability of mechanical components and systems. Reliability testing – planning of the reliability testing, test environments, accelerated tests. Fault Diagnosis (FD), supervision and control of technical conditions in machines and mechanical devices – general methods and techniques. Analysis, evaluation and prognosis of technical conditions of machines and mechanical devices via non-destructive control methods. Maintainability, maintenance and availability of machines and mechanical devices – preventive maintenance strategy, maintenance schedules, maintainability prediction and demonstration.

PREREQUISITES: Devices and equipment for measurement; equipment for control and supervision.

TEACHING METHODS: Lecture course, supported by samples, prospects, multimedia and posters. The laboratory works are performed on specific experimental laboratory platforms and software modules (specially created for the purpose) and include experiments, evaluation of the obtained data-bases, and development of decision-making procedures.

METHOD OF ASSESSMENT: Written exam, at the end of the semester.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1.Dimitrov, K.D., D.I. Danchev, Reliability of Machines and Systems, Sofia, Technika, 1994, 1998 (in Bulgarian). 2.Dimitrov, K.D., Reliability of Mechanical Equipment Machines and Systems, Publisher: ABC TECHNICA, Sofia, 2011. 3.Dimitrov, K.D., Fault Diagnosis in Industrial Systems, Publisher: Propeller, Press: Dailycont, Sofia, 2012. 4.Dimitrov, K.D., Reliability and Diagnosis of Machines and Systems; Publisher: Propeller, Press: Dailycont, Sofia, 2013.

DESCRIPTION OF THE COURSE

Name of the course: **Innovative materials and technologies in mechanical engineering**	Code: **MpME05**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW - yes	Number of credits: **4**

LECTURER(S):

Assoc. Prof. Eng. Boyan Dochev, PhD (FME), tel.: 659 615, e-mail: dochev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the training in "Innovative materials and technologies in mechanical engineering" is to acquaint students with new, highly effective and innovative materials and technologies used in mechanical engineering.

DESCRIPTION OF THE COURSE: New materials related to the application of special methods for alloying, modification, use of micro and Nano disperse additives providing the production of materials with increased physical-mechanical and technological properties are considered. Students get acquainted with innovative technologies for thermal and thermomechanical impact on materials, the use of laser and plasma technologies in metalworking, coating with PVD and CVD processes and more.

PREREQUISITES: Knowledge of physics, chemistry, materials science, technology of machine-building materials, machine elements, resistance of materials, mechanics of fluids is required.

TEACHING METHODS: Lectures, using technical means, laboratory work with protocols with written report and individual defense.

METHOD OF ASSESSMENT: The assessment of the laboratory exercises is formed on the basis of ongoing control. A written examination is conducted according to an approved unified system for testing and assessment.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Жуков М. Ф., И. Н. Черский, А. Н. Черепанов и др., Низкотемпературная плазма. Том 14. Упрочнение металлических полимерных и еластомерных материалов ультрадисперсными порошками. Новосибирск, Наука, 1999. 312 с.; 2. Калинина Н.Е., Калинин В.Т. и др. Наноматериалы и нанотехнологии: получение, строение, применение. Монография. Днепропетровск: Изд. Маковецкий Ю.В., 2012, 188 стр.; 3. Косторнов Анатолий, Олга Фущич, ТатянаЧевичелова, Юлика Симеонова, Алексей Костенко. Високоефективни самосмазващи се композитни антифрикционни материали. SENS'2006 Second Scientific Conference with International Participation SPACE, ECOLOGY, NANOTECHNOLOGY, SAFETY 14 – 16 June 2006, Varna, Bulgaria; 4. Крушенко Г. Г., Черепанов А. Н., Полубояров В. А., Кузнецов В. А. Результаты опытно-промышленных исследований повышения свойств черных и цветных металлов с помощью тугоплавких нанопорошковых материалов. Изв. вузов. Черная металлургия, 2003, № 2, 12-14.; 5. Оришич А.М., А. Н. Черепанов, В. П. Шапеев, Н. Б. Пугачева. Наномодифицирование сварных соединений при лазерной сварке металлов и сплавов. Новосибирск, издательство СО РАН, 2014, 247 с. 6. Пужайло Л.П., С. Л. Поливода. Проблемы и перспективы модифицирования

алюминиевых сплавов скандием. -Процессы литья, 2006, № 2, 29-33. 7.; 6. Черепанов А. Н., отв. ред. В. М. Фомин, Низкотемпературная плазма. Том 12. Плазмохимический синтез ультрадисперсных порошков и их применение для модифицирования металлов и сплавов, Новосибирск, Наука, Сибирская издательская фирма РАН, 1995, 344 с; 8. Cao Lamei, A.N. Cherepanov, Tang Xin et al. Effect of nanopowdered refractory compound on the refinement of solidifying structure and properties of K403 superalloy. –Rare Metals, Oct. 2009, Vol. 28, Spec. Issue, 1-4.; 9. Hongseok Choi, Hiromi Konishi, Xiaochun Li. Al2O3 nanoparticles induced simultaneous refinement and modification of primary and eutectic Si particles in hypereutectic Al–20Si alloy. Materials Science and Engineering A 541 (2012) 159– 165 (Department of Mechanical Engineering, University of Wisconsin-Madison, Madison, WI 53706, USA); 10. Knuutinen, K. Nogita, S. D. McDonald, A. K. Dahle, Modification of Al–Si alloys with Ba, Ca, Y and Yb, Journal of Light Metals, Volume 1, Issue 4, November 2001, Pages 229-240.; 11. Kuzmanov P., Dimitrova R., Lazarova R., Cherepanov A. and Manolov V., Investigations of the structure and mechanical properties of castings of aloy AlSi7Mg, cast iron GG15 and GG25 and steel GX120Mn12, modified by nanosized powders, Journal of Nanoengineering and Nanosystems, March 2014 vol. 228 no. 1, pp. 11-18.; 12. 82. Lee, Jung-Moo; Kang, Suk-Bong; Yoon, Sang-Chul, Role of the primary silicon particle on the dry sliding wear of hypereutectic aluminium-silicon alloy A390, NASA Astrophysics Data System (ADS) http://adsabs.harvard.edu/abs/1999MM..5..357L; 13. Stavrev S.et al. Patent US005353708A, Oct.11, 1994., Method for production of ultradispersed diamond; 14. David Talbot, James Talbot - CorrosionScience and Technology, [CRC Press 1998]; 15. Antelman, M., Harris, F. The encyclopedia of chemical electrode potentials, NY: Plenum press, 1982; 16. Киш, Л., Кинетика электрохимического растворения металлов, Москва: Мир, 1990; 17. Angel VELIKOV, Stefan BUSHEV. Foundry-Gas Pressing Method. Bulgarian Society for NDT International Journal “NDT Days”, Volume II, Issue 2, 2019, ISSN:ISSN: 2603-4018, eISSN: 2603-4646, 224-229; 18. 125. N. Bojanova, I. Panov, R. Lazarova, V.Manolov. Investigation of nanomodified aluminum alloys melts and castings from them. // Journal of Materials Science and Technology, Vol. 21, 2013, No. 4, pp. 271–285, ISSN 0861-9786.

DESCRIPTION OF THE COURSE

Name of the course: **Engineering research**	Code: **MpME06**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	Code: **MpME08**	Number of credits: **2**

LECTURER(S):
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Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is for students to study the essence of engineering research methods and to be able to apply these methods for research projects and technological purposes in production.

DESCRIPTION OF THE COURSE: Within the course the main methods for experimental - statistical modeling and optimization of objects in mechanical engineering are studied. Issues related to the collection and processing of experimental data and their statistical analysis are considered. The methods of correlation, variance and regression analysis and the main issues related to their application in the active experiment are presented. Procedures for pre-planning and planning the experiment, as well as the interpretation of the results are discussed.

PREREQUISITES: Knowledge of Metrology, Measuring Equipment, Mechanical Engineering Technology, Mathematics is required.

TEACHING METHODS: Lectures delivered with the help of visual aids, slides, slides, videos. Laboratory exercises with the implementation of independent tasks, independent solution of applied course tasks.

METHOD OF ASSESSMENT: Exam at the end of the semester and defence of self developed protocols from laboratory exercises. The final grade is formed by the grade from the exam - 70% and from the laboratory exercises - 30%.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Andonov I., Application of mathematical statistics in mechanical engineering., S., Technique 1981; 2. Active control in mechanical engineering, edited by Ped, Mechanical Engineering, Moscow, 1971; 3. Bojanov E., Vuchkov I., Statistical solutions in production and research; 4. Vinarsky MS, Planning an experiment in technological research, Kiev, Technology, 1975 5. Stefanova I., Fundamentals of Engineering Research, Gabrovo, V. Aprilov, 2003

DESCRIPTION OF THE COURSE

Name of the course: **Technical legislation and law**	Code: **MpME07**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 15 hours LW – 0 hours	Number of credits: **3**

LECTURER(S):
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COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is for students to study the essence of the basics of law, industrial property and technical legislation and methods for assessing the conformity of product quality and to be able to apply this knowledge in their practice to future engineers.

DESCRIPTION OF THE COURSE: The course consists of two modules - module law and module technical legislation. The first module studies: the concept of law, sources, legal systems, private and public, substantive and procedural law, legal norms, legal acts, subjects of law, interpretation, property rights, industrial and intellectual property. The second module includes: nature of technical legislation, types of EU technical regulations, conditions for placing on the market, link between technical legislation and standardization, proof of quality, European approach to safety, safety marking, introduction of European technical legislation, market surveillance.

PREREQUISITES: Knowledge of Metrology, Mechanical Engineering Technology is required.

TEACHING METHODS: Lectures delivered with the help of visual aids, slides, slides, videos. Laboratory exercises with the implementation of independent tasks, independent solution of applied course tasks.

METHOD OF ASSESSMENT: Ongoing assessment . The final assessment is formed by the assessment of tests - 70% and laboratory exercises - 30%.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Милкова Д. Обща теория на правото, София, Албатрос,2001год. 2. Стефанов Г. Гражданскко право, Обща част, София, Сиви, 2001 год. 3. СандалскиБр., Международна и европейска стандартизация, Изд. „Софтрейд", 2002год., София 4. Николова Ир., Европейско техническо законодателство, Софтрейд, 2002 г., София

DESCRIPTION OF THE COURSE

Name of the course: **Computer-integrated production systems**	Code: **FaMpME01**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 30 hours	Number of credits: **4**

LECTURER(S):
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COURSE STATUS IN THE CURRICULUM: Facultative subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The course aims to acquaint students with the basic methods of motion control in mechatronic systems, as well as mastering their application in solving scientific-applied and engineering problems in the relevant fields.

DESCRIPTION OF THE COURSE: A unified approach for presentation in vector-matrix form of control systems is proposed and modern methods for motion control in mechanical systems, and in particular - of robots and manipulators are considered. An introduction to Lyapunov's theory for studying the stability of control systems is presented. The main approaches for solving the problem of stabilization of the program movements of manipulation robots using control methods from both linear and nonlinear control theory are considered. Attention is also paid to the synthesis of adaptive control in case of uncertainty of the parameters of the managed object. The labs specify the theoretical material covered in lectures such as the use of specialized software MATLAB / SIMULINK promotes skills building and testing systems for controlling movements in modern bottle -border systems.

PREREQUISITES: Knowledge of mathematics, mechanics, control technology, as well as modeling and simulation of automation technology.

TEACHING METHODS: Lectures with the help of slides and Power Point. Laboratory exercises performed on developed methodological materials using specialized software MATLAB / SIMULINK.

METHOD OF ASSESSMENT: Written exam in the form of an open test, including questions from the entire study material, taking into account the work of the laboratory exercises.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Н. Маджаров, Въведение в съвременната теория на автоматичното управление. Част първа – анализ, Техника, 1982г. 2. И. Томов, Въведение в съвременната теория на автоматичното управление. Част втора – синтез, Техника, 1982г. 3. А. Первозванский, Курс теории автоматического управления, Наука, 1986г. 4. B. Kuo, Automatic control systems, Prentice Hall, 2003. 5. M. Spong, M. Vidyasagar, Robot dynamics and control, John Wiley&Sons, 1989.

DESCRIPTION OF THE COURSE

Name of the course: **Intelligent Measurement Systems**	Code: **MpME09.1**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**

LECTURER(S):
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Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The purpose of this course is to give knowledge and skills to the students for the methods and meaning for construction of intelligent measurement systems (IMS), for the architecture and programming of these systems.

DESCRIPTION OF THE COURSE: Main topics: Main characteristics of IMS. Architecture of the microprocessor control of IMS. IMS with duplicated structures-principles of construction, efficiency and reliability. Interpretative models of the cumulative error of the measurement process. Models of measurement transducers. Analog to digital convertors and methods for analog to digital conversion. Expert systems in IMS. Purpose and structure of the intelligent sensors. Virtual measurement devices – main characteristics and design principles.

PREREQUISITES: The lectures and laboratory exercises are based on the knowledge from the Bachelor Degree - Physics, Electrical Measurement, Control Theory, Measurement of Non-electrical Quantities.

TEACHING METHODS: Lectures are given with visual materials, posters and slides. Laboratory exercises is organized according to the laboratory manual with reports made by the students and defended in front of the lecturer.

METHOD OF ASSESSMENT: Written examination after the end of the semester (80%) and a mark from the laboratory exercises (20%).

INSTRUCTIONAL LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Калчев, Ив., Интелигентни измервателни системи, ТУ-София, 2006. 2. Арнаудов, Р., Р. Динов, Измервания в комуникациите, ТУ-София, 2007. 3. Пенчев, П., Измервания в електрониката и комутационната техника, УИ „В. Априлов", Г., 2006. 4. Шевчук, В., Расчет динамических погрешностей интеллектуальных измерительных систем, М., Физматлит, 2008. 5. Mazda, F., Electronic Instruments and Measurement Techniques, Cambridge University Press, 1990. 6. Doebelin, E. and oth., Measurement Sistems – Application and Design, Mc Graw-Hill Book Co, 1990.

DESCRIPTION OF THE COURSE

Name of the course: **Control and measuring systems**	Code: **MpME09.2**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**

LECTURER(S):

Prof. PhD Pancho Tomov, (FME), tel. 965 2980, e-mail: pkt@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: Aim of the course Reverse engineering and modernization of automation equipment (REMAE) is to provide mechanical engineering students with basic knowledge about the: fundamentals of production innovation; design of modern manufacturing processes; role of reengineering in the innovative procedures; relevant methodology and instruments. An important objective is to teach the students how to apply the acquired skills and knowledge to solve "real world" problems.

DESCRIPTION OF THE COURSE: The course discusses novel conceptions for design of innovation and re-engineering projects using efficient economical and organizational approaches and modern technical devices. The accent is put on the subject of innovation and re-engineering and their application potentials; gathered world experience; principles of launching modern manufacturing processes etc. Some of the Major topics concern the innovative development of mechanical engineering operations and its regular updating, practical application of the re-engineering principles etc.

PREREQUISITES: Basic knowledge of the computer skils and the principles of operation of production systems in mechanical engineering is required in order to carry out their effective design and implementation in different variants.

TEACHING METHODS: Lectures delivered using illustrative materials, including: multimedia, video and more. Laboratory exercises conducted in the presence of the necessary computer equipment and software and manuals for laboratory exercises.

METHODS OF ASSESSMENT: A written examination is conducted on an approved uniform test and evaluation system, using a scoring system. An open-ended test is used to include questions of varying complexity.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY: 1.Модернизация на производството Дамянов Д., - ТУ-София 2000; 2. Дамянов Д., Е. Соколов, П. Томов, Т. Панайотова „Основи на конкурентния инженеринг" МП Издателство на ТУ София, 2007; 3.Theories of Industrial Modernization and Development, Lewis Frederick Abbott – ISR 2011; 4.Theories of the Labour Market and Employment, Lewis Frederick Abbott – ISR 2010; 5.Localised Technological Change: Towards the Economics of Complexity, Cristiano

DESCRIPTION OF THE COURSE

Name of the course: **Control and measuring systems**	Code: **MpME09.3**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Pavlinka Kacarova, PhD (FME), tel.: 659 636, e-mail: p.kacarova@tu-plovdiv.bg
Assist. Prof. Eng. Kliment Georgiev, PhD, (FME), tel.: 659 636, email: k.georgiev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

PURPOSE OF THE COURSE: The discipline "Control and measuring systems" aims to acquaint students with the control devices used in instrument making. To make the connection between the metrological assurance and the means for measuring linear and angular dimensions. To acquaint students with the combination of several measuring instruments and converters in a measuring system.

DESCRIPTION OF THE COURSE: The course covers a wide range of instruments and systems for measurement and control in instrument making. Most of the details in the instrument making are made with a small size tolerance. The control of the dimensions of such parts requires the availability of precise measuring instruments to meet these requirements. This special and universal high-precision optical-mechanical instruments such as measuring microscopes, projectors and coordinate measuring machines are the subject of study and work by students.

PREREQUISITES: Prerequisites: Physics, Mathematics, Materials Science, MIT, MOM and KUK.

TEACHING METHODS: Lectures, laboratory work with protocols with written report and individual defense.

METHOD OF TESTING AND EVALUATION: Exam. The final grade is formed by two components: - bearing 70% of the exam question and another 30%. - from the assessment received in defense of LE.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Lecture notes from the lead lecturer - Assoc. prof. PhD Pavlinka Tsanova Katsarova. 2.Радев. Хр. Метрология и измервателна техника,справочник Том 1 , 2, Първо издание; Софтрейд , 2012г. 3. Радев.Хр, Уреди за измерване на линеини размери,Техника,София,1988г. 4. Троянов, Уреди за измерване на физикомеханични величини, ТУ София, 1990г.

DESCRIPTION OF THE COURSE

Name of the course: **Flight Dynamics**	Code: **MpME09.4**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Atanas Nachev, PhD (FME), tel.: 659 521, e-mail: anachev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty “Mechanical and Instrument Engineering”, Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIM OF THE COURSE: The course "Flight Dynamics" provides knowledge of the aerodynamics of winged and wingless axisymmetric bodies.

DESCRIPTION OF THE COURSE: The course studies different models of flight of projectiles stabilized on the flight path either by rotation or by wings. Studies the influence of the factors influencing the accuracy of the meeting of the studied body with the target point.

PREREQUISITES: Prerequisites: Physics, Mathematics, Theoretical Mechanics.

TEACHING METHODS: Lectures and laboratory work.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Абгарян К. А., Рапопорт ИМ . Динамика ракет. М .: Машиностроение, 1969. 378 с. 2. Аппазов Р.Ф., Лавров С.С., Мишин В.П. Баллистика управляемых ракет дальнего действи я. М.: Н аука, 1966. 307 с. 3. Вентцель Д.А., Окунее Б.Н., Шапиро Я.М. Внешняя баллистика. Ч. I, II. Л.: Изд. АА РККАА им. Дзержинского. 1934. 4. Ганпыахер Ф.Р., Левин Л.М. Теория полета неуправляемых ракет. М .: Физматиздат, 1959. 360 с. 5. Девис Л., Фоллин Д , Блитцер Л. Внешняя баллистика ракет. М .: Воениздат, 1961. 520 с. 6. Локк А.С. Управление снарядами. М .: Физматиздат, 1956. 775 с. 7. Ренкин Р.А. Математическая теория движения неуравляемых ракет. ИЛ. 1951. 424 с. 8. Эйлер Л. Исследования по баллистике. М : Физматиздат. 1961

DESCRIPTION OF THE COURSE

Name of the course: **Application of computer technologies for the design of mechanical engineering products**	Code: **MpME10.1**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW - yes	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Albena Taneva, PhD (FME), tel.: 032 659 585, E-mail: altaneva@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The course aims to acquaint students with the basic methods of motion control in mechatronic systems, as well as mastering their application in solving scientific-applied and engineering problems in the relevant fields.

DESCRIPTION OF THE COURSE: A unified approach for presentation in vector-matrix form of control systems is proposed and modern methods for motion control in mechanical systems, and in particular - of robots and manipulators are considered. An introduction to Lyapunov's theory for studying the stability of control systems is presented. The main approaches for solving the problem of stabilization of the program movements of manipulation robots using control methods from both linear and nonlinear control theory are considered. Attention is also paid to the synthesis of adaptive control in case of uncertainty of the parameters of the managed object. The labs specify the theoretical material covered in lectures such as the use of specialized software MATLAB / SIMULINK promotes skills building and testing systems for controlling movements in modern bottle -border systems.

PREREQUISITES: Knowledge of mathematics, mechanics, control technology, as well as modeling and simulation of automation technology.

TEACHING METHODS: Lectures with the help of slides and Power Point. Laboratory exercises performed on developed methodological materials using specialized software MATLAB / SIMULINK.

METHOD OF ASSESSMENT: Written exam in the form of an open test, including questions from the entire study material, taking into account the work of the laboratory exercises.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Н. Маджаров, Въведение в съвременната теория на автоматичното управление. Част първа – анализ, Техника, 1982г. 2. И. Томов, Въведение в съвременната теория на автоматичното управление. Част втора – синтез, Техника, 1982г. 3. А. Первозванский, Курс теории автоматического управления, Наука, 1986г. 4. B. Kuo, Automatic control systems, Prentice Hall, 2003. 5. M. Spong, M. Vidyasagar, Robot dynamics and control, John Wiley&Sons, 1989.

DESCRIPTION OF THE COURSE

Name of the course: **Stack-up Analysis and Functional Dimensioning**	Code: **MpME10.2**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW - yes	Number of credits: **3**

LECTURER(S):

Assoc. Prof. PhD Petar Goranov (FME), tel. 965 3451, e-mail: pvgor@tu-sofia.bg

Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The purpose of the course is for students to gain in-depth knowledge and skills to perform mechanical tolerance stack-up and analysis and to write down the results of this analysis in the technical documentation.

DESCRIPTION OF THE COURSE: Modern technological processes for the production of mechanical products are a source of variations in geometric parameters. Understanding these variations, quantifying them and their influencing on the operation of the product is an essential part of the design process. The tolerances are engineering specifications of the acceptable level of variation in geometric aspect. They are recorded in the technical documentation or defined in the CAD model. They serve to control the inaccuracies of the shape or size of a particular geometric element or the relative positioning or orientation of several geometric elements. The stack-up analysis allows to calculate the cumulative effect of the inaccuracies of the individual elements and to ensure that this effect is acceptable.

PREREQUISITES: The discipline is based on the acquired knowledge and skills in the studied engineering disciplines in the bachelor's degree program.

TEACHING METHODS: Lectures with visual aids – slides and computer presentations. Specific theoretical aspects are illustrated by direct demonstration. Laboratory exercises involve solving specific problems.

METHOD OF ASSESSMENT: The final mark is formed as a result of the written examination. The exam includes a case study in the problem area of the course.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY: 1. Fischer B., Mechanical tolerance stackup and analysis, CRC Press, 2011; 2. Henzold G., Geometrical Dimensioning and Tolerancing for Design, Manufacturing and Inspection, Elsevier, 2006.

DESCRIPTION OF THE COURSE

Name of the course: **Automated production systems**	Code: **MpME10.3**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW - yes	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Atanas Nachev, PhD (FME), tel.: 659 613, e-mail: alengerov@tu-plovdiv.bg
Assist. Prof. Eng. Penko Mitev, PhD (FME), tel.: 659 590, email: penkomitev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The students to study and be able to apply the principles and approaches for automation of machine-building production, to know the technique and technology for its realization.

DESCRIPTION OF THE COURSE: The main topics concern: introduction to the automation of machine-building production; automatic machines, rotary machines, aggregate machines - structure, work cycle, productivity; CNC machines; industrial robots kinematic structures, standard configurations, aggregate-modular systems; automatic transport, feeding and storage means - types, field of application; automatic lines - types, structural-layout schemes, rotor and aggregate automatic lines; flexible automated production systems; automatic technological modules - structural-layout schemes, work cycle.

PREREQUISITES: Theory of mechanisms and machines, Drive and control of production equipment, Tool machines, Tool and technological equipment, Technology of mechanical engineering.

TEACHING METHODS: Lectures with multimedia presentation, laboratory exercises with stands of automation devices, modules of industrial and educational robots and educational automated systems.

METHOD OF ASSESSMENT: Exam test on the lecture course and points from the development and defence of protocols from laboratory exercises.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Гановски В.С., Д.Д. Дамянов, Д.С. Чакърски. Основи на автоматизацията, роботизацията и ГАПС. С., Техника, 1994. 2. Грозданов В.Д. и др. Агрегатни машини. С., Техника, 1984. 3. Чакърски Д.С. и др. Промишлени роботи, роботизирани технологични модули и системи. Част 1 и 2, МП Издателство на ТУСофия, 2003.

DESCRIPTION OF THE COURSE

Name of the course: **Applied thermogas dynamics**	Code: **MpME10.4**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW – yes	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Atanas Nachev, PhD (FME), tel.: 659 521, e-mail: anachev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: Introduces students to the laws of thermoand gas dynamics and their application in the calculation of thermo-ballistic systems. DESCRIPTION OF THE COURSE: The mathematical apparatus for calculation of thermal gunpowder engines and rocket engines with solid fuel is studied.

PREREQUISITES: Knowledge of Thermodynamics and Heat Transfer, Physics, Mathematics is required.

TEACHING METHODS: Lectures and laboratory work.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Чурбанов Е.В. Внутренняя баллистика: учебник. - Л.: Военная артиллерийская академия им. М.И. Калинина, 1975. 2. Серебряков М.Е. Внутренняя баллистика ствольных систем и пороховых ракет. - М .: Оборонгиз, 1962. 3. Внутренняя баллистика артиллерийского и стрелкового оружия / под ред. Б.В. Орлова. - М : ЦНИИНТИ, 1975. 4. Баллистика ствольных систем / РАРАН; В.В. Бурлов и др.; под ред. Л.Н. Лысенко и А.М. Липанова. - М : Машиностроение, 2006. - 461 с. 5. Внутренняя баллистика РДГТ / РАРАН; А.В. Алиев и др.; под ред. А.М. Липанова и Ю.М. Мелехина. - М.: Машиностроение, 2007. - 504 с. 6. Балаганский И А. Конспект лекций по дисциплине «Основы спецтехники и баллистики» / Новосиб. электротехн. ин-т. - Новосибирск, 1987.

DESCRIPTION OF THE COURSE

Name of the course: **Lifting manipulators and robots**	Code: **MpME11.1**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	CP – yes	Number of credits: **0**

LECTURER(S):

Prof. DSc Rosen Mitrev (FME), tel. 965 2656, e-mail: rmitrev@tu-sofia.bg

Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course Robots and manipulators to give the students knowledge about the areas of application, basic principles of building design as well as the principles of control of industrial robots in manipulators, applied in moderm manufacturing. This course deals with basic the basic terminology and gives the mathematical foundation of robotics including problems of geometry, kinematics and control. The design solutions of the contemporary manipulation systems is regarded in respect to the driving systems. Special attention is paid to the basic control systems of robots - position control and force control. Information is given about sensors - types, designs, application in the control systems. The knowledge gained will fill up the necessary knowledge volume for the specialty, and could be used as well as a foundation for further research activities in the field of robotics. The course is also a starting point for a number of courses during the masters degree of Mechanical Engineering specialty.

DESCRIPTION OF THE COURSE: Contemporary status of robotics; Classification of robots and industrial robots; Fundamental terminology; Technical parameters; Structural diagram of a robot; Properties of the manipulating system; Service factor; Structural and geometrical synthesis; Pneumatic manipulators; Electrically driven manipulators; Hydraulically driven manipulators; Grippers; Sensors - types, application in control systems; Mathematical modeling of multiarm structures; vector transformations, homogeneous coordinates; Local coordinate systems; Principle of the local coordinate systems set-up. Denavit-Hardenberg representation; Forward and reverse kinematics; Force and velocity propagation between links; Position control of manipulators; Force control of manipulators. Program languages and program systems

PREREQUISITES: Basic knowledge of Mathematics - linear algebra and analytical geometry, mechanics - static and kinematics. Elements of the machines.

TEACHING METHODS: Lectures are supported and supplemented by digital visual projection which serve to illustrate the discussed problems. The theoretical considerations are greatly augmented and concrete examples are given and solved. The laboratory exercises are problem oriented and devoted to the solution of simulation tasks using specialized software. The study cases are additionally illustrated by modelling in CAD environment.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY: 1. Митрев, Р. Лекционни записки. 2. Craig, J,J Introduction to Robotics Mechanics and Control. Addison -Wesley Publishing company 1989; 3. Bruno S., S., Lorenzo S., Luigi Villani, Giuseppe Oriolo, Robotics Modeling, Planning and Control. Springer 2009. 4. Selig, J.M., Introductory robotics, Prentice Hall, 1995. 5. Jörg, Walter, Rapid Learning in Robotics, Göttingen: Cuvillier, 1996. 6. Bergen, Charles M. Anatomy of a robot, The McGraw-Hill Companies, Inc., 2003.

DESCRIPTION OF THE COURSE

Name of the course: **Computer Aided Modelling and Analysis of Mechanical Systems**	Code: **MpME11.2**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	CP – yes	Number of credits: 0

LECTURER(S):
Assoc. Prof. Eng. Iliya Chetrokov, PhD (FME), tel.: 659 611, e-mail: chetrokov@tu-plovdiv.bg
Assist. Prof. Eng. Penko Mitev, PhD (FME), tel.: 659 590, email: penkomitev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to acquaint students with the possibilities of computer modeling and simulation of various material objects, machines and mechanical devices. After completing the course, students acquire knowledge and skills for: working with modern software products used in practice; use of existing computer programs for synthesis, analysis and optimization; creating programs to solve specific tasks.

DESCRIPTION OF THE COURSE: The main topics concern: Methods for mechano - mathematical modeling. Introduction to MATLAB. Program realization of the main tasks of the kinematic analysis of lever mechanisms. Computer modeling of the motion of a material point; of plane motion of an ideal rigid body; the small oscillations of mechanical systems with a degree of freedom; of mechanical systems with two or more degrees of freedom. Program realization of dynamic synthesis of a mechanical system with one degree of freedom.

PREREQUISITES: Knowledge of Mathematics, Informatics, Mechanics, Theory of Mechanisms and Machines, Resistance of Materials is required.

TEACHING METHODS: Lectures and laboratory work - held in a computer room.

TEST METHODS: Exam. Students compile a program (block diagram) in Matlab for numerical solution of a given task.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Генова П., ТММ. С., 1994. 2. Писарев А., Ц. Парасков, С. Бъчваров. Курс по теоретична механика. Част 2, С., Техника, 1975. 3. Яблонский А. Сборник заданий для курсовьгх работ по теоретической механике. М., Вьгсшая школа, 1978. 4. Гарипов Ем. Решени задачи по проектиране на системи за управление в MATLAB и Simulink. ТУ - София, 1999. 5. Йорданов Й. Приложение на MATLAB в инженерните изследвания. Част I и II. РУ, Русе, 2004. 6. Стойчев Г. Метод на крайните елементи. С., 2000.

DESCRIPTION OF THE COURSE

Name of the course: **Applied thermogas dynamics**	Code: **MpME11.3**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	CP – yes	Number of credits: 0

LECTURER(S):
Assoc. Prof. Eng. Pavlinka Kacarova, PhD (FME), tel.: 659 636, e-mail: p.kacarova@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

PURPOSE OF THE COURSE: The aim of the course "Quality Management Systems" aims to acquaint students with the basic requirements for the development and certification of quality management systems. As well as with the principle and the different modules of the quality systems in the different production activities.

DESCRIPTION OF THE COURSE: The course covers a wide range of regulations and standards used in the field of quality management systems. Quality management is a system of activities of all divisions of the company related to the formation of product quality, its maintenance and improvement. The basic requirements of the quality management system are studied from the series of standards series of standards ISO 9001-2018 between metrological assurance and quality management systems.

PREREQUISITES: Prerequisites: Physics, Mathematics, MIT and KUK.

TEACHING METHODS: Lectures, laboratory work with protocols with written report and individual defense.

METHOD OF TESTING AND EVALUATION: Exam. The final grade is formed by two components: - bearing 70% of the exam question and another 30%. - from the assessment received in defense of LE.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Lecture notes from the lead lecturer - Assoc. prof. PhD Pavlinka Tsanova Katsarova. 2.Дюкенджиев Г.,Р. Йорданов,Контрол и управление на качеството,Софтрейд 3. Хаджийски П.,Технологични основи на управление на качеството на машиностроителните изделия,Ту—София 4. Тодоров Д.,Мениджмънт на качеството,Аскони-София

DESCRIPTION OF THE COURSE

Name of the course: **Applied thermogas dynamics**	Code: **MpME11.4**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	CP – yes	Number of credits: 0

LECTURER(S):
Assoc. Prof. Eng. Angel Lengerov, PhD (FME), tel.: 659 613, e-mail: alengerov@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

PURPOSE OF THE COURSE: The aim of the Course "Design of mechanisms and devices for automatic weapons" aims to acquaint students with the various designs of automatic thermal machines.

DESCRIPTION OF THE COURSE: The course introduces the constructions of automatic thermal machines and their mechanisms.

PREREQUISITES: Prerequisites: Physics, Mathematics, Theoretical Mechanics.

TEACHING METHODS: Lectures and laboratory work.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Бачев В., Конструиране и проектиране на стрелково оръжие. 2000г. 214 с. 2. Артиллерийское вооружение. Основи устройства и конструирование. М., Машиностроение. 420 с. 3. Боровиков А. Ф., Вооружение самолета. М., Оборонгиз. 1940. 480 с. 4. Толочков А. А., Теория лафетов. М., Оборонгиз. 1960. 348 с.

DESCRIPTION OF THE COURSE

Name of the course: **Applied thermogas dynamics**	Code: **MpME12.1**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW – yes	Number of credits: **3**

LECTURER(S):
Assist. Prof. Eng. Sabi Sabev, PhD (FME), tel.: 659 614, e-mail: sabi_sabev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to be able to create generating parts and assemblies, to create applications with Visual Basic for Applications (VBA), to extend the functionality and adapt CAD system to the specifics problems.

DESCRIPTION OF THE COURSE: The main topics concern: working with parameters, generating models of parts and assemblies, rule based geometric models, object-oriented model of the CAD system API, API tools for modelling parts and assemblies, to work with technical drawings and attributes, access API using VBA.

PREREQUISITES: The course is based on essential engineering knowledge of the students in the given speciality as well as on the basic knowledge of Mathematics, Informatics, Applied geometry and Engineering graphics.

TEACHING METHODS: Lectures with visual aids – slides and computer presentations. Specific theoretical aspects are illustrated by direct demonstration. Laboratory exercises involve solving specific problems.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1.Autodesk Inventor 2021 API User's Manual, Autodesk, 2020. 2. Autodesk Inventor 2021 API Reference Manual, Autodesk, 2020.

DESCRIPTION OF THE COURSE

Name of the course: **Computer quality management and metrological activity**	Code: **MpME12.2**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW – yes	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Pavlinka Kacarova, PhD (FME), tel.: 659 636, e-mail: p.kacarova@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The course "Computer quality management and metrological activity" aims to acquaint students with the basic requirements and use of software products in the development and certification of quality management systems and their application in the metrological assurance of companies.

DESCRIPTION OF THE COURSE: The course covers a wide range of standards, documents and programs used in the field of metrological support of production. Quality management systems and their management and maintenance with software products. The main requirements of the system for quality management and the possibilities for digitalization of the process are studied in order to facilitate and reduce the volume of documents while maintaining the requirements to the system. The process of preparing a register of checklists; Attaching an initiating document, setting up control questions, etc.

PREREQUISITES: Prerequisites: Physics, Mathematics, ME, Materials Science, MIT and KUK.

TEACHING METHODS: Lectures, laboratory work with protocols with written report and individual defense.

METHOD OF ASSESSMENT: Exam. The final grade is formed by two components: - bearing 70% of the exam question and another 30%. - from the assessment received in defense of LE.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Lecture notes from the lead lecturer - Assoc. prof. PhD Pavlinka Tsanova Katsarova. 2.Дюкенджиев Г.,Р. Йорданов,Контрол и управление на качеството,Софтрейд 3. Тодоров Д.,Мениджмънт на качеството,Аскони-София,1995 4.СтанчеваВ.,Киров К., Управление на качеството,варна ,1996.

DESCRIPTION OF THE COURSE

Name of the course: **Computer quality management and metrological activity**	Code: **MpME12.3**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW – yes	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Pavlinka Kacarova, PhD (FME), tel.: 659 636, e-mail: p.kacarova@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The course "Computer quality management and metrological activity" aims to acquaint students with the basic requirements and use of software products in the development and certification of quality management systems and their application in the metrological assurance of companies.

DESCRIPTION OF THE COURSE: The course covers a wide range of standards, documents and programs used in the field of metrological support of production. Quality management systems and their management and maintenance with software products. The main requirements of the system for quality management and the possibilities for digitalization of the process are studied in order to facilitate and reduce the volume of documents while maintaining the requirements to the system. The process of preparing a register of checklists; Attaching an initiating document, setting up control questions, etc.

PREREQUISITES: Prerequisites: Physics, Mathematics, ME, Materials Science, MIT and KUK.

TEACHING METHODS: Lectures, laboratory work with protocols with written report and individual defense.

METHOD OF ASSESSMENT: Exam. The final grade is formed by two components: - bearing 70% of the exam question and another 30%. - from the assessment received in defense of LE.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Lecture notes from the lead lecturer - Assoc. prof. PhD Pavlinka Tsanova Katsarova. 2.Дюкенджиев Г.,Р. Йорданов,Контрол и управление на качеството,Софтрейд 3. Тодоров Д.,Мениджмънт на качеството,Аскони-София,1995 4.СтанчеваВ.,Киров К., Управление на качеството,варна ,1996.

DESCRIPTION OF THE COURSE

Name of the course: **Ammunition**	Code: **MpME12.4**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours CW – yes	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Angel Lengerov, PhD (FME), tel.: 659 613, e-mail: alengerov@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The course "Ammunition" introduces students to the construction of ammunition and the mathematical apparatus for their design.

DESCRIPTION OF THE COURSE: The constructions of small arms and artillery are studied. The methods of their design are studied.

TEACHING METHODS: Lectures and laboratory work.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1.Кириллов В. М. Патрони стрелкового оружия. 1980. 372 с. 2. Лазарев В. В. Боеприпаси. 2011. 544 с.

DESCRIPTION OF THE COURSE

Name of the course: **Ammunition**	Code: **MpME13.1**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	CP – yes	Number of credits: 0

LECTURER(S):
Assoc. Prof. Eng. Georgi Tonkov, PhD (FME), tel.: 965 3887, e-mail: gptonkov@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: Students will acquire knowledge and skills so that they can cope with certain tasks related to the application of drive systems in engineering, and to apply an optimal approach in the selection, design and optimization of these systems.

DESCRIPTION OF THE COURSE: The course mainly deals with mechanical gears, electro-power machines and electronic equipment for control and management, applicable in electromechanical transmissions to achieve certain power and kinematic parameters.

PREREQUISITES: Knowledge of the following courses: "Material science", "Mechanics", "Machine Elements", "Strength of Materials", "Theory of Mechanisms and Machines".

TEACHING METHODS: Lectures – held with the help of multimedia. Laboratory works – the laboratorial exercises are carried out with the help of modern laboratories with personal computers. Course project – consultations with analytical, software and practical explanation. AUXILIARY MEANS FOR TEACHING: The available manuals and textbooks, standards and company booklets.

METHOD OF ASSESSMENT: Defence of laboratory protocols, defence of the course project after the submission and written examination

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY: 1.Тонков Г, Д. Ралев, А. Хинков. Пособие за проектиране на машинни елементи. София, „ПРОПЕЛЕР" , 2012. ISBN 978-954-392-127-0. 2.Niemann, G.; H. Winter; B-R. Höhn: Maschinenelemente, Band 1,2,3. Springer, Berlin 2001,2003,2004.

DESCRIPTION OF THE COURSE

Name of the course: **Computer Aided Design of Machine Modules and Aggregates**	Code: **MpME13.2**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	CP – yes	Number of credits: 0

LECTURER(S):
Assoc. Prof. Eng. Georgi Tonkov, PhD (FME), tel.: 965 3887, e-mail: gptonkov@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The course aims to upgrade and improve students' skills in designing statically and dynamically loaded structures of varying complexity with the use of specialized CAD software in the field of mechanical engineering.

DESCRIPTION OF THE COURSE: The design process is entirely in CAD environment. It starts with a clearly formulated technical assignment, analytical determination of input parameters - geometric, force, kinematic, as well as certain quality indicators. A CAD model of the structure is created. Software calculations are performed. The construction is optimized according to certain criteria. Constructive documentation is prepared.

PREREQUISITES: Knowledge in: "Engineering Graphics", "Computer 3D Design", "Material Science", "Mechanics", "Machine Elements", "Strength of Materials" and "Computer Integrated Design in Mechanical Engineering".

TEACHING METHODS: Lectures – carried out with the help of multimedia. Laboratory exercises – the laboratorial exercises are carried out in modern laboratories equipped with personal computers. Course project - set individually or in groups, enabling teamwork. Analytical methodologies and software programs are used. The consultations are conducted with detailed clarification and, where possible, practical observations. AUXILIARY MEANS FOR TEACHING: Basic and supplementary literature, standards, brochures, catalogs. Availability of 3D printer capable of prototyping software models.

METHOD OF ASSESSMENT: Defence of reports for the conducted laboratory exercises; Assessment of course work; Semester written exam based on the lectures.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY: 1. Григоров, Б. Въведение в Inventor, София 2006. 2. Хинков А., Г. Тонков, Д. Ралев. Практическо ръководство/Проектиране на двустъпален цилиндричен редуктор с MITCalc. София, „ПРОПЕЛЕР" , 2012. ISBN 978- 954-392-128-7. 3. Roger S Pressman, Roger Pressman. Software Engineering: A Practitioner's Approach.McGraw-Hill, 2004. 4.Huang, George Q.; Mak, K.L. Internet Applications in Product Design and Manufacturing, Berlin, Springer, 2003. 5.Managing your data, Autodesk, 2007, ISO 10303 STEP application handbook, version2, SCRA, 2001.

DESCRIPTION OF THE COURSE

Name of the course: **Automation of control in mechanical engineering**	Code: **MpME13.3**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	CP – yes	Number of credits: 0

LECTURER(S):
Assoc. Prof. Eng. Pavlinka Kacarova, PhD (FME), tel.: 659 636, e-mail: p.kacarova@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

PURPOSE OF THE COURSE: The aim of the course is for students to study the nature of active and passive control and to be able to apply the methods and technical means for design, manufacture, research and maintenance of control machines and semi-automatic machines.

DESCRIPTION OF THE COURSE: Metrological features of automatic control, electrocontact devices for automatic control, pneumatic measuring devices for automatic control, electronic and optoelectronic measuring devices, active dimensional control in mechanical engineering, accuracy of processing in conditions of active control, automation of passive dimensional control are considered. in mechanical engineering, economic efficiency of automatic control.

PREREQUISITES: Prerequisites: Knowledge of Metrology, Measuring Equipment, Mechanical Engineering Technology, Production Automation and Robotics.

TEACHING METHODS: Lectures delivered with the help of visual materials, slides, videos. Laboratory exercises with the implementation of independent tasks, independent solution of applied course tasks.

METHOD OF ASSESSMENT: Exam. The final grade is formed by two components: - bearing 70% of the exam question and another 30%. - from the assessment received in defence of LE.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Димитров Д., Семерджиев А., Устройства за автоматичен контрол, Техника, София, 1979 2. Активный контроль в машиностроении, под редакции Педь, Машиностроение, Москва, 1971 год. 3. Балакшин О., автоматизация пневматического контроля размеров в машиностроении, Машгиз, Москва, 1974

DESCRIPTION OF THE COURSE

Name of the course: **Design of small arms and ammunition**	Code: **MpME13.4**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 15 hours	Number of credits: **3**
Course project (CP)	CP – yes	Number of credits: 0

LECTURER(S):
Assoc. Prof. Eng. Angel Lengerov, PhD (FME), tel.: 659 613, e-mail: alengerov@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to teach students how to design a small weapon and ammunition for it.

DESCRIPTION OF THE COURSE: The methodologies for designing small arms and ammunition are considered. PREREQUISITES: Knowledge of Flight Dynamics, Thermo- and Gas Dynamics, Theoretical Mechanics and Resistance of Materials is required.

TEACHING METHODS: Lectures and laboratory work.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1.Бачев В., Конструиране и проектиране на стрелково оръжие. 2000г. 214 с. 2.Артиллерийское вооружение. Основи устройства и конструирование. М., Машиностроение. 420 с. 3.Кириллов В. М. Патрони стрелкового оружия. 1980. 372 с. 4. Лазарев В. В. Боеприпаси. 2011. 544 с.

DESCRIPTION OF THE COURSE

Name of the course: **Optimization of machine-building structures**	Code: **FaMpME02**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)/Tutorials (T) Course work (CW)	Hours per semester: L – 30 hours T – 0 hours LW – 30 hours	Number of credits: **4**

LECTURER(S):
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Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Facultative subject from the curriculum for training of students to obtain Master's degree, specialty "Mechanical and Instrument Engineering", Professional orientation 5.1 Mechanical Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to expand students' knowledge of methods for numerical modeling and analysis of structures, paying special attention to the possibilities for engineering analysis, optimization and verification of technical solutions in CAD / CAE environment.

DESCRIPTION OF THE COURSE: The main topics concern: optimization problems with different objective functions, allowing analysis of stress distribution, deformations, displacements, change of the potential energy of deformations in the optimized parts, assemblies or structures; optimization and analysis of the loss of stability, the distribution of safety coefficients, the values of the natural frequencies and the type of oscillation forms, change of the geometry and boundary conditions for the purpose of vibration damping.

PREREQUISITES: Materials science, mechanics and resistance of materials, numerical methods of analysis (finite element method), basic knowledge of working with FEM software.

TEACHING METHODS: Lectures with the use of multimedia, laboratory exercises with the use of software for work in CAD / CAE environment.

METHOD OF ASSESSMENT: The work related to the training in the discipline is controlled by ongoing assessment, formed on the basis of participation in laboratory exercises and two independently solved examples in the classes for extracurricular activities. There is an option to choose a course work.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Стойчев Г., Метод на крайните елементи – якостен и деформационен анализ, София 2000; 2. Милков В., Съвременни числени методи за анализ на конструкции, Колорпринт, Варна, 1999; 3. Ташев М., Йорданов П., "Инженерен анализ с Метод на крайните елементи", изд. "Експрес", Габрово 2012; 4. Хаджийски В. М., Стефанов Ст., Компютърен инженерен анализ на машинни елементи Cosmos Works, Академично издателство на УХТ-Пловдив, 2007.