DESCRIPTION OF THE COURSE

Name of the course **Quality Control**	Number: **BpIEe57**	Semester: 7
Type of teaching: Lectures, tutorials and laboratory work	Lessons per week: L – 2 hour; T - 1 hour; LW – 1 hour	Number of credits: **5**

LECTURER: assoc. prof. Dr. Katya Stefanova, email: docentstefanova@gmail.com

COURSE STATUS IN THE CURRICULUM: Compulsory for the students speciality IndustrialEngineering BEng programme of the Faculty of Electronics and Automation, FEA.

AIMS AND OBJECTIVES OF THE COURSE: To give knowledge about use of techniques to achieve, sustain, and improve the quality of a product or service. It involves integrating the following related techniques and activities – specifications, design of the product or service to meet the specifications, production or installation to meet the full intent of the specifications.

DESCRIPTION OF THE COURSE: The course treats the Quality Control basic principles and international systems. The theory of probability and statistics, which is used in the various methods for Quality Control, is discussed. The basic experimental methods and techniques for evaluation of quality are treated.

PREREQUISITES: Mathematics, Measurements and Instrumentation, Measurement Systems.

TEACHING METHODS: Lectures with slides, supplemented by auxiliary materials and virtual labs in Moodle for self-preparation. Tutorials with problem solving and discussion on the topic. Laboratories with individual reports.

METHOD OF ASSESSMENT: Written examination.

INSTRUCTION LANGUAGE: English

BIBLIOGRAPHY:

1. D. Besterfield, Quality Control, 8-th Edition, Prentice Hall, USA, 2009;
2. E. Ott, E. G. Schilling, D. V. Neubauer, Process Quality Control, McGraw-Hill, USA 2000;
3. J. R. Evans, W. M. Lindsay, The Management and Control of Quality, Thomson, Singapore, 2005;
4. R. Deliyski, Quality Control – Problems and solutions. Student manual, Publishing house of TUSofia, 2014.

DESCRIPTION OF THE COURSE

Name of the course **Control Engineering**	Code: **BpIEe58**	Semester: 7
Type of teaching: Lectures and laboratory work	Lessons per week: L - 2 hours, LW - 1 hour	Number of credits: **4**

LECTURERs:
Assoc. Prof. Ivan Ganchev Ph.D. tel. 032 659 585; e-mail: ganchev@tu-sofia.bg
Technical University - Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory basic course in the curriculum for BEng in Industrial Engineering, at the Faculty of Electronics and Automation, FEA.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course, the students must be able to apply the basic methods for continuous- and discrete-time control systems analysis and design and use them in solving relative engineering problems. The course aims at creating and developing knowledge and skills for adequately representing and solving control problems from various fields by using control theory and modeling tools and methods.

DESCRIPTION OF THE COURSE: The main topics concern: mathematical modeling of systems; block diagrams and signal flow graphs; first-order and second-order systems; stability, steady-state error and speed of response; frequency domain analysis; analysis in the s-plane; system compensation; controllers; main blocks in the control loop; frequency domain design; control loops; PID controller design and tuning methods; common nonlinearities (nonlinear elements) in control systems. The course simultaneously extends theoretical basis and develops applied skills in control system design and implementation with analog and digital microprocessor- or PC-based, electrical, pneumatic and hydraulic elements. The course uses case studies from the process automation field in order to illustrate concepts and methods.

PREREQUISITES: Physics, Technical Mechanics, Control Theory, Measurements and Instrumentation, Electronics, Elements of Industrial Automation.

TEACHING METHODS: Lectures, using slides, case studies, laboratory work from laboratory manual, work in teams, protocols preparation and defence.

METHOD OF ASSESSMENT: One three-hour examination at the end of semester (80%) plus laboratories (20%)

INSTRUCTION LANGUAGE: English

BIBLIOGRAPHY:
1. Dorf, D.C. Modern Control Systems, Prentice Hall, 12 ed. 2011. 2. Norman S. Nise. Control Systems Engineering, 6th Ed.. 2010. 3. Morris, N.M. Control Engineering. McGraw-Hill Book Company,1991. 4. Sami Fadali, Antonio Visioli. Digital Control Engineering, 2 ed: Analysis and Design,2012. 5. Astrom, K.J., Tore Hägglund. Advanced PID Control. ISA, 2006. 6. Драготинов, И.,И Ганчев. Автоматизация на технологични процеси. П.,УХТ,2003. 7. Тодоров А.,Енев Ст. и др. Автоматизация на технологични процеси, Ръководство за лабораторни упражнения. С., ТУ-София. 8. Фархи О., А.Тодоров, Е.Николов, Промишлени системи за автоматизация, В., Изд, ВМЕИ, 1989, 1993.

DESCRIPTION OF THE COURSE

Name of the course: **Systems Modeling and Simulation**	Code: **BpIEe59**	Semester: 7
Type of teaching: Lectures and laboratory work, Course work	Lessons per week: L - 2 hours; LW - 1 hour	Number of credits: **4**

LECTURER:

Assoc. Prof. PhD Rumen Mishkov (FEA), tel. 032/659584, email: r.mishkov@gmail.com

Technical University Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM. Compulsory discipline for the students from Industrial Engineering BEng specialty in the Faculty of Electronics and Automatics of the Technical University Sofia, Branch Plovdiv.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to be able to apply the methodology for modeling, simulation, analysis, and design of continuous, discrete, linear, and nonlinear systems, to know the software products MATLAB, SIMULINK, and to use them in solving of engineering problems, analysis and validation of results.

DESCRIPTION OF THE COURSE. The students study computer-aided design and simulation of control systems. Central in the course are the topics of computer-aided analysis, modeling, and simulation of linear, nonlinear, continuous, and discrete control systems. Computer modeling and simulation of dynamical systems by differential and difference equations, transfer functions in various forms, transformations and properties of models, system responses in the frequency and time domains are considered. The peculiarities of numerical and analogue simulation, methods of numerical integration of differential equations, computer-aided methods for analysis and design of continuous and discrete control systems, matrix-vector algebra, manipulating of vectors and matrices, matrix functions, 2D and 3D computer graphics are included.

PREREQUISITES. The discipline uses knowledge acquired in the courses "Mathematics I, II, III, IV", "Technical mechanics I, II", "Physics I, II", "Informatics I, II", "Theoretical electrotechnics I, II", "Control theory I", "English language".

TEACHING METHODS. Lectures with multimedia, case studies, laboratory exercises with protocols, work in teams, course work preparation and defense.

METHOD OF ASSESSMENT. Two one-hour written assessments at mid and end of semester (62%), laboratory exercises (18%), and course work with two tasks (20%).

INSTRUCTION LANGUAGE: English

BIBLIOGRAPHY. **1.** Jones P. F., CAD/CAM: Features, Applications and Management, Macmillan Press Ltd., 1992; **2.** Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, Second Edition, McGraw-Hill Book Company, 1988; **3.** Law A. M. Simulation Modeling and Analysis, 4th Ed., McGraw-Hill, NY, 2007; **4.** Chapra S. C., Applied Numerical Methods with MATLAB for Engineering and Science. 3rd Ed., WCB/McGraw-Hill, New York, 2011; **5.** MATLAB User's Guide, The Math Woks, Inc. 1993; **6.** MATLAB Reference Guide, The Math Works, Inc. 1992; **7.** SIMULINK User's Guide, The Math Works, Inc. 1993; **8.** Control systems Toolbox User's Guide, The Math Works Inc. 1992; **9.** Optimization Toolbox User's Guide, The Math Works Inc. 1992; **10.** Signal Processing Toolbox User's Guide, The Math Works Inc. 1992;

DESCRIPTION OF THE COURSE

Name of the course: **Manufacturing Design II**	Code: **BpIEe60**	Semester: 7
Type of teaching: Lectures and laboratory work, Course work	Lessons per week: L - 2 hours; LW - 1 hour	Number of credits: **4**

LECTURERS:
Assoc. Prof. Dr. I. Chetrokov тел. 032 659 616, email: il_chetrokov@abv.bg
Technical University of Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory for the students from Industrial Engineering BEng programme of the Faculty of Electronics and Automation, FEA

AIMS AND OBJECTIVES OF THE COURSE: To give the students knowledge about the design of basic units used in modern machine-building industry and in high degree automated machinery; computer aided analysis practice, CNC programming, basic principles of machine tool design.

DESCRIPTION OF THE COURSE: General principles of machine design; Concurrent engineering; Functional characteristics of machine tools; Work accuracy; Stiffness; Thermal deflections; Technical performances of production machinery; Main and feed drives – requirements, kinds of drives; Spindle systems; Linear drives; Beds and bodies – materials, requirements; Guideways; Lubrication of production machines; Forms of flexible manufacturing automation; Subsystems of flexible manufacturing structures and their components; Technological design for flexible manufacturing structures; Program composition tool nose compensation, tool offset, manual programming; Canned and multiple repetitive cycles; Computer programming for CNC machines using programming languages FAPT and GEOPATH.

PREREQUISITES: Mechanics; Applied Geometry and Engineering Graphics; Materials Science; Strength of Materials; CAD; Industrial Manufacturing Systems; Manufacturing Design I.

TEACHING METHODS: Lectures, using slides, case studies, laboratory and course work from laboratory manual, work in teams, protocols and Course project description preparation and defence.

METHOD OF ASSESSMENT: Proportion of marks: Test - 40%; Project - 60%.

INSTRUCTION LANGUAGE: English.

BIBLIOGRAPHY:

1. Hadjikosev G., Automation of Discrete Production Engineering, TUS Publishing house, 2013;
2. Dimitrov L., Principles of Mechanical Engineering Design, Technical University of Sofia, 2001;
3. Shigley J., Ch. Mischke, Mechanical Engineering Design - 6th ed., McGraw Hill, 2001;
4. Otto K.N., L. Kristen, Product Design: Techniques in Reverse Engineering and New Product
Development, Prentice Hall, 2001;
6. 5. Boothroyd G., P. Dewhurst, Product Design for Manufacturing and Assembly, M. Dekver, 1994.

DESCRIPTION OF THE COURSE

Name of the course **Computer Integrated Manufacturing 1**	Code: **BpIEe61**	Semester: 7
Type of teaching: Lectures and laboratory work	Lessons per week: L - 2 hours, LW - 1 hour	Number of credits: **4**

LECTURER: prof. Michail Petrov Ph.D.,phone: 032 659 585e-mail: mpetrov@tu-plovdiv.bg;
Assoc. Prof. Albena Taneva Ph.D. phone: 032 659 585; e-mail: altaneva@tu-plovdiv.bg;
Technical University - Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory basic course in the curriculum for BEng in Industrial Engineering, at the Faculty of Electronics and Automation (FEA).

AIMS AND OBJECTIVES OF THE COURSE: To provide the basic knowledge about basic discrete manufacturing structures, its automation and information integration.

DESCRIPTION OF THE COURSE: The main topics concern: types of discrete manufacturing systems, working and layout models and metric, structures for automation of production and assembly process (orientation, transport, storage), robotics (kinematics, industrial environment, control and programming) and the identification of objects and processing data.

PREREQUISITES Physics, mechanics, industrial production systems, production engineering, computer science.

TEACHING METHODS: Lectures using slides. Laboratory works in a computer class and / or laboratory with stands. Individual or team work with input control, preparation of e-protocols and presentations.

METHOD OF ASSESSMENT: Two written test (at the end of the semesters) with a duration of one academic hour, with weight in the overall assessment - 80% (up to 80 points). The remaining 20% (20 points) is formed from the current control and presentation of laboratory protocols.

INSTRUCTIONAL LANGUAGE: English

BIBLIOGRAPHY:

1.Lectures' slides.
2. Groover M. P., 2008, Automation, Production Systems, and Computer Integrated Manufacturing, *Pearson Education Inc.* ISBN 0-13-207073-1;
3. Assembly automation, *The international journal of assembly technology and management*, ISSN: 0144-5154, Thomson Scientific (ISI);
4. Lotter, L. Wirtschaftliche Montage. VDI Verlag, 1986;
5. Gershwin S., B., 1994, Manufacturing systems engineering, ISBN 0-13-560-608X.
6. De Ron A., J., 1999, Performance measures for technical production systems, Eindhoven University of technology, School of industrial Engineering and management science, Syllabus;
7. Lin Zhang at all, 2014, Cloud manufacturing: a new manufacturing paradigm, Enterprise Information Systems, Vol. 8, 167-187.
8. Neshkov, T., 2013, Introduction to the speciality machatronic systems, University Textbook, Heron Press Ltd, ISBN 978-954-580-329-1,
9. *Pahl G., Beitz W., at all*, 2007, Engineering Design. A Systematic Approach, Springer-Verlag London Limited, ISBN-10: 1846283183

DESCRIPTION OF THE COURSE

Name of the course: **Elements of Industrial Automation**	Code: **BpIEe62**	Semester: 7
Type of teaching: Lectures and laboratory work	Lessons per week: L – 2 hours; LW - 1 hours	Number of credits: **4**

LECTURERS:
Assoc. Prof. Ivan Ganchev, Ph.D. phone: 032 659 585;e-mail: ganchev@tu-plovdiv.bg;
Assoc. Prof. Albena Taneva Ph.D. phone: 032 659 585; e-mail: altaneva@tu-plovdiv.bg;
Technical University of Sofia, branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory for the students from Industrial Engineering BEng programme of the Faculty of Electronics and Automation, (FEA)

AIMS AND OBJECTIVES OF THE COURSE: To provide knowledge on elements, used in process automation and control systems, and their properties and applications.

DESCRIPTION OF THE COURSE: The main topics concern: Transducer of non-electrical quantities (nozzle-and -flapper, velocity and acceleration, torque and shaft power transducers; flow measurements; temperature and humidity) - block diagrams, static and dynamic characteristics, transfer functions; nonlinearity, connection; Process controllers - classification, control laws, mathematical description and characteristics; Electrical controllers - on-off, analogue with pulsewidth modulated output and on operational amplifiers, digital microcomputer-based, programmable logic controllers (function blocks, programming languages, controller networks); Pneumatic and hydraulic control elements - amplifiers, integrators, differentiators, feedback elements, controllers; Final control elements - actuators, positioners, valves; Principles of data transmission between plants and PLCs - communication standards and systems, SCADA systems.

PREREQUISITES: physics, electrical engineering, electronics, control systems, computer integrated production, measurement, informatics

TEACHING METHODS: Lectures, using multimedia, case studies, laboratory work from laboratory manual, work in teams, protocols preparation and defence.

METHOD OF ASSESSMENT: A three-hours exam at the end of the semester (75%) plus laboratories (25%).

INSTRUCTION LANGUAGE: English.

BIBLIOGRAPHY:

1. Yordanova S., N.Kolev, R.Litchev. Elements of Industrial Automation. TU-Sofia, 1998;
2. Petruzella F., Programmable Logic Controllers, McGraw-Hill Science, 2010
3. Popovic D. Distributed Computer Control for Industrial Automation, Marcel Dekker, 1990.
4. Parr A, Hydraulics and Pneumatics, Third Edition: A technician's and engineer's guide, 2011;
5. Berger H, Automating with STEP 7 in LAD and FDB: SIMATIC S7-300/400 Programmable controllers, 2012, Publics

OPTIONAL SUBJECTS LIST 2

List2 (BpIEe63 – ECTS 4)

BpIEe63.1 Control Theory II
BpIEe63.2 Composite Materials
BpIEe63.3 Industrial Power Supply and Switchgear
BpIEe63.4 Embedded Systems
BpIEe63.5 Multidimensional Systems
BpIEe63.6 Introduction to Business Intelligence
BpIEe63.7 Fundamentals of Telecommunications Engineering
BpIEe63.8 Databases
BpIEe63.10 Internet Multimedia Communications
PRACTICE - 2 weeks

DESCRIPTION OF THE COURSE

Name of the course: **Control Theory II**	Code: **BIEe63.1**	Semester: 7
Type of teaching: Lectures and laboratory work	Lessons per week: L – 2 hours; LW - 1 hours	Number of credits: **4**

LECTURERS:

Prof. DSc. A.Topalov, 032 659 528, email: topalov@tu-plovdiv.bg
Technical University of Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Optional for the students speciality Industrial Engineering BEng programme of the Faculty of Electronics and Automation, FEA.

AIMS AND OBJECTIVES OF THE COURSE: To give knowledge on the modern methods for analysis and design of robust and optimal control systems. To develop skills for description of uncertain systems, robust stability and robust performance analysis, to perform H_∞ design and μ – synthesis of multivariable control systems. To develop practical skills for using MATLAB in the robust analysis and design of control systems.

DESCRIPTION OF THE COURSE: The main topics concern: Properties of multivariable feedback systems, application of the singular values in the analysis of multivariable systems, H_2 and H_∞ norms of transfer matrices, uncertainty description, application of the linear fractional transformations, obtaining of unstructured and structured uncertainty models, properties of the structured singular value, robust stability and robut performance, mixed sensitivity H_∞ design, H_∞ loop shaping, · synthesis and D-K iterations. Program language – MATLAB.

PREREQUISITES: Mathematics I, II, III, IV, Physics, Mechanics, Computing, Electrical Engineering, Control Theory I.

TEACHING METHODS: Lectures, laboratory work, work in teams.

METHOD OF ASSESSMENT: In order to assess the achievement of the course learning goals, a three hour written exam test is held at the end of 7th semester during the examination session.

INSTRUCTION LANGUAGE: English.

BIBLIOGRAPHY:

1. Gu Da-Wei, Petkov Petko H., Konstantinov Mihail M., Robust Control Design with MATLAB - Second Edition, ISBN: 978-1-4471-4681-0, 2013;
2. Petkov P., Christov N., Konstantinov M., Compotational Methods for Linear Control Systems, Prentice Hall, 1991;
3. Zhou K., Doyle J. C., Glover K., Robust and Optimal Control, Prentice Hall, 1996;
4. Skogestad S., Postlethwaite I., Multivariable Feedback Control. Analysis and Design, John Willey & Sons, 1998

DESCRIPTION OF THE COURSE

Name of the course: **Multidimenisonal systems**	Code: **BpIEe63.5**	Semester: 7
Type of teaching: Lectures and laboratory work	Lessons per week: L – 2 hours; LW - 1 hours	Number of credits: **4**

LECTURERS:

Prof. Dr. Nikos Mastorakis email: mastor@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Optional for the students speciality Industrial Engineering BEng programme of the English Language Faculty of Engineering.

AIMS AND OBJECTIVES OF THE COURSE: The course main goal is to provide the students with to design multidimensional filters as the 2-D Systems are the necessary mathematical background for the modern image processing.

DESCRIPTION OF THE COURSE: The main topics concern:

– Discrete and Continuous Multidimensional Signals and Systems Introduction, Region of Support, Quantization, Periodicity, Separability, Linearity, Shift Invariance, Causality. Recursive Filters, Non-recursive Filters;

– Flow graphs and Networks. Space Domain Analysis. Convolution Description of Discrete and Continuous Multidimensional Systems;

– Conversion from one description to the other Transfer function, States-space equations, Impulse Response, Difference Equations;

– Realization: Direct Structure, Cascade Structure, Separable Structures, Multi-Input and Multioutput Filters, Multidimensional Filters;

– Givone-Roesser Model, Fornasini-Marchesini Model. Conversion from one model to the other Model. Modelling of Partial Differential Equations of Mathematical Physics with Givone-Roesser Model or Fornasini-Marchesini Model;

– Observability of 2-dimentional systems Controllability and minimality of 2-dimentional systems; – The m-D (multidimensional) Z Transform. Region of Convergence. The Inverse m-D ZTransform. Complex Convolution. m-D Parseval Theorem. The m-D Fourier Transform. The Sampling Process. 2-D Sampled Signals. The 2-D Sampling Theorem. Symmetries. Idealized Systems and Filters;

– Stability. Stability Analysis in Frequency Domain. Stability Analysis in State Space. Stability Properties. Stability Theorems, Stability Tests and Criteria. m-D Lyapunov Stability Theory. Stability of Low-Order Filters;

– Stability Margin. Definitions and Computation of Stability Margin with various methods. Comparison and Benchmarks;

– Systems' and Signals' Factorizability and Factorization. Multivariable polynomial factorization. Exact and Approximate Factorization. Methods and Results;

– Multidimensional Digital Filters Theory: Approximation for Nonrecursive Filters. Properties of m-D nonrecursive Filters. Linear-Phase Filters. Frequency Response. Design Based on Fourier Series. Multidimensional Window Functions. Design of 2-D Circularly Symmetric Filters. Fan Filters. Design based on McClellan Transformation;

– Multidimensional Digital Filters Theory: Approximation for Recursive Filters. Bilinear Transformation. Linear Transformations. Analog-Filter Transformations. Method of Hirano and Aggarwal. Filters with Half-Plane Symmetry. Circularly Symmetric Filters. Method of Goodman. Other Transformations;

– m-D Filters' Design by Optimization. Quasi-Newton Optimization Algorithms. Minimax Method. SVD (Singular Value Decomposition) based design. Error Analysis. Stability aspects and problems of m-D systems Design. Computational Intelligence based m-D design. New Aspects and Directions for Further Research. Realization. Finite Wordlength Effects. Overflow Limit Cycles.

PREREQUISITES: Mathematics I, II, III, Electrical Engineering, Control Theory I.

TEACHING METHODS: Lectures and laboratory work.

METHOD OF ASSESSMENT: One three hours exam at the end of the semester (70%), plus laboratories (30%).

INSTRUCTION LANGUAGE: English.

BIBLIOGRAPHY:

1. Bahram Javidi, Enrique Tajahuerce, Pedro Andres, Multi-dimensional Imaging, Wiley-IEEE Press, 2014;
2. Special issue on symbolic methods in multidimensional systems theory, Springer Multidimensional Systems and Signal Processing - Volume 26, Issue 2, 2015;
3. T. Matsuo, Y. Hasegawa, Realization Theory of Discrete-Time Dynamical Systems, Two-Dimensional Linear Systems, Springer-Verlag, Lecture Notes in Control and Information Sciences, Berlin-Heidelberg, 2003;
4. B. A. Shenoi, Magnitude and Delay Approximation of 1-D and 2-D Digital Filters realization Theory of Discrete-Time Dynamical Systems, Two-Dimensional Linear Systems, Springer-Verlag, Digital Signal Processing Book Series, 1999;
5. T. Kaczorek, Two-Dimensional Linear Systems, Springer-Verlag, Lecture Notes in Control and Information Sciences, Berlin-Heidelberg, 1985;
6. Wu-Sheng Lu, Andreas Antoniou, Two-Dimensional Digital Filters, Marcel Dekker, New York, 1992;
7. N. K. Bose (Editor), Multidimensional Systems Theory, Progress, Directions and Open Problems in Multidimensional Systems, D. Reidel Publishing Company, Dordrecht, Holland, 1985;
8. N. K. Bose (Editor), Multidimensional Systems: Theory and Applications - 2nd edition, Springer, 2003;
9. S. G. Tzafestas (Editor), Multidimensional Systems, Marcel Dekker, New York, 1986;
10. G. F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, New York, 1980;
11. R. P. Roesser, A discrete state-space model for image processing, IEEE Trans. Automat. Contr., vol. AC-20, 1975.

DESCRIPTION OF THE COURSE

Name of the course: **Introduction to Business Intelligence**	Code: **BpIEe63.6**	Semester: 7
Type of teaching: Lectures and laboratory work	Lessons per week: L – 2 hours; LW - 1 hours	Number of credits: **4**

LECTURERS:

Dr. P. Petrova email: pepi_petrova@yahoo.com
Technical University - Sofia

COURSE STATUS IN THE CURRICULUM: Optional for the students speciality Industrial Engineering BEng programme of the English Language Faculty of Engineering.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the subject is to provide a basic knowledge about ERP systems and their role at organization. Comparison between traditional and modern approach in development and implementation an ERP system. Work with BI development platform.

DESCRIPTION OF THE COURSE: The subject main topics includes work with Data Bases, DB creation, enterprise data collection, Big Data exploitation, Data Warehouse, OLTP, OLAP, ETL, data analysis, data cleaning, data mining, BI development approaches, user requirements for BI application, develop own BI application.

PREREQUISITES: Data Base and DB Management systems, Mathematics, Analysis.

TEACHING METHODS: Lectures, using slides, laboratory work using BI development platform. Individual work, team work, project preparation and project evaluation.

METHOD OF ASSESSMENT: Project preparation and evaluation at the end of the 7th semester – (80% part of final evaluation) and continuous control throughout the semesters Laboratory works - (20% part of final evaluation).

INSTRUCTION LANGUAGE: English.

BIBLIOGRAPHY:

1. Slides for the lectures (given to students at the beginning of the 7th semester);
2. Larissa T. Moss, Shaku Atre, Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications, Addison Wesley, 2003, ISBN: 0-201-78420-3;
3. Adelman, Sid, Larissa T. Moss, Data Warehouse Project Management, Addison-Wesley, 2000;
4. Beck, Kent, Extreme Programming Explained: Embrace Change, Addison-Wesley, 2000;
5. Kimball, Ralph. The Data Warehouse ETL Toolkit. Indianapolis, IN: Wiley, 2004;
6. http://tdwi.org/Home.aspx;
7. http://www.qlik.com/.

DESCRIPTION OF THE COURSE

Name of the course **Computer Integrated Manufacturing 2**	Code: **BpIEe64**	Semester: 8
Type of teaching: Lectures and laboratory work	Lessons per week: L - 2 hour, LW - 2 hours	Number of credits: **3**

LECTURER: Prof. Michail Petrov Ph.D. tel. 032 659 585; e-mail: mpetrovg@tu-plovdiv.bg

Assoc. Prof. Albena Taneva Ph.D. tel. 032 659 585; e-mail: altaneva@tu-plovdiv.bg

COURSE STATUS IN THE CURRICULUM: Compulsory basic course in the curriculum for BEng in Industrial Engineering, at the Faculty of Electronics and Automation (FEA).

AIMS AND OBJECTIVES OF THE COURSE: To provide the basic knowledge about basic discrete manufacturing structures, its automation and information integration.

DESCRIPTION OF THE COURSE:

: The main topics concern: types of discrete manufacturing systems, working and layout models and metric, structures for automation of production and assembly process (orientation, transport, storage), robotics (kinematics, industrial environment, control and programming) and the identification of objects and processing data.

PREREQUISITES: Physics, mechanics, industrial production systems, production engineering, computer science.

TEACHING METHODS: Lectures using slides. Laboratory works in a computer class and / or laboratory with stands. Individual or team work with input control, preparation of e-protocols and presentations.

METHOD OF ASSESSMENT: Two written tests (at the end of the semesters) with a duration of one academic hour, with weight in the overall assessment - 80% (up to 80 points). The remaining 20% (20 points) is formed from the current control and presentation of laboratory protocols.

INSTRUCTIONAL LANGUAGE: English

BIBLIOGRAPHY:

1. Lectures' slides;
2. Groover M. P., 2008, Automation, Production Systems, and Computer Integrated Manufacturing, *Pearson Education Inc.* ISBN 0-13-207073-1;
3. Assembly automation, *The international journal of assembly technology and management*, ISSN: 0144-5154, Thomson Scientific (ISI);
4. Lotter, L. Wirtschaftliche Montage. VDI Verlag, 1986;
5. Gershwin S., B., 1994, Manufacturing systems engineering, ISBN 0-13-560-608X.
6. De Ron A., J., 1999, Performance measures for technical production systems, Eindhoven University of technology, School of industrial Engineering and management science, Syllabus;
7. Lin Zhang at all, 2014, Cloud manufacturing: a new manufacturing paradigm, Enterprise Information Systems, Vol. 8, 167-187.
8. Neshkov, T., 2013, Introduction to the speciality machatronic systems, University Textbook, Heron Press Ltd, ISBN 978-954-580-329-1,
9 Pahl G., Beitz W., at all, 2007, Engineering Design. A Systematic Approach, Springer-Verlag London Limited, ISBN-10 1846283183

DESCRIPTION OF THE COURSE

Name of the course: **Environmental Production Engineering**	Code: BpIEe65	Semester: 8
Type of teaching: Lectures and laboratory work	Lessons per week: L – 2 hours; LW – 2 hours	Number of credits: 3

LECTURER:Assoc. Prof. Margarita Deneva, Ph.D. tel. 032 659 739; e-mail: deneva@tu-plovdiv.bg;

Technical University - Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory for the students specialty Industrial Engineering BEng programme of the Faculty of Electronics and Automationm FEA.

AIMS AND OBJECTIVES OF THE COURSE: To develop an understanding of the concept and principles of environmental friendly policy, assessments, pollution control and management to the students, and also to give them knowledge to some aspects of existing environmental problems and sustainability.

DESCRIPTION OF THE COURSE: The main topics concern: Sustainable development; Basic Concepts, Structure and Function of Ecological Systems; Ecosystems Balance and Change; Air Resources: Atmosphere, Climate & Weather; Renewable Energy Resources; Air Pollution - Global Problems; Air Pollution Control Technologies; Water Resources, Use & Management; Waste Water Treatment; Solid Waste Treatment Management. The result of treatment facilities construction, based on application and optimization of the operation observed in nature and technologies designed into harmony with the natural environment will be production of the end industrial products, included air emissions, waste waters and waste, compatible with the existing environmental resources without overtaxing the assimilative powers of atmosphere, hydrosphere or lithosphere. The purpose of this course is to give students basic knowledge of available technological tools concerning some main topics: - the structure of ecological systems; - the strategy of environmental pollution and protection; - the interaction between the industry and the environment; - the description of major technologies used for pollution control of gaseous, liquid and solid wastes from the industries with sustainable development in mind.

PREREQUISITES: Chemistry, Physics.

TEACHING METHODS: Lectures - using slides, case studies; laboratory and course work from laboratory; presentation of an environmental problem and defense during discussion.

METHOD OF ASSESSMENT: Two Assessment tests (each of them 45%) and Presentation of an environmental problem (10%) during discussion.

INSTRUCTIONAL LANGUAGE: English.

BIBLIOGRAPHY:1. G. Masters, Introduction to Environmental Engineering and Science, Prentice Hall, 1991.

1. G. Tchobanoglous, H. Thiesen, S. Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw-Hill, N.Y., 1993.
2. G. Tchobanoglous, L. Burton, Wastewater Engineering: Treatment, Disposal and Reuse, Metcalf & Eddy, N.Y., 1991.
3. H. Bridgman, Global Air Pollution, Belhaven Press, 1990.
4. H. Bringman, Global Air Pollution: Problems for the 1990's, Belhaven Press, London, 1990.
5. J. Twidell, T. Weir, Renewable Energy Resources, E. & F. N. Spon, London, 1990.
6. John Wainwright, Mark Mulligan, Environmental Modelling: Finding Simplicity in Complexity, Willy, 2004.
7. Nelson L. Nemerow, Franklin J. Agardy, Joseph A. Salvato, Environmental Engineering: Water, Wastewater, Soil and Groundwater Treatment and Remediation, 6th Edition, Willy, 2009.
8. Stefan Franzle, Bernd Markert, Simone Wunschmann, Introduction to Environmental Engineering, Willy, 2012.

DESCRIPTION OF THE COURSE

Name of the course: **Manufacturing Strategies**	Code:**BpIEe66**	Semester: **VIII**
Type of teaching: lectures, tutorials	Lessons per week: L - 2 hours; T - 2 hours	Number of credits: **3**

LECTURER: Elena Zlatanova, PhD, tel.032 659 714; +359 893 69 06 55

Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory for the students specialty Industrial Engineering BEng programme of the Faculty of Electronics and Automation, FEA.

AIMS AND OBJECTIVES OF THE COURSE: To familiarise the students with the main problems and tasks of the manufacturing strategy and the ways for their solution. The course includes the interface relations between the manufacturing strategy and the marketing, R&D, F&A, management, CIS, etc. activities. It deals with the practical manufacturing strategy implementation issues, related to the business plan and strategic alternatives development.

DESCRIPTION OF THE COURSE: The main topics include: manufacturing strategy role and scope; manufacturing strategy development; areas of strategic manufacturing decisions; management of the material supply chain; production capacity planning strategy; production improvement strategies; interface between the manufacturing and the other functions; practical implementation of the manufacturing strategy.

PREREQUISITES: Industrial Manufacturing Systems, POM, Management science, Marketing, CIM.

TEACHING METHODS: Lectures, tutorials, case studies, personal and group presentations.

METHOD OF ASSESSMENT: Mid-term test (30%); exam in the end of the semester (40%); case study participation (30%).

INSTRUCTIONAL LANGUAGE: English.

BIBLIOGRAPHY:

1. Miltenburg J. Manufacturing Strategy: How to Formulate and Implement a Winning Plan, 2nd ed. Productivity Press, 2005
2. Hill T. Manufacturing Strategies. Text and Cases 3rd ed. Palgrave Macmillan 2009.
3. Stevenson W. Production and Operations management, 11th ed., McGraw Hill, 2011.
4. Byrne A. and J. P. Womack. The Lean Turnaround: How Business Leaders Use Lean Principles to Create Value and Transform Their Company. McGraw Hill, 2012
5. Chopra S. and P. Meindl. Supply Chain Management: Strategy, Planning, and Operation. 6th ed. 2015.

DESCRIPTION OF THE COURSE

Name of the course **Finance and Accounting**	Code: **BpIEe67**	Semester: VIII
Type of teaching: Lectures and laboratory work	Lessons per week: L - 2 hours, LW - 2 hour	Number of credits: 3

LECTURER:
Assoc. Prof. S.Konstantinova Ph.D. tel. 359 32 659 714; +359 893 69 06 55

Technical University - Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory basic course in the curriculum for BEng in Industrial Engineering, at the Faculty of Electronics and Automation, FEA (FLFE).

AIMS AND OBJECTIVES OF THE COURSE: To provide students with basic knowledge about theoretical base of corporate finance and accounting.

DESCRIPTION OF THE COURSE: The main topics concern: Calculation of profit/loss from investments in tangible assets or purchase of common stocks and bonds or other securities, selection source of finance and price of finance, developing financial plans – budgets, analyse and assessment of financial condition of the company, capital structure assessment.

PREREQUISITES: Business Economic.

TEACHING METHODS: Lectures, using slides, case studies, laboratory and course work from laboratory manual, work in teams, protocols preparation and defence.

METHOD OF ASSESSMENT: Continuous Assessment - two tests at the middle and at the end of the semester – 45 minutes. Wighting coefficient 0.8 (up to 80 points) and continuous control throughout the semesters Laboratory works with weighting coefficient 0.2 (up to 20 points).

INSTRUCTION LANGUAGE: English

BIBLIOGRAPHY: 1. Dyson J., Accounting for Non-accounting Students, 3rd ed., Pitman, 1994, 2. Kimmel. D., J. Weygandt, and D Kieso, **Financial Accounting: Tools for Business Decision Making**, Irwin McGraw-Hill., 2006, 3. Maness T., Introduction to Corporate Finance, McGraw-Hill, 1988, 4. Libby R., P. Libby and D. Short, Financiql Accounting, 4th ed., Irwin McGraw-Hill, 2005, 5. Merrill Lynch's "How to Read Financial Statements" translated into Bulgarian with notes prepared by Dr. Jeremy Cripps and Mrs. Ann Wallace kindly donated by USAID Capital Markets Regulation Project.

OPTIONAL SUBJECTS LIST 3

List3 (BpIEe68 – ECTS 4, BpIEe69 – ECTS 4)

BpIEe68.1 Networks Communications in Process Control Systems
BpIEe68.2 Object - Oriented Programming
BpIEe68.3 Materials and Technologies Selection
BpIEe68.4 XML Based CAD/CAM/CAx Integration
BpIEe68.5 Mechanical Fundamentals of Micro Electromechanical Systems

DESCRIPTION OF THE COURSE

Name of the course **Network Communications in Process Control**	Code: **BpIEe68.1**	Semester: 8
Type of teaching: Lectures and laboratory work	Lessons per week: L - 2 hours, LW - 2 hour	Number of credits: **4**

LECTURER:

Assoc. Prof. Michail Petrov Ph.D. tel. 032 659 585; e-mail: mpetrov@tu-plovdiv.bg;
Assoc. Prof. Albena Taneva Ph.D. tel. 032 659 585; e-mail: altaneva@tu-plovdiv.bg
Technical University - Sofia , Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Eligible course in the curriculum for BEng in Industrial Engineering, at the Faculty of Electronics and Automation (FEA).

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is for students to learn and be able to apply the approaches, methods and technical means for analysis, modeling and configuration of industrial communication systems and taking into account their specificity in accordance with their needs and interests to acquire new knowledge and skills in this subject area.

DESCRIPTION OF THE COURSE: Industrial field networks along with information management level are considered. Particular attention is paid to the field of industrial networks for connecting intelligent terminals, as a prerequisite for the creation of systems with open architecture. The students are able to make comparative analysis of many modern industrial networks to carry various kind of information - digital and analogue audio and video, and wireless communications in industrial environments. The course discusses the sample solutions (case studies) in various industries - chemical, metallurgical, machine tool, textile and others. There are also examples for the program and technical implementation of systems for network communication in industrial environments. The specifics of automatic control systems with network communication as part of the management process

PREREQUISITES: Communication foundation, Control Theory, Electrical Engineering, Physics, Electronics.

TEACHING METHODS: Lectures, using slides, case studies, laboratory and course work from laboratory manual, work in teams, protocols preparation and defence.

METHOD OF ASSESSMENT: Final exam at the end of the 4^{th} semester – 1,5 hours with weighting coefficient 0.8 (up to 80 points) and continuous control throughout the semesters Laboratory works with weighting coefficient 0.2 (up to 20 points).

INSTRUCTIONAL LANGUAGE: English

ПРЕПОРЪЧИТЕЛНА ЛИТЕРАТУРА: **1.** Slides for the lectures/updated each year/; 2. Andre Neubauer, Jurgen Freudenberger, Coding Theory: Algorithms, Architectures and Applications,2007 . 3. Sergei Semenov., Modulation and Coding Techniques in Wireless Communications,.2011. 4. John Proakis. Digital Communications, 5th Ed.,2007 5. Deon Reynders., Practical Industrial Data Communications., 6. Sunit Kumar. Fiedlbus and Networking in Process Control. 2014 7. Борисов А.М., Основы построения промышленных сетей автоматики.2012, ЮУрГУ.

DESCRIPTION OF THE COURSE

Name of the course **Object-Oriented Programming**	Code: **BpIEe68.2**	Semester: 8
Type of teaching: Lectures and laboratory work	Lessons per week: L - 2 hours, LW - 2 hour	Number of credits: **4**

LECTURER: assoc. prof. Velko Ilchev, tel.032 659 726, e-mail: e-mail: iltchev@tu-plovdiv.bg
Technical University - Sofia , Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Optional for the students specialty Industrial Engineering BEng programme of the Faculty of Electronics and Automation, FEA.

AIMS AND OBJECTIVES OF THE COURSE: To develop a student's ability to solve problems using an object oriented programming language.

DESCRIPTION OF THE COURSE: The main topics concern: Object-oriented programming methodology; introduction to Java programming language; data types – objects and primitive data types: integers and gloating points, characters, Booleans, expressions, operator precedence, data conversion, string, variables and constants, assignment statements; control flow – conditional statements and loops, bleak and continue; arrays; classes – declaration, class modifiers, variable declaration, method declaration, constructors, objects, class member invocation, static variables and static methods, abstract classes and abstract methods, applet methods; inheritance – class declaration, constructor declarations, overloading methods, overriding instance methods, hiding class methods, hiding variables, multiple inheritance; abstract classes; nested classes; interfaces – definition, interface declaration, implementing an interface, using an interface as a type; polymorphism - polymorphism via interfaces, polymorphism via inheritance; events and listeners; graphical user interface; exceptions; input/output streams – text files, binary files; multiple threads.

PREREQUISITES: Computing I, Computing II.

TEACHING METHODS: Lectures, using a beamer, case studies, laboratory work in teams, preparation of exercises and laboratory works, solve a problem using an object oriented programming language.

METHOD OF ASSESSMENT: One two-hour exam at the end of semester (70%) plus laboratories (30%).

INSTRUCTIONAL LANGUAGE: English

BIBLIOGRAPHY:

1. Herbert Schild, Java 2 – ръководство за програмиста, Софт Прес 2001;
2. John Lewis, William Loftus, Java Software Solutions. Foundations of Program Design, Second Edition, Addison Wesley Longman, Inc., 2000;
3. Bruce Eckel, Thinking in Java, Prentice Hall, 1999;
4. Кристофър Стоун, Джо Уебър, Програмиране за Интернет, Книги първа и втора, LIO Book Publishing, 1997;
5. Patrick Naughton, The Java handbook, Osborne;
6. Jamie Jaworski, Java Developer's Guide, Sams.net Publishing, 1996.

DESCRIPTION OF THE COURSE

Name of the course **Materials and Technologies Selection**	Code: **BpIEe68.3**	Semester: 8
Type of teaching: Lectures and laboratory work	Lessons per week: L - 2 hours, LW - 2 hour	Number of credits: **4**

LECTURER: Assoc. Prof. Dr. L. Vasileva

Technical University - Sofia

COURSE STATUS IN THE CURRICULUM: Optional for the students specialty Industrial Engineering BEng programme of the English Language Faculty of Engineering.

AIMS AND OBJECTIVES OF THE COURSE: To complete the knowledge of engineering module Materials Science - Materials Technologies- Material and Technology Selection. To give the students procedures for material and process selection in mechanical design by systematic scheme of isolating the optimal subset of materials and technologies among the full enormous ranges.

DESCRIPTION OF THE COURSE: The main topics concern: Design as a structural-functional process. New interpretation of engineering properties. Materials Selection Charts. Graphical Representation of the Functional Connections between Materials. Properties and Criteria for Complex Evaluation in Selection Charts; Functional Relationships between Materials, Technologies, Structures and Properties Materials properties profiles diagrams. Procedure of Materials and Technology Selection. Optimization of Relationship between Materials - Technologies - Structures - Properties as a key of Mechanical Design.

PREREQUISITES: Materials Sciences, Materials Technologies, Mechanics.

TEACHING METHODS: Lectures, using slides, case studies, laboratory and course work from laboratory manual, work in teams, protocols and course work description preparation and defence.

METHOD OF ASSESSMENT: Exam in the end of the term.

INSTRUCTIONAL LANGUAGE: English

BIBLIOGRAPHY:

1. M.F.Ashby, Materials Selection in Mechanical Design, Butterworth Heinemann Ltd, 1995;
2. J.A.Charles, FAA Crane, Selection and Use of Engineering Materials, Butterworth & Co.Ltd, 1989;
3. R.Honeycombe, H.K.D.H.Bhadeshia, Microstructures and Properties, Hodder Headline PLC, 1995;
4. Niebel B.W., A.B. Draper, R.A.Wysk, Modern Manufactoring Process Engineering, McGraw-Hill Publ. Company, 1986.

DESCRIPTION OF THE COURSE

Name of the course: **Mechanical Fundamentals of Microelectromechanical**	Code: **BpIEe68.5**	Semester: **8**
Type of teaching: Lectures and Laboratory work	Lessons per week: L - 2 hours; LW - 2hours	Number of credits: **4**

LECTURER:
Prof. Todor Todorov Ph. D., tel.: +359 2965 2794, e-mail: tst@tu-sofia.bg;
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Optional course in the curriculum for BEng in Industrial Engineering, at the English Language Faculty of Engineering (ELFE).

AIMS AND OBJECTIVES OF THE COURSE: To provide basic knowledge about the mechanical nature of micro electromechanical systems (MEMS), their modeling, design, and application.

DESCRIPTION OF THE COURSE: The main topics concern: MEMS Technology; Materials for MEMS; Energy transductions; Elastic properties of anisotropic materials, beams, membranes, plates and shells; Compliant micromechanisms; Mechanical and electromechanical models of microsystems; MEMS accelerometers, gyroscopes, inertial measurement units (IMU), MEMS sensors for pressure, force, flow, humidity; MEMS DLP projectors, Inkjet print heads, microgrippers, atomic force nanoprobes; Smart material sensors and actuators; MEMS energy harvesters.

PREREQUISITES: Mechanics, Theory of Mechanisms and Machines, Strength of Materials, Electrical engineering, Electronics, Microelectronics, Physics, Chemistry, Fluid mechanics, and Material science.

TEACHING METHODS: Lectures are held by slides, models of microsystems, panels and power point presentations. The labs are based on laboratory manuals and use evaluating and experimental setups, equipped with modern computer systems for data acquisition and processing of the measured parameters. Students write lab reports and defend them before the lecturer.

METHOD OF ASSESSMENT: Final exam at the end of the 8^{th} semester – 2 hours. The grading is 80% of the final exam grade and 20% of the lab grade.

INSTRUCTIONAL LANGUAGE: English.

BIBLIOGRAPHY:

1. Lobontiu N., Garcia E., *Mechanics of Microelectromechanical Systems*, Springer, 2014.
2. Gianchandani Y. B., Tabata O., Zappe H., *Comprehensive Microsystems*, Elsevier, 2008,
3. Senturia S.D., *Microsystem design*, Kluwer Academic Publishers, 2001.
4. Korvink G., Paul O., *MEMS: A Practical Guide to Design, Analysis, and Applications*, William Andrew Inc., 2006.
5. Briand D., Yeatman E., Roundy S., Korvink, G, Tabata O., *Micro Energy Harvesting*, Wiley, 2015.
6. Armenise N, Ciminelli C., Francesco D., Passaro V., *Advances in Gyroscope Technologies*, Springer, 2011.
7. Howell L. L., *Compliant mechanisms*, John Wiley & Sons, Inc, 2001.

OPTIONAL SUBJECTS LIST 4
List4 (BpIEe69 – ECTS 4)
BpIEe69.1 Finite Element Structures Analyses
BpIEe69.2 Manufacturing in Electronics Industry
BpIEe69.3 Corrosions of Metals and Methods of Protection

DESCRIPTION OF THE COURSE

Name of the course: **Finite Element Structures Analysis**	Number: **BpIEe69.1**	Semester: **8**
Type of teaching: **Lectures and laboratory work**	Lessons per week: **L – 2 hours; LW – 2 hours**	Number of credits: **4**

LECTURER: Assist.Prof. E.Chankov email: chankov@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Optional, for the students, specialty Industrial Engineering, B.Sc. program of the English Language Department of Engineering.

AIMS AND OBJECTIVES OF THE COURSE: To give knowledge about theory and application of Finite Element Method for structural analysis, to gain experience in using finite element software of commercial quality.

DESCRIPTION OF THE COURSE: The main topics concern: Introduction to modeling of structures: hypothesis and assumptions. Elastic models: equations of equilibrium, straindisplacements relationships, stress-strain relationships, plane stress and plane strain problem, axisymmetric problem. Fundamentals of FEM: virtual displacement principle, discretization and approximation of unknown functions, element stiffness matrix and load vector, assembling. FEM for trusses and frames: variational formulation, shape functions, element stiffness matrix, problems. Plane problems: interpolation fields for triangle and quadratic elements, isoparametric formulation. Numerical integration. Axisymmetric problems. 3D problems. Modeling, errors and accuracy of FEM solution. Plates and shells. Plate-bending theory, displacements, strains and stresses, finite elements for plates. Shells and shell theory, assumptions and hypotheses, displacements, strains and stresses. Shell elements. Problems. Dynamic problems: introduction, mass and damping matrixes, natural frequencies.
PREREQUISITES Mathematics, Physics, Mechanics, Strength of materials.

TEACHING METHODS: Lectures, using slides and laboratory work..

METHOD OF ASSESSMENT: Three written theoretical tests (50%) and three laboratory tests (50%).

INSTRUCTIONAL LANGUAGE: English.

BIBLIOGRAPHY:

1. O. C. Zienkiewicz, R. L. Taylor, J. Z. ZhuThe, Finite Element Method: Its Basis and Fundamentals - Seventh Edition, Butterworth-Heinemann, 2013;
2. O. C. Zienkiewicz, R. L. Taylor, D. D. Fox, The Finite Element Method for Solid and Structural Mechanics - Seventh Edition, Butterworth-Heinemann, 2013;
3. J. T. Oden, J. N. Reddy, An Introduction to the Mathematical Theory of Finite Elements, Dover Publications, 2011.

DESCRIPTION OF THE COURSE

Name of the course: **Manufacturing in Electronic Industry.**	Number: **BpIEe69.2**	Semester: **8**
Type of teaching: **Lectures and laboratory work**	Lessons per week: **L – 2 hours; LW – 2 hours**	Number of credits: **4**

LECTURER: Assist. Prof. Ph.D. Ilia Petrov, tel. 032 659 718,, e-mail: ilpetrov@tu-plovdiv.bg

Technical University of Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Optional, for the students, specialty Industrial Engineering, B.Sc. program of the Faculty of Eletronics and Automation FEA.

AIMS AND OBJECTIVES OF THE COURSE: To give knowledge about technological processes and sequences used in the contemporary microelectronics, principles of operation, parameters, design requirements and practical application of microelectronic devices and processes. This will give them the possibility to find the right and optimal way for solving of specific constructional or technological problems, and producing of right and proper reaction, corresponding to the situation.

DESCRIPTION OF THE COURSE: The main topics concern: Basic technology materials in electronic manufacturing – conducting, resistive, insulating; Thin film deposition methods; Thick film screen printing technology; Photolithography methods and technological steps; Maskmaking; Dry and wet etching; Printed circuit boards (PCBs); Surface mount technology (SMT); Basic materials in semiconductor technology; Thermal oxidation of Silicon; Diffusion in Silicon; Ion implantation; Epitaxy; Recent mounting and assembly procedures – probing and marking, scribing, breaking, die attachment, wire and tape automated bonding; Encapsulating and housing of electron devices, integrated circuits and PCBs; Bipolar Integrated Circuits (ICs) - basic technological process; Elements of bipolar ICs – the n-p-n transistors, the p-n-p transistors, diodes, passive circuit elements; MOS Integrated Circuits; Basic CMOS process; Elements of CMOS ICs – the NMOS and the PMOS transistors;

PREREQUISITES: Physics, Electronics, Production systems, Operational Research.

TEACHING METHODS: Lectures, using slides, case studies, laboratory work, work in teams, protocols preparation and defence. Available Internet web sites and materials.

METHOD OF ASSESSMENT: Two-hours assessment at the end of semester (80%) plus laboratories (20%). Coordinated with the lecturer.

BIBLIOGRAPHY:

DESCRIPTION OF THE COURSE

Name of the course: **Corrosion of metals and methods of protection**	Code**: BpIEe 69.3**	Semester: **8**
Type of teaching: Lectures and laboratory work	Lessons per week: L – 2 hours; LW – 2 hours	Number of credits: **4**

LECTURER: Assist. Prof. Ph.D Yordanka.Marcheva, (FEET), tel.: 9653287;
E-mail: ysm@tu-sofia.bg,

Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Optional course in the syllabus for BEng in Industrial Engineering, at the English Language Faculty of Engineering (ELFE).

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is the students to have knowledge of the nature of the corrosion processes, types of corrosion, corrosion behaviour of the basic construction materials, methods of corrosion protection as well as contemporary international standards in the field of corrosion. The course gives to the student knowledge of the main corrosion problems in different branches of techniques and methods for corrosion protection and monitoring.

DESCRIPTION OF THE COURSE: In the course the main topics concerned are: Basic concepts in chemical and electrochemical corrosion; corrosion measurements; units and techniques for corrosion rate expression; factors, controlling corrosion rate; corrosion characteristics of the main construction materials; methods for corrosion prevention; corrosion in techniques; corrosion standards; corrosion monitoring.

PREREQUISITES: Chemistry, Materials Science, Materials Technologies.

TEACHING METHODS: Lectures are delivered with the support of contemporary technical equipment. A multimedia system is used for better visual presentation.The laboratory works are equipped with all up-to-date technical means. Labs are performed in groups of 3 students, finishing with reports.

METHODS OF ASSESSMENT: Written examination (open tests) for two hours in the end of the term.

INSTRUCTION LANGUAGE: English

BIBLIOGRAPHY:

1. R.W.Revie, H.H.Uhlig, *Corrosion and Corrosion Control*, 4th Edition, John Wiley & Sons, Inc., 2008
2. Z. Ahmad, *Principles of Corrosion Engineering and Corrosion control*, Elscevier, 2006
3. *Corrosion: understanding the basics*, J.R.Davis Ed., ASM International, 2008
4. *Corrosion Tests and standarts, Application and interpretation*, 2nd Edition, R. Baboian Ed., ASTM International, 2005

M. Lukaycheva, Y. Marcheva, *Laboratory works on CMMP*, ELFE, TU- Sofia, 2012 ISBN: