Faculty: FACULTY OF TELECOMMUNICATIONS AND MANAGEMENT
Department: GENERAL ENGINEERING
Professional Field: 5.13. GENERAL ENGINEERING
Specialty: DIGITAL ENTREPRENEURSHIP AND HIGH TECHNOLOGY
Educational-qualification degree: BACHELOR

LEARNING COURSE DESCRIPTION

1. Course title: *CYBER-PHYSICAL PRODUCTION SYSTEMS*
2. Course code: B.45.044.1
3. Type of the course: *Compulsory*
4. Level: *Bachelor*
5. Year of study: *Third*
6. Semester: *Fifth*
7. Number of credits: 6
8. Name of the lecturer: *Prof. Dr. Miglena Temelkova*
9. Course learning outcomes:

The aim of the course is to give students a systematic knowledge of basic cyber-physical production technologies.

Students who have completed their training in the discipline must acquire:

Basic knowledge of:

- ✓ the characteristic features of cyber-physical systems;
- ✓ components of cyber-physical systems;
- ✓ the functions of cyber-physical systems;
- ✓ the nature and varieties of cyber-physical production systems;
- ✓ the nature, application and significance of cyber-physical production systems in production.

Practical skills for practical use of the capabilities of the components of cyber-physical production systems - Internet of Things, Internet of Services, cloud computing.

Competencies: Upon completion of the course, students who successfully complete the course must have mastered the theoretical and practical capabilities of cyber-physical production systems.

10. Teachingmethods:

The method of teaching is "experience-based learning", as the material is presented in seminar form, in the form of business games and case studies. The use of a group dynamic process allows students to master the basic concepts related to the discipline and to form specific skills.

The training is individualized and the learner is considered to be an active self-organizing individual. Active learning is achieved through action (making), interaction, multimedia, virtual and interactive platforms, through which students independently reach knowledge and apply it in specific practical cases.

11. Prerequisites:

Students should have in-depth knowledge in the following disciplines: Enterprise economy, Industrial revolutions and entrepreneurial process or Entrepreneurship in the high-tech business sector, Entrepreneurial and leadership digital competencies, Mechatronic systems and cyber systems, Engineering - Part I and II.

Courses using the discipline are: Additive manufacturing, Production logistics, Cloud computing, Controlling of high-tech industries.

12. Course contents:

The course deals with current topics related to the fundamentals of the new type of production systems - cyber-physical. Section One discusses the nature and basic characteristics of cyber-physical systems. Emphasis is placed on their components. The section "Cyber-physical production systems" considers these productions as intelligent self-regulating systems. Essential in this section is the definition of smart factories, user-oriented platforms.

13. Bibliography

Basic literature:

1. **Стоянов, И.** Основи на управлението. Авангард прима. 2018.
2. **Темелкова, М.** Въведение в контролинга. Колор принт. Варна, 2016.
3. **Темелкова, М.** Стратегически контролинг в бизнес организацията от сектора на услугите. Колор принт. Варна, 2017.

4. **Дамянов, Д., Гешев, Т., Чукалов, К.** Четвърта индустриална революция – същност и проблеми. Кинг. 2019.
5. **Kreutzer, R.** Dang, M. Big Data Analytics und cyber-physische Systeme. Auswirkungen von Industrie 4.0-Technologien im Bereich E-Procurement. Grin Verlag. 2019.
6. **Temelkova, M.** Development of Controlling in the Organizations from the Service Sector under the Conditions of the Forth Industrial Revolution. International Journal of Advanced Research in Management and Social Sciences, Volume 6, Issue 3, March 2017.
7. **Temelkova, M.** Model of the relation "digital leadership - digital entrepreneurship" in the realities of industry 4.0. International Journal "Information Theories and Applications", Vol. 26, Number 4, 2019.

Additional literature:

1. **Темелкова, М.** Оптимизация на производствената организация в условията на криза. ВСУ Черноризец Храбър. 2010.
2. **Темелкова, М.** Семинарна тетрадка по контролинг. Колор принт. Варна, 2011.
3. **Britzelmaier, B.** Controlling: Grundlagen, Praxis, Handlungsfelder. Pearson Studium. 2017.
4. **Graumann, M.** Controlling: Begriff, Elemente, Methoden und Schnittstellen. NVB Verlag. 2018.
5. **Olfert, K., Schreiber, M.** Kompakt-Training Controlling. NVB Verlag. 2018.

14. Assessment methods and criteria:

The course ends with an *exam.* The achievement of the set goal of the training is controlled during the semester through current control in the form of individual and team assignments, test during the lectures. The assessment is formed by a point scale, taking into account the participation in the practical classes and the individual work of the student during the semester.

1. Requirements for forming the six-point rating system

A part of the grade in the course is formed on the basis of a point system and the maximum number of points that students can receive is 100 (Table 1).

The final grade is formed by a theoretical test during the exam session and results from the cases and business games performed during the group dynamic process, taking into account the activity of students during the learning process during the semester.

Burden of evaluation:

- ✓ Assessment in the learning process - individual work, research, case studies and business games, group dynamic process - carries 50% weight in the final assessment;
- ✓ Theoretical exam online test of 20 questions with a duration of 40 minutes - carries 50% weight in the final grade. The evaluation of the test is according to the following criteria: up to 50% correct answers – Fall 2; up to 70% correct answers - Satisfactory 3; up to 80% correct answers - Good 4; up to 90% correct answers - Very good 5 and over 91% - Excellent 6).

2. Formation of the final assessment

The formation of the final grade (CA) is based on the results of the exam test in the course of training and group dynamic process (TC) and the result of the theoretical test (TT), as the correspondence between the number of points and the grade on the six-point system is given in *Table 1.*

$$КО = 0,5\ ТТ + 0,5\ ТК$$

The knowledge acquired by the students, expressed in percentages, is assessed according to the six-point system as follows:

To 50%	Fall (2)
51% – 70%	Satisfactory (3)
71% – 80%	Good (4)
81% – 90%	Very good (5)
Over 90%	Excellent (6)

15. Language of instruction: *Bulgarian*