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FACULTY OF TECHNICAL SCIENCES ČAČAK**



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**TECHNICS AND  
INFORMATICS IN  
EDUCATION**

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## PREFACE

Sixth conference *Technics and Informatics in Education – TIO 2016* which acquired the status of an International conference for the first time this year, pursues an important objective to promote and support research in education of new generations in technical and technological fields at all levels of education, and contribute to technology development and education improvement.

For this Conference, some 86 papers have been submitted within various fields of technical, IT and technology-supported education at all education levels – primary, secondary, high education and education for adults. After reviewing, 71 papers have been accepted for current edition of Book of abstracts in the form of plenary lectures and original scientific papers by the authors from countries within the region and beyond.

Conference papers in the *Book of Abstracts TIO 2016* are organized in the following topics:

- Plenary lectures
- Challenges in technical and IT education – from preschool to university
- Information and Educational Technologies
- Professional development of IT and technical education teachers and European educational perspective
- Engineering Education.

Special activities within the Conference are the following:

- Remote experiments - NeReLa Demo session
- Day of Computing
- Poster Session: Research project on Faculty of Technical Sciences

The Scientific and Organizing Committee wish to thank all the scientific and professional employees from various fields who contributed to the Conference.

We would like to thank Partner Institutions which participated as co-organizers of the Conference.

We express special thanks to the Ministry of Education, Science and Technological Development of the Republic of Serbia for financial contribution to this scientific gathering

*Chairman of the Organizing Committee  
Dr Ivan Milićević, Assistant Professor*

## **CHAIRMEN'S FOREWORD**

Faculty of Technical Sciences Čačak, University of Kragujevac, has the honour to organize International Scientific Conference 'Technics and Informatics in Education – TIO 2016'.

The Conference continues the tradition of gathering scientific associates and professionals in technical, technological and IT education in primary and secondary schools in Serbia. For the last 50 years this assembly has been organized in various forms (scientific and professional conferences and consultations on technical education, information technologies, technical seminars, etc.). These scientific and professional conferences have had a huge impact on the development of technical education, mostly in primary education, as well as in secondary education. The impact is also noticeable in both higher and university education. Five National conferences with International participation titled Technics and Informatics in Education were held in 2006, 2008, 2010, 2012 and 2014. Still, the necessity for continuous, organized scientific assembly related to technics and informatics in new surrounding and connection with other technologies has increased.

The aim of the conference TIO 2016 is to improve the exchange of knowledge and experience between experts, scientific associates and professionals from Serbia, neighbouring countries and Europe, engaged in the subject matter. The conference will provide an analytical review of technical (technological) and IT education, as well as education regarding technical (technological) and IT achievements including assistive technology, teaching aids, student books, etc. Teacher training is considered highly significant for research and development in education in this field.

The Conference includes technical (technological) education at all levels: from preschool institutions, primary and secondary schools over higher and university education, to various forms of lifelong learning.

Furthermore, the special emphasis will be given to the place, importance, and role of informatics and IT in technical and professional education, as well as correlation with other natural, social and education science.

A comprehensive analytical review will be given on the state of education in the fields of technics and informatics, as well as the contribution of technical and IT education to other fields.

The conference results are expected to provide the basis for planning the development of education in Serbia, especially in the fields of technical (technological) education, engineering, IT and informatics. The results are also expected to support and contribute to the exchange of educational patterns in the neighbouring region and coordination with European trends in this field.

We hope that experience gained at the Conference will be very useful both for the participants and for the development of technical-technological education field.

*Chairman of Honour*  
*Prof. Dragan Golubović*

*Chairmen*  
*Prof. Živadin Micić*  
*Prof. Željko Papić*



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## **PLENARY SESSION**





## **Redefining base education programme in technics and informatics in Serbia**

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**Abstract:** Technical and computer literacy is a part of the knowledge, skills and understanding which should be reached until the end of basic compulsory education, and which should provide proper professional guidance, further education and daily functioning. In order to fulfil these most general aims of the subject – Technical and IT Education, its teaching process should be guided by standards, programs, defined goals and outcomes, as well as other elements of planning the teaching process. Based on the European experiences, paper presents the projection of the Standards for the course Engineering and Informatics including pre-school education (level 0), four-year primary education (level 1), fifth and sixth grade (level 2), the seventh and eighth grade (level 3) and the first / second grade of secondary education - grammar schools and secondary vocational schools (level 4). The paper defines the objectives of the education subjects, as well as the expected students' achievements at all four levels of education – for students aged 7-18 years (5-16 years old variant for the nine-year basic education). This paper suggests some guidelines for redefinition of technics and informatics in base education and upbringing of children, which are related to the program covering the complete educational system at all levels.

**Keywords:** education, redefining, technology, information, programme

## Where the computing ends, and begins...?

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**Abstract:** Turn of the century brought a new technological revolution, which was mainly manifested through the development of computer techniques. The extensive use of computers and the benefit of this application resulted in the continuous computing development. The important goal was to create opportunities, so that software support development would be as close as possible to the end user. As a result of these efforts the software development tools were created. With the aid of software development tools the existing computing framework – hardware and system software received an additional dimension. The operation of computer hardware has become more transparent for both users and designers of the application software.

At the same time the development and application of modular computer hardware have facilitated the development of computerized systems. Modular computer hardware and software development tools facilitated the development systems with computer support. The particular progress was made through the integration of hardware platforms and software development tools in the so-called development systems. They made possible for the expert practitioners to develop such systems.

Facilitating the development of computer support and participation in its development by the specialists from various fields of technology raises the question of the actual framework of computing. The aim of this paper is to offer some answers to that question

**Keywords:** computing, system software, application software, modular computer hardware, software development.

**SECTION I**  
**CHALLENGES IN TECHNICAL AND**  
**IT EDUCATION – FROM**  
**PRESCHOOL TO UNIVERSITY**



## Importance of TIE subject in education

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**Abstract:** Developed countries pay special attention to education, in which an important place occupied by the creation of technical culture and proper attitude towards work and the production. These principles are the foundation of subject technology and IT education (TIE) and it should be one of the most important subjects, from 5th grade (and possibly before) of the primary school to the end of high school. The curriculum is based on studying the basis of all branches of engineering and technology. Classes are theoretical and practical, encourages creativity, initiative, independence and teamwork also. Introduces students to the world of work and production, and provides a choice of possibility of future occupations and opening the way for an independent production and entrepreneurship.

The work contains evidence that the TIE meets all requirements of the law on education, agrees with the plans of economic development and sustainable development. The work is carried out by surveys of students using online questionnaires on education and teaching as seen through the prism of the importance and needs of TIE.

**Keywords:** education, teaching, TIE, entrepreneurship, professional orientation

## Technical and IT education challenges, fears and hopes

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**Abstract:** Technical and IT education is a subject with different names so far, but with a long tradition. This is the only theoretical and practical subject where students acquire functional knowledge at the class applied in practice through

practical work, and knowledge which is applicable at different levels outside school in real life. The century we live in is the century of inexhaustible and spiraling development of techniques and new technologies, which is the basis of development in all fields, and the society as a whole. Without knowledge of techniques and technology, the development of ICT and its efficient use will halt. IT facilities in the TIE are in the function of computer applications in technique. Possible separation of informatic techniques by subtracting one class of TIE and the impossibility of practical application of the acquired knowledge to students would deny the application of ICT in education, skills development and mobility (sensorimotorics, psychomotor, fine motor skills), the development of technical creativity, creativity, and the subject would lose its multidisciplinary nature.

**Keywords:** techniques; functional knowledge; informatics

## **The global perspective of technics in education**

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**Abstract:** A characteristic of production-oriented economies of the developed countries is that they demand technology literate students from their educational system. The paper presents key characteristics of technics in education with reference to the international standards and subject development perspectives. Modern education involves multidisciplinary knowledge and the production in digital environment, so the student skills and competencies make a complex kaleidoscope.

**Keywords:** technics; education; perspective

## **Control input/output interface with the program for control of robotic production line segment models**

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**Abstract:** This paper is based on modernization of teaching the school subject Technical and Information Education by introducing an interface with 8 digital inputs and 16 relay outputs as a new teaching aid in the final grades of elementary school. The basic interface parts, their role and mode of operation are presented. In order to better understand the function of this teaching aid this paper presents a program through which executions are ordered to the interface by the computer. The program is presented in the operating cycle of four models in living and work environment which are joined together making a production line.

**Keywords:** control; input/output; interface; program; production line

## **Technical resources in the construction industry, educational software**

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**Abstract:** "Technical resources in the construction industry" is an educational software for the same teaching unit in the sixth grade of elementary school for technical and IT education. Educational software consists of a Windows Form and relational database. Relational database Technical resources in the construction industry consists of two tables and is a relational database with files picture. The basic mask as a Windows Form is connected to the database via SQL (Structured Query Language) queries that result in view of the database, a single value attribute view for each record (the record order)

destined awarded (in three TextBox, in one RichTextBox, in one PictureBox) Windows Form. In the PictureBox in the images are stored. Record navigation is done with the help of a four-Button (button) on the Windows Forms. The software is programmed in Visual Basic MS Visual Studio 2012, a database in Access 2007.

**Keywords:** Technical and IT education, technical resources in the construction industry, educational software, relational database with pictures, Visual Basic

## Simple electrical circuit to light up a gas discharge lamp

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**Abstract:** In order to successfully monitor achievements of scientific and technology revolution, modern society invests growing efforts in popularizing technical sciences. In order to motivate pupils and students to realize the importance that their knowledge has in everyday life, teachers often use experiments and laboratory methods in the schooling. This paper is devoted to a simple construction of Tesla coil with electrical circuit where transistor is used as amplifier and switch too. Tesla coil can be used as a teaching tool to demonstrate the high frequency currents, i.e. for causing electrical discharge in the gas discharge lamps. Also, some problems that can occur during the preparation of this experimental set up as well as on laboratory excersises with participants of the Regional Centre for talents in Cacak, are explained.

**Keywords:** Tesla coil; electrical circuit; transistor



## **Modeling, simulation and control of electronic circuits in the application electronics lab**

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**Abstract:** In the paper are present description, properties and use of application Electronics Lab/from Autodesk 123D CIRCUITS environment, for the modeling and simulation of electrical/electronic circuits in technical systems. This application can be used as an efficient tool in the realization of teaching themes from Electrical installations and Digital electronics. It is available through the Internet, contains a number of components, and also is gratuitous. Characterized by a simple interface on the desktop/protoboard with placing of electrical/electronic components/devices and with the ability to change certain characteristics the same. Quickly, clearly and in a visually interesting way in the application are simulated circuits in installations of appliances, machines and buildings. The application integrates the Arduino microcontroller platform, contains sensors, relays and measuring devices. It is especially important that Electronics Lab allows the entry code for the programming and consequently control of the created models; as shown in paper for LED, traffic light and display, in real time.

**Keywords:** teaching electrical engineering, control, Arduino, programming

## **Preventive work od driving schools and the local community on eliminating the causes of young people suffering in traffic**

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**Abstract:** This paper indicates the importance of the cooperation of driving schools and the local community while planning and realizing preventive activities on eliminating the causes of young people getting hurt in traffic. The traffic behavior, that is to say, the level of traffic behavior, was identified as the immediate cause. The family is presented as the most powerful factor of the traffic education. Systematic approach, as well as adequate engagement of all holders of prevention in the implementation of prevention programs and the strong influence of the implementation of measures in the education of parents as well as children, is expected to help the proposed solution become accepted in the community as the standard of behavior.

**Keywords:** Family, upbringing, traffic culture

## **The development of motorcycles in terms of passive safety in traffic**

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**Abstract:** This paper points to the importance of the application of passive safety elements in series production of modern motorcycles. Nowadays, the need for further development of safety motorcycle is increasingly emphasized, because of the motorcyclists. Factual situation is evident from the analyses and statistics on traffic accidents involving motorcyclists.

**Keywords:** passive safety, development, safety

## **Educational standards for the subject Digital Literacy in the functional primary adult education**

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**Abstract:** One of the key factors in adult education is the acquisition and improvement of digital competences. Therefore, the subject Digital Literacy is integral part of the program for adult education as a compulsory subject. This paper presents the educational standards for the subject Digital Literacy. Also, in this paper, the results of analysis domains and educational standards obtained by empirical research, during the process of preparation of educational standards, are presented. In the process of preparing standards, teachers of appropriate subject, andragogist and experts involved in adult education were included. Based on the analysis results, conclusions and appropriate suggestions are provided.

**Keywords:** adult education; educational standards; functional education; digital literacy

## **Education as prevention of cyberbullying**

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**Abstract:** The number of IT users is rapidly increasing, and most of them belong to the young population. In addition to numerous possibilities, modern technology also brings many risks. The aim of this work is to determine how much and for what purposes young people use digital devices and the Internet, how they expose themselves to the risks of digital communication and to what

extent young people are involved in various forms of, as well as how to react in case they are victims of cyberbullying. In this paper we used descriptive statistic methods. The sample consisted of 98 pupils from two primary schools. The results showed that most pupils who use the Internet, are aware of the measure of protection, but do not use them enough, and as a result, they are most often exposed to the harassment on social networks. In the case of violence, pupils are rarely asking for help, and teachers mostly warn them of possible danger.

**Keywords:** cyberbullying; education; prevention.

## **Google classrooms and its application in teaching**

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**Abstract:** This paper will be presented to the Google Labs and means that the classroom can be applied in the classroom. The vast majority of teachers applying innovative in their teaching methods, although few of them to work across Google Drive. This will be explained to the Google Labs, you can set the material in the classroom and work with this material, methods of assigning the role of students and how a specific classroom for a certain student. In this study, a procedure for obtaining a school task, and complete administration, as both teacher and student accounts, making individual classrooms, installation of all materials within the classroom, as well as ways of evaluating and providing feedback to students.

**Keywords:** Google; Teaching in the cloud; Internet; tests; tasks; classroom

## The use of computers and the Internet for learning elementary school pupils

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**Abstract:** The progress of information and communication technology requires considerable changes in the organization and implementation of the teaching process. The aim of this study is to determine the extent in which pupils use computers, how many are available to them, how often they use the Internet to learn, but also how the frequent use of certain teaching aids. Survey was conducted, and sample consisted of 94 pupils from elementary school. The results indicate that students generally have conditions for learning via computers and the Internet, as well as to pupils relatively often used the computer and outside of class.

**Keywords:** computer; Internet; education

## Application of modern educational technology in teaching technical and IT education

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**Abstract:** This paper presents examples of application of modern educational technology computer assisted, in the implementation of the contents of teaching technical and information education, from the fifth to the eighth grade. This methodical approach in teaching technical and IT education, aims to develop the students' interest in the use of modern information - communication technology for learning. The paper presents the finished software tools which, as part of modern information - communication technologies, we successfully applied in the actualization of content of technical and computer education. Teaching enriched ready software tools and the Internet provides an opportunity for students to acquire teaching content in

an interesting and entertaining way, and can positively influence the motivation to learn.

**Keywords:** multimedia, internet, e-learning

## **The use of tablet devices and Google Drive service in teaching in the case of information technology high school-ITHS**

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**Abstract:** This paper focuses on the importance of the form of communication between teachers and students, the transmission of information and data, exchange of materials in the modern educational process, and gives a brief description of the application Google Drive service using a tablet as a teaching tool in the Information Technology High School - ITHS. It is the school that fully supports the new modern information - communication technologies (ICT) that are used in the modern educational process.

**Keywords:** Education, tablet device, Google Drive, ICT, learner – centered paradigm

## **Use of digital movies in teaching**

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**Abstract:** Modern teaching involves the use of modern teaching aids and teaching methods . Teaching tool that evokes audio - visual perception of

students is the film. Use of film in the classroom allows the teacher to express their creativity, as well as active participation of students in the teaching process and builds partnership between teachers and students.

**Keywords:** film; teaching; students

## **Textbooks in three dimensions (linking in electronic textbooks)**

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**Abstract:** University (and school) textbooks must be, in electronic versions, available on the websites of educational institutions or teachers and they should contain a number of links to other websites where students can find additional information on the teaching matter. Learning is an individual process, but students should be encouraged to go broader and deeper for teaching materials above the minimum required level. Routing students to additional texts, images, graphs, tables, video clips, etc. can be used for all students including those who are able to effortlessly acquire knowledge by reading textbooks written exclusively in textual form. The widespread use of links in electronic versions of textbooks can increase the efficiency of the individual's learning and may increase the overall quantitative and qualitative effects of learning of the entire student population.

**Keywords:** linking, textbooks, Internet





**SECTION II**  
**INFORMATION AND**  
**EDUCATIONAL TECHNOLOGIES**



## Open education resources in enhancing education of biotechnology engineers

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**Abstract:** The paper explores the concept of Open Education Resources emphasizing its importance in education of biotechnology engineers in Serbian education context. In order to fill the gap which exists in agricultural education of various target groups such as teaching staff at agriculture universities, teachers in high vocational schools teaching agricultural courses, and agricultural advisors in agricultural extension service considering the development of their professional competences the attempt is made to create the open resources in the field of agriculture. A result of such attempts is the creation of National Repository for Agricultural Education in Serbia. The National Repository for Agricultural Education in Serbia as an open education resource for biotechnology engineering is presented in the paper. Another result refers to the contents created for the repository - face-to-face, blended and online courses created by the agricultural university teaching staff for all stakeholders in biotechnology engineering education in Serbia.

**Keywords:** biotechnology engineering; open education resources; repository for agricultural education

## A contribution towards using multimedia and Moodle at the Faculty of Maritime Studies in Kotor (Montenegro)

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**Abstract:** The paper describes how multimedia can be used in the preparation of instructional materials and their exporting to the web. As an example, e-

educational materials for the course “Information technologies in navigation”, at the Faculty of Maritime Studies (University of Montenegro), are taken into consideration. Specifically, using Camtasia Studio (ver.7) multimedia program in the preparation of audio and video lectures in ECDIS, along with their adjustment for exporting to the Moodle portal are presented. Additionally, some general guidelines for further development of e-learning in the blended environment at the Faculty are given.

**Keywords:** e-learning, blended environment, Camtasia Studio program, Moodle

## **Progress of Web tools from Web 2.0 to 4.0 and their implementation into the educational process**

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**Abstract:** Web has become an endless and ubiquitous component in all educational systems from the moment when it changed the theory of learning and enabled its users to create everything, including educational materials available for everyone, all around the planet. From the Web 1.0 that made all information available to the Web 4.0 that make the networked intelligence of the future, where an individual is just a part of the global mind, the goals remain the same - deeper integration of ICT into the process of education.

**Keywords:** web, information society, education, ICT

## **A new approach to learning with the introduction of modern information tools and software in the teaching process**

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**Abstract:** The paper presents the importance of the concept of lifelong education in the time we live and necessity for a modern school where the teacher is appointed to the student. In this context, the work is based on research analyzing the reform of introducing modern information tools and didactic software, both in teaching and learning process, which can significantly contribute to the quality of teaching process, learning efficiency and better didactic organization of individual subjects. The paper affirmed the logic of development of modern information society, both teachers and students, which must be directly supported by introducing adequate information technology in schools, aspects of tools in teaching, OneDrive software applications for the storage of educational materials, the use of blogs and social networks in the implementation of modern teaching and use software package GeoGebra in teaching.

**Keywords:** information technology; tools; software; teaching; learning; changes

## **Computer games in the function of developing initial mathematical concepts**

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**Abstract:** Since modern civilization flows move towards the information society, the computer has become a central medium of our everyday life. The computer is an integral part of childhood for children growing up in the 21st century, and it employs increasingly large number of applications in the

process of learning and games. The paper describes characteristics and educational value of computer games for children, as well as a possibility of their use in the development of initial mathematical concepts. In addition, the paper describes certain sites that contain lots of interesting games that can be in the function of developing initial mathematical concepts, and provides some useful links to websites with diverse and interesting games.

**Keywords:** computer, computer games, initial mathematical concepts

## The effects of digital dialogue in teaching programming

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**Abstract:** This paper describes the testing of the application of digital dialogue during direct teaching on the process of the presented material. The conducted experiment had the goal of showing that by applying digital dialogue through the transformation of acquired information in different representations and bigger involvement of the students, the students' memory processes in class could be enhanced. In the experiment, the students were required to memorize the basic information from the content of the programming class unit. Immediately after the class, the tests were conducted. The acquired results, processed by the t-test, have shown that by getting the students more involved in the class, through digital dialogue, the process of memorizing the content of the curriculum can be greatly affected and they have confirmed the purposefulness of applying digital dialogue as a teaching concept that enables the students to functionally use their mobile devices during class for the purpose of acquiring the material more easily.

**Keywords:** Digital dialogue, teaching programming, interactive teaching, the process of forgetting

## Bitstrips in school

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**Abstract:** The aim of this paper is to present the characteristics and possible applications of the Bitstrips tool in curricular and extracurricular activities of primary school pupils. The tool allows you to work in a virtual class through individual and /or team work of students with the help of teachers. The product of this tool is a strip, which can represent the content of teaching units which are dealt with in elementary-school subjects. Specifically in this paper a lesson in mathematics designed for the needs of regular classes and Math Club "Kefalica". This paper also represents a display of works of pupils – members of the Club, presenting the theme “Rules of Conduct”, which can be used to present this topic in the homeroom class.

**Keywords:** Bitstrips; curricular activities; extracurricular activities

## Examples of using One Drive in establishing more interactive cooperation among students, teachers and parents

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**Abstract:** This paper will present the opportunities offered by cloud service OneDrive, through examples of good long-term teaching practice in High school "Takovski ustanak" in Gornji Milanovac. The areas covered are: evaluation and self-evaluation of students' and teachers' work; exchange of good teaching resources, work on projects and cooperation with parents. The aim of this paper is to introduce the opportunities and positive effects of the appliance of OneDrive in education to the wide audience of teachers and to encourage them to apply it in their work and contribute to their professional development.

**Keywords:** (self)evaluation; project; good teaching practice; cooperation

## Using PowerPoint presentation in teaching

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**Abstract:** PowerPoint has become very popular presentation software used in educational settings. This paper presents the analysis of the use of PowerPoint presentation in teaching. The paper presents the results of a survey conducted among the students of the Faculty of Education in Sombor. These results show that teachers often use PowerPoint presentations in class, because in that way the motivation of students increases. Half of the students believe that the biggest obstacle to the use of PowerPoint presentations is still lack of sufficient competence of professors which should be provided with more training seminars and courses.

**Keywords:** student; professor; PowerPoint presentation

## The mobile learning classroom potential

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**Abstract:** Mobile learning construct has been present in the field of education for more than a decade. Intuitively, it was expected that the mobile technology development as one of its basic characteristics will directly influence the teaching practice. However, trend of implementation to large extent does not follow social changes.

**Keywords:** implementation; mobile learning; teaching



## Informal learning via Internet forum

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**Abstract:** This study examined students' attitudes about general issues related to internet forums, as well as about their advantages and disadvantages. The questionnaire, consisting of three parts, was specially prepared for this research. The study included 165 students from the Faculty of Technical Sciences Čačak, of which 150 said they used the internet forum, so their estimations were relevant for this study. It was found that the students are well informed on what internet forum is, that a large percentage of students use it and that the internet forum has more advantages for learning than disadvantages.

**Keywords:** internet forum; informal learning; discussion; participant; survey

## The university library information system adaptability in an intelligent based university environment

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**Abstract:** Agent-based (intelligent) systems technology has generated lots of excitement in recent years because of its promise to conceptualize, design and implement software systems as a new paradigm. Multi-agent systems are

designed as a collection of interacting autonomous agents, each having their own capacities and goals that are situated in a common environment. An information system is a very important part of the contemporary university. Adaptation as a new trend in the modern e-Learning concepts aimed to produce more effective learning curve by tailoring a course's curriculum to individuals' specific preferences. This paper presents an AeLS (Adaptive e-Learning System) successfully implemented as an advancement from the previous agent-based eLS IABUIS (Integrated Intelligent Agent Based University Information System). The main point of interest would be an ULIS (University Library Information System) adaptability as a part of AeLS.

**Keywords:** Intelligent University Information System; Library Information System; Adaptive e-Learning System

## **Library information system and graduates**

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**Abstract:** The role of libraries in modern society is changing and is getting greater in supplying information resources, because users are informed and equipped to perform bibliographic research outside the library. "They will look for information that is immediately accessible to internet, consult their favorite sites and access the library catalogs which are available on the network." [1] By raising the level of media and information literacy of secondary school pupils, their professional development will be made easier. At the same time we will set the foundation for the development of knowledge society. Modern scientific achievements in our country as well as in the world are easily accessible to young people due to the use of library information system and new resources within the Virtual Library of Serbia. This is especially interesting for graduates who wish to continue their formal education. Since this is an area that is constantly changing and supplementing, a continuous systemic education of students is needed.

**Keywords:** secondary school pupils, media and information literacy, library and information system, Virtual Library of Serbia, graduates

## Text analytics applications in higher education institutions

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**Abstract:** Previous knowledge of the institution environment was based on the use of structured data. In recent years, unstructured data have been more used by predictive analysis. The impact of unstructured data is dominant in different types of texts. One of the leading approaches to analysis and obtaining the necessary information is based on the use of text analytics. This paper shows a real use-value text analytics with particular emphasis on some of the possible aspects of text analytics used in the area of higher education institutions.

**Keywords:** competence; teachers; modern media

## Influence of English language on Serbian language in the context of computer terminology

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**Abstract:** Due to its topicality and frequent novelties, computer terminology is very interesting and dynamic field. Since the majority of technological innovations come from English speaking countries, domination of English terms is evident in computer terminology. The paper represents the results of research conducted at Polytechnic school of professional studies Urosevac with temporary seat in Leposavic in order to determine to what extent the students are familiar with computer terms, how and in what form they use them compared to the source terms in English language, in relation to the fact that

majority of students have sufficient background knowledge both of English language and computers. Thus, the aim of this paper is to determine whether the knowledge of English language, as a foreign language, is in correlation to the knowledge of computer terminology.

**Keywords:** computers; English language; terminology, students

## **Introduction of computer algebra systems in electrical engineering education using Wolfram language on Raspberry pi**

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**Abstract:** This paper introduces the innovative use of symbolic calculation in field of computer science on low cost computers Raspberry pi with free software in education and engineering design. A new approach is presented for acquiring of basic knowledge in the field of solving electrical circuits using symbolic tools by applying computer algebra system. As an example of rapid learning, the analysis and solving of transient response in electrical circuits are illustrated. For this, it is needed a good knowledge of differential equations and set initial conditions. Solving can sometimes be exhausting when done by hand, but in complex circuits are almost impossible. Many numerical-based software tools can provide a graphical interpretation of the transitional response, but cannot provide an analytical result in close form solutions. The new methodology provides a way for students to learn faster solving of transient response of electrical circuits, and engineers gain a better insight into the processes that are running.

**Keywords:** symbolic computation, computer algebra system, transient response, software tools

## Serbian language speech database “Phonemes\_1.0”: design and application

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**Abstract:** In this paper we explained how to create Serbian speech database called “Phonemes\_1.0” and how to use it for pattern match tests. This database contains a list of all 30 phonemes that cover the Serbian alphabet called “Azbuka”. The database is divided in two parts: vowels and consonants. For vowels we applied an initial DTW comparison.

**Keywords:** Serbian speech database; vowels; consonants; DTW algorithm.

## Grails application in entrepreneurship

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**Abstract:** The subject of this paper is the development of applications in the field of entrepreneurship using the Grails framework. This study describes some of the most important Grails features and its architecture. The demonstration application, which was created for the needs of this papers, is based on Grails framework and it is developed for the company’s Sales subsystem. The goal of this work is analyzing the use of Grails framework in the field of entrepreneurship and providing an overview of the results of the analysis, as well as the advantages and disadvantages that have been proved during the research. Also, in this paper the overall impression of whether Grails meets the software requirements set by today's complex business environment or not is presented.

**Keywords:** Grails; Entrepreneurship; Framework

## The importance of programming languages in education

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**Abstract:** This paper presents the importance of learning programming languages in schools and colleges in Serbia. The main purpose of programming languages is to create different types of applications that help people in their ordinary activities. What programming language should be learned depends on various factors. This paper presents a proposal for programming languages that should be learning in schools, so that students get the basic knowledge for further learning. TIOBE index provides an overview of the most popular programming languages in the world. In Serbian high schools in the last years are opened experimental education profile of Electro technician of information technologies. The main reason is increasing need for IT experts who will find job in short period when graduate this school. They will be educated to become desktop and web programmers, database developer or network administrators or they continue to study in faculties or collages.

**Keywords:** programming language; programming; learning;

## Innovation sources of knowledge for clustering standardized field of creativity

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**Abstract:** This paper presents a comparative analysis of global (ISO/IEC) and local (SRPS) knowledge sources in PDCA loop quality, with the ability to monitor innovation intensity in the standardized fields of creativity. The study

refers to standardized fields of the first level of International Classification Standards (ICS1) grouped in clusters of innovation. The paper focuses on the latest trends in the knowledge sources, and trend lines of certain standardized field of higher (daily) intensity of innovation in the fields of technics and informatics: ICS1 = 25 Manufacturing engineering and ICS1 = 35 Information technologies. The aim is to monitor the intensity of knowledge innovation, trends, sources of knowledge by innovation clusters and update the knowledge base for quality improvement (on standardization platform).

**Keywords:** knowledge sources; knowledge base (KB); trend; cluster innovation; standardization





**SECTION III**  
**PROFESSIONAL DEVELOPMENT**  
**OF IT AND TECHNICAL**  
**EDUCATION TEACHERS**



## Comparisons of educational processes and students assessments in Spain and Serbia

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**Abstract:** The aim of this paper is to explore how different education processes are in the terms of formal, informal and non-formal education shape and support student's assessments. Special attention is paid to the importance of complementary elements of official education which could influence values critical to a personal development of youth. Furthermore, the paper focuses on the role of information-communication technology (ICT) as an accessorial factor in different education processes which facilitates learning process, makes knowledge more accessible and less abstract. Recent reforms of settings and frames of educational policies as well as student's achievements in Spain and Serbia have been explored and contrasted. In essence, the paper gives insight into educational policies through the lens of the students assessments in order to outline the best practices and to point out preferably improvements in this matter.

**Keywords:** education policies; student's assessment; ICT

## ICT support to people with developmental disorders (specific learning disabilities)

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**Abstract:** Specific learning disabilities are one of the most common developmental disorders in inclusive education systems. For the formation of

a "friendly" environment for these pupils within the school institutions, as well as for promoting and facilitating the learning process, correct application of ICT support is of great importance. The paper presents the basic principles and the positive aspects of using ICT support in work with students with specific learning disabilities, as well as practical problems that the education system in Greece is facing in this area of work.

**Keywords:** Specific learning disabilities, ICT support

## **Analysis of the results of the entrance exam and the first colloquium of Business Informatics**

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**Abstract:** This paper presents the analysis of student performance on the entrance exam and the first colloquium on the subject Business Informatics teaching in the school year 2015/2016 at the Faculty of Hotel Management and Tourism Vrnjačka Banja. The analysis is conducted through several hypotheses. For the implementation of analysis, appropriate statistics and data were used and an adequate interpretation of the results is given.

**Keywords:** hypothesis testing; entrance exam; business informatics; mathematical statistics

## **The pedagogical benefits and pitfalls of applying tools for teaching and learning laboratory practices in the biological sciences**

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**Abstract:** The aim of this study is to research the different methods used by biology teachers and their effects on the success of the students. Three student groups of biology students in University “GoceDelcev”, Faculty of Natural and Technical Sciences, Institute of Biology, - Stip, R. Macedonia were offered a topic on general characteristics of Hemoglobin, Methods Based on color development (Sahli's/acid hematin Method) with different sequences of 3 teaching methods. The teaching methods were Laboratory method (student experiment), slide demonstration and lecture method. The first group started the course with experiments in the laboratory, then the lecture method was given to relevant theory of proteins, and then the slides were shown (Group I). The sequence of these three teaching methods used in the first group was changed in both second and third group as follows:

The lecture methods, slide show and experiment in Group II, and slide show, experiment and lecture method in Group III, respectively. Laboratory method used in the study was focused on the topic of Estimation of hemoglobin - Methods based on color development (Sahli's/acid hematin Method)

This experiment was carried out by students. Slide demonstration method included slides about hemoglobin structure and function. The slides were shown by teachers. Lecture method was performed by teachers as usual. Effectiveness of different sequential teaching methods was measured quantitatively by an achievement test. Achievement test contained 20 questions, testing the knowledge of facts as well as the ability to transfer the knowledge and problem solving ability. This test was used as pre-test before methods' application, post-test after the methods' application and retention test after 30 days from methods' applied.

**Keywords:** Slide demonstration, laboratory method, lecture method, teaching methods, biology studying

## Application of ICT in teaching biology (Example of a lesson)

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**Abstract:** The computer programs as a didactic aid are often described in didactic literature all over the world. It is not enough that they play, for instance, motivational, exercising, synthesizing or supervising function, they are to be made an independent source of reliable, easily comprehensible information, given in a way that activates students. It is also important not to replace various functions and tasks of didactic aids applied in the process of teaching-learning Biology with each other, but only to interfere skillfully. It is underlined that school practice requires methodically grounded application of these aids in the processes of teaching and educating. In this paper in selected ICT tools have been presented in the light of teaching principles and cognitive activities model. Computer science education, information and communication technology (ICT) are at present becoming one of the most important elements defining the basic competences of students. Information technology integrates medial, informative and computer science education, but also all the educational subjects mentioned in the curriculum basis of general education. In science and biology education there increasingly appear concepts of integrated teaching, showing the student the world in a holistic manner. The principle of universal activity of students in cognitive, emotional and motivation, as well as in practical sphere is preferred. More and more often attention is paid to the fact that the contemporary problem is not so much lack of information as its surplus, and the crowd of information as well as its unnecessary excess of details may be an effective tool of disinformation. Hence forming in students such skills as selection, evaluation and organizing of information (forming its structure) seems justified, so that they can serve drawing conclusions.

**Keywords:** information and communication technology (ICT), biology, learning and teaching, knowledge

## Students E-portfolio in art classes

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**Abstract:** E-portfolio in teaching art is a modern way of monitoring, recording and presentation of students' creativity and competence in general. Art e-portfolio has great potential in promoting students' products and is a good way of presenting students, groups of students and schools.

This is much more than just a collection of pieces of work - this is a complete record of growth, development and advancement of students. Archived data can be easily accessed, the development path of each student can be easily viewed and it is available to peers, teachers, parents and different audiences.

In addition to traditional portfolios of students this portfolio represents a suitable time in which we live, the way of collecting and archiving of students' art works and as a testimony of individual development and advancement in the art classes.

**Keywords:** portfolio, e-portfolio, teaching art

## Teacher competence as a predictor of acceptance and use of modern media and technology in the classroom

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**Abstract:** Contemporary changes bring many novelties we encounter. Changes do not circumvent the education, i.e. school. Tasks that are placed in modern school are numerous and significant in the context of acceptance and dissemination of changes and innovations that have occurred. Exactly in this context, developing and strengthening teachers' competences present an important predictor, according to technical and vocational training, respectively. A teacher who is willing to learn and improve continuously, to approach own work critically and reflexively in accordance with modern

scientific and technological change seems to be a model teacher of the 21st century. This paper presents a review of research on the self-perception of the competence of teachers for the use of modern media and technology in the classroom. The results showed a positive trend in the assessment of competence for the application of modern achievements of science and technology in the classroom, by teachers working in primary and secondary schools. Teachers highly value their competence, which is one of the predictors for the innovation of teaching methods, by using modern technology in teaching.

**Keywords:** competence; teachers; modern media

## **Applying e-portoflio for improving the monitoring process and evaluation of teachers' work in elementary schools**

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**Abstract:** The paper presents the contribution of the e-portofolio application in the process of evaluation of teaching work as the basis of evaluating the working process itself and the effects of improving competences of teachers. For evaluation it's important to set in advance the criteria and indicators on the basis of which the work of teachers will be evaluated. Monitoring of teaching work is the important element in the process of evaluating their work and its aim is to identify the potential problems and include teachers in training programmes. The importance of this process is reflected in obtaining the clear picture of the achievement level of the objectives and tasks planned and in development of teachers. The process of work monitoring and vocational training of teachers can be successfully conducted using the planned managing of documents through teaching record – portfolio. Portfolio has a long tradition in education and teaching work, today it's also available in electronic form. The importance of applying portfolio is analysed using the example of elementary school “Sveti Sava” in Batocina.

**Keywords:** portfolio, vocational training of teachers, evaluation



## Opportunities and challenges of professional development school pedagogues in contemporary conditions

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**Abstract:** In recent years, both in the world and in our country, is increasingly emphasizes the importance of professional development of expert associates in school and their adaptation to the new social conditions. One of the starting points for this work represents recognizes the need for explication of the meaning of the language used when talking about professional development of school pedagogues in the context of modern schools, to allow that it is being discussed that he reviewed, in order to build shared meanings .Professional development of school pedagogue conceive in the context of lifelong learning starting from the conclusion that professional development starts in very early departure of an individual in a formal system of education, and possibly before. This paper analyzes the Ordinance on permanent professional development of teaching positions, teachers and educationists (Official Gazette of RS, No. 13/2012).

**Keywords:** teacher; professional development; opportunities

## Teaching and learning through the use of screencasting tools in teaching informatics and computing

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**Abstract:** In this paper was conducted a research of success of the implementation the screencasting tools in teaching of computer science in the elementary school and the impact on improving the areas of evaluation

teaching and learning, based on the quality standards of work the school. Through the testing of students in order to determine the impact on the level of student achievement; evaluating the quality of lessons by teachers and interviewing teachers and students in which they expressed their views to relevant questions for their target groups, it comes to results which show that teaching aided by using screencasting tools excels compared to traditional classes. Survey results of both target groups indicate that the use of screencasting tool in teaching computer science is recognized as the quality of the work and influence on the improvement of the teaching process. Identified the potential for application in other cases. It comes to the conclusion that combining e-learning with traditional teaching and the use of electronic tutorials teaching contributes to ensuring the quality of work the school.

**Keywords:** screencasting tools; improvement of teaching and learning; e-learning

## **Bridging the gap between the classroom and reality (ESP) – Task based/Topic centred learning**

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**Abstract:** One of the main goals of teaching a foreign language is its application and usage in real, everyday life. Task based learning is an approach in teaching English which gives students the opportunity to learn by doing while a teacher has a complex task to help them master variety of language and professional skills.

As students experience different roles in accomplishing their task, the opinion is that task based learning gives the opportunity to bridge the gap between the classroom and reality because it is authentic and true to life, and the results of students' work can be used in real life.

**Keywords:** task based; topic centred learning; ESP

## Learning styles of students of different professions

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**Abstract:** Teaching process in higher education, in addition to teaching requires careful planning due to the specificity of different study programs. It also requires consideration of personal characteristics of students, such as learning styles. The aim of this paper is to investigate the differences in preferred learning styles between students of integrated academic studies of Techniques and Informatics (TI) and the undergraduate academic studies of Information technology (IT) where Kolb's model of learning styles has been used. The sample consisted of 51 students. The research results showed that differences occur in the preferred learning styles between these two directions, and also that the majority of students prefer a convergent learning style.

**Keywords:** Kolb's model of learning styles, organization of teaching, learning styles of students

## School-based mentoring of students–teachers in the practice and beginning teachers

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**Abstract:** Teacher education is a very important field of university work because the quality of educational system mostly depends on teacher qualification. Responsibility of higher education institutions for teacher education is great, especially in the first phase of teacher education – initial education. Attention on the school practice of student-future teacher and on mentoring is increasing. The school-based mentoring of students-teachers in

school practice and of beginning teachers in induction period is considered in the paper. Some conditions of effective mentoring are selected; these conditions are the criteria for teacher-mentor selection, too. Education of teachers in the field of technics and informatics directed the selection of comparison between mentoring of students-future teachers and mentoring of beginning teachers. This is necessary for mentoring school and teaching practice (both for the student-teacher and beginning teacher), not only for supervising. Then, the role of teacher-mentor is very complex and requires adequate preparation and professional development of mentors.

**Keywords:** mentoring, school-based practice, student-teacher, novice (beginning) teacher, initial education, induction period

**SECTION IV**  
**ENGINEERING EDUCATION**



## Comparative analysis of engineering study programs at two universities in Italy and Serbia

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**Abstract:** Engineering is the discipline and profession that has as its objective the application of knowledge and results of the mathematical, physical and natural sciences to the resolution of problems regarding the satisfaction of human needs. In the context of internationalization of higher education, the main goal of this paper is to compare opportunities for engineering education in educational systems of two European countries, Italy and Serbia. For that purpose, the structure of university study programs in the field of engineering education at University of Brescia and University of Kragujevac was analyzed.

**Keywords:** engineering education, university study programs, comparative analysis

## Seafarers' Education and Training in the context of improvement leadership and managerial knowledge and skills

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**Abstract:** This paper presents the observations about changing conditions and circumstances affecting seafarers' professional lives, today and in the near future. The focus is on the Leadership and Teamwork Course in terms of its objectives, purpose, content and ways of implementation, all in the context of presenting the latest achievements in the field of education and training of seafarers. Furthermore, the paper provides an analysis of results of the survey performed in order to investigate how trainees of the Course are satisfied with

some specific aspects of teaching process and staff at the Faculty of Maritime Studies Kotor.

**Keywords:** seafarer; leadership; teamwork; management

## **Financial literacy of the students of technical sciences**

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**Abstract:** The terms and procedures of economics and finance may often seem unfamiliar for engineers, as they did not have much chance to learn more about these fields. Financial literacy could enable better understanding of their role in the organization and facilitate task accomplishment, as well as their professional development. The goals of this paper are to show the level of knowledge in finance, familiarity with financial products, level of financial planning and control, and the most often used ways for money saving. The paper emphasizes the need for improvement of this knowledge and skills. A few engineer competency models emphasized financial literacy as one of necessary skills for engineers in global, complex and dynamic world.

**Keywords:** finance, competence, engineer

## **Supporting education of Engineers of 2020 through Triple Helix model**

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**Abstract:** This paper presents Triple Helix model and its appropriate key aspects (components, relationships and functions among helices) as the



framework for collaboration among Universities-Industry-Government, with the overall objective to improve engineering education and formation of Engineers of 2020 and to overpass the most significant deficiencies of engineering education. This approach, with adequately defined roles of all parties, benefits and correlations, offers benefits for all model components and, in terms of education, facilitates overcoming deficiencies of traditional education.

**Keywords:** Engineer of 2020; Higher Education; Triple Helix model; Engineering education; Networking

## **Remote laboratory concepts: a conceptual model of remote laboratory for solar energy engineering**

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**Abstract:** The notion of remotely controllable laboratories (RCL's) is the practice of providing control of scientific instruments from remote locations. The devices which can be accessed remotely include variety of equipment. Bearing in mind the cost and complexity of these devices, many specialized scientific instruments cannot be reached by some institutions, while the institutions that pose such instrumentation, scheduling and other logistical issues prevent full utilization of those tools. Therefore, initiatives that offer remote access tend to address issues of access and efficiency, ultimately improving educational quality and student opportunities. Given the aforementioned, the aim of this paper is to provide an insight on the most common concepts of RCL's that are encountered in engineering practice. Furthermore, a conceptual model of RCL's for solar energy engineering (SEE) is briefly displayed and discussed. Lastly, potential advantages and disadvantages of RCL's are stressed out concisely.

**Keywords:** Remote laboratory; engineering education; solar energy; Moodle.

## Remote control of pneumatic circular manipulator using CompactRIO controller

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**Abstract:** Pneumatic circular manipulator is a new experimental facility developed for testing different control methods and energy efficiency of automated systems with compressed air as a working medium. Also, the manipulator has the ability of remote control, via the Internet and thereby it is an important didactic tool for teaching in the field of pneumatic control with multiple actuators. In this paper, the realization of control is presented using the CompactRIO controller, which eliminates the need for a server computer.

**Keywords:** circular manipulator; remote control; CompactRIO

## Using of remote controlled pneumatic spring in teaching

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**Abstract:** The paper presents application of a new didactic resource - the remote controlled pneumatic spring in teaching at the Faculty of Technical Sciences Novi Sad in studies of Mechatronics and Industrial engineering. The paper provides basic theoretical background and description of the developed experiment as well as results of the student evaluation related to design, quality of use and application results of the presented remote experiment.

**Keywords:** remote experiments; pneumatic spring; evaluation

## Computable functions and lambda calculus

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**Abstract:** The lambda calculus is one of the more known formulizations of the effective procedure and is widely applied in functional programing. In relation to this, the main goal of this paper is to show a way of interpreting some computable functions via lambda terms. Thus, the paper gives a special insight into interpreting Boolean functions, Church's numerals and the most important arithmetic operations with them. A review of some combinators which have been proven to be useful when dealing with lambda terms is also given. Finally, an idea of proofs is presented and it shows that the class of lambda computable functions is equal to the class of primitive recursive functions.

**Keywords:** lambda calculus; lambda definability; Church numerals; computability

## Mathematica as program support in the integral calculations

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**Abstract:** This paper gives insight into a connection between the mathematical notions and the use of computer as educational support at university level. Mathematical notions specifically used in integral calculations will be explained with the help of computer program. The notions, indefinite and definite integral, their calculations and their applications can be easily understood using the computer programs for their presentation. Images obtained with computer programs allow the students to understand and learn

integrals better, and also give them appropriate training to use this knowledge for current real problems. In this paper, we will use mathematical package Mathematica, as computer program to help learning integral calculations.

**Keywords:** Indefinite integral, definite integral, Mathematica, application of integral calculations

## **The application of Microsoft Excel in teaching courses of mechanical engineering**

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**Abstract:** The applications of information technologies in the field of mechanical engineering are various and numerous. This paper presents the application of basic computer software i.e. Microsoft Excel in solving a series of calculations in the field of mechanical engineering which can be encountered during studies, or later in practice. Using the knowledge and literature both in these areas and in the field of information technology, this software is used through an interactive application to calculate the geometric characteristics of standard profiles, as well as the calculation of the efficiency and state parameters of the thermodynamic cyclic processes. The examples shown in this paper will provide students a great help in the preparation of assignments from these fields of study, and also teachers when reviewing them.

**Keywords:** geometric characteristics; cyclic processes; Microsoft Excel

## Realization of sensory mobile platform “WEGY” and possibilities of use in education

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**Abstract:** This paper discusses the design, implementation and features of simple mobile robot system, WEGY, and introduces possibilities of use in education, research and popularization of engineering. WEGY drives are in the form of WHEel+leG configuration, shorten WHEG, which gives system the ability to move easily on the open and uneven terrain. Crossing the barriers is easier than with wheels. The platform has a small mass, and compared with a caterpillar drives is much more efficient. Robots elements with a description of options will be shown. The main controller of the robot is Arduino Mega. The platform can integrate a large number of sensors and actuators so it's suitable for different teaching modules, such as sensors, actuators, automatic control, mobile robots and others. The platform allows specific application problems to be solved, which also represents an adequate way to adopt engineering knowledge, according to the method practical-theoretical-practical (PTP).

**Keywords:** robot; whег; sensor; arduino

## Up-to-date approach to design of mechatronic systems

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**Abstract:** Rapid development of software tools for modeling and simulation along with the implementation of new technological achievements in engineering require a new approach to design of mechatronic systems. The paper presents modern approaches to design in mechatronics which are based

on the application of software for three-dimensional modeling and simulation. It also shows the methods of designing an industrial robot according to constraint-based modeling and model-based design. Special attention is paid to the importance of developing a simulation CAD model of the robot, the integration of mechanical, electrical and software components in the process of developing the model of mechatronic systems and automatic generation of control algorithms.

**Keywords:** mechatronics; modeling; simulation, robot

## Simulation model of Direct Torque Control with discretized voltage vector intensities

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**Abstract:** This paper describes the development process for direct torque control algorithm with multiple voltage vectors aiming to reduce torque ripple as a main drawback of DTC algorithm with discrete voltage vectors and switching tables. The idea and the selection principle of voltage vectors with different intensities that need to provide torque ripple reduction is given in Section 2. In Section 3, the developed Simulink model of the proposed DTC algorithm is described in detail and simulation results for different numbers of voltage vector intensities are shown. The model of proposed algorithm is convenient for students who attend the course of control of electric drives in order to comprehend DTC principle more easily. Experimental results of the proposed DTC method are presented in section 4, followed by the conclusion at the end of the paper.

**Keywords:** direct torque control, discretized voltage intensities, simulation, torque ripple reduction, EMF compensation

## **ODROID-XU4 as a desktop PC and microcontroller development boards alternative**

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**Abstract:** This paper presents an ODROID - XU4 SoC computer, for whom even now we can say that has pioneered Nano computer revolution, present computing and the Internet of things.

**Keywords:** ODROID - XU4, information systems, sensor systems, Internet of things.

## **Some aspects of using the XBOX Kinect technology in the human – computer interaction class**

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**Abstract:** The technological development has lately provided a large spectrum of its application in different areas of everyday life. The principles and education methods that were used before are still being implemented, but the technology greatly affect them. One of such improvements is XBOX Kinect, which can be easily used in every structure of education system. By using interesting and visually appealing manner of teaching, the students' interest in taught subjects increases. XBOX Kinect has been applied in the Human – Computer Interaction class, where the aforementioned interaction has been emphasized. This paper describes the use of XBOX Kinect in this class in order to have better approach to teaching theoretical basics in more interesting and

efficient way. The paper brings the possibilities of Kinect, with the analysis of its application in education so far and description of software that comes along. Also, the difficulties in its implementation are given as well.

**Keywords:** XBOX Kinect; Education; Human-computer interaction

## **Educational set up for measurement of photovoltaic modul electrical parameters**

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**Abstract:** This paper presents educational set up for practical teaching about photovoltaic systems. The paper gives theoretical aspects of photovoltaic panels with description of the current-voltage characteristic. Measuring of electrical parameters using conventional measurement instruments and data acquisition system are shown. Usage of the measuring data acquisition systems speeds up obtaining important characteristics of photovoltaic panel. The main focus is on the processing and analysing of results, not on reading the data from conventional measurement instruments. The LabVIEW software automatically generates a report after completing the measurement. Ideas for further development of set up and enhance the teaching of photovoltaic modules are also given.

**Keywords:** photovoltaic cells; photovoltaic module, I-V characteristics, LabVIEW



## **Automated noise measurement technique of petrol engine**

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**Abstract:** Economy, prevalence, open architecture and high computational capabilities provided by the PC led to the rapid development in the field of measurement, automation and instrumentation. Computer technology has found a variety of applications in automatic measurement of physical quantities, but all options are yet to be exhausted, so that in the future further development of this branch of the measurement techniques can be expected.

**Keywords:** Automated measurement techniques, methods of measuring noise

## **Determination of velocity and acceleration of the object in motion moving down along vertical cylindrical rails**

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**Abstract:** In this paper is presented the methodology for measuring the velocity and acceleration of the object in motion moving down along vertical cylindrical rails of laboratory device for pipe impact testing. For this purpose are used magnetic sensors and digital oscilloscope. An overview has been given of all relevant parameters, measurement procedure and measurement results. Since the measurement of velocity and acceleration was done indirectly, by measuring the time of movement of the object along a specified path, an overview has been given of all the necessary conversion formulas required to calculate the desired physical values.

**Keywords:** measurement; time; speed; acceleration; sensor

## **Energy efficiency of electrical drives: between energy engineering, energy policy and energy education**

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**Abstract:** For implementation of the concept of energy efficiency of electrical drives (EEED) it is necessary to accomplish some prerequisites: to train engineers for of (energy efficient) electrical drives construction, to design and realize ED, to define principles and create procedures of energy efficient implementation of ED, to choose energy efficient use of ED, to accept energy efficient behaviour in this field and to train to use it. According to the multidisciplinary of the concept of energy efficiency, three basic dimensions of energy efficiency are considered: (electrical) engineering, policy and education in this field. Necessity of the connection of three dimensions to meet energy efficient criteria, is presented with the practical examples – activities and results of scientific research focused on the energy efficiency of ED.

**Keywords:** energy engineering, energy policy, energy education, energy efficiency of electric drives, multidisciplinary.

## **Day of computing at TIO 2016**

Day of Computing is an event that is held with the aim to connect former and current students of the Computer Science at Faculty of Technical Sciences. Also, it's an opportunity to show the results achieved at the Laboratory for Computer Science, together with the results that have been achieved in the field of Computer Science at the Faculty of Technical Sciences. Day of Computing will be an opportunity to get feedback from former students of computing regarding the importance of the knowledge acquired at the Faculty on practicing the profession.

It is expected that during this year's Day of Computing the association of former students of Computer Science at the Faculty of Technical Sciences will be formed.

## **NeReLa at TIO 2016**

The activities of the TEMPUS project NeReLa (Building a network of remote laboratories for strengthening the cooperation between universities and vocational secondary schools, <http://www.nerela.kg.ac.rs/>) will be presented within the 6th international conference TIO2016. The coordinator of the project is Prof. Radojka Krneta, Faculty of Technical Sciences in Čačak. The aim of the project is to improve engineering studies in Serbia by introducing innovative teaching methods concerning remote experiments, as well as strengthening the cooperation between universities and vocational schools through training vocational school teachers in using remote experiments in the classroom.

Serbian project partners: University of Kragujevac, University of Belgrade, University of Novi Sad, University of Nis, Network of Reg. centers for voc. schools teacher prof. development, Association of Electrotechnical Vocational Secondary Schools, Association of Mechanical Vocational Secondary Schools and Balkan Distance Education Network (BADEN).

EU project partners: University of Maribor, Slovenia; University of Deusto, Bilbao, Spain; University of Porto, Portugal; European University Cyprus; Best Cybernetics, Patra, Greece.

During the last two project years a huge number of project activities have been performed from which we can choose the following:

- Four largest state universities in Serbia signed the contract of founding the NeReLa network that will enable joined use of remote experiments which are set in laboratories of these universities,
- LiReX web library of remote experiments was created,
- NeReLa Winter and Summer school were conducted and more than 100 teachers of secondary schools from whole Serbia were trained there to work with remote laboratory experiments,
- Catalogue of remote laboratory experiments and exercises with user manuals was printed for NeReLa Winter and Summer school participants,
- Teaching modules with remote experiments within professional courses in Electronics, Computers and Mechatronics were realized at partner universities and several secondary vocational schools.
- NeReLa team has published a lot of papers in numerous conferences dedicated to remote experimentations and laboratories such are following: REV2014, TIO2014, TAEE 2014, New Technologies in Education 2015, YU INFO 2015, EXP.AT'15, ETRAN 2015, TREND 2016, REV2016.



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