



## Proposal with regarding to teaching programme on Technics and informatics in elementary schools and high schools in Serbia

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**Abstract:** *Both technical and computer literacy are a part of the know-how, skills and understanding that a student should be able to comprehend at the end of its compulsory education, which should further promote proper professional guidance, further education and daily functioning. To fulfill most of these general aims of the subject called Technical Education and Computer Literacy (Informatics), teaching process should most certainly be guided by the standrads, programs, defined goals, outcomes as well as by other elements throughout the teaching process. The paper [5], which is based on the European experience, shows the projection of the Standard for the course entitled Engineering and Informatics, where pre-school children (level 0), children of four-year primary education (level 1), fifth and sixth graders (level 2), seventh and eighth graders (level 3) and the first / second graders of secondary education - gymnasiums and secondary vocational schools (level 4) have all been included. Goals with regard to formation of the subject in question have been defined, as well as the expected student achievement for all four levels of education, i.e., for students aged between 7-18 (5-16-year old students- an option for an elementary education of 9 years). This paper suggests some guidelines in terms of redefinition of the techniques and informatics in elementary schools as well as some guidelines for children and students concerning the program by covering the entire educational system at all levels.*

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

### 1. INTRODUCTION

Previous papers produced by the author showed the then-current state of technology and information technology, the possibility of applying modern methods as well as creating desirable environments for further development of the subject in question ([1] - [4]), whereas paper [5] shows the projection of the Standard, i.e., outlines needed for the development in the field. When it comes to current situation and development of technology and information technology and procedures, which seem to be the key strategic point in development of education in Serbia, one must say that some further changes are most certainly needed and not just in this field but in other educational fields as well. ([6], [7]).

Even though we see that some significant improvements have been made as regards the school subject Technical and IT education, especially in the sphere of modernization of programmes and introduction of information technologies, however, due to its complexity, the subject has come across a series of problems [5].

We all know that both technical and IT subjects in Serbia are learnt from the subject called Technical and IT education, which is a regular teaching programme in elementary schools in the second cycle of education (from 5th-8th grade, students aged 11 to 15). Compared with other educational systems of other countries, especially European countries ([9] - [12], where this subject is learnt in the first grade – at the age of 5), we can draw a certain conclusion that our educational system slightly ignores technology and informatics, meaning that the subject in question has not been sufficiently present at schools neither in terms of scope nor structure (stages) of learning, i.e., it definitely falls behind other countries.

To attain most of these general goals from the subject called Technical Education and Informatics, the school curriculum should most certainly be guided by standards, programs, defined goals and outcomes as well as other elements of teaching process planning.

Paper [5] shows details of the standard regarding technique and informatics - a proposal for redefining; below you will find only a programme proposal for all levels of education.

## **2. THE IMPORTANCE OF TECHNICS AND INFORMATICS**

### **2.1. Importance of technics**

Learning techniques (design-construction and technology, the term has become more accepted in Western countries) prepare students to follow the increasingly rapid technical and technological development. They should learn to think and act creatively to improve the quality of life. The subject prepares students to become independent and solve problems in a creative manner, both as individuals and as team members. They need to look at the needs, aspirations and opportunities and confront them by developing a number of ideas and producing specific products and systems. They combine practical skills with an understanding of aesthetics, social and environmental issues, function and industrial practices. In doing so, they look back and evaluate present and past design and technology, its use and impact. With the help of design and technology, all students can become informed users of products and thus can easily become innovators. The product most often defines its meaning and usefulness. The nature of the relationship between technology and people is determined by the manufacturer. Understanding the available technical features, together with the interest and sensitivity of language use allows a person to express its design ideas with more ease. There is one famous phrase which perfectly depicts learning through practise and it goes as follows: "Tell me and I will forget it-show me and I will be able to remember it- allow me do it and I will learn".

### **2.2 Importance of information and communication technologies**

Information and communication technologies prepare students to participate and be trained for technologies for future jobs that are rapidly changing and developing. Students should use the tools (a software) to explore, analyze, exchange and present information in a responsible, creative and original way. They need to learn how to access both ideas and experiences from a large number of people, societies and cultures. By mastering it, ICT students boost their self-initiative, independent learning and development. It allows them to make informed decisions about when and how to use ICT and to understand the implications

of using these systems at home and work in the future. It is a well-known fact that the ICT has a great potential. It will bring about a change in both the teaching and learning method, as well as a way students perform their tasks. The modern world requires new skills. By understanding the ICT, but more importantly the ability to use it for problem-solving, will be without a shadow of a doubt of great importance in the future. More and more will ICT will affect the prosperity of one's country economy. The expansion of ICT has made the world become closer and more compact.

### **2.3 Integrative approach to learning the technics and informatics**

Already applied twenty-year integrative analytical concept of techniques, computer and communication technologies in the subject called Techniques and Informatics (formerly Technical Education) had justified set out goals and requirements. The swift development of technique and technology has enabled the rapid development of information-communication technologies as one of the technique's and technology's segments of engineering and technology, which has been broadly implemented in technique and technology. Implementation of applications in already existing technical systems has helped the level of technical and technological systems significantly modernize owing to a multidisciplinary approach of these fields. That is how the 'new baby' has enriched its creator, which was the main reason why 20 years ago our country analysed new information technologies coupled with the technique all joined in one subject called Technical and Information Technology taught 2 times a week all the way from the fifth to the eighth grade. Application of information technologies has been foreseen in all subjects as well as additionally in an optional subject called Accounting and Informatics.

Therefore, there are significant reasons as to why this unique subject called Technical and IT education should be preserved and taught 2 times a week by continually improving both the realisation method and subject content especially when it comes to information technologies. In addition, computer and information-technology literacy, apart from the current subject Accounting and Informatics, should be broadly spread out and included in elementary schools and harmonized with other digital competences that appear in other subjects, i.e., to make these competencies grow through various subjects from the very beginning of going to school, with special emphasis on the development of ICT competences in the subject called Technical and IT education.

### **2.4 Know-how, skills and understanding**

Teaching should ensure that the knowledge, skills and understanding is something that a student will apply when developing its own ideas, planning, developing its own products/applications and participating in the rating of the achieved results.

## **3. PROPOSAL WITH REGARDING TO TEACHING PROGRAMME ON COMPUTER TECHNIQUE AND INFORMATICS**

In accordance with the standards of learning techniques and informatics global operational program, as well as the proposal is still given to all levels of education.

**LEVEL 1: from 1st 4th grade****PROGRAMME TECHNIQUES****NATURAL RESOURCES**

Resources that create life conditions on Earth: matter and energy. Over the centuries there has been a tendency of a man to adapt natural resources to its needs. Meet the world of technology: technology in shaping materials, use of technical means, natural resources on Earth: solid matter (rocks, minerals, clay, earth, coal ...), liquid (water, rivers, lakes, seas, oil ...) and gaseous ( atmosphere, gas ...) matter.

**MATERIALS**

Natural materials: Natural materials: metal, stone, clay, wood, wool, silk, leather, fur, cotton, etc. Artificial or synthetic materials: metal alloys, polymers, semiconductors, technical ceramics, composites, biomaterials, etc. Exercise: creating a product with an aesthetic designs material: choosing the subject, creation of various handicrafts, for example, souvenirs or performing other suitable works or making similar objects from different materials, without using tools, equipment or simple tools, describe and comment the process of making.

**HUMAN SETTLEMENTS**

Development of human habitats starting from: forests, caves, stilt houses, the house made from solid material to modern residential buildings. Construction and architectural development. Exercise: making houses, resorts and other, from natural materials and materials used by contractors on site.

**HANDICRAFTS**

Development of handicrafts, traditional crafts: cobblers, blacksmiths, tailors, potters, carpenters,... Nurturing tradition of crafts. Exercise: Using craft tools and accessories.

**POWER SUPPLY**

Energy: forms (mechanical, thermal, light, chemical, electrical, nuclear) sources (non-renewable-coal, natural gas, oil, uranium ore), renewable (water, wind, muscles), alternative renewable energy sources (solar energy, hydrogen energy, biomass). The need for rational use of energy. Exercise: Create a model that points to the rational use of energy.

**INDUSTRIAL REVOLUTION**

The invention of steam engine-the first major industrial revolution. The invention of internal-combustion engine- other great industrial revolution. Electrification - the third great industrial revolution. The era of information technology- the fourth large-scale industrial revolution. The time when information technology was first applied in machines-time mechatronics. Exercise: see a film about industrial revolution and provide feedback.

**TIME OF GREAT INVENTIONS- MACHINES AND MECHANISMS**

Inventions-basic principles of machines and mechanisms: ramp and wedge, lever, wheel, shaft, drum, four-wheeler, reel, pulley and winch, pulleys and belts transmissions, gears and gear drives, gearboxes, bevel gears and transmissions, worm and worm gear, rack, piston mechanism, cam mechanism, braking mechanism and other.

**ELECTRICITY AND MAGNETISM**

What is electricity: static, mobile electricity. Where does it come from? Magnetism: What is a magnet, an electromagnet. Conductors and insulators. How does a battery work? Hazard from an electric shock. Electric circuit with a battery. What are sockets, plugs and switches/circuit-breakers. Electric machines and devices: transformer, electric motor,

electromagnet. Small electrical appliances. Exercise: Develop a model of an electric device or a machine by assembling components from the constructor.

#### **TRAFFIC SAFETY AND RESOURCES**

Development of transport means from the sled and chariot to ships, automobiles, locomotives, airplanes and hovercrafts. Traffic safety: traffic signs, traffic rules and children.

#### **NEW TECHNOLOGIES**

Materials: plastic materials - nylon, polyester, vinyl, plastic film, glass fiber, composites. Electronics and materials at work: semi-conductors, silicon chips, computers. Robotics: computer controlled machine. Lasers in new technologies: cutting, welding, gauging, recording and reproduction of sound, holograms. CNC controlled machines. Exercise: get to know some modern machine. Construct and design your robot.

#### **COMPUTER PROGRAMME**

##### **INTRODUCTION TO COMPUTERS**

It's time to get started. Meet PC. Computer Hardware. Connectivity. External devices, computer terms. Applications - Software. Applications in Windows. Microsoft Office. Start menu in Windows. Shutting down the computer.

##### **LEARN BY PLAYING**

Program Windows. Windows help. Games: Games with maps, interactive games. Calculator. Create a logo or image. Drawing Tools. Computer discs. Listen to music. Media Player - play. Save the music on your computer. Make a list of songs. Burn CD.

##### **PERSONALISE / SET WINDOWS**

Topics for the monitor. Variable wallpaper screens. Screen saver. Gadgets - program application, time and space. Add shortcuts. Program Pinning. Shortcut to start or task bar. Setting the display. Access Center - Center for easy access. The buttons on the mouse. Pointer options. Change the picture on your account.

##### **COMMUNICATION**

Mail applications. Make your e-mail address. Configure Live Mail. Using of Live Mail. Live Mail folder. Receive e-mail. Create a message. Manage your mail applications. Reply and forward. Attachments. Receive attachment. See attachments. Security and "fishing". Create a list of contacts. Travel and send e-mail. Chat with your friends.

##### **INTERNET SEARCH - "SURFING"**

What is the Internet? Web Addresses. Hyperlinks. Select your home page. Search web pages. Tabbed browsing. Back to page. Save image from the web site. Online PDF document. Antivirus Software. Updating Windows. Manage your search engine. TV and Radio. Useful website.

##### **SHOPPING ON THE INTERNET**

Subscribe to RSS. Newspapers. Electronic books. Explore products. Set filters. Compare prices. Register on the web site. Buy online. Order groceries online. Buy and sell on eBay. Preventing Internet scam.

##### **LETTERS AND REPORTS**

Inscriptions note. Save note. Manage files. View Documents Folder. Organize your documents. Open the document. Governing document. Print the document. Working with text. Move and copy. Improve document. Write a letter. Write a header. Add image. Create a table.

**MONEY MANAGEMENT**

Household budget. Show cost and value. Budgets. Automatic summation. Copy and fill. Formatting. Keep track of your shares on the market. Internet market of stocks. Online banking. Find Online Bank. Open online account.

**DIGITAL PHOTOGRAPHY**

Camera. Connecting the camera. Transferring images. Safely Remove Hardware. Windows Live Photo Gallery. Adding tags and evaluation. Changing the size of views. Improving the image. Advanced photo editors. Slide show. Print. Pictures on the internet. Making movies with Windows Live programs. Share movies. Creating DVDs. Tips for Digital Photography.

**ORGANIZATION OF COLLECTION - DATABASE**

What is a database? Planning. Create a catalogue of CD-s. Sort collection. Search. Advanced Search. Printing catalogues.

**PLANNING PROJECT**

Plan project. Customize the invitation. Add a photo, drawing, animation, message. Add more creative tools. Add folder. Add the recipient's address. View and change of address.

**COMPUTER MANAGEMENT**

Sharing your computer. Creating a task. Initial monitor. Passwords. The order for the customer. Choosing the user. Fast User Switching. Home Network. Maintenance and security using Action Center. Uninstall the program. Sets the power and connectivity using Mobility Center. Creating a secure copy of the System. Recover files. System repair.

**LEVEL 2: from 5st 8th grade****PROGRAMME TECHNIQUES****INTRODUCTION TO TECHNIQUE**

Natural resources on Earth: matter, energy, space and time. The concept of engineering and technology. The impact of techniques development on life on Earth. The subject and the importance of technical and IT education, work and organization of the workplace in the cabinet and the application of protective measures.

**GRAPHIC COMMUNICATIONS**

Modeling from concept to realization. Technical drawing as the basis of graphic communication: sketches, technical drawings, paper sizes, types of lines in the technical drawing, spatial presentation of cases, technical letter labeling, measures on technical drawing, scale, basic equipment for technical drawing, model (model) - concept and graphics display.

**FROM IDEA TO REALIZATION**

Constructors algorithm modeling from concept to realization. Introducing elements Constructors sets and ways to connect them into a whole. Algorithm development model based on their own idea. Individual work with the constructor sets and pre-fabricated elements according to their idea. Technical documentation models.

**MATERIALS**

The concept and classification of technical materials (natural, artificial). Types and properties of materials (physical, chemical and mechanical): wood, paper, textile, leather, plastic materials.

**PROCESSING TECHNOLOGY**

Processing method (principles of tools for the mechanical processing of materials, materials testing). Preparation for processing. Proper use of tools for manual processing of materials, performing operations and safety at work: marking, cutting, finish (drilling, planing, filing, sanding). The choice of materials, operations and sequencing tools and their application. Material recycling and environmental protection.

**POWER SUPPLY**

The concept and importance of energy. Sources of energy (non-renewable, renewable and alternative). The transformation, utilization and conservation of energy. Use of energy: sun, wind, water.

**CONSTRUCTORS MODELING OF MATERIALS**

Constructors Modeling: students are free to choose the activity (project), based on which we get the algorithm: making sketches and forming technical drawings (in pencil or on a computer), planning and preparation of necessary materials, planning and sequencing of processing operations, realization of projects: development of models according to your own design from easily manipulated material or Constructors' elements. Practical application of knowledge about design modelling through mastered technologies and using materials from: wood, paper, fiber, textile, leather, plastics and other. Students who are especially interested in working on the computer can use software for physical modeling and construction (SketchUp, Visio).

**TRAFFIC**

Traffic (concept): types, structure, function. Regulation and road traffic safety. Pedestrian traffic. Bicycle traffic. Horizontal, vertical and light signals. Duties and responsibilities of the participants. The impact of transport on the environment.

**INTRODUCTION TO ARCHITECTURE AND CONSTRUCTION**

Introduction to architecture and construction. History of Architecture (building styles). The types of buildings.

**TECHNICAL DRAWINGS IN CONSTRUCTION**

The structural elements of the building structure. The construction systems in construction engineering. Activities and phasing over the course of building construction (technical documentation). Technical drawing as the form according to which the building is built.

**CONSTRUCTION MATERIALS**

Classification and types of construction materials. Power supply in construction

**POWER SUPPLY**

Measures for the rational use of heat energy in the construction industry. Tools and equipment for the construction industry

**TECHNICAL RESOURCES IN CONSTRUCTION**

Tools and equipment for the construction industry. Measures to protect buildings.

**TRAFFIC SYSTEMS**

Buildings in traffic: highways, railway stations, airports, ports. Ethics related to housing. Creating a plan of the apartment and a proposal for its construction.

**CULTURE HOUSING**

Water supply and sewage systems. Both interior and exterior.

**TECHNICAL RESOURCES IN AGRICULTURE**

Work organization and the application of modern machines in agricultural production. Both machinery and equipment in agricultural production. Work on your own project (technical documentation, creation of mock-ups, building structures, models of agricultural machinery and equipment, computer skills). Work on your own project.

**CONSTRUCTORS MODELING IN CONSTRUCTION**

Systematization content mastered in the 6th grade. Occupations in construction. Housing culture –flat outline for its interior design development.

**PROGRAMME INFORMATION TECHNOLOGY****OPERATING DESIGNS COMPUTER SYSTEM**

Graphical desktop operating system. Working with the keyboard and mouse. Switching on and off the computer. Adjusting the working environment. Organization of data. Working with folders and files. Starting the program. Installation and removal program. Malicious programs and protection. Legal and pirated software. Installation of additional devices. Installing fonts. Search for files. Group program accessories (accessory).

**BASIS OF WORKING WITH TEXT**

Choice of working language in the program. WORD Starting, Operating environment. Getting ready to write the text. Create a document and enter text. Capture documents and completion of work. Loading of the recorded document. Changes in the document. Text formatting. Print. Working with images. Drawing in Microsoft Word.

**INTRODUCTION TO MULTIMEDIA**

Multimedia Players. Application of multimedia in teaching.

**WORKING WITH TEXT**

Basics of working with a word processor MICROSOFT WORD : WORD launch , prepares to write, record, document and upload the recorded document changes in a document , format text , spreadsheets, printing. Operation : forming table changes to the table , making the frame, line drawing , shading , move or copy a table. Design by : Framing and shading of the paragraph , frame and change to the background of the page , a page break , insert a page number, insert date and time , creation ( modification) headers and footers.

**INTERNET**

Computer networks : the notion of global and local area networks , connect to the Internet, basic Internet services . Search the Internet: Web - ( *WWW - WORLD- WIDE WEB* ), electronic mail . Security on the Internet : protection of personal information , misuse of e-mail programs to spy ( *SPYWARE* ) and privacy violations.

**GRAPHICS**

Types of digital images records: Presentation of graphics on the computer, basic formats for storing drawings and paintings. Sources of digital images: drawing, painting screens, downloading from the Web, scanning, photography, creating images in image editing programs. Image processing: tagging, move or copy, resize the highlighted part, highlighted the work of manipulation, cutting and delete parts of the image, adjust brightness and colors, resizing the image, change the aspect ratio, preparing images for printing, display graphics and computer and internet presentations.

**ANIMATION**

What is animation? download and install *BENETON MOVIE GIF*, launch programs *BENETON MOVIE GIF*, create your own animations: bouncy balls, traffic lights, the use of effects built into the program to create animations

**PROGRAMMING**

Install and run the program: Download and install Visual Basic.net, launch Visual Basic.net, load and run existing programs, programming calendar, additional settings, writing a program that add up two numbers, variables and variable declaration. Branching in the program: commands for branching, write a program that determines whether a given number is even, writing the program according to which the bigger number is chosen out of two numbers. Repeat the program: writing programs which produce all integers that sit between two specified integers, write a program that simulates a calculator.

**INTERACTIVE GRAPHICS**

Download and install GEOGEBRA. GEOGEBRA start up and first examples: drawing points, longer and elementary transformation of drawn objects, parts of the base of the screen and the basic controls, draw a triangle, labeling and renaming objects. The construction of the circle circumscribed around the triangle, and entered into a triangle. The construction of a right triangle. Working with corners. Measuring distances and areas.

**LEVEL 3: 7th and 8th grade****PROGRAMM TECHNIQUES****INTRODUCTION TO MECHANICAL ENGINEERING**

The concept and the tasks of machines and mechanisms : transformation of matter and energy , transmission and transformation of load and movement .

**TECHNICAL DRAWING IN MECHANICAL ENGINEERING**

Technical documentation in mechanical engineering. Orthogonal projection . Dimensioning, cut and simplification, spatial representation. From idea to realization.

**INFORMATION TECHNOLOGY**

Draw using a computer and making presentations. Interface system computer connection. Management models using a computer. Working with designers based interface technology. Mechanical Engineering Materials: metals, alloys, composites, non-metals, operating materials. The properties of metals and alloys (testing the hardness, strength, etc.).

**MEASUREMENT AND CONTROL**

Measurement and measuring devices: length, angle, mass and momentum. Marking and measuring metal. Control definition.

**MATERIAL TECHNOLOGY**

Principles of metal processing with and without merging and cutting metals. Safety precautions.

**MACHINES AND MECHANISMS**

Principles of machines and mechanisms. The elements of machines and mechanisms: components for connection elements for power transmission and motion, special elements. Production machines: operating principles, composition, use. External machines (bike, car, rail vehicles, ships, aircraft, etc.) And internal (conveyors, cranes, etc.). Transport: operating principles, composition, use.

**ROBOTICS** term robot. The types of robots, purpose, construction (mechanics, drive and manipulation). Modeling of the robot from constructors sets and user interfaces.

POWER SUPPLY, use and transformation of energy. Power Machines Motors: hydraulic, pneumatic, thermal (cylinders, turbines, steam engines and turbines, two-stroke gasoline engines, four-stroke gasoline engines, diesel engines and other engines).

#### MODELING OF MACHINES AND MECHANISMS

Constructors modeling for independent work on their own project according to the algorithm: defining the task, solution to energy sources, selection of motion, transmission and executive mechanisms, management solution, composition or structure of the model, checking compliance with environmental and ergonomic requirements, technical documentation. Modeling of production machinery, transport equipment, transportation machinery and equipment and others.

#### ELECTRICAL SYSTEMS AND MATERIALS

Electrical materials and accessories - properties and applications (conductors, superconductors, insulators, switches, plugs, lamp holders, fuses, heaters, thermostats). Household wiring. Risks and protection against electric shock. Electrical machinery and apparatus production, transformation and transmission of electricity. Alternative sources of electricity. Electrical machinery, apparatus and appliances in household and industry.

DIGITAL ELECTRONICS Fundamentals of analogue and digital technologies. Basic electronic components. The structure of a computer: motherboard, processor, memory, interface, modem. Electronic devices in the household. Telecommunications and audiovisual media: mobile phones, GPS systems, internet and cable TV.

#### MODELING OF ELECTRICAL AND ELECTRONIC CIRCUITS

Practical development of electrical circuits - experiment - research - modeling of constructors materials and using computer simulation software according to students' preferences. Practical examples of management using a computer. Modeling of electrical machinery and apparatus, automatic systems and robots.

#### PROGRAMME INFORMATION TECHNOLOGY

##### INTERNET

Electronic communications: the concept of electronic communication, safe behavior on the Internet. E-mail: The structure of the electronic letters, functions of email programs, programs for e-mail, Web mail. Communication in real-time, instant-Thu (chat), messages, phone calls over the Internet, video conference. Discussions on the Internet forums, discussion groups, blog, dating network. Use of the Internet for learning, distance learning, digital libraries, using information gathered from the Internet.

##### SOUND PROCESSING

Sound and computer generated sound and how we hear it, sound digitization and playback. Sound formats: uncompressed formats, compressed formats without loss, compressed formats with losses. Conversion between different formats. Recording and processing of voice and other sounds. Practical work on the sound recording and processing.

##### VIDEO PROCESSING

Image, video and computer. How the image is created in the eye. The first film. Record a video. Record a video by mobile phone. Record a video with a digital camera. Record a video by digital camera. Processing of video sequences. Edit video, sound, graphics and text materials as a whole: video installation, installation of sound recordings, edit text material. Independent film making. Formats and Conversion.

##### MAKING PRESENTATIONS

Basic concepts: presentations, slides, presentation devices, displaying computer presentations. Forming a presentation: preparation for making presentations, organizing images in a presentation. Computer presentations: launching a program to create presentation, the start of making a presentation, navigate menu and basic toolbar, basic settings, review text in the presentation, add, delete and hide slides, change the order of slides, non-text part of the presentation, animation of objects on a slide, the effects of the transition between the slides, display presentations, record presentations, printing of both presentations and business materials. Hold a presentation.

#### AUTOMATED COMPUTER DRAWINGS

Introduction to computer drawings: basic formats for storing drawings and images, programs for graphic design elements and principles of graphic design. Program *INKSKAPE*: launch programs, prepare to draw, draw basic graphic elements, change of style in the drawn object, drawing of lines, drawing in a record file, work completion, uploading files from drawings, labeling, global overview of image changes made to objects, move objects, duplicate buildings, align and relocate facilities, transformation of facilities using text in the drawing, working with bitmaps, prepare drawings for internet and printing.

#### WORKING WITH TABLES

Spreadsheet workbook and worksheet: description, placing commands in Microsoft Excel, adjustment of the working environment, setting worksheet, entering data into a table, data manipulation, shift tables, manipulating worksheets, recording a document to a file, complete the work, upload a document from a file. Entering data into a cell: formatting the display of the cell contents, automatic data entry. Formatting cells and creation of tables, determining alignment, formatting characters and blocks, drawing edges around the cell, deciding the color and shading cells. Formula: values or constants, operators, entering and editing formulas, referencing the cells. Using built-in functions: classification, administration. Creating charts: types, creation, modification, examples. Working with building structures in the drawing, print a document.

#### INDEPENDENTLY DEVELOPED PROJECT

Preparation for project development: Selection of form according to which the project will be shown, the choice of theme in the presentation, Terms of Reference, plan development. Example of the project called "History of Photography": sorting and analysing materials, form by which the project is shown, units of text and image, final observations. The project called " Program making for issuing of fiscal receipts": what is a project, the choice of topics, project development, program making.

### **LEVEL 4: 1st and 2nd class Colleges and Vocational Schools**

#### **PROGRAMME TECHNIQUES**

##### PROGRAM GRAPHIC COMMUNICATION TECHNIQUES

Display object in the drawing in plane and space (2D and 3D models) using the appropriate software on your computer (CAD / CAM / CAE platform). Programs for drawing, production preparation and simulation: AutodeskCAD, AutodeskInventor, SolidWorks, Catia, etc. ProEngener. CAD / CEM / CAE platform to support: programming of numerically controlled machines (NU, CNC), integrated product development (IRP), numerical analysis using finite element method (FEM), rapid prototyping (Rapid prototyping), motion simulation models and simulation process processing (SIM), computer integrated production (CIM).

##### MODERN MACHINES AND TECHNOLOGY

Development of components in modern machines, tools and machinery of complex systems;

development of control, drive, measuring and manipulating systems. Designing of machine tools and their components; new methods in designing, construction and budgeting. Numerically controlled machines and processes. Computer integrated manufacturing systems - conceptual solutions, achievements and development.

#### MANAGEMENT OVER SYSTEMS USING ICT

The use of computers in management over systems and processes that improve their efficiency and effectiveness. Interface technologies in management over machines and processes. Computer hardware and software for managing the systems.

#### MODERN MATERIALS AND TECHNOLOGIES

Modern materials-production and use: composite materials, fiber optics, superconductors, super insulators and other. New methods of material processing: electric erosion, plasma technology and laser processing and other. Practical knowledge and skills so as to manipulate modern materials, develop technical and technological Pack documents, choose the right technological procedure, choice of tools, equipment, machinery and other technical means of work through corresponding procedure and testing of technology, measurement and control of the results achieved, application of high-tech machines and implementation of safety measures.

#### ARTIFICIAL INTELLIGENCE

Use of computers in the field of artificial intelligence and its implementation in expert data search systems, its application in the game theory, learning systems and neural networks. Getting to know the basics of artificial intelligence; artificial intelligence and translation - speech recognition; its application in robotics.

#### MECHATRONICS

Mechatronics as an integrated (synergistic) blend of mechanical engineering, electrical engineering and information and communication technology (computer science, informatics, automation, signal processing, etc.). Machine control systems and processes: direct and feedback, input, output, system transfer function. Sensors, transducers and signal processing. Mechanical, electrical switch and hydraulic mobile systems. Digital logistics, programmable logic controllers, microprocessors. Communication and programming of mechatronic systems. Designing mechatronic systems.

#### INDEPENDENT PROJECT DESIGN PRODUCTION

Solution to construction and technical documentation development for the selected products. Solving technological process of the work plan and the launch of production. Simulation of the production process using computer simulations. Organization of the production process on school machines. Selection of forms showing the project, the choice of theme for the presentation. An example of work on the project "a machine for the production of brackets": sorting and analysing material, the form of presenting the project, analysis and final conclusions.

#### PROGRAMME INFORMATION TECHNOLOGY

##### COMPUTER SIMULATION

*MatLab* simulation: mechanical systems, power systems, hydro and pneumo systems, mathematical simulation, robots. *RoboSimuling*: robot simulation software modeling and presentation.

##### PRESENTATIONS ON THE NET

Web presentations. the basic elements of *HTML*: introduction, tags and elements, attributes,

color and background image. Working with the text: insert, edit and delete text, move to the next line, the distance between words, special characters, alignment, lists, headings, fonts, style. Working with images: insert image on the page, change image size, positioning of the image on the screen, set up and call the image source. hyperlink - link: text and links, images and link, *E-mail* and links. Working with tables: defining tables, rows and columns, merge table rows and columns, frames, tables, work with text and images in a table. Create web presentations: tools for creating presentations, other tools.

#### DISTANCE LEARNING

Use of the Internet for learning , distance learning - distance learning , digital libraries , using information gathered from the Internet.

#### PROGRAMMING

Loops and other control structures: Counting program structure - *FOR-NEXT* loop, cyclic program structure - *WHILE* loop, other control structures. Subroutines, procedures and functions. Sequences: basic concepts of arrays, sorting arrays. Solving of problems. The process of problem solving tasks. Additional content (selected programming language, eg. C ++).

#### INDEPENDENT PROJECT DEVELOPMENT

Logistic preparation for project development: Internet search to define the Terms of Reference, design plan preparation, the choice of project presentation form, the choice of presentation theme. For example, project called "computer logistics for production of bracket machines": sorting and analyzing material, project presentation form, analysis and final conclusions.

### 3. CONCLUSION

This paper represents a draft form for the course entitled Engineering and Computer Science starting from level 1 - a four-year basic education, level 2 - the fifth and sixth grade, level 3 - the seventh and eighth grade, level 4 - the first and second grades of secondary education - gymnasium and secondary vocational schools for the existing eight-year education model, as set out in paper [5]. An option also included nine years of elementary education where the main elements of the subject complete with five levels of learning among students of different age have been specified. According to proposed Standard and the accompanying Curriculum, classes should ensure that the attained knowledge, skills and understanding are applied by all students so as to help them develop their own ideas, plan and develop their own products / applications and participate in the evaluation of the achieved results.

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