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## Didactic methodology to producing multimedia materials for e-learning Electrotechnics Course

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**ABSTRACT:** This paper describes a logical and pedagogically effective sequence of topics and methods for teaching electric circuit analysis in a one-semester online courseware structure. This paper presents how to teach using the web, components of a course website, and the structure of the instructional process. These learning environments will improve student performance in engineering courses offered at Technical University Iași, and Maritime University Constanța, Romania. Our web-based instructional methodology focuses on teaching this systematic problem-solving skill. The development of courseware materials for student engineers in Romania will have an increasing impact on the national scene of engineering education. The research and development of online materials devoted to the development of human resources and human potential will accelerate the process of transfer of up-to-date technology. If new information and communication technologies are introduced in order to enhance independent / autonomous learning in the context of information society to be introduced in Romania.

### INTRODUCTION

The Technical "Gh. Asachi" University Iași (Faculty of Electrical Engineering and Department for Teacher Education –DPPD) and Maritime University Constanța, România, have initiated a multimedia research and development program to develop engineering courseware using various multimedia technologies.

*e-Learning* can be defined as the use of digital technologies and media to deliver support and enhance teaching, learning, assessment and evaluation. *e-Learning* includes:

- research using the World Wide Web (WWW), digital libraries and/or online databases;
- interactive learning materials (sometimes multimedia) that provide simulations;
- group work through electronic conferencing facilities, real time chat or email discussions;
- lectures or discussions delivered via video conferencing;
- online course administration.

Learning technology makes use of a range of communication and information technologies to support learning and provide learning resources. Learning technology adds value to both the efficiency, and the effectiveness, of the learning process.

*e-Learning* is learning facilitated and supported through the use of information and communication technologies.

Adaptive / Assistive technology designed to assist users. Learning technologists usually combine a broad range of skills such as web design, programming and knowledge of instructional design in order to get the best out of these technologies.

Computer Assisted Learning (CAL) or Computer Based Learning (CBL) means any use of a computer to support

learning. The most common use is for online tutorials (text, multimedia, quizzes, and feedback) in a structured framework. eBooks are electronic versions of traditional print books that can be read via a computer or personal digital assistant. Multimedia materials include graphics, pictures, photographs, animations, film, video, and sound. Most used are: presentation technologies such as Microsoft PowerPoint, digital projectors and interactive whiteboards.

Electronic virtual library consists of an electronic catalogue and electronic information resources described in the catalogue.

Online assessment or Computer assisted assessment (CAA) refers to the use of computers in assessment. The term encompasses the use of computers to deliver, mark and analyse assignments or examinations. It also includes the collation and analysis of data gathered from optical mark readers (OMRs).

Computer Mediated Communication (CMC) refers to any form of interpersonal communication that uses some form of computer technology to transmit, store, annotate, or present information that has been created by one or more participants. CMC tools include e-mail, conferencing, groupware, chat rooms, desktop videoconferencing, and Internet-based audio applications. Audioconferencing and Videoconferencing involve the use of audio and visual communication, via phone lines or the Internet. These can be used with applications, such as MicrosoftNetMeeting, which allow simultaneous conferencing, editing of documents, communication via chat, or via a shared whiteboard.

Visualisation tools can be used to represent complex sets of data in a visual way. Examples include weather systems, topography, financial and economic systems, as well as medical imaging. Simulations and models allow students to explore real world environments, and develop practical skills. These allow students to practice tasks in a safe environment, as well as helping them integrate theory and practice for real laboratory experiments or field trips

well as helping them integrate theory and practice for real laboratory experiments or field trips

Streaming media allows users to watch a video or hear sound via the web without downloading large files which are then played back later; streaming media is sent in a continuous stream and is played as it arrives.

Virtual Learning Environments (VLEs) provide an integrated set of tools, enabling easy upload of materials, online communication, and online assessment and offers a consistent look and feel that can be customised by the user. Popular commercial VLEs currently being used in higher education — HE include Blackboard and WebCT. Most HE institutions have to adopt an institutional VLE.

An institutional portal is an online service that provides a personalised single point of access to resources that support the end-user in one or more tasks (such as learning with a VLE, resource discovery, research etc). The resources made available via a portal are typically brought together from more than one source.

Mobile technologies include technologies such as mobile phones, personal digital assistants, handhelds, wearable devices or laptops.

Memory pens are portable storage media which plug into a USB port and allow large amounts of information to be carried around more easily by individuals from workspace to workspace.

e-Learning can offer students and lecturers some support with flexible and widening access to materials and resources, assessment and communication both on and off campus.

## USING THE WEB TO TEACH AND LEARN

Traditional models of teaching (one-to-many communication supported with one-to-few encounters) do not sustain the quality of learning and teaching. e-Learning used creatively and effectively can offer support, maintain and enhance student learning.

The *teacher's role* in a networked learning environment changes:

- From lecturer to consultant, guide, and resource provider
- Teachers become expert questioners, rather than providers of answers
- Teachers become designers of student learning experiences rather than just providers of content
- Teachers provide only the initial structure to student work, encouraging increasing self-direction
- Teachers present multiple perspectives on topics, emphasizing the salient points
- From a solitary teacher to a member of a learning team (reduces isolation sometimes experienced by teachers)
- From teachers having total autonomy to activities that can be broadly assessed
- From total control of the teaching environment to sharing with the student as fellow learner
- More emphasis on sensitivity to student learning styles

The *student's role* in a networked learning environment changes:

- From passive receptacles for hand-me-down knowledge to constructors of their own knowledge
- Students become complex problem-solvers rather than just memorizing of facts
- Students see topics from multiple perspectives
- Students refine their own questions and search for their own answers

- Students work as group members on more collaborative/cooperative assignments; group interaction significantly increased
- Increased multi-cultural awareness
- Students work toward fluency with the same tools as professionals in their field
- More emphasis on students as autonomous, independent, self-motivated managers of their own time and learning process
- Discussion of students' own work in the classroom
- Emphasis on knowledge use rather than only observation of the teacher's expert performance or just learning to "pass the test"
- Emphasis on acquiring learning strategies (both individually and collaboratively)
- Access to resources is significantly expanded

The following definitions may help clarify the use of the Web for teaching. **A. Web-supported course**— Any face-to-face course that uses a course website, including: **B. Web-enhanced course**— A face-to-face course that includes a course website as a supplemental resource but does not require students to access materials or participate in activities via the course website; **Web-required course**— A face-to-face course that requires students to access materials and/or participate in activities via the course website; **Web-exchange course**— A face-to-face course that requires students to satisfy a specified number of contact hours via the course website.

## ONLINE EDUCATION BASED UPON STUDENT LEARNING STYLES

Some strategies that have been taken to accommodate a variety of student learning styles in the Electric Circuit Theory Engineering Course are outlined below as an example. Active Learners prefer trying things out and working with others. Practical sessions require students to perform laboratory experiments in small teams of 2-3 students. During these sessions, practical supervisors will ask students questions related to the experiment. Students will submit team reports on performed experiments and all students in a team are required to contribute to writing each report. Reflective Learners prefer to think things out and work alone. Study guide and the course web site contain all necessary information about the material to be covered in lectures and practical sessions. Students are advised to prepare for all classes by reading from the textbook and other resources. This allows students to reflect on material being presented. Sensing Learners like learning facts and using tried methods in practical settings. Practical sessions will be supported by detailed guidelines on how to perform experiments. Also practical supervisors will be available for help with the procedures. A number of typical problems will be solved during tutorial sessions and step by step procedure explained. Also practical sessions are good hands-on opportunity for relating theory and practice. Intuitive Learners are innovative and enjoy abstract concepts. Practical sessions will be accompanied with a number of questions to be answered by students in their reports. These questions are of various-graded level of difficulty and are aimed to enforce students' abilities to draw conclusions that link practical results with the theory. Visual Learners relate well to graphs, pictures, diagrams etc. All lectures will be presented in power point mode with lots of diagrams to allow students visualization of electrical circuits, which are by their nature invisible. Wherever possible, learner interactivity and other multimedia material will be used to support visual learning style. Verbal Learners enjoy reading and lectures. Students will be required

to write 4 reports based on experiments done in the laboratory. Report writing will support development of verbal learning style as well as development of technical writing skills that are important in engineering practice. Students will also be encouraged to discuss material using electrical engineering jargon. Use of the course textbook and the study guide is largely verbal. Sequential Learners prefer taking logical steps toward an outcome. Material will be presented starting from fundamental concepts towards more advanced topics. Although some topics may seem not to be related they may be related in the similar concepts used to understand different systems like electrical vs. magnetic circuit. Therefore it is important for students to attend regularly all classes and follow the sequence of the material presented. Global Learners grasp the big picture quickly and work out the steps later. This course is designed to give students a global overview of electrical circuit theory and various methods for analysing electrical circuits. The course introduces students to global concepts and then case studies are analysed to enforce students' understanding of application of learned principles in various specific cases. [3]. All students may be tested for their preferred learning styles and be given detailed information on how to interpret test results and how to use this information to make their learning more effective. The teaching arrangements in this course also aims to expand the students' learning styles, therefore it is important for students not only to practice their preferred leaning styles but to try to develop other learning styles using techniques more suitable for these styles.

#### PLANNING THE COMPONENTS OF A WEB-SUPPORTED COURSE WEBSITE

In order to enhance your face-to-face course by using the Web, there are two major uses: to make course content available to students and for online activities.

As in all courses, the quality of the instructional planning maximizes the learning for all students. In the Web environment, the components of a course website, which enhance teaching and learning and save time by being posted for students to access online, are especially valuable.

At the most basic level, instructors can post content and announcements at a course website. However, course planning usually begins with a course map – an outline of topics, weeks, objectives, activities, assignments, and assessments to show alignment of course components with each other in a weekly calendar format. Planning also includes the purposeful design of activities to create a student learning community – supportive student groups in a course that develop with the students' active access, pursuit, generation, and evaluation of information and learning in their discussion, chats, and e-mail communications.

Course content is aligned with curriculum standards, objectives, assignments, assessments.

- **Course Syllabus.** The course contains a syllabus and supporting documents. The course includes items such as: course title; correct course semester; course description; course contact and credit hours; course prerequisites; course objectives; course assignment; course test schedule; required course materials; grading criteria; testing information; library resources; any on-campus requirements; work ethics information.

- **Staff Information.** The course contains staff information: instructor name; appropriate picture (optional); e-mail address; telephone and fax numbers; office hours

- **Student Information.** The course contains a student orientation and explains: how to get started; technical equipment requirements; technology competency requirements; browser recommendations; drop deadlines; format for assignments; requirements for chat room and/or e-mail; instructor response time; troubleshooting advice.

#### LEARNING SYSTEM STRUCTURE AND WEBSITE ORGANIZATION

A modular and hierarchical structure was incorporated in designing the organization of the learning system. Five levels were maintained to hierarchically structure contents. The learning material was classified into modules at each level to ease the content and course management by providing flexibility for reuse. The structure of the learning system is shown in Figure 1.

The structure was designed in close relationship to that of an academic curriculum. Each level can be compared relatively to a traditional education system. The top level in the system structure was broadly divided into categories called “modules”; this stage is similar to the different streams and majors in the academic curriculum that a student can take. As there may be different courses available in each stream that make them unique, the modules consists of individual “lessons” that supplement information on related topics.

The lessons were further divided into “objectives” to provide a fundamental learning experience for the students with explicit material focusing on specific topics.

These objectives, which are the building blocks for the entire learning system, and are comparable to the different chapters in a textbook followed for a course.

The last level in the learning system was the content organization and presentation in each objective. The contents in the objective were displayed by segregating into frames. This level in the system is similar to the pages of each chapter in the textbook. As each chapter may vary in the number of pages, the objectives were also designed to vary from 1–20 frames depending on the volume of content. Though each frame displayed specific content, they were made self-contained in a single environment for an objective.

This was done to maintain continuity in learning and minimize waiting time to load each frame. This frame-based structure was designed to display small chunks of material and help the user to grasp concepts gradually before proceeding to the next one.

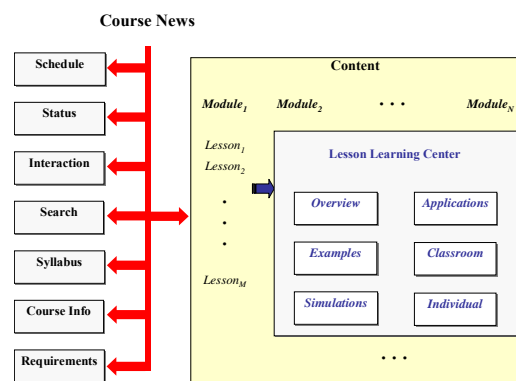


Figure 1 Website Organization

- **Course Calendar** – Due dates for readings, activities, assignments, quizzes, and exams

- Assignments and Activities, including directions and due dates. Course assignments are designed: to be interactive and requires students to interact with: each other and their instructor via e-mail, chat room, and/or discussion board; and to address a variety of learning styles through: written assignments; reading activities; discussions; simulations; case studies; and give students the opportunity to engage in critical and abstract thinking. Students are challenged to complete one or more of the following: solve problems; apply concepts in context; complete practical applications.
- Course Documents – Additional documents for reference or study or answers to frequently asked questions. Course document section includes a variety of learning media. Course content is delivered through media such as: PowerPoint presentations; Short lectures in audio or video format; links to resources on websites; CD-ROM materials.
- Lectures – Notes and audio to highlight key concepts of course content Caution: For face-to-face classes with web-enhancement, faculty may wish to include required assignments, even if minor, for extra points to be turned in at the scheduled class times or other incentives to maintain class attendance.
- Communication Tools – Areas for sending and receiving e-mail, participating in group or class discussions about particular issues, keeping electronic journals, completing “dry or simulated lab” exercises to prepare for “wet or real lab” experiences, or engaging in chat sessions. Many students are able and willing to participate more fully online than in face-to-face classes, especially when discussion assignments require each student to post a comment or the results of a brief assignment and to reply to a comment or question from other students.
- Student Tools – Areas for using a digital drop box to send and receive completed papers, homepages, or personal profiles of students, and access to grades.
- Assessment Tools– Areas for quizzes, exams, and surveys; online grade books; and assessment statistics. Course assignments are designed to be interactive and require students to interact with: each other and their instructor via e-mail, chat room, and/or discussion board. The course structure includes adequate and appropriate methods and procedures to measure student mastery of course competencies. Assessments include a variety of the following: online or proctored testing; standardized tests; projects; demonstrations; presentations; case studies.

## ELECTRIC CIRCUIT THEORY (ELECTROTECHNICS) COURSE ORGANIZATION

Course organization is based on Bloom's taxonomy of education objectives applied to e-learning of electric circuit theory (electrotechnics), see Tables 3a and 3b.

As engineering curricula and courses continue to be restructured due to emerging technologies and ideas, it has become difficult to decide what body of knowledge to be retained and what is to be left out, given that the length of time for undergraduate education is limited to four years.

The selection of e-learning technologies should involve the assessment of course content, learning outcomes, and interaction needs. Olcott (1999) provides what he calls five “Five *I*s” of effective e-learning: interaction, introspection, innovation, integration, and information.

**Interaction** refers not only to the communication that should occur between the student and the instructor and the student with other students but also the interaction between the

students and the content of the course. Thus, asynchronous and synchronous communications as well as the presentation of print materials and links to the Internet from the technology needs of interaction. **Introspection** is the interpretation, revision, and demonstrated understanding of concepts. Discussion boards and graphics can be effective technologies to encourage introspection. **Innovation** refers to the ability of instructors to experiment with technologies to address various learning styles. Thus, combination of audio, video, and asynchronous discussion can provide various opportunities for students to learn. **Integration** reflects the integration of facts, concepts, theories, and practical application of knowledge. Using case studies, print exercises, and role-play can create a setting in which integration can occur. **Information** refers to the knowledge and understanding that is a prerequisite for students to move to the next level of learning.

The instructional objectives provide the basis for instructional activities in and outside of the classroom. For each class, the students come in with different learning styles and capabilities. Variation in learning styles of the students can be addressed through course organization. At this point, course organization is generally at the prerogative of the instructor who teaches the course. However, there is a general consensus and effort is being mounted by all faculty members to adapt instructional techniques that enhance student learning in and out of the classroom. It is therefore the instructor who is required to take into consideration the different learning styles and the teacher builds the class presentations around a hybrid of pedagogical techniques so as to accommodate all the students enrolled in the course.

Shown in Table 1 is a sample of course objective for Circuit Analysis. It is obvious from the objectives that this is not the traditional first circuit course in a typical Electrical Engineering program. Also note worthy is that only the first two sets of objectives are written out in detail. The objectives indicate things that the student must be able to do at the end of the course.

Table1: Sample Instructional Objective for Circuit Analysis

1. Be able to explain basic concepts in electrical engineering:
  - Give a descriptive definition of an electric circuit.
  - List electrical and magnetic quantities, their units, and symbols.
  - Use scientific and metric unit notations.
  - Describe the relationship among the basic quantities in electric circuit theory: charge, current, potential, voltage, work (energy), and power
  - Distinguish between passive and active circuit elements
2. Be able to explain experimental and basic laws:
  - Explain Ohm's law
  - Calculate current, voltage, and resistance in a circuit; for elements in series, parallel and combinations of both.
  - Derive the conditions for voltage and current division.
  - Explain Kirchhoff's current and voltage laws.
  - Apply Kirchhoff's current law to determine an unknown branch current.
  - Apply Kirchhoff's voltage law to determine an unknown voltage drop.
3. Be able to apply methods of network (circuit) analysis:
4. Be able to apply circuit theorems to analyze circuit

5. Be able to use operational amplifiers as active circuit components
6. Be able to describe the structure and characteristics of energy storage elements (capacitors and inductors)
7. Be able to relate sinusoids, phasors, and complex numbers to circuit elements and variables.
8. Be able to apply Ohm's law and Kirchhoff's laws in AC circuits
9. Be able to determine sinusoidal and pulse response of RC circuits.
10. Be able to determine sinusoidal and pulse response of RL circuits.
11. Be able to analyze basic RC and RL filters.
12. Be able to explain the concept of electromagnetism, magnetic induction, and mutual inductance.
13. Be able to describe the construction and operation of transformers.
14. Be able to analyze circuits with transformers.

It is pertinent to call the reader's attention to the entries in the instructional objective Table 1. The writing of instructional objectives or course objectives is an elaborate exercise that takes a lot of time. Generally, the instructional objectives are divided into weekly activities and entered into the course calendar.

The basic outline of the course consists of Content Building Blocks (see Table 2).

Table 2 Course Content Building Blocks

Content	Circuits Analysis
AC Fundamentals	BK/ AP
DC Fundamentals	BK/ AP
Circuit Theorems	BK/ AP
Complex Numbers	BK/ AP
Energy Storage Elements	BK/ AP
Transients	BK/ AP
AC Power Analysis	BK/ AP
Three-Phase Circuits	BK/ AP
Magnetically Coupled Circuits	BK/ AP
AC Steady-State Analysis	BK/ AP
Analog Filters	BK/ AP
Fourier Transforms	BK/ AP
Laplace Transforms	BK/ AP

BK = Basic Knowledge  
AP = Application

Some helpful strategies for establishing education objectives for on line courses are: a) Establishing online threaded discussions that deal specifically with assignments and projects; b) Establishing course projects that: • require problem finding and problem solving, not only the rote memorization of facts and information; and • challenge everyday thinking to address diverse perspectives on issues; c) Establishing learning outcomes that translate to and have lasting benefit to real-world practice.

Create conditions for a knowledge sharing community to emerge and create as many opportunities for others to learn your infrastructure for knowledge sharing.

Table 3a: Bloom's Taxonomy of Education Objectives

Six categories of learning	(1) Knowledge / Remembering	(2) Comprehension / Understanding	(3) Application
<b>Student</b>	Simple Memory/General knowledge	Student knows and understands information.	Student knows, understands, and uses information.
<b>Computer Tool:</b>	Drill and Practice.	Visualization software, tutorials	Internet research, Databases, Spreadsheets, Simulations
<b>Internet Task:</b>	As students read articles and triangulate to determine the accuracy of facts, they learn the facts.	In order to avoid plagiarism, students must summarize information and relay it in their own words.	The use of an Internet based simulation / game would be useful here.

Table 3b: Bloom's Taxonomy of Education Objectives

Six categories of learning	(4) Analysis	(5) Synthesis / Creating	(6) Evaluation
<b>Student</b>	Student knows, understands, uses and critically examines information.	Student internalizes information to generalize about and beyond what is known.	Student judges known and/or hypothesized information
<b>Computer Tool:</b>	Presentation Software, Visualization Software, Databases, Spreadsheets, Simulations	Presentation Software, Word Processing	Presentation Software, Word Processing, Internet Research
<b>Internet Task:</b>	During the process of triangulation, students must examine, compare and test information and ideas for accuracy and logic	When students write their report, they create a new piece of work compiling ideas and facts as well as generating conclusions.	When students write a conclusion for their report they judge among competing ideas and draw a conclusion.

The numbers in parentheses are based on the six categories of learning from Bloom's Taxonomy of Education Objectives. Traditionally, categories (4)-(6) are considered more challenging, requiring higher level thinking skills.

As examples we considered

- the objectives for chapter ac power analysis (1 introduction; 2 instantaneous and average power; 3 maximum average power transfer; 4 the effective value; 5 apparent power and power factor; 6 complex power; 7 conservation of ac power; 8 power factor correction; 9 applications; 9.1 power measurement; 9.2 electricity consumption cost) and
- the objectives (see Table 4) for the review of single-phase power and power factor correction, (• solve for the real, reactive, apparent, and complex power of a circuit and determine the power factor (leading or lagging); • use the power triangle to relate the power components of a given

circuit; • explain the purpose of performing power factor correction; • determine the reactive power and capacitance required to obtain a specified power factor, see figure 2).

**Table 4 Objectives for chapter ac power analysis**

(2) Comprehension	(3) Application	(4) Analysis
Describe (2) how the power triangle for a given circuit relates to the impedance components on the complex plane. Describe (2) how the power triangle for a given circuit relates to the impedance components on the complex plane. Explain (2) the purpose of doing power factor correction.	Solve (3) for the instantaneous power $p(t)$ , average (or real) power $P$ , reactive power $Q$ , apparent power $S$ , complex power $S$ , and power factor $pf$ for any of the elements of an AC circuit. Use (3) the power triangle to describe the power components of a given circuit or element.	Explain (4) the physical meaning of instantaneous power, average power, reactive power, apparent power, complex power and the power factor (leading or lagging).

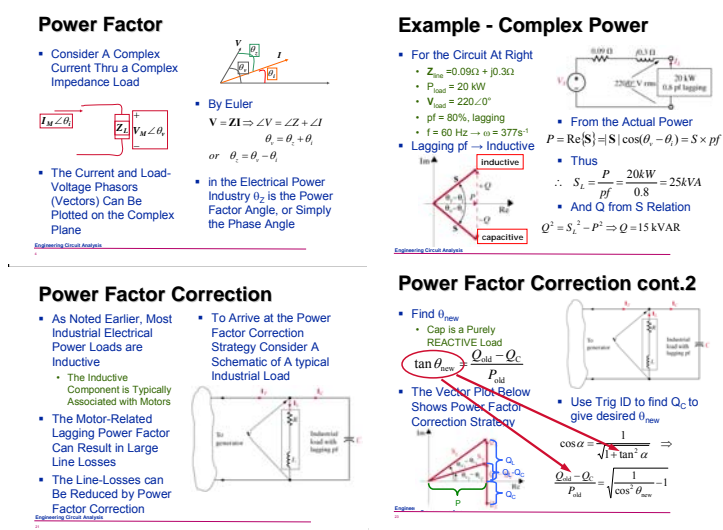


Figure 2 Power Factor Correction

**CONCLUSIONS**

We developed a framework to teach systematic problem-solving skills and allow students to complete interactive exercises at their own pace. Conventional web-based exercises tend to take two major forms: multiple-choice questions and short problems asking students to fill in numerical answers. The multiple-choice question format, even in a regular classroom, tends to encourage guessing or elimination to arrive at the correct answer.

While the ability to guess or to eliminate incorrect answers is desirable, the lower-level courses need to teach students how to use basic theory to arrive at the correct answer. The implementation of this format on the web leads to another undesirable learning characteristic: students can get to the correct answer after several wrong clicks without even guessing. There is essentially no learning involved in this fast-click exercise. The short-problem format, with filled-in boxes, avoids these drawbacks but fails to teach students how to

proceed step-by-step from the problem statement to the correct solution. The systematic problem-solving skill is the major learning outcome of low-level engineering courses, and web-based instruction needs to provide methods to teach this skill. Our web-based instructional methodology focuses on teaching these systematic problem-solving skills.

The development of courseware materials for Student Engineers in Romania will have an increasing impact on the national scene of Engineering Education.

The research and development of online materials devoted to the development of human resources and human potential will accelerate the process of transfer of up-to-date technology. New information and communication technologies are introduced in order to enhance Independent / Autonomous Learning in the context of Information Society to be introduced in Romania.

**REFERENCES**

- Zakis J. D. and Pudlowski Z. J. The world wide web as universal medium for scholarly publication, information retrieval and interchange. *Global Journal of Engineering Education*, 1(3), 1997. <http://www.eng.monash.edu.au/uicee/gjee/vol1no3/paper5.htm>.
- Pudlowski, Z.J. and Hadgraft, R.G., «The Application of Computer-Assisted Training Programmes in Engineering Education», Monash Engineering Education Series, Melbourne, Australia, <http://www.eng.monash.edu.au/non-cms/uicee/activites/calprogr.htm>
- Olcott D., Instructional Technologies-Part Two-Strategies for Instructor Success-Selecting and Using Distance Education Technologies, *In Teaching at a Distance: A handbook for Instructors*, League for Innovation in the Community College and Archipelago, 1999.
- Mayer, B., ENGR-44 Circuit Analysis, Chabot College, <http://online.chabotcollege.edu/bmayer/ChabotEngineeringCourse/s/ENGR-44.htm>
- Adăscăliței A. (2001) *Contributions to the improvement of the multimedia systems in the didactic process of knowledge transfer and assimilation in the subject domain of Fundamentals of Electrical Engineering (Electromagnetic Compatibility)* (in Romanian), Technical „Gh. Asachi” University Iași.
- Paul, Clayton R, A One-Semester Course in Electric Circuit Analysis, ASEE Southeastern Section Symposium, April 2003, Macon, GA.
- Horton W (2000) *Designing web-based training*, New York: Wiley.
- Forte, E. (1991) *Elements de Methodologie pour le Developpement de Didacticiels Scientifique en Milieu Universitaire*, LEAO-Laboratoire d’Enseignement Assiste par Ordinateur, E.P.F.Lausanne.
- de Coulon, F. (1993) What Can We Really Expect from CAL in Engineering Education, *Intl. Conf. on Computer-Aided Engineering Education*. Bucuresti. pp. 3-8
- Adăscăliței A., Gâlea D., Belousov V., Suceveanu I. D., Creating Open and Distance Learning Environments for Developing Human Resources in Iasi Technical Institute, *Proceedings of the 4th World Conference on Engineering Education*, Saint Paul, Minnesota, USA, October 15-20, 1995, Vol. 1, pp. (1) 160 -- 164.



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