TQF and pedagogy innovation
OHEC - EACO

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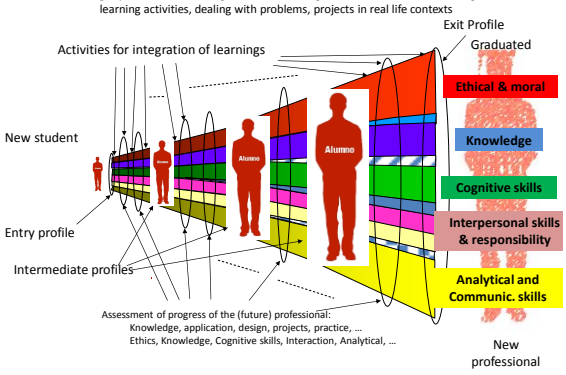
Curriculum domains

- **Program Profiles**
  - The purposes of programs
- **Study plans**
  - Organization of learning activities
    - Topics, ressources
    - Learning outcomes
- **Pedagogy**
  - Teaching strategies
  - Learning strategies
  - Assessment and Evaluation
    - For teaching
    - For learning
    - For certification
- **Management**
  - Human and material capabilities
  - Burocracy and logistics
  - Quality assessment
- **Social world, students' life**
  - Hidden curriculum, ….
  - Diverse university and cultural activities,..
  - Social being in social worlds, …
  - Family matters…
- ….

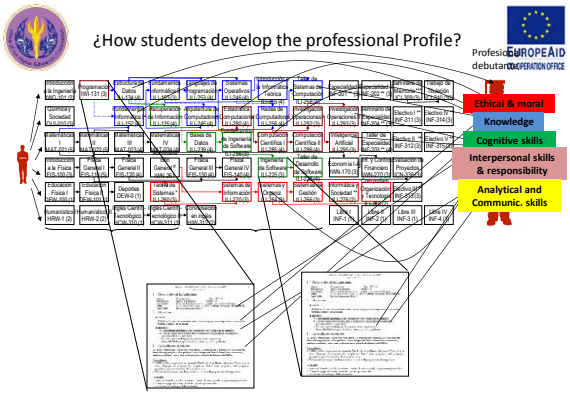
Domains of Learning Outcomes

- **Ethical and Moral Development:** Development of:
  - Habits of acting ethically and responsibly in personal and public life in ways that are consistent with high moral standards.
  - Ability to resolve value conflicts through application of a consistent system of values.
- **knowledge,** the ability to understand, recall and present information including:
  - Knowledge of specific facts,
  - Knowledge of concepts, principles and theories and
  - Knowledge of procedures.
- **cognitive skills,** the ability to
  - Apply knowledge and understanding of concepts, principles, theories and procedures when asked to do so; and
  - Analyze situations and apply conceptual understanding of principles and theories in critical thinking and creative problem solving when faced with unanticipated new situations.
- **interpersonal skills and responsibility, the ability to**
  - work effectively in groups, and exercise leadership;
  - accept personal and social responsibility, and
  - plan and take responsibility for their own learning.
- **analytical and communication skills,** the ability to
  - use basic mathematical and statistical techniques,
  - communicate effectively in oral and written form, and
  - use information and communications technology.

New vision of study plans:
learning experiences, with integration of knowledge, skills and values, in meaningful learning activities, dealing with problems, projects in real life contexts

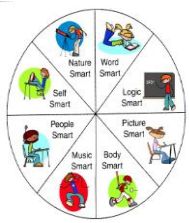


¿How students develop the professional Profile?



Keep this in mind

Learning Styles



People generally remember... (learning activities)

People are able to... (learning outcomes)

Then, what to do?…

- Let your students …
  - Work with others, analyze and discuss their ideas, learn by themselves, think critically, identify, formulate and solve problems, communicate their findings and ideas, …
  - … putting in action the intellect, emotions, body, ….
- Focus on "learning" of the students
  - also on your teaching (for learning): tutoring, coaching, …
- Evaluate the processes and outcomes
  - Never forget the assessment, monitoring and evaluation are essential
- Shift your focus:
  - From "*helping students to learn about engineering*"
  - To "*helping students to become good engineers*"

– Jack Lohmann
– Aalborg, SEFI, july'08

What else to do?…

- Review learning outcomes
  - think about students' learning activities for the LOs
- Link content with real life situations
  - Give the students the opportunity of knowing, first hand, real situations…
  - Ask students to apply the content in those situations
- Don't forget that **learning improves** when body, emotions, and intellect, all participate in the learning process, … (and when the context helps)

Some examples of experiences that have worked well…

- First year courses
  - Collaborative learning in MAT, FIS, QUI, INF
    - With activities, before, during, and after the classes
  - Project Based Learning in *Introduction to Engineering*
    - Real projects, in real contexts
- Other courses
  - Collaborative web based learning
    - Learn any time, anywhere… with some restrictions

A good experience (2005)

What? To adopt **collaborative learning** in MAT, FIS, QUI, INF, to improve:
- **learning quality** of first year students
- **Transversal competencies**
- **Students' satisfaction** with their HE experience

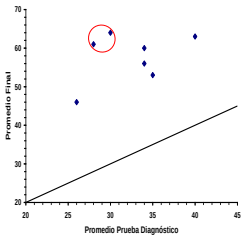
How? Some key actions:
Reduce lecture time to 20-30 min, from 90 min
Ask students to work in groups to solve problems, or analyze cases, and share results
Promote analysis and discussion
Give pre-class 1 hour activities, with monitoring

Manage the process:
Professors: weekly meetings; micro workshops; peer instructions; friendly discussions of ideas; take care of students' acad. work load; assessment of teaching/learning contexts

Results?

- The courses with Collaborative Learning
  - Improved understanding of content
    - 2 of the courses obtained the highest final grades
    - 6 other reduced failure by 30% and more
  - Attracted students from other (lecture type) courses
    - They were told that in this courses "*we learn more*"
  - Improved general skills
    - autonomous and collaborative learning, social responsibility, team work, analysis and modeling, critical thinking, communication

Results



2005: 64%

Resultados IWI-131, 2do Semestre
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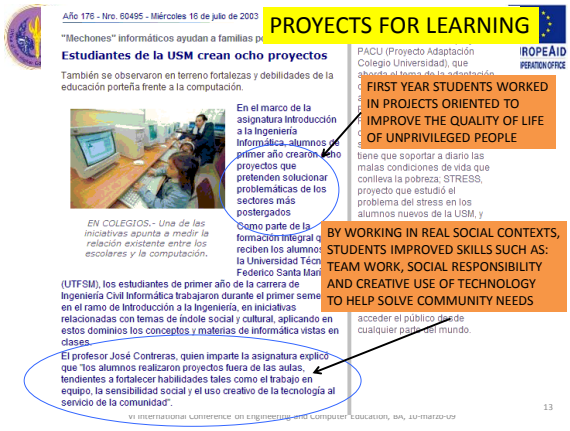
Total de alumnos: 439 (descontados los retirados o los que nunca vinieron)
Total aprobados : 387
Total reprobados : 52
% de aprobación : 88%

Tamaño promedio de curso: 34 alumnos
Cursos **computines (INF-ELO-TEL)**: Nota promedio: 75,4 aprobación promedio: 93%
Cursos "**no computines**" (los demás) : Nota promedio: 68,1 aprobación promedio: 84%

IWI-131 2-2006

	PAR	N	prom		repr	apr		%apr	
JMH	1	44	77		5	39		89%	inf
CS	2	36	70		3	33		92%	tele/inf
SA	3	41	79		2	39		95%	elo
SA	4	36	77		2	34		94%	elo
MB	5	33	74		1	32		97%	elo/tele
				75,4					93%
MB	6	36	71		7	29		81%	civ
CB	7	35	66		5	30		86%	quí/mec
MS	8	36	67		6	30		83%	amb
FM	9	29	67		5	24		83%	común
MS	10	31	68		5	26		84%	común
FM	11	27	68		3	24		89%	común
MS	12	35	67		5	30		86%	común
JC	13	20	71		3	17		85%	mec/qui
				68,1					84%
Promedios		34	70,92		52	387		88%	
		439				88,2%			



Learning in real life contexts, putting in action the body, emotion and intelect…

Students created a mouse for handicapped people

One group was invited to present its project to a congress in Central America, all travel expenses paid.

Well…how to start?…

- **Reduce lecture time**, and give students time for collaborative learning
  - Small challenges (10 - 15 min) related to the content
  - Ask students to share their findings
  - Give pre-class activities (with monitoring and feedback)
  - Give post-class activities, if needed
- **Use web services**
  - To give and receive feedback
  - To promote students' interactions
  - To promote discussions of cases

Why to use ICT to support teaching and learning

- ICT is everywhere
  - 24/24, 7/7
- Our students were born in an ICT world
  - it's natural for them to use it
  - They can't live without it
  - The are connected 10 or more hours a day
  - They are connected in our classes
- So, the question is: why NOT to use ICT in teaching and learning?

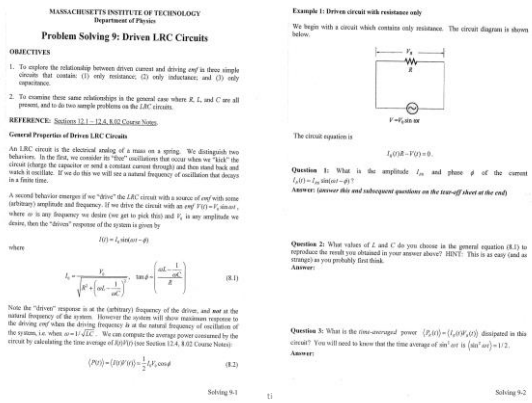
A classical case of ICT support for teaching and learning, in last decade

- TEAL: Technology Enhanced Active Learning
  - MIT physics dept., 2000, idea from SCALE-UP (NCSU)
  - 13 tables, 9 students, teams of 3, 113 students max
  - 1 Teacher + 2 PhD + 4 Master in the classroom

TEAL in action

Previous activity: students study and solve some problems
In class activity: professor explains the theory and shows how it works
Then students solve in-class problem doing simple experiments, assembling electrical components and collecting data, to answer the questions of the problem
Professors and TAs go over the groups, helping them and showing to other groups some interesting findings. Students use all available resources to advance on the solution with their peers. 2 hours class, free open to visits.

TEAL at MIT Physics Department



MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Problem Solving 9: Driven LRC Circuits

OBJECTIVES

1. To explore the relationship between driven current and driving *emf* in three simple circuits that contain: (1) only resistance; (2) only inductance; and (3) only capacitance.
2. To examine these same relationships in the general case where R, L, and C are all present, and to do two sample problems on the LRC circuits.

REFERENCE: Sections 12.1 – 12.4, 8.02 Course Notes.

General Properties of Driven LRC Circuits

An LRC circuit is the electrical analog of a mass on a spring. We distinguish two behaviors. In the first, we consider its "free" oscillations that occur when we "kick" the circuit (charge the capacitor or send a constant current through) and then stand back and watch it oscillate. If we do this we will see a natural frequency of oscillation that decays in a finite time.

A second behavior emerges if we "drive" the LRC circuit with a source of *emf* with some (arbitrary) amplitude and frequency. If we drive the circuit with an *emf* $V(t)=V_0\sin\omega t$, where ω is any frequency we desire (we get to pick this) and V_0 is any amplitude we desire, then the "driven" response of the system is given by

$$I(t)=I_0\sin(\omega t-\phi).$$

where

$$I_0=\frac{V_0}{\sqrt{R^2+\left(\omega L-\frac{1}{\omega C}\right)^2}},\quad \tan\phi=\left(\frac{\omega L-\frac{1}{\omega C}}{R}\right) \qquad (8.1)$$

Note the "driven" response is at the (arbitrary) frequency of the drive, and **not** at the natural frequency of the system. However the system will show maximum response to the driving *emf* when the driving frequency is at the natural frequency of oscillation of the system, i.e. when $\omega=1/\sqrt{LC}$. We can compute the average power consumed by the circuit by calculating the time average of $I(t)V(t)$ (see Section 12.4, 8.02 Course Notes):

$$\langle P(t)\rangle=\langle I(t)V(t)\rangle=\frac{1}{2}I_0V_0\cos\phi \qquad (8.2)$$

Solving 9-1

Example 1: Driven circuit with resistance only

We begin with a circuit which contains only resistance. The circuit diagram is shown below.

The circuit equation is

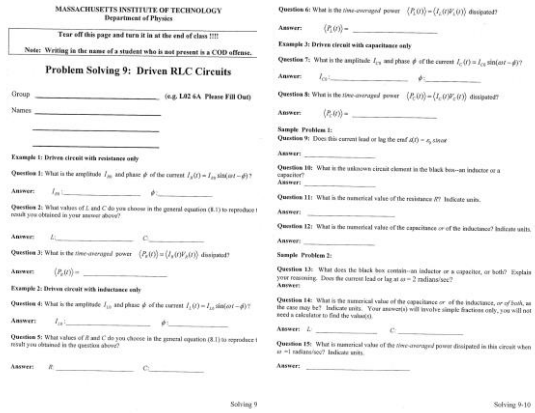
$$I_R(t)R-V(t)=0.$$

Question 1: What is the amplitude I_{R0} and phase ϕ of the current $I_R(t)=I_{R0}\sin(\omega t-\phi)$?
Answer: ***(answer this and subsequent questions on the tear-off sheet at the end)***

Question 2: What values of L and C do you choose in the general equation (8.1) to reproduce the result you obtained in your answer above? HINT: This is as easy (and as strange) as you probably first think.
Answer:

Question 3: What is the *time-averaged* power $\langle P_R(t)\rangle=\langle I_R(t)V_R(t)\rangle$ dissipated in this circuit? You will need to know that the time average of $\sin^2\omega t$ is $\langle\sin^2\omega t\rangle=1/2$.
Answer:

Solving 9-2



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Tear off this page and turn it in at the end of class !!!!

Note: Writing in the name of a student who is not present is a COD offense.

Problem Solving 9: Driven RLC Circuits

Group _____ (e.g. L02 6A Please Fill Out)

Names _____

_____

_____

Example 1: Driven circuit with resistance only

Question 1: What is the amplitude I_m and phase ϕ of the current $I_R(t) = I_m \sin(\omega t - \phi)$?

Answer: I_m = _____ ϕ = _____

Question 2: What values of L and C do you choose in the general equation (8.1) to reproduce t result you obtained in your answer above?

Answer: L: _____ C: _____

Question 3: What is the *time-averaged* power $\langle P_R(t) \rangle = \langle I_R(t) V_R(t) \rangle$ dissipated?

Answer: $\langle P_R(t) \rangle$ = _____

Example 2: Driven circuit with inductance only

Question 4: What is the amplitude I_{Lo} and phase ϕ of the current $I_L(t) = I_{Lo} \sin(\omega t - \phi)$?

Answer: I_{Lo} = _____ ϕ = _____

Question 5: What values of R and C do you choose in the general equation (8.1) to reproduce t result you obtained in the question above?

Answer: R: _____ C: _____

Solving 9

Question 6: What is the *time-averaged* power $\langle P_L(t) \rangle = \langle I_L(t) V_L(t) \rangle$ dissipated?

Answer: $\langle P_L(t) \rangle$ = _____

Example 3: Driven circuit with capacitance only

Question 7: What is the amplitude I_{Co} and phase ϕ of the current $I_C(t) = I_{Co} \sin(\omega t - \phi)$?

Answer: I_{Co} = _____ ϕ = _____

Question 8: What is the *time-averaged* power $\langle P_C(t) \rangle = \langle I_C(t) V_C(t) \rangle$ dissipated?

Answer: $\langle P_C(t) \rangle$ = _____

Sample Problem 1:

Question 9: Does this current lead or lag the emf $\mathcal{E}(t) = \mathcal{E}_0 \sin\omega t$

Answer: _____

Question 10: What is the unknown circuit element in the black box--an inductor or a capacitor?

Answer: _____

Question 11: What is the numerical value of the resistance R? Indicate units.

Answer: _____

Question 12: What is the numerical value of the capacitance *or* of the inductance? Indicate units.

Answer: _____

Sample Problem 2:

Question 13: What does the black box contain--an inductor or a capacitor, or both? Explain your reasoning. Does the current lead or lag at $\omega = 2$ radians/sec?

Answer:

Question 14: What is the numerical value of the capacitance *or* of the inductance, *or of both*, as the case may be? Indicate units. Your answer(s) will involve simple fractions only, you will not need a calculator to find the value(s).

Answer: L: _____ C: _____

Question 15: What is numerical value of the *time-averaged* power dissipated in this circuit when $\omega = 1$ radians/sec? Indicate units.

Answer: _____

Solving 9-10

Other uses of ICT in HE

- Web course platforms
  - ex. Moodle, Edmodo, Blackboard, …
- Web resources
  - **for info and learning**: papers, stat data, tutorials, google earth, youtube, TED, …
  - **for interaction**: social networks, interest groups, chat, virtual walls, video conference,
- Cheap (20us$) computers for introductory courses
- Special ICT: voting systems, ip-camera,
- Smartphones: wifi, 3G, gps, compass, video, accelerometer, …

Examples… Collaborative learning using the web

- Collaborative learning using the web
  - Students study a topic, write a summary document (4-6 pages), and do a presentation that is put in the web. They give to the course the link of the presentation
  - Other students view the presentation, and each one post 2 questions
  - Students in charge of the presentation answer the questions
  - Other students evaluate the presentation and the answers
- Part of the written control include some of the questions and answers

Collaborative learning using the web

- Video in the web examples
  - Thermo Electrical Plant Campiche: mortal pollution
  - Interview to professors Rojas Dujardin
  - Comment style presentation Peet Camilo
- Show questions and answers
  - PREGUNTAS-2 (see links inside the doc)
- Show co-evaluations
- Show summary document
  - Claudia Andrea Chacon: view time table at the end

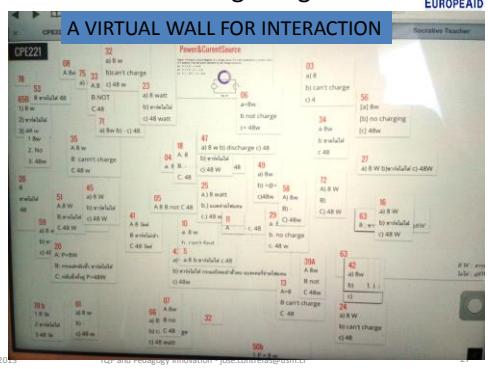
Collaborative learning using the web…

- Results
  - Students are very happy, mainly, because they decide when and where to view the presentations
  - More meaningful questions, more meaningful answers, than traditional presentations in classroom
    - Students contribute with more information on the subject (papers, links to videos, or other authors point of views, etc.)
    - Discussions and arguing are present
  - Students comment that they learn more about the topics
  - Few students miss presentations and discussion in classroom
  - Improvement of: critical thinking, autonomous learning, team work, use of ICT, management of time, arguing, creativity,

Collaborative learning using the web

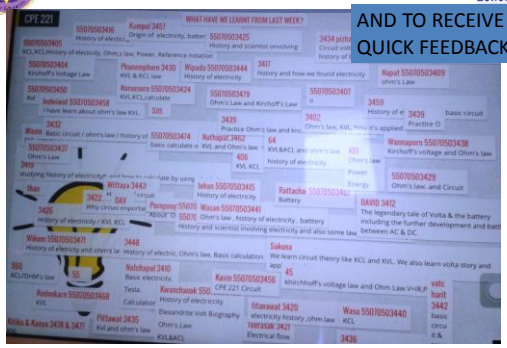
A VIRTUAL WALL FOR INTERACTION

Computer Engineering at KMUTT



ICT for learning awareness & feedback

AND TO RECEIVE QUICK FEEDBACK



Use of clickers

(next ppt)