Plan 900 Semestre Internacional de la Escuela de Ingenierías Industriales

Asignatura 75002 SYSTEM DYNAMICS. MODELLING AND SIMULATION IN ENGINEERING

Tipo de asignatura (básica, obligatoria u optativa)

Optional

Créditos ECTS

6 ECTS

Competencias que contribuye a desarrollar

General
CG1. Capacity of analysis and synthesis.
CG2. Capacity to organize plan.
CG3. Capacity of oral expression.
CG4. Capacity of written expression.
CG5. Capacity to learn and work autonomously.
CG6. Capacity to solve problems.
CG7. Capacity of critical/logical reasoning.
CG8. Capacity to apply knowledge.
CG9. Capacity to work in a team.
CG11. Capacity of creativity and innovation.
CG13. Capacity to act ethically and with social compromise.
CG14. Capacity to evaluate.

Especific
CE21 Comprehension of the quantitative methods, algorithms, optimization, queue theory, decision taking, modelling and simulation, validation in the field of industria, economic and social systems.
COp4. Capacity to analyze the dynamics of hybrid systems with imprecise information of different sources.
COp5. Capacity to apply the system dynamics modeling techniques and control theory to the modeling of technological, economic, social and natural systems.

Objetivos/Resultados de aprendizaje

- Know the basis of system dynamics modeling
- Modeling systems of different nature qualitative in a and quantitative form
- Capacity to analyze the dynamics that appear in systems subject to feedback.

- Capacity to analyze the effects of non-linearity and delays in dynamic systems.
- Apply modeling techniques to technological, economic, social and natural systems.
- Work in group and in autonomously.
- Organize and plan time.
- Apply critical reasoning.

Contenidos

1. Dynamic models applied to technological, social, economic, natural systems.
2. Elements of system dynamics: stocks, flows, information and material flows, inputs, outputs, feedback and delays.
3. Basic structures.
4. Analysis methods in system dynamics
5. Introduction to systems identification.
6. Examples of application of system dynamics to business, environmental and social systems.

Principios Metodológicos/Métodos Docentes

Explanation of theoretical contents and practical cases with the participation of students. Practical exercises and simulations with the software Vensim and MATLAB in the laboratory.

Criterios y sistemas de evaluación

Individual assignments (50%) group assignment (50%).

Recursos de aprendizaje y apoyo tutorial

vídeos about the subject by Luis Javier Miguel (in Spanish)
http://www.youtube.com/playlist?list=
PLSbo9kXA_LcxMraWH-neSVm-Nh_i_W2Pj

Calendario y horario

Schedule:
Mondays from 9:00 to 11:00 theory and exercises
Tuesdays from 12:00 to 14:00 laboratory

Work plan:
Weeks 1 and 2. Theory sessions: introduction and basic notions of system dynamics. Practical sessions: introduction to the Vensim program and examples.

Weeks 3, 4 and 5: Sessions of theory: basic elements of system dynamics modelling, model structure, stocks, flows, feedbacks. Practical sessions: elaboration of simple models and causal diagrams.

Weeks 6, 7 and 8: Sessions of theory: behavior patterns and its corresponding models. Practical sessions: elaboration of the first models of students (first assignments).

Weeks 9, 10 and 11: Sessions of theory: archetype models, scenario generation, decision taking. Practical sessions: models of stocks and sales management, models of populations' dynamics.

Weeks 12, 13, and 14: Sessions of theory: system identification and model validation. Practical sessions: work on final project.

Week 15: finalization and presentation of the final Project.

Tabla de Dedicación del Estudiante a la Asignatura/Plan de Trabajo

4.
Dedication of the student to the subject

ON-SITE ACTIVITIES
HOURS
HOMEWORK ACTIVITIES
HORAS
Sessions of theory and practical cases
26
Autonomous work on theoretical contents
20
Computer simulation
30
Autonomous work on practical contents
20

Work presentations
4
Carrying out of assignments and reports.

45

Preparation of evaluation

5

Total on-site
60
Total not on-site
90

Responsable de la docencia (recomendable que se incluya información de contacto y breve CV en el que aparezcan sus lineas de investigación y alguna publicación relevante)

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Luis Javier Miguel González (ljmiguel@eii.uva.es)
rsity of Valladolid. Both belong to the research group of Energy, Economy and System Dynamics (GEEDS) a recogniced research group of the Unviersity of Valladolid that studies the world enery resources and the evolution of energy availability taking into account technology, society and natural constrains.(http://www.eis.uva.es/energiasostenible/).
The group uses as a methodological tool System Dynamics, which is the tool studied in this subject.
GEEDS has developed in recent years an intense research activity that has been published in hight impact international journals. In the groups web page those publications can be seen, many of them with a working paper version for free download.
http://www.eis.uva.es/energiasostenible/?page_id=17
The most relevant and the one most related to this subject is the one related to the development of the WoLiM model that uses system dynamics to evaluate the world energy resources.
http://www.eis.uva.es/energiasostenible/?page_id=2216
Some videos can be found in:
https://www.youtube.com/watch?v=jQLV8x0wKtc (entrevista en vídeo)
https://www.youtube.com/watch?v=GGuiiGRAgX8 (entrevista en TVE-2)
and in the web page of the GEEDS some of the courses organized by the gropu can be seen:
http://www.eis.uva.es/energiasostenible/?page_id=1246

Idioma en que se imparte

English