220604 - Applied Dynamics

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering
Academic year: 2018
Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Teaching unit Compulsory)
ECTS credits: 5
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: FRANCISCO JAVIER FREIRE VENEGAS
Others: BEATRIZ PURAS GÓMEZ
ANA MARAÑON MARTINEZ
CARLOS GUSTAVO DIAZ GONZALEZ
CARLOS RIO CANO

Degree competences to which the subject contributes

Specific:
1. Use the mechanics simbology and determine the number of drivers needed to achieve an exact motion.
2. Solve multibody motion equations.
3. Improve self-learning capacity

Transversal:
4. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
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Teaching methodology

The teaching methodology is divided into three parts:

* Face-to-face sessions for content exposure.
* Classroom sessions of practical work (exercises and problems).
* Presentation of a project.
* Self study study and completion of exercises and activities.

In the contents exposition sessions, the teaching staff will introduce the theoretical bases of the subject, concepts, methods and results illustrating them with convenient examples to facilitate their understanding.

In the sessions of practical work in the classroom, the teaching staff will guide the students in the application of the theoretical concepts to solve problems, based at all times on the critical reasoning. Exercises will be proposed that students solve in the classroom and outside the classroom, in order to encourage the contact and use of the basic tools needed to solve problems.

In the tutorial sessions, the teaching staff will guide the students in the realization of the project where the theoretical concepts will be applied, based at all times on the critical reasoning.

The student, independently, must work the material provided by the teaching staff in order to assimilate and set the concepts. The teaching staff will provide a plan for study and follow-up activities (ATENEA).

Learning objectives of the subject

The Dynamics Applied introduces the student to the concepts, principles and basic fundamentals of the dynamics of multi-body mechanical systems. Starting with the introduction of the basic concepts of movements, forces and masses, the subject addresses the methods to obtain the equations of the movement in multi-body systems.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group: 31h</th>
<th>24.80%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group: 14h</td>
<td>11.20%</td>
</tr>
<tr>
<td></td>
<td>Self study: 80h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
# Applied Dynamics

## Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
<th>Related activities</th>
<th>Learning time</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Kinematics</td>
<td><strong>Description:</strong> Structural analysis of mechanisms</td>
<td>Activity 1, 2, 3, 4, 5</td>
<td>45h</td>
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<tr>
<td></td>
<td>Velocity analysis</td>
<td></td>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td></td>
<td>Acceleration analysis</td>
<td></td>
<td>Laboratory classes: 5h</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Self study: 30h</td>
</tr>
<tr>
<td>- Transmissions</td>
<td><strong>Description:</strong> Gears, Gearbox</td>
<td></td>
<td>17h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Theory classes: 5h</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Self study: 10h</td>
</tr>
<tr>
<td>- Mechanisms statics</td>
<td><strong>Description:</strong> Force, work and performance in mechanisms</td>
<td></td>
<td>18h</td>
</tr>
<tr>
<td></td>
<td>Reduction of forces: graphical method</td>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>virtual work and power</td>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Self study: 10h</td>
</tr>
<tr>
<td></td>
<td><strong>Related activities:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1, 2, 3, 4, 5</td>
<td></td>
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</tbody>
</table>
### Mechanisms Dynamics

**Learning time:** 45h  
Theory classes: 10h  
Laboratory classes: 5h  
Self study: 30h

**Description:**  
- Energy theorem  
- Exergian equation  
- Lagrange equations  
- D'Alembert method

**Related activities:**  
1, 2, 3, 4, 5
### Planning of activities

<table>
<thead>
<tr>
<th>SESSIONS LARGE GROUPS / THEORY</th>
<th>Hours: 52h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 26h</td>
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<tr>
<td></td>
<td>Self study: 26h</td>
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</tbody>
</table>

**Description:**
Previous and subsequent preparation of the sessions of theory and assistance to them.

**Support materials:**
General bibliography of the subject

**Descriptions of the assignments due and their relation to the assessment:**
During some sessions may be proposed non-attendance exercises, individually or in small groups.

**Specific objectives:**
To Transfer the knowledge necessary for a correct interpretation of the contents developed in the sessions of large groups, resolution of doubts in relation to the subject of the subject and development of the specific competence. To Know the principles of the theory of machines and mechanisms.

<table>
<thead>
<tr>
<th>SESSIONS SMALL GROUPS / PROBLEMS</th>
<th>Hours: 22h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory classes: 8h</td>
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<tr>
<td></td>
<td>Self study: 14h</td>
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</tbody>
</table>

**Description:**
Previous and subsequent preparation of the sessions of problems and of practices and assistance to them.

**Support materials:**
General bibliography of the subject

**Descriptions of the assignments due and their relation to the assessment:**
During these sessions, the practical exercises, face-to-face sessions in class or virtual, individually or in small groups, would be developed by the teaching staff and the student. During some sessions you can propose non-attendance exercises, individually or in small groups.

**Specific objectives:**
1. Acquire the skills necessary for a correct interpretation of the problems of the subject, as well as a satisfactory resolution of these. Preparation for the practical part of the exams of the subject. Development of generic competence Capacity to generate and solve the equations of movement for multi-body mechanical systems.

<table>
<thead>
<tr>
<th>SESSIONS GROUPS SMALL / TUTORIAL PROJECT</th>
<th>Hours: 24h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory classes: 8h</td>
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<tr>
<td></td>
<td>Self study: 16h</td>
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</tbody>
</table>

**Description:**
Monitoring of the project in small groups. In these sessions, students will present the current status of their project, will discuss and propose the work they will have to present to the next session.
## Support materials:

- General bibliography of the subject
- Exercises on the Athena platform
- Notes on the subject

### Descriptions of the assignments due and their relation to the assessment:

It will depend on each session, according to the conditions specified in each particular case.

### Specific objectives:

Recognize and apply the concepts studied in the project.

### REALIZATION OF THE PROJECT

<table>
<thead>
<tr>
<th>Description</th>
<th>Hours: 18h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomous work to make the project.</td>
<td>Self study: 18h</td>
</tr>
</tbody>
</table>

- General bibliography of the subject
- Exercises in the Atenea platform
- Collection of problems of the subject

### Specific objectives:

1. Apply the skills necessary for a correct interpretation of the problems of the subject, as well as a satisfactory resolution of them.

### PROJECT PRESENTATION AND DISCUSSION

<table>
<thead>
<tr>
<th>Description</th>
<th>Hours: 9h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each group will present their project and the teacher will ask questions to each one of the members of the group.</td>
<td>Theory classes: 3h</td>
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<tr>
<td></td>
<td>Self study: 6h</td>
</tr>
</tbody>
</table>

- The project,

### Specific objectives:

The test must demonstrate that the student has acquired and assimilated the concepts, principles and basic fundamentals of the whole subject.
The final grade of the course depends on five evaluative acts:

* 1st and 2nd activities (problems), weight: 10%
* 3rd activity (tutorials), weight: 30%
* 4th activity (project), weight: 30%
* 5th activity (presentation and defense), weight: 30%

There are no recoveries of the first two evaluations in a formal way. Each one will have 3-4 assessment minutes throughout the course.
In any case, if the project is acceptable and is defended with correctness, the recovery of the evaluations will be automatic.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

Regulations for carrying out activities

The problems proposed in activities 1 and 2 will be carried out in groups and in writing. You may be asked to be publicly defended and to be discussed. Alternatively, a collection of problems may be presented, but the score will be lower.
Activities 3, 4, 5 will be carried out in groups. But at any time each member of the group must be able to respond to the totality of the work presented.
A 20 minute presentation and 10 questions have been scheduled for the presentation and defense.
## Bibliography

### Basic:


### Others resources:

- **Hyperlink**
  - [Documentació a ATENEA](#)

- **Audiovisual material**
  - [Col.lecció de problemes sense solució, per treballar l'assignatura](#)