340357 - INTE-C5O44 - Internet

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering
Teaching unit: 744 - ENTEL - Department of Network Engineering
Academic year: 2017
Degree: BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: Rafael Morillas Varón

Opening hours
Timetable:
Tuesday:
Thursday:
Friday:
Room D-171 (1st floor), rafael.morillas@upc.edu
and at the CAMPUS ATENEA or e-mail: lluis.gutierrez@entel.upc.edu as well

Requirements
Is highly recomendable have taken the course of Computers Networks (XACO) of the 4th semester in the past

Degree competences to which the subject contributes

Specific:
1. CEF85. Knowledge of informatic systems, its structure, function and interconnection, as well as fundamentals of its programming.
2. CETI2. Ability to select, design, develop, integrate, value, construct, tmanage, exploit and maintain technologies of machines, programming and nets, keeping suitable costs and quality parameters.
3. CETI4. Ability to select, design, deploy, integrate and manage network and communications infrastructure in an organization.
4. CETI6. Ability to design systems, applications and services based on network technologies, including internet, website, e-commerce, multimedia, interactive services and mobile computing.
5. CETI7. Ability to understand, implement and manage security and safety of computing systems.
6. CE12. Knowledge and use of the basics of programming networks, sistems, telecommunication services.
7. CE17. Knowledge and use of the concepts of network architecture, protocols and communication interfaces.
8. CE18. Ability to distinguish net concepts of access and transport, circuits and package commutation nets, fixed and mobile nets, as well as of application systems of distributed nets, voic, data and audio services and interactive and mutimedia services.
9. CE19. Knowledge of interconnection and routing methods, as well as basics of planning, network dimensioning based on traffic parameters.
10. CE2. Basic knowledge of use and programming computer, operating systems, data base and informatic programs with engineering applications.

Transversal:
12. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information
This course will provide a broad introduction to the topics related with data networking by focusing on the TCP-IP reference model, particularly the network architecture and protocols related. Topics being addressed analyze how networks work on the inside by applying a top-down approach; but because students' background already includes the upper layers, of the model, e.g. application and transport layer which were developed in the past courses; our effort should be placed on the:

- IP layer, both the legacy version 4 and the upgraded version 6.
- The control, address resolution and routing protocols
- And, finally huge effort should be devoted to analyze networks, either fix or mobile, which interconnect communication equipments and end user devices.

It is also remarkable to say that the subject is basic to follow future subject of the same track of this curricula, such as Multimedia networks, security and network secucrity and management, and finally Future Internet.

Students' should also be trained in transversal competences such as:

- Team work, to learn or improve the way they cooperate whit colleagues to plan activities and/or solve problems, applying the best solution by using the methodologies learned along the course.
- Search any documentation autonomously he/she needs to carry out satisfactory the work charged, ie. books, articles, tutorials or any kind of document presented in any format, eg. electronic or written.
- To present his/ her works with a high level of quality by using any kind of office tools he/she needs; and also complete any document with relevant information such as references, cross-reference-tables, index, conclusions, and so on; so to produce an professional document.
- Understand, write documents and even talk more fluently in English as a work language. It is well-known that English is almost imperative in today's technical and business world. This course is intended to foster the use of English as if the
students were working in a real company, integrating the learning of the language and the contents.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Total learning time: 150h</th>
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<tbody>
<tr>
<td>Hours large group:</td>
<td>45h</td>
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<tr>
<td>Hours medium group:</td>
<td>0h</td>
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<tr>
<td>Hours small group:</td>
<td>15h</td>
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<tr>
<td>Guided activities:</td>
<td>0h</td>
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<tr>
<td>Self study:</td>
<td>90h</td>
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# 340357 - INTE-C5044 - Internet

## Content

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<tr>
<th>Topic 1: Introduction to Internet</th>
<th>Learning time: 5h</th>
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<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Introduction to Internet</td>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td>Network architecture</td>
<td>Self study: 1h</td>
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<tr>
<td>Organisms</td>
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<tr>
<td>RFC</td>
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<tr>
<td>Transport protocol review</td>
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<tr>
<td>Related activities:</td>
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<tr>
<td>Activity: Class presentation: TCP version</td>
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<table>
<thead>
<tr>
<th>Topic 2: IP protocol v.4</th>
<th>Learning time: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>IP protocol IP v4</td>
<td>Guided activities: 1h</td>
</tr>
<tr>
<td>Main concepts: datagram</td>
<td>Self study: 1h</td>
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<tr>
<td>Address formats: classless i classfull. NAT.</td>
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<tr>
<td>IP frame format</td>
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<tr>
<td>Subnetting and mask</td>
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<tr>
<td>Related activities:</td>
<td></td>
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<tr>
<td>Activity 2: Case study - subnetting and addressing</td>
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</tr>
</tbody>
</table>
### Topic 3: IPV v6 protocol

**Description:**
- Protocol IPv6
- Upgraded functions.
- IPv6 frame format, header and address formats.
- IPv6 vs IPv4: pros and cons
- Transition from IPv4 to IPv6
- IPv6 upgraded protocols: DHCPv6, ICMPv6, ...

**Related activities:**
- Activity: IPv6 vs IPV4 and exercises

**Learning time:** 3h
- Theory classes: 1h 30m
- Guided activities: 1h
- Self study: 0h 30m

### Topic 4: Routing

**Description:**
- Internet routing: concept, types domain.
- Routing internally and externally
- Routing tables
- Routing Protocols: OSPF, RIP and interdomain protocols
- Routing algorithms
- Multicast routing protocol

**Related activities:**
- Activity: Classroom exercise - routing algorithm

**Learning time:** 4h 30m
- Theory classes: 2h
- Guided activities: 1h
- Self study: 1h 30m

### Topic 5: Network control Protocols and address resolution

**Description:**
- Network control: Internet Control message Protocol (ICMP)
- Address resolution: ARP, RARP and DHCP

**Learning time:** 2h
- Theory classes: 1h
- Self study: 1h
# Topic 6: Network interconnection

**Description:**
Interconnections problems based on the TCP/IP architecture
- Routers
- Bridges and switches
- VLAN

**Related activities:**
- Activity: Work in classroom - Spanning Tree protocol

**Learning time:** 5h
- Theory classes: 2h
- Guided activities: 1h 30m
- Self study: 1h 30m

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# Topic 7: Network management

**Description:**
- Concept
- SNMP protocol
- MIB and components

**Related activities:**
- Activity: session devoted to the EPSEVG network: architecture and management. Visit on the ground installations.

**Learning time:** 5h
- Theory classes: 1h 30m
- Guided activities: 2h
- Self study: 1h 30m

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# Topic 8: Link and transport networks

**Description:**
- Wired Local Area Networks: Ethernet (IEEE 802.3)
- Wireless LANS, WIFI (IEEE 802.11)
- WAN networks
- Switched WAN
- Mobile WAN
- Access networks

**Related activities:**
- Activity: access networks today

**Learning time:** 6h
- Theory classes: 3h
- Guided activities: 1h 30m
- Self study: 1h 30m
The final rating will be the result of the average of the activities undertaken by the student throughout the course:

- **Theory (T):** The theoretical concepts related with the subject acquired by the student by individual study and by any other learning activity performed mainly in the classroom. They will be assessed by appropriate written exams or tests. Precisely there will be two main written exams as detailed below:
  * A partial exam, named **CONTROL**, at the middle of the course
  * and the final exam at the end of the semester, named **Aval Final**. Pay attention to the fact that this final exam covers the entire topics covered throughout the course.

Therefore the theory qualification comes up easily from the equation below:

\[ T = 40 \cdot \text{Control} + 60 \cdot \text{Aval Final} \quad (\%) \quad (\text{If Control rate is } > \text{AF rate}) \]

\[ \text{otherwise } T = \text{AF rate} \]

- **Practice (P):** The practice tasks performed at the laboratory will be assessed according to some parameters: personal attitude, task developed, attendance and the qualification of the final test after the task is finally delivered. (25 %)

- **Class activities:** Students will work in the classroom by doing individual and group collaborative tasks and exercises throughout the course. Such tasks will also be assessed:
  * Work, activities and exercises done in class: 15%

Given the previous division, the final rating is obtained as follows:

\[ \text{Final Rating} = 60 \cdot T + 25 \cdot P + 15 \cdot C \quad (\%) \]

### Qualification system

#### Regulations for carrying out activities

The attendance to the **Theory exams: Control and final evaluation & Practice (labs) classes** is mandatory.

<table>
<thead>
<tr>
<th>Practice 1: Network performance evaluation</th>
<th>Learning time: 10h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory classes: 8h</td>
</tr>
<tr>
<td></td>
<td>Self study : 2h</td>
</tr>
</tbody>
</table>

**Description:**
By using a network simulator (OPNET) we will understand and evaluate the performance of a a domestic setting

Total 4 sessions

<table>
<thead>
<tr>
<th>Practice 2: Network management and configuration</th>
<th>Learning time: 5h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory classes: 4h</td>
</tr>
<tr>
<td></td>
<td>Self study : 1h 30m</td>
</tr>
</tbody>
</table>

**Description:**
Managing network exercises
Total 3 sessions.

### Practice 1: Network performance evaluation

**Learning time:** 10h

- Laboratory classes: 8h
- Self study: 2h

**Description:**
By using a network simulator (OPNET) we will understand and evaluate the performance of a domestic setting.

Total 4 sessions

### Practice 2: Network management and configuration

**Learning time:** 5h 30m

- Laboratory classes: 4h
- Self study: 1h 30m

**Description:**
Managing network exercises
Total 3 sessions.
Bibliography

Basic:


Others resources:

Hyperlink

http://www.torrens-ibern.cat

http://wps.aw.com/aw_kurose_network_5/