270129 - IM - Wireless and Mobile Communications

| Coordinating unit: | 270 - FIB - Barcelona School of Informatics |
| Teaching unit:     | 701 - AC - Department of Computer Architecture |
| Academic year:     | 2018 |
| Degree:            | BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Teaching unit Optional) |
| ECTS credits:      | 6 |
| Teaching languages:| Catalan |

**Teaching staff**

**Coordinator:** - Jorge García Vidal (jorge@ac.upc.edu)

**Others:** - Jose María Barceló Ordinas (joseb@ac.upc.edu)

**Prior skills**

Basic knowledge of TCP / IP networks and network protocols.
Basic knowledge of probability and linear algebra

**Requirements**

- Prerequisite XC

**Degree competences to which the subject contributes**

**Specific:**
- CTI1.1. To demonstrate understanding the environment of an organization and its needs in the field of the information and communication technologies.
- CTI1.2. To select, design, deploy, integrate and manage communication networks and infrastructures in an organization.
- CTI1.3. To select, deploy, integrate and manage information system which satisfy the organization needs with the identified cost and quality criteria.
- CTI1.4. To select, design, deploy, integrate, evaluate, build, manage, exploit and maintain the hardware, software and network technologies, according to the adequate cost and quality parameters.
- CTI2.1. To manage, plan and coordinate the management of the computers infrastructure: hardware, software, networks and communications.
- CTI3.1. To conceive systems, applications and services based on network technologies, taking into account Internet, web, electronic commerce, multimedia, interactive services and ubiquitous computation.
- CTI3.2. To implement and manage ubiquitous systems (mobile computing systems).
- CTI3.4. To design communications software.

**General:**

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Teaching methodology**

- Classroom sessions
- Lab classes (python programming)
- Case-based sessions (mobile app design)
270129 - IM - Wireless and Mobile Communications

**Learning objectives of the subject**

1. knowledge of specific problems in the radio transmission
2. know the technology of wireless networks
3. knowing the value chain of mobile Internet
4. know the basic processing techniques for smartphone sensors
5. understand the business models, development costs, marketing, competition, etc., associated with the development of a mobile application
6. work together to develop a design work
7. technologies known no children of short-range.
8. known auxiliary technologies: positioning, secure mobile payments, advertising insertion, etc.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 45h</th>
<th>30.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group: 15h</td>
<td>10.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 6h</td>
<td>4.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 84h</td>
<td>56.00%</td>
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</table>
# Content

## The value chain of mobile Internet

<table>
<thead>
<tr>
<th>Degree competences to which the content contributes:</th>
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## Radio Transmission

<table>
<thead>
<tr>
<th>Degree competences to which the content contributes:</th>
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</table>

## Cellular networks

<table>
<thead>
<tr>
<th>Degree competences to which the content contributes:</th>
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## WiFi Networks

<table>
<thead>
<tr>
<th>Degree competences to which the content contributes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description: IEEE 802.11. CSMA / CA. Different standards of physical (802.11b, 802.11g, 802.11a, 802.11n). Solutions security (WEP, WPA). New standards: 802.11ac, 802.11ah.</td>
</tr>
</tbody>
</table>

## Low power wireless transmission technologies

<table>
<thead>
<tr>
<th>Degree competences to which the content contributes:</th>
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</thead>
<tbody>
<tr>
<td>Description: Bluetooth. 802.15.4. RFID and NFC. Mesh Networks and adhoc networks. Sensor networks. 6LowPAN, CoAP.</td>
</tr>
</tbody>
</table>

## Sensors and signal processing techniques

| Degree competences to which the content contributes: |
**LBS and Complementary Technology**

**Degree competences to which the content contributes:**

**Description:**
Positioning techniques, GPS, and Based Location Services (LBS). Secure Payment. Mobile Advertising.
### Planning of activities

| Topic 1 | Hours: 6h  
|---------|---------------|  
|         | Theory classes: 3h  
|         | Practical classes: 0h  
|         | Laboratory classes: 0h  
|         | Guided activities: 0h  
|         | Self study: 3h  
| Specific objectives: | 3  

| Item 2 | Hours: 24h  
|--------|---------------|  
|        | Theory classes: 6h  
|        | Practical classes: 0h  
|        | Laboratory classes: 0h  
|        | Guided activities: 0h  
|        | Self study: 18h  
| Specific objectives: | 1  

| Item 3 | Hours: 12h  
|--------|---------------|  
|        | Theory classes: 6h  
|        | Practical classes: 0h  
|        | Laboratory classes: 0h  
|        | Guided activities: 0h  
|        | Self study: 6h  
| Description: | IEEE 802.11. CSMA / CA. Different standards of physical (802.11b, 802.11g, 802.11a). Solutions security (WEP, WPA). New standards: 802.11n, 802.11p, 802.11.  
| Specific objectives: | 2  

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**Planning of activities**

| Topic 1 | Hours: 6h  
|---------|---------------|  
|         | Theory classes: 3h  
|         | Practical classes: 0h  
|         | Laboratory classes: 0h  
|         | Guided activities: 0h  
|         | Self study: 3h  
| Specific objectives: | 3  

| Item 2 | Hours: 24h  
|--------|---------------|  
|        | Theory classes: 6h  
|        | Practical classes: 0h  
|        | Laboratory classes: 0h  
|        | Guided activities: 0h  
|        | Self study: 18h  
| Specific objectives: | 1  

| Item 3 | Hours: 12h  
|--------|---------------|  
|        | Theory classes: 6h  
|        | Practical classes: 0h  
|        | Laboratory classes: 0h  
|        | Guided activities: 0h  
|        | Self study: 6h  
| Description: | IEEE 802.11. CSMA / CA. Different standards of physical (802.11b, 802.11g, 802.11a). Solutions security (WEP, WPA). New standards: 802.11n, 802.11p, 802.11.  
| Specific objectives: | 2  

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**Planning of activities**

| Topic 1 | Hours: 6h  
|---------|---------------|  
|         | Theory classes: 3h  
|         | Practical classes: 0h  
|         | Laboratory classes: 0h  
|         | Guided activities: 0h  
|         | Self study: 3h  
| Specific objectives: | 3  

| Item 2 | Hours: 24h  
|--------|---------------|  
|        | Theory classes: 6h  
|        | Practical classes: 0h  
|        | Laboratory classes: 0h  
|        | Guided activities: 0h  
|        | Self study: 18h  
| Specific objectives: | 1  

| Item 3 | Hours: 12h  
|--------|---------------|  
|        | Theory classes: 6h  
|        | Practical classes: 0h  
|        | Laboratory classes: 0h  
|        | Guided activities: 0h  
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| Description: | IEEE 802.11. CSMA / CA. Different standards of physical (802.11b, 802.11g, 802.11a). Solutions security (WEP, WPA). New standards: 802.11n, 802.11p, 802.11.  
| Specific objectives: | 2  

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### Use case: Mobile Application Design

**Hours:** 20h  
Theory classes: 0h  
Practical classes: 0h  
Laboratory classes: 9h  
Guided activities: 0h  
Self study: 11h

**Description:**  
The goal is to design a mobile application. You can choose an application. It will analyze the applications available on Apple App Store or Android Market with similar characteristics, comparing our implementation with the competition. We will choose a business model (ie, how will money with this application), marketing, etc.. We will design the application (graphics, functionality, etc.). On a voluntary basis can we deploy the application for Android OS and iOS. In this case you can publish the application for the market.

**Specific objectives:**  
3, 4, 5

### item 4

**Hours:** 21h  
Theory classes: 9h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 12h

**Description:**  

**Specific objectives:**  
2

### Partial Review

**Hours:** 6h  
Guided activities: 1h  
Self study: 5h

**Description:**  
Exam topics 1-3

**Specific objectives:**  
1, 2, 3

### item 5

**Hours:** 12h  
Theory classes: 6h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 6h
### Description:

### Specific objectives:
- 7

<table>
<thead>
<tr>
<th>Item</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>9h</td>
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<tr>
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<td>Practical classes: 0h</td>
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<td>Laboratory classes: 0h</td>
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<td></td>
<td>Guided activities: 0h</td>
</tr>
<tr>
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<td>Self study: 3h</td>
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### Description:

### Specific objectives:
- 2

<table>
<thead>
<tr>
<th>Item</th>
<th>Hours</th>
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<tbody>
<tr>
<td>7</td>
<td>9h</td>
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<tr>
<td></td>
<td>Theory classes: 5h</td>
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<tr>
<td></td>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 0h</td>
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<td>Guided activities: 0h</td>
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<tr>
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<td>Self study: 4h</td>
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</table>

### Description:
- Positioning techniques and Location Based Services (LBS). Secure Payment. Mobile Advertising.

### Specific objectives:
- 8

<table>
<thead>
<tr>
<th>Item</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>12h</td>
</tr>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
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<td>Practical classes: 0h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 6h</td>
</tr>
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<td></td>
<td>Guided activities: 0h</td>
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<tr>
<td></td>
<td>Self study: 3h</td>
</tr>
</tbody>
</table>

### Description:
- Sensors. Signal processing

### Specific objectives:
- 4
Presentation mobile application

Hours: 6h
Guided activities: 3h
Self study: 3h

Description:
Presentation of the application designed

Specific objectives:
3, 4, 5, 6

Final Exam

Hours: 13h
Guided activities: 3h
Self study: 10h

Description:
Review of issues 1-8

Specific objectives:
1, 2, 3, 4, 5, 6, 7, 8

Qualification system

Ep: Midterm exam: 0 <= Ep <= 10
Ef: Final exam: 0 <= Ef <= 10
Ec: Use case: 0 <= Ec <= 1.

Final mark = 0.8 x MAX(Ef, 0, 0.75 x Ef + 0.25 x Ep) + 2 x Ec

Bibliography

Basic: