Economic planning of an investment is not simple or easy sometimes. The economic constraints of enterprises to tackle this task requires the use of financial tools to evaluate, through appropriate methods the characteristics and timing of investment to make. This seminar introduces the essential foundations of financial engineering in the economic planning of network investments and provides the basic mathematical tools to address these challenges. Attendance at this seminar can be very attractive, since not only the basics of financial engineering but also the way they treat are introduced, reviewing math skills already acquired.

Prior skills
Basic calculus (integrals, derivatives, partial derivatives, Taylor expansion, etc.), Linear Algebra (Matrices and operations) and probability theory (mean, variance, normal random variables, Poisson, etc.)
# Content

<table>
<thead>
<tr>
<th>1- Introduction to the seminar</th>
<th>Learning time: 2h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
</tbody>
</table>

**Description:**
1.1. Main objectives of the seminar  
1.2. Basics of financial engineering (interest rate, bonds, futures contracts, options on assets, etc.)  
1.3. Application exercises

<table>
<thead>
<tr>
<th>2- Mathematics in financial engineering. Review</th>
<th>Learning time: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
</tr>
</tbody>
</table>

**Description:**
2.1. Reviewing calculus (integration, derivation, Taylor developments, etc)  
2.2. Probability review  
2.3. Linear algebra review  
2.4. Application exercises

<table>
<thead>
<tr>
<th>3- Interest rate and bonds</th>
<th>Learning time: 2h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
</tbody>
</table>

**Description:**
3.1. Compound Interest  
3.2. Bond yields  
3.3. Application exercises

<table>
<thead>
<tr>
<th>4- Forward and futures prices</th>
<th>Learning time: 2h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
</tbody>
</table>

**Description:**
4.1. Trading strategies  
4.2. Determination of forward and futures prices  
4.3. Application exercises
5- Pricing financial derivatives. Pricing an option

**Learning time:** 8h

**Theory classes:** 8h

**Description:**

5.1. Trading strategies involving options
5.2. European and American options
5.3. Methods to price options. Methods:
   5.3.1. Binomial trees
   5.3.2. Cox Rubinstein formula
   5.3.3. Black-Scholes-Merton. Implied volatility
   5.3.4. Monte Carlo simulation
5.4. Application exercises

6- Efficient Portfolios. Risk management.
Markowitz’s portfolios

**Learning time:** 2h

**Theory classes:** 2h

**Description:**

6.1. Maximum expected value of the return on a portfolio
6.2. Efficient Portfolios. Maximum expected return and minimum variance
6.3. Application exercises

---

**Bibliography**

**Basic:**


