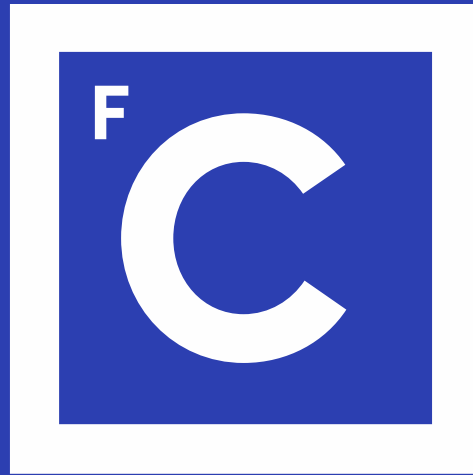




# Ciências ULisboa

Faculdade  
de Ciências  
da Universidade  
de Lisboa

# **DISCIPLINA MIEEA 2020**



# **Technologies of combustion**

# Calendário escolar

| Horas         | Segunda | Terça                                            | Quarta | Quinta | Sexta | Sábado |
|---------------|---------|--------------------------------------------------|--------|--------|-------|--------|
| 08:00 - 08:30 |         | [4MIEEA01; 4MIEEA02]<br>[8 2 39]<br>[PL]<br>PL21 |        |        |       |        |
| 08:30 - 09:00 |         |                                                  |        |        |       |        |
| 09:00 - 09:30 |         |                                                  |        |        |       |        |
| 09:30 - 10:00 |         | [4MIEEA01; 4MIEEA02]<br>[8 2 39]<br>[TP]<br>TP21 |        |        |       |        |
| 10:00 - 10:30 |         |                                                  |        |        |       |        |
| 10:30 - 11:00 |         |                                                  |        |        |       |        |
| 11:00 - 11:30 |         | [4MIEEA01; 4MIEEA02]<br>[8 2 39]<br>[T]<br>T21   |        |        |       |        |
| 11:30 - 12:00 |         |                                                  |        |        |       |        |
| 12:00 - 12:30 |         |                                                  |        |        |       |        |
| 12:30 - 13:00 |         |                                                  |        |        |       |        |

- Low cost and high cost pollutants sensors/ oral examination
- Theory and practical examples
- Theory and practical examples

# Calendar/exams

## 2.º Semestre

|                                 |                                |          |                   |
|---------------------------------|--------------------------------|----------|-------------------|
| <b>Início</b>                   | <b>17 de fevereiro de 2020</b> |          |                   |
| <b>Período de aulas</b>         | <b>17-02-2020</b>              | <b>a</b> | <b>29-05-2020</b> |
| Férias de Carnaval              | 24-02-2020                     | a        | 26-02-2020        |
| Férias da Páscoa                | 08-04-2020                     | a        | 14-04-2020        |
| Pausa letiva                    | 30-05-2020                     | a        | 02-06-2020        |
| <b>Exames de Época Normal</b>   | <b>03-06-2020</b>              | <b>a</b> | <b>20-06-2020</b> |
| Pausa letiva                    | 21-06-2020                     | a        | 22-06-2020        |
| <b>Exames de Recurso</b>        | <b>23-06-2020</b>              | <b>a</b> | <b>04-07-2020</b> |
| <b>Exames de Época Especial</b> | <b>14-07-2020</b>              | <b>a</b> | <b>21-07-2020</b> |
| <b>Férias de Verão</b>          | <b>27-07-2020</b>              | <b>a</b> | <b>01-09-2020</b> |

## Calendar/exams – Oral examinations

25 May – oral for those that did the 2 assignments

### **All subject will be covered**

03-06-2020 qua 16:30:00 19:30:00 03:00:00 1.3.14 | 1.3.15 miEEA

2ª Época 23-06-2020 ter 16:30:00 19:30:00 03:00:00 1.3.14 | 1.3.15 miEEA

É. Especial 14-07-2020 ter 09:00:00 12:00:00 03:00:00 6.1.25 miEEA

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## Corpo docente

**Carla Silva (Teóricas e práticas) /Theory and practice**  
**[camsilva@ciencias.ulisboa.pt](mailto:camsilva@ciencias.ulisboa.pt)**

# Program

## Content

**Introduction to combustion, definition, applications, world fuels and projections, problems of combustion**

**Thermochemistry: stoichiometry, chemical reactions, mass and molar concentrations, CO<sub>2</sub> emissions estimation**

**Thermochemistry: Heating value, chemical equilibrium, flame temperature**

**Fuels and properties, examples**

**Ignition- spontaneous and forced, examples Internal combustion engine**

**Flame types: pre-mixture, diffusion , laminar and turbulent, examples Internal combustion engine**

**Liquid fuel and solid fuel combustion, examples internal combustion engine, power plants**

**Pollutant control/standards**

**Pollutant control/standards**

**Pollutant formation and estimation**

**Pollutant formation and estimation**

**Internal combustion engine**

**Biomass/Coal/combined cycle natural gas Power plant**

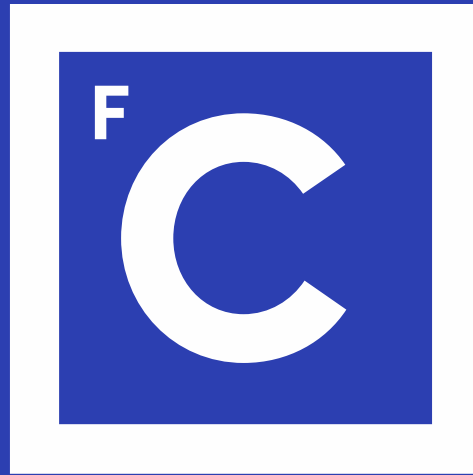
**Biogas Power plant**

## At the end you should:

- ✓ Know the contribution of combustion to world energy generation and its contribution to emissions;
- ✓ Distinguish between local and global emissions;
- ✓ Know typical values of energy efficiency and typical emission factors e.g.  $\text{g}/(\text{kWh}_{\text{electricity}})$ ;  $\text{g}/\text{km}$ ;  $\text{g}/\text{MJ}_{\text{heat}}$ ;
- ✓ Know the main combustion technologies, advantages and disadvantages and potential for improvement;
- ✓ Know how internal combustion engines work;
- ✓ Know how a gas turbine work;
- ✓ Estimate emissions from thermoelectric powerplant and compare with regulation;
- ✓ Propose measures to minimize emissions.

1. **Pedro Coelho e Mario costa. Combustão. 2012. Edições Orion.**
2. Stephen R. Turns. An introduction to combustion. Concepts and applications. 1996. McGraw-Hill.
3. EMEP/EEA air pollutant emission inventory guidebook – 2013. European Environment Agency.
4. John Heywood. Internal Combustion Engine Fundamentals. 1988. McGraw-Hill.
5. M.K. Gajendra Babu, K.A. Subramanian. Alternative Transportation Fuels: Utilisation in Combustion Engines. 2013. CRC Press.

**Thanks**



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