



## Teaching Guide

| Teaching Guide           |                                                                                  |        |                               |           |
|--------------------------|----------------------------------------------------------------------------------|--------|-------------------------------|-----------|
| Identifying Data         |                                                                                  |        |                               | 2019/20   |
| Subject (*)              | Fluorescence Spectroscopy and Photochemistry                                     |        | Code                          | 610509108 |
| Study programme          | Mestrado Universitario en Investigación Química e Química Industrial (Plan 2017) |        |                               |           |
| Descriptors              |                                                                                  |        |                               |           |
| Cycle                    | Period                                                                           | Year   | Type                          | Credits   |
| Official Master's Degree | Yearly                                                                           | First  | Optional                      | 3         |
| Language                 | Spanish                                                                          |        |                               |           |
| Teaching method          | Face-to-face                                                                     |        |                               |           |
| Prerequisites            |                                                                                  |        |                               |           |
| Department               | Departamento profesorado másterQuímica                                           |        |                               |           |
| Coordinador              | Fernandez Perez, Maria Isabel                                                    | E-mail | isabel.fernandez.perez@udc.es |           |
| Lecturers                | Fernandez Perez, Maria Isabel<br>Novo , Mercedes<br>Wajih , Al-Soufi             | E-mail | isabel.fernandez.perez@udc.es |           |
| Web                      |                                                                                  |        |                               |           |
| General description      |                                                                                  |        |                               |           |

## Study programme competences

| Code | Study programme competences                                                                                                                                                                                                                                              |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A1   | Define concepts, principles, theories and specialized facts of different areas of chemistry.                                                                                                                                                                             |
| A3   | Innovate in the methods of synthesis and chemical analysis related to the different areas of chemistry                                                                                                                                                                   |
| A7   | Operate with advanced instrumentation for chemical analysis and structural determination.                                                                                                                                                                                |
| B2   | Students should apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.                                                                                    |
| B3   | Students should be able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments. |
| B7   | Identify information from scientific literature by using appropriate channels and integrate such information to raise and contextualize a research topic                                                                                                                 |
| B10  | Use of scientific terminology in English to explain the experimental results in the context of the chemical profession                                                                                                                                                   |
| B11  | Apply correctly the new technologies to gather and organize the information to solve problems in the professional activity.                                                                                                                                              |
| C1   | CT1 - Elaborar, escribir e defender publicamente informes de carácter científico e técnico                                                                                                                                                                               |
| C3   | CT3 - Traballar con autonomía e eficiencia na práctica diaria da investigación ou da actividade profesional.                                                                                                                                                             |
| C4   | CT4 - Apreciar o valor da calidade e mellora continua, actuando con rigor, responsabilidade e ética profesional.                                                                                                                                                         |

## Learning outcomes

| Learning outcomes | Study programme competences |                                   |                   |
|-------------------|-----------------------------|-----------------------------------|-------------------|
|                   | AC1<br>AC3<br>AC7           | BC2<br>BC3<br>BC7<br>BC10<br>BC11 | CC1<br>CC3<br>CC4 |
|                   | AC1<br>AC3<br>AC7           | BC2<br>BC3<br>BC7<br>BC10<br>BC11 | CC1<br>CC3<br>CC4 |



|  |                   |                                   |                   |
|--|-------------------|-----------------------------------|-------------------|
|  | AC1<br>AC3<br>AC7 | BC2<br>BC3<br>BC7<br>BC10<br>BC11 | CC1<br>CC3<br>CC4 |
|  | AC1<br>AC3<br>AC7 | BC2<br>BC3<br>BC7<br>BC10<br>BC11 | CC1<br>CC3<br>CC4 |
|  | AC1<br>AC3<br>AC7 | BC2<br>BC3<br>BC7<br>BC10<br>BC11 | CC1<br>CC3<br>CC4 |
|  | AC1<br>AC3<br>AC7 | BC2<br>BC3<br>BC7<br>BC10<br>BC11 | CC1<br>CC3<br>CC4 |
|  | AC1<br>AC3<br>AC7 | BC2<br>BC3<br>BC7<br>BC10<br>BC11 | CC1<br>CC3<br>CC4 |

| Contents                                                                             |                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic                                                                                | Sub-topic                                                                                                                                                                                                                                                                                  |
| Tema 1. Fundamentos de espectroscopia electrónica y espectroscopia de fluorescencia. | Fenómenos luminiscentes. Procesos radiantes y no radiantes. Características de los espectros de excitación y emisión de fluorescencia. Rendimiento cuántico de fluorescencia. Tiempo de vida de fluorescencia. Efecto del disolvente en la fluorescencia.                                  |
| Tema 2. Estados electrónicos excitados y fotoquímica.                                | Formación de complejos en estado excitado: excímeros y exciplejos. Transferencia electrónica fotoinducida. Transferencia protónica fotoinducida. Otras reacciones fotoquímicas.                                                                                                            |
| Tema 3. Técnicas experimentales                                                      | Medida de espectros de fluorescencia: el espectrofluorímetro. Corrección de espectros de excitación y emisión. Técnicas de medida de luminiscencia. Medida de tiempos de vida de fluorescencia mediante la técnica de recuento de fotones individuales.                                    |
| Tema 4. Extinción de la fluorescencia.                                               | Extinción colisional o dinámica. Ecuación de Stern-Volmer. Extinción estática. Extinción estática y dinámica. Aplicaciones en el estudio de formación de complejos y cambios conformacionales en macromoléculas.                                                                           |
| Tema 5. Transferencia de energía electrónica.                                        | Mecanismos de la transferencia de energía electrónica. Determinación de distancias mediante FRET. Aplicaciones en la determinación de distancias dador-aceptor y en el estudio de asociaciones supramoleculares. Fotosensibilización y terapia fotodinámica. Microscopía de fluorescencia. |
| Tema 6. Sondas fluorescentes.                                                        | Tipos de sondas fluorescentes. Aplicaciones en biomedicina, análisis, medio ambiente y materiales. Biosensores. Fluorescencia de moléculas individuales.                                                                                                                                   |

| Planning |
|----------|
|----------|



| Methodologies / tests                                                                                                           | Competencies                    | Ordinary class hours | Student's personal work hours | Total hours |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------|-------------------------------|-------------|
| Guest lecture / keynote speech                                                                                                  | A1 B2 B3 B10                    | 12                   | 6                             | 18          |
| Seminar                                                                                                                         | A7 B2 B3 B7 B10                 | 7                    | 13                            | 20          |
| Supervised projects                                                                                                             | A3 B2 B3 B7 B10 B11<br>C1 C3 C4 | 20                   | 13                            | 33          |
| Objective test                                                                                                                  | A1 A3 A7 B2 B10 C4              | 2                    | 0                             | 2           |
| Personalized attention                                                                                                          |                                 | 2                    | 0                             | 2           |
| (*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. |                                 |                      |                               |             |

| Methodologies                  |             |
|--------------------------------|-------------|
| Methodologies                  | Description |
| Guest lecture / keynote speech |             |
| Seminar                        |             |
| Supervised projects            |             |
| Objective test                 |             |

| Personalized attention |                                                                                                                              |
|------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Methodologies          | Description                                                                                                                  |
| Supervised projects    | Tutorías programadas por el profesor y coordinadas por la Comisión Académica del Máster. Supondrán para cada alumno 2 horas. |

| Assessment          |                                 |             |               |
|---------------------|---------------------------------|-------------|---------------|
| Methodologies       | Competencies                    | Description | Qualification |
| Seminar             | A7 B2 B3 B7 B10                 |             | 20            |
| Supervised projects | A3 B2 B3 B7 B10 B11<br>C1 C3 C4 |             | 20            |
| Objective test      | A1 A3 A7 B2 B10 C4              |             | 60            |

| Assessment comments |
|---------------------|
|                     |

| Sources of information |                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Basic                  | <ul style="list-style-type: none"> <li>- Joseph R. Lakowicz (2006). Principles of Fluorescence Spectroscopy, 3rd Ed. Springer, New York</li> <li>- Bernard Valeur (2012). Molecular Fluorescence. Principles and Applications, 2nd Ed. Wiley-VCH, Weinheim</li> <li>- Petr Klán y Jacob Wirz (2009). Photochemistry of Organic Compounds: From Concepts to Practice,. Wiley, Chichester</li> </ul> |
| Complementary          |                                                                                                                                                                                                                                                                                                                                                                                                    |

| Recommendations                                          |
|----------------------------------------------------------|
| Subjects that it is recommended to have taken before     |
|                                                          |
| Subjects that are recommended to be taken simultaneously |
|                                                          |
| Subjects that continue the syllabus                      |
|                                                          |
| Other comments                                           |
|                                                          |



(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.