

# MATHEMATICAL MODELS OF PHYSICS

<b>MODULE NAME</b>	SPECIAL TECHNIQUES
<b>SUBJECT NAME</b>	MATHEMATICAL MODELS OF PHYSICS
<b>SEMESTER</b>	SECOND
<b>NUMBER OF ECTS</b>	4
<b>COORDINATOR</b>	UNYVERSITY OF GRANADA
<b>LEARNING</b>	<b>STANDARD</b>
<b>UNIVERSITIES</b>	<b>UNIVERSITY OF GRANADA UNIVERSITY OF CÁDIZ</b>
<b>LANGUAGE</b>	<b>ENGLISH (UGR), SPANISH (UCA)</b>
<b>TEACHING STAFF</b>	
<b>NAME</b>	<b>ADDRESS</b>
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<b>PREREQUISITES</b>	
None	
<b>COMPETENCES</b>	
They are described in the verification document	
<b>OBJECTIVES</b>	
<ul style="list-style-type: none"><li>• Learn to analyze some important equations that model physical phenomena. To study the analysis and interpretation of solutions.</li><li>• To establish the foundations of the Mathematical Axiomatization of Quantum Mechanics.</li><li>• Know some methods of Functional Analysis with application to differential equations.</li></ul>	

## THORETICAL CONTENT

- 1.- Review of the theory of Hilbert spaces and some concepts of Functional Analysis. Introduction to the formalism of Quantum Mechanics.
- 2.- Operators and compact operators theory. Selftadjoint Operators. Spectral theorem
- 3.- Banach algebras and spectral theory. Representation Theory.
- 4.-  $C^*$ -álgebras.
- 5.- Non-associative algebras.

## BIBLIOGRAPHY

- ARVERSON W., *A short course on Spectral Theory*, Graduate Text in Mathematics 209, Springer-Verlag 2002.
- BERBERIAN S.K., *Lectures in Functional Analysis and Operator Theory*, Springer-Verlag, New York, 1988
- BOURBAKI N., *Théories spectrales*, ch. 1 et 2, Hermann, 1967
- BONSALL F.F., DUNCAN J., *Complete normed algebras*, Springer, 1973.
- GALINDO A., PASCUAL P., *Mecánica Cuántica*, Ed. Eudema Universidad, 1989
- GARCÍA GONZÁLEZ, P. ALVARELLOS J. E., GARCÍA SANZ J.J., *Introducción al Formalismo de la Mecánica Cuántica*, Universidad Nacional de Educación a Distancia, 2000.
- R. V. KADISON AND J. R. RINGROSE: *Fundamentals of the Theory of Operator Algebras*. Volume I: Elementary Theory, vol. 15 of Graduate Studies in Mathematics. American Mathematical Society, Providence, 1997.
- KADISON R. V. AND RINGROSE J. R.: *Fundamentals of the Theory of Operator Algebras*. Volume II: Advanced Theory, vol. 16 of Graduate Studies in Mathematics. American Mathematical Society, Providence, 1997.
- MURPHY, G. J.  *$C^*$ -algebras and operator theory*, Academic Press, 1990
- NEUMANN, J. Von: *Fundamentos Matemáticos de la Mecánica Cuántica*. C.S.I.C., Madrid, 1991
- OKUBO, S., *Introduction to Octonion and Other Non-Associative Algebras in Physics*, Cambridge University Press, 1995.
- PALMER, T. W., *Banach algebras and the general theory of  $C^*$ -algebras*. Cambridge Univesity Press, 1994
- SCHAFFER, R.D., *An introduction to non-associative algebras*, Academic Press, New York, 1966.

## LINKS

<http://150.214.18.236/login/index.php>

## TEACHING AND LEARNING METHODOLOGY

The teaching of this subject will standard. For the teaching of this subject we propose the following educational activities:

- Lectures (10%)
- Practical teaching and seminars: (20%)
- Tutorials (attendance: 5%, online: 5%)
- Individual activities:
  - i) Study: 20%,
  - ii) Examinations: 12%,
  - iii) Presentation and discussion of student Works: 3%,
  - iv) Problems sessions: 25%.

As a general reference, one ECTS will mean 25 hours of student work. In the theoretical and practical sessions, we will encourage the participation of students by promoting seminars where to present and discuss their works (references and material that students need will available to through the virtual platform).

<b>ACTIVITIES</b>											
<b>6 weeks second semester</b>	<b>Parts of the content</b>	<b>Face to face activities</b>						<b>Self-taught work and online activities</b>			
		<b>Lectures (hours)</b>	<b>Practical content (hours)</b>	<b>Seminars (horas)</b>	<b>Academic tutorials (horas)</b>	<b>Exams (hours)</b>	<b>Work in group</b>	<b>Self-taught work (hours)</b>	<b>Work in group (hours)</b>	<b>Tutorial (hours)</b>	<b>Exam. preparation</b>
<b>Weeks 1-3</b>	<b>1-5</b>	<b>9</b>	<b>18</b>	<b>4</b>	<b>4</b>		<b>13</b>	<b>40</b>	<b>5</b>	<b>5</b>	<b>5</b>
<b>Weeks 3-6</b>		<b>9</b>	<b>18</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>14</b>	<b>40</b>	<b>5</b>	<b>4</b>	<b>4</b>
<b>Total hours</b>		<b>18</b>	<b>36</b>	<b>8</b>	<b>9</b>	<b>1</b>	<b>9</b>	<b>80</b>	<b>10</b>	<b>9</b>	<b>9</b>
<b>ASSESSMENT CRITERIA AND PROCEDURES</b>											
<p>Attendance and participation in lectures is essential to pass the course, and additional work will be proposed for those students who wish to improve their grades. Those students who are unable to attend all lectures will be helped to pass the course based on their self-taught work and the material available on the Internet.</p>											
<b>MORE INFORMATION</b>											
Master's homepage											