

SUBJECT CONTENT**1. Informations about program**

1.1 Institution	West University of Timisoara
1.2 Faculty	Faculty of Physics and Mathematics
1.3 Department	Physics Department
1.4 Domain for university master studies	Exact science
1.5 Level of study	Master
1.6 Study directions	Advanced Research Methods in Physics

2. Informations about discipline

2.1 Subject matter	Fields in Interaction ARMP2306						
2.2 Course	Conf. dr. Cosmin Crucean						
2.3 Seminar	Conf. dr. Cosmin Crucean						
2.4 Discipline code	ARMP 2306						
2.5 Year of study	II	2.6 Semester	II	2.7 Type of evaluation	E	2.8 Subject category	Ob

3. The total estimated time (hours of teaching activities on semester)

3.1 Number of teaching hours on week	2	from which course	2	seminar	1	laboratory	
3.2. Number of hours on semester	42	from which course	28	seminar	14	laboratory	
3.3.Time distribution:							ore
Study of course notes,tutorials, bibliography and other notes							40
Supplementary study in library, on media etc.							33
Preparation of seminars / laboratory, homework, reports, portofolio and essay							50
Tutoring							6
Exams							4
Other activities.....							
3.4 Total hours of individual study	133						
3.5 Total hours on semester ¹	175						
3.6 Credits	7						

4. Preconditions (where appropriate)

1 Numărul total de ore nu trebuie să depășească valoarea (Număr credite) x 27 ore

4.1 of curriculum	•
4.2 of competences	•

5. Condition (where appropriate)

5.1 of the course	
5.2 of the seminars	
5.3 of the laboratory	

6. Specific competences

Professional competences	• Basic knowledge (fundamental concepts of quantum field theory) . • Deep understanding (of basic notions, of physical parameters in order to understand the complex calculations from Quantum field theory) . • Physical interpretation of the calculations results and their applications. • Capacity of analyze and synthesize (realization of synthesis and comparisons). • Capacity to plan and organize theoretical applications . • Bibliography investigation . • Knowledge of foreign languages (English) .
Transversal competences	• effective use of information sources and training assistance (Internet portals, specialized software, data bases, online courses, etc..) both in romanian and in a foreign language (english)

7. Objectives (reieșind din grila competențelor specifice acumulate)

7.1 Main obiectiv	• Acquiring basic knowledge about quantum field theory • Understanding of the fundamental principles of QED
7.2 Specific objectives	• Basic notions needed to construct the interaction theory • Developing the skills needed to perform complex calculations in QED

8. Table of contents

8.1 Course	Teaching methods	Observations
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1. Basic introduction in the theory of free fields. Dirac field and electromagnetic field.	Interacting teaching using the blackbord	4 hours
2. The theory of interaction between Dirac field and electromagnetic field	Interacting teaching using the blackbord	4 hours
3. The theory of interaction between charged scalar field and electromagnetic field	Interacting teaching using the blackbord	4 hours
4. Reduction formalism. Construction of the S matrix and Feynmann diagrams	Interacting teaching using the blackbord	6 hours
5. Processes in the first order of perturbation theory	Interacting teaching using the blackbord	2 hours
6. Processes in the second order of perturbation theory	Interacting teaching using the blackbord	4 hours
7. Scattering cross sections calculation	Interacting teaching using the blackbord	4 hours

References

1. V.Novacu, Teoria cuantica a campului (Editura Tehnica, Bucuresti 1984).
2. S. Weinberg, The Quantum Theory of Fields (Cambridge University Press, Cambridge, 1995).
3. C.Itzykson, J.B.Zuber , Quantum Field Theory (Mc Graw-Hill Inc. 1980).
4. S.Drell and J.D.Bjorken, Relativistic Quantum Fields (Mc Graw-Hill Book Co., New York 1965).

8.2 Seminar	Teaching methods	Observations
1. Particle reduction from in-out states	Interacting teaching using the blackbord	2 hours
2. Coulomb scattering of fermions and scalar particles	Interacting teaching using the blackbord	2 hours
3. Amplitudes in the second order of perturbation theory.		2 hours
4. Electron-electron scattering. (Moller scattering)	Interacting teaching using the blackbord	3 hours
5. Bhabha scattering	Interacting teaching using the blackbord	1 hours
6. Electron-positron pair annihilation	Interacting teaching using the blackbord	2 hours
7. Compton scattering.	Interacting teaching using the blackbord	2 hours
8.3 Laboratory	Teaching methods	Observations

References

1. V.Novacu, Teoria cuantica a campului (Editura Tehnica, Bucuresti 1984).
2. S. Weinberg, The Quantum Theory of Fields (Cambridge University Press, Cambridge, 1995).
3. C.Itzykson, J.B.Zuber , Quantum Field Theory (Mc Graw-Hill Inc. 1980).
4. S.Drell and J.D.Bjorken, Relativistic Quantum Fields (Mc Graw-Hill Book Co., New York 1965).

9. Use of tools based on generative artificial intelligence

To complete the tasks defined in the assessment section for course and seminar the use of generative AII tools is not permitted .

The most well-known examples of generative AII tools include, but are not limited to: ChatGPT, Google Gemini, Copilot for text, or MidJourney for images.

1. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment method	10.3 Percent in final mark
10.4 Course	The assimilation level of knowledge gained	Oral examination	50%
10.5 Seminar / labs	Capacity of solving specific problem	Written test	50%
10.6 Minimum performance standards			
-To know the basic terminology -To correct address three topics, even if they cannot develop completely; -Do not make major mistakes.			

Data completării

15.09.2026

Titular de disciplină

Conf. Dr. Cosmin CRUCEAN



Data avizării în departament

Director de departament

Conf. Dr. Nicoleta STEFU