SYLLABUS

1. Information on the study programme

1.1. Higher education institution	West University of Timisoara
1.2. Faculty	Faculty of Physics
1.3. Department	Physics Department
1.4. Study program field	Physics
1.5. Study cycle	Master
1.6. Study programme / Qualification	**Astrophysics, elementary particles and computational physics**/ according to COR: physicist (211101); teacher (233001); research assistant (248102);

2. Information on the course

2.1. Course title			Solar Resources in Space AP2305				
2.2. Lecture instructor			Dr. Robert Blaga				
2.3. Seminar / laboratory instructor			Dr. Robert Blaga				
2.4. Study year	2	2.5. Semester	1	2.6. Examination type	V	2.7. Course type	Ob

3. Estimated study time (number of hours per semester)

3.1. Attendance hours per week	3	out of which: 3.2 lecture	2	3.3. seminar / laboratory	1
3.4. Attendance hours per semester	42	out of which: 3.5 lecture	28	3.6. seminar / laboratory	14

Distribution of the allocated amount of time*	**hours**
Study of literature, course handbook and personal notes	28
Supplementary documentation at library or using electronic repositories	14
Preparing for laboratories, homework, reports etc.	28
Exams	3
Tutoring	-
Projects	14

3.7. Total number of hours of individual study	87
3.8. Total number of hours per semester	129
3.9. Number of credits (ECTS)	5

4. Prerequisites (if it is the case)

4.1. curriculum	Mathematics, Computational physics
4.2. competences	Elementary knowledge on programming computers

5. Requirements (if it is the case)

5.1. for the lecture	-
5.2. for the seminar / laboratory	Individual access to computer

6. Specific acquired competences

Professional competences	• Understanding the main themes from solar radiation physics • Acquiring knowledge on solar radiation field • Explaining the quantities, concepts and phenomena in the field of solar radiation using terms, notions, theories, models, equations, schemes and graphical representations. • Elaboration of numerical algorithms for estimating the available solar energy in space and the amount of electricity that can be obtained from it by photovoltaic conversion.
Transversal competences	• Accessing the NASA database, selecting and sorting data • Explaining data meaning using specific statistical methods • Developing the skills to use the R programming environment

7. Course objectives

7.1. General objective	**Understanding photovoltaic conversion of solar energy in the terrestrial and extraterrestrial environment.**
7.2. Specific objectives	Developing students' skills to calculate solar energy in the extraterrestrial space, on the Moon and Mars. Developing students' skills to size the photovoltaic generators operating in the extraterrestrial space.

8. Content

8.1. Lecture	**Teaching methods**	**Remarks, details**
1. Course Introduction.	Interactive lecture	In person
2. The Sun. General parameters of the Sun.	Interactive lecture	In person
3. Solar radiation. Solar energy at the top of the terrestrial atmosphere	Interactive lecture	In person
4. Propagation of solar flux through the atmosphere. Atmospheric transmittances	Interactive lecture	In person
5. Solar irradiance modelling. Beam component.	Interactive lecture	In person
6. Solar irradiance modelling. Diffuse component.	Interactive lecture	In person
7. Solar irradiance modelling. Sources of data.	Interactive lecture	In person
8. Solar irradiance in the extraterrestrial environment.	Interactive lecture.	In person

9. Solar energy at the surface of the Moon and Mars.	Interactive lecture	In person
10. Photovoltaic cells	Interactive lecture	In person
11. Spectral characteristics of a PV cell.	Interactive lecture	In person
12. Modelling the operation of a PV cell in space	Interactive lecture	In person
13. Project. Designing a PV generator operating on the Mars surface.	Interactive lecture. Guidance Questioning	In person
14. Other ways of valorizing the solar resource in space.	Interactive lecture.	In person

Recommended literature

1. Modern celestial mechanics : aspects of solar system dynamics, by Alessandro Morbidelli. London: Taylor & Francis (2002) ISBN 0415279399
2. Seinfeld, J.H. and Pandis, S.N. *Atmospheric chemistry and physics: from air pollution to climate change*. John Wiley & Sons (2016).
3. Friedlander, S.K. *Smoke, dust, and haze* (Vol. 198). New York: Oxford university press (2000).
4. A. Luque, S. Hegedus. *Handbook of photovoltaic science and engineering*. John Wiley & Sons (2011).

8.2. Seminar / laboratory	**Teaching methods**	**Remarks, details**
1. Solar radiation. Solving problems	Guidance Questioning	
2. Estimation the solar energy on the Earth's surface. Solving problems	Guidance Questioning Individual implementation of the numerical algorithms	
3. Estimation of the solar energy on the Earth's surface. Solving problems.	Guidance Questioning Individual implementation of the numerical algorithms	
4. Exploring various databases (BSRN, AERONET, various NATA sources)	Guidance Questioning Individual implementation of the numerical algorithms	
5. Estimation the solar energy on Mars.	Guidance Questioning Individual implementation of the numerical algorithms	
6. Estimating the properties of	Guidance	

a solar cell. Interpreting an I-V characteristic.	Questioning Processing data.	
7. Project. Designing a PV generator operating on the Mars surface.	Guidance Questioning Individual implementation of the numerical algorithms	

Recommended literature

1. A. Luque, S. Hegedus. *Handbook of photovoltaic science and engineering*. John Wiley & Sons (2011).
2. M. Paulescu. Solar Resources in Space. Lecture notes. http://www.physics.uvt.ro/~marius/res

10. Evaluation

Activity	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in the final mark
Lecture	Theoretical knowledge	Continuous assessment	33.3%
Seminar / laboratory	Solving problems.	Continuous assessment	33.3 %
	Projects	End of year	33.3 %
10.6. Minimum needed performance for passing			
The student is able to estimate the available solar energy on the top of the atmosphere and to model a solar cell operating at STC.			

Date of completion

11.09.2023

Signature (lecture/seminar instructor)

Dr. Robert Blaga [redacted]

Date of approval

Signature (director of the department)

Conf.univ.dr.habil. C.N. Marin

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