

## COURSE SYLLABUS

**Subject: Photovoltaic Systems**

**Academic field: Energy**

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**Academic year: 2016/2017**

### I. COURSE DESCRIPTION

<b>Credit points</b>		
<b>Level</b>	Undergraduate	
<b>Teaching time Location</b>	University of Science and Technology of Hanoi	
<b>Time Commitment</b>	Lecture	30 hrs
	Exercises	10 hrs
	Practical	8 hrs
	Total	48 hrs
<b>Prerequisites</b>	Introduction to Renewable energies, Electric Circuits I, II. Material for Energy Conversion Power Electronics	
<b>Recommended background knowledge</b>	Electrical circuit analysis	
<b>Subject description:</b>	<p>This subject is about Renewable Energies and especially Photovoltaic Systems.</p> <p>We will deal with the conversion of solar energy into electricity.</p> <p>We will see the different technologies available to design the photovoltaic panels and the different installation methods based on electrical and environmental characteristics.</p> <p>One part will be devoted to the inverters, their operation and their installation.</p> <p>Finally we will discuss research and development.</p>	
<b>Objectives &amp; Out-come</b>	<ol style="list-style-type: none"> <li>1. To provide students a general knowledge on photovoltaic systems.</li> <li>2. To provide students basic techniques to analyse and size a PV installation.</li> </ol>	
<b>Assessment/ Evaluation</b>	Attendance/Attitude	10%
	Exercise(s)	10%
	Practicals	20%
	Mid-term test	20%
	Final exam	40%

<b>Prescribed Textbook(s)</b>	[1] Photovoltaics: System Design and Practice, Heinrich Häberlin, John Wiley & Sons, Ltd. DOI:10.1002/9781119976998 [2]
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## II. COURSE CONTENTS & SCHEDULE

Class	Contents	Hours			Ref./Resources	Assignment(s)
		Lect.	Exr.	Prc.		
1	Introduction	1.5	0.5			
2	Background information	1	0.5			
3	History	1	0.5			
4	Key figures	1	0.5			
5	Solar Energy	2	0.5			
6	Solar Radiation	1.5	0.5			
7	PV Conversion	2	0.5	1		
8	Cell technologies	1	0.5	0.5		
9	Electrical characteristics	2	0.5	1		
10	Inverters	2	0.5	1		
11	PV integration methods	1.5	0.5	0.5		
12	Installation requirements	2	0.5	0.5		
13	Grid connection	1.5	0.5	0.5		
14	Sizing of the PV system	1.5	0.5	0.5		
15	A powerful software for your photovoltaic systems	1	0.5	0.5		1
16	Implementation of a PV installation	1.5	0.5	0.5		
17	Pricing	1	0.5	0.5		
18	Benefits/Drawbacks	1	0.5			
19	Research & Development project	2	0.5			
20	Recycling	2	0.5			



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*Notes:*

- *Abbreviation: Lect. (lecture), Exr. (Exercise), Prc. (Practise).*
- *Exercises may include assignment, reports, student's presentation, homework, class exercises ...for each class sessions*
- *Practicals mostly refer to Lab- work or outside practice such as field trip.*

**III. REFERENCE LITERATURE:**

[1]. Photovoltaic installations, Anne Labouret and Michel Villos (Dunod)
[2]. Photovoltaic installations, Louis Paul Hayoun and Aurian Arrigoni (Eyrolles)
[3]. <a href="http://www.energies-renouvelables.org/sommaire.asp">http://www.energies-renouvelables.org/sommaire.asp</a>
[4]. <a href="http://www.leonics.com/support/article2_12j/articles2_12j_en.php">http://www.leonics.com/support/article2_12j/articles2_12j_en.php</a>
[5]. A guide to photovoltaic (pv) system design and installation - California Energy Commission Energy Technology Development Division 1516 Ninth Street Sacramento, California 95814 (Gray Davis)
[6]. Solar Electric System Design, Operation and Installation-An Overview for Builders in the Pacific Northwest, October 2009 (Carolyn Roos).