

Schedule and syllabus for ELEG 628 “Solar Energy Tech and Appls”

Meeting: Monday 3:00-6:00 pm at IEC Bldg.

*Instructor: Steve Hegedus x6253 ssh@udel.edu (office hours by arrangement)*Readings: Solar Electricity (Markvart, 2nd Ed); Course book of reprinted chapters and articles at Morris Reserve (24 hr); PDF from Home Power Mag (emailed by instructor); other PDF from instructor/UD Library Electronic Holdings;Code: SE= Solar Electricity; HP(Vol#)P(page#) =pdf file from Home Power; CB=Course Book on reserve, page numbers sequentially renumbered; **readings are listed for the class where they will be discussed**; PIP= Prog in Photovoltaics (electronic journal UD library) TBS= to be sent by instructor; PVST 1-41 is Chap 1 of Handbook of PV Science and Tech (ed Luque, Hegedus) “Status, Challenges and Bright Future of PV” - access it at <<http://knovel.com/knovel2/Toc.jsp?BookID=1081>> ; TBD= to be determined

week	date	Discussion topics	Readings
1	2/11	Introduction; discuss class schedule; energy vs work; 6 forms of energy; energy units; fuels for US electricity supply; conventional power plants; calculating CO ₂ emission and energy content from fossil fuels	
2	2/18	Basic electricity; conductors vs semiconductors vs insulators; Ohm’s law; resistors and diodes; basic circuit concepts (series vs parallel, current, voltage and power); introduce solar cell and solar module as circuit	HP82P104 (non-EE) HP 52P64 (non-EE) HP 53P38 (non-EE) HP 23P37 (non-EE) HP 52P74 HP 23P37 HP 87P36 HP 18P31 HP14P32
3	2/25	Operation of PV cells; pn junction physics; how light generates current flow; cells and modules; effect of temperature and light intensity	PVST 1-5 SE 24-46
4	3/3	Rating cell and module performance (STC vs reality); motion of the sun; cloudiness; effect of angle, time of day, variability of sunlight; trackers; rating power vs energy	SE 5-19 PVST 5-19 TBS (29 th IEEE PVSC, 1356-1361 King.) HP36P14 TBS (solar resource)
5	3/10	Solar cells: Si crystal growth, wafering, fabrication of Si solar cell; methods to make Si cheaper (mc-Si vs c-Si); advanced Si designs; Solar grade Si; Si supply limitations	PVST 19-27 SE 46-62 TBS (Si process/shortage)
6	3/17	Thin film solar cells; advantages and disadvantages vs Si; production technology; transferring lab results to manufacturing; relative costs and performance; very large	PVST 27-32 SE 62-74 TBS (utility a-Si exp) TBS (CdTe manufacture)

		scale manufacturing	PIP 14 (2006) pp393-411
7	3/24	MIDTERM EXAM ; tour IEC ???	Study all of the above
8	3/31	Spring Break	Readings below
9	4/07	Environmental issues (toxic mats); worldwide availability of materials for non-Si PV; energy payback times; recycling hazardous PV mats; worldwide view of applications, industry players, national status	PVST 32-40 CB 104-126 HP58P38
10	4/14	Stand-alone PV systems: components; system sizing; batteries; AC vs DC efficiency; loss-of-load probability; hybrid (diesel/PV);	SE 81-130 HP58P66 HP1P25 Others TBD
11	4/21	Grid tied; utility scale; distributed generation; utility experience with large scale PV in Southwest; grid support, peak power matching; electrical and architectural aspects of BIPV	TBS 1 st WCPEC pp792-796 Wenger PIP 2008 ppXX, Moore, Post Others TBD
12	4/28	Solar thermal-to-electric systems: parabolic trough and solar power tower collectors.. Collectors, heat transfer fluid, various concentrating schemes. Stirling engine. Storage. Compare to PV.	CB 367-438
13	5/5	Small scale PV (single module, battery, controller, 3 CF lights). Developing country PV experience; reliability; non-technical barriers.	PIP 5 (1997) pp3-27 Lorenzo PIP 9 (2001) pp455-474 Nieuwenhout Energy Pol 30 (2002) pp477-499 Duke
14	5/12	NO CLASS; SSH attend conference	Your reports
15	5/19	In-class presentations of reports	None

Books from which chapters have been used in the Course Book

1. *Handbook of Photovoltaic Science and Engineering* eds Luque, Hegedus, Wiley and Sons, 2003 (Chapter 1)
2. *Harnessing the Sun*, Zweibel, Plenum Press, 1990, (Chapter 13), out of print
3. *Photovoltaic Systems Engineering*, Messenger and Ventre, CRC press, 2003 (Chapter 4, 7, 8)

Other references

1. *Solar Cells*, Green, UNSW, 1982 (very good basic intro but dated)
2. *Applied Photovoltaics* 2nd Ed, Wenham et al, UNSW, 2006 (no process, device)
3. *Progress in Photovoltaics* (bi-monthly journal), Wiley and Sons, UD electronic subscription