Kingdom of Saudi Arabia Ministry of Higher Education **Qassim University** College of Engineering		**المملكة العربية السعودية** وزارة التعليم العالي **جامعة القصيم** **كليه الهندسه**

Solar System Engineering

College: Engineering

Department: Mechanical

First: Course Definition

1- Course Code: ME679

2- Units : 3 credit hrs

3 – Semester

4 -Prerequisite : None

5- Co-requisite : None

6- Location (if not on main Campus): N/A

Second: Course Objectives

1. To gain an understanding of the state of the art and current primary research focuses in all common and emerging photovoltaic technologies.
2. To learn how solar cell operation is modeled to diagnose and optimize devices.
3. To gain an overview of methods to produce solar cells and some of the problems and solutions in manufacturing the devices.
4. To understand how photovoltaics fit in to future energy generation schemes.
5. To learn the general aspects of how solar cell materials and devices are characterized.

Third: Course Specifications

1- Topics to be covered

Subject	No of Weeks	Units
Thermal network modelling	2	6
passive design tools	2	6
photovoltaic system design	2	6
solar thermal system design	3	9

daylighting	1	3
fuel cells, and economics	2	6
hybrid solar thermal systems	2	6
solar energy storage systems	1	3

2- Course components (Total hrs in the Semester)

Lecture	Exercise or lab	Other	Total
45 hours	------	None	45hour

3- Intended Learning Outcomes of the Course (ILO's)

a. *Knowledge*

i) Description of the knowledge to be acquired:

On successful completion of this course, students should be able to:

- identify and classify the different thermal network modeling
- recognize the passive design tools.
- recognize the methodology for photovoltaic system design
- recognize the methodology for solar thermal system design
- describe daylighting
- outline hybrid solar thermal systems
- outline solar energy storage systems
- describe fuel cells and recognize its economics

ii) Teaching strategies to be used to develop that knowledge

- Class lectures.
- Reading assignments
- Students' presentations.
- Reports.

iii) Methods of assessment of knowledge acquired

- Exams.
- Quizzes.
- Homework assignments.

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

On successful completion of this course, students should be able to:

- analyze the different the different thermal network modeling

- differentiate between the passive design tools
- design photovoltaic system
- design solar thermal system
- interpret daylighting
- develop hybrid solar thermal systems
- construct solar energy storage systems.
- distinguish fuel cells and recognize its economics

ii) Teaching strategies to be used to develop that these cognitive skills

- Class lectures.
- Tutorial sessions
- Case study (data collection, Internet search, and reporting)
- Problem assignments and Students' presentations.
- Reports.
- Group discussion.

iii) Methods of assessment of students cognitive skills

- Exams.
- Quizzes.
- Homework
- Assignments.

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

On successful completion of this course, students should be able to:

- participate in class discussions with colleagues and with teachers.
- work in team
- develop ideas and share with others
- appreciate the need for make use of solar energy and its optimal use.
- recognize the conflicting issues between using energy and environmental issues (sustainability, diversity and pollution).

ii) Teaching strategies to be used to develop these skills

- Class lectures.
- Reading assignments and Students' presentations.
- Case study (data collection, Internet search, and reporting)
- Problem assignments and Students' presentations.
- Reports.
- Group discussion.

iii) Methods of assessment of student's interpersonal skills and capacity to carry responsibility

- Exams.
- Quizzes.
- Homework
- Assignments.

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

On successful completion of this course, students should be able to:

- Use of the internet search for course related issues.
- Write acceptable technical report.
- Verbally present technical report.

ii) Teaching strategies to be used to develop these skills

- Reading assignments and Students' presentations.
- Case study (data collection, Internet search, and reporting)
- Reports.
- Group discussion.

iii) Methods of assessment of students numerical and communication skills

- Homework
- Assignments.

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required

Not Applicable

ii) Teaching strategies to be used to develop these skills

Not Applicable

iii) Methods of assessment of student's psychomotor skills

Not Applicable

4- Student Assessment Schedule

Serial	*Assessment tool (test, group project, examination etc.)*	*Week due*	*Weight*
1	Four quizzes	Weeks 5, 8, 9 and 14	10 %
2	Two mid-term exams	Weeks 6 and 12	20 %
3	Mostly eight assignments (in-class/out-class) and homework. This number may increases according to the instructor view.	Weeks 3, 5, 7, 9, 11, 12, 14 and 15	16 %
4	Attendance	All weeks	4 %
5	Final Exam	Week 16	50%

5- Student Support

Four office hours per week are offered by the instructor to aid the students and support them.
University data base access (electronic library of textbooks and scientific periodicals)

6- Learning Resources

i) Essential Books (References)

- Jone A. D. and William A.B., Solar Engineering of Thermal Processes, John Wiley & Sons, 1991.
- M. M. Elsayed, and Jaffar A. S., Design of Solar Thermal System, Scientific Publishing Center, King Abdulaziz, KSA, 2009.

ii) Course Notes

None

iii) Recommended Books

- John A. Duffie and William A. Beckman, Solar Engineering of Thermal, John Willy & Sons Inc, 2006.
- Jan F Kreider and D Yogi Goswami, Principles of solar engineering, Taylor and Francis, 2000.
- G N Tiwari, Solar Energy: Fundamentals, Design, Modelling and Applications, Narosa Publishing House Pvt. Ltd, 2010.
- Roger A. Messenger, Jerry Ventre, Photovoltaic systems engineering, CRC Press, 2004.

- G.N. Tiwari, S. Suneja, Solar Thermal Engineering Systems, Narosa Publishing House, 1997.
- Soteris A. Kalogirou, Solar Energy Engineering: Processes and Systems, Elsevier Inc. 2007.
- Alireza Khaligh and Omer C. Onar, Energy Harvesting: Solar, Wind, and Ocean Energy Conversion Systems, PRC Press, 2009.
- D Yogi Goswami, Frank Kreith, Jan F Kreider, Principles of Sustainable Energy, Taylor Francis Inc, 2010.
- Mukund R. Patel, Wind and Solar Power Systems, CRC Press, 1999.

iv) Electronic Books & Web Sites:

- Weston, Kenneth C., Energy Conversion, electronic edition; revised from the 1992 edition, http://onlinebooks.library.upenn.edu/webbin/book/lookupid?key=olbp33597
- Solar Energy Systems, LLC (SES), www.solaresystems.com

v) Periodicals

- International Journal of Solar System Studies
- Solar Energy, Elsevier
- Solar System Research- Springer.
- Solar Energy Materials and Solar Cells Journal, Elsevier
- Journal of Solar Energy Engineering - ASME
- Journal of Fuel Cell Science and Technology

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Students questionnaires,
- Appeal box

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Instructor course evaluation report by the end of the course
- Periodical (semester/annual) review of the department subject committee

iii) Processes for Improvement of Teaching

- The educational continuous improvement process which applied in the department according to the ABET criteria are also applied here, moreover
- Evaluation of the course outlines by external staff member from outside the university

- Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.

iv) Processes for verifying standards of student

- Check marking by an independent faculty member of a sample of student work.

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

According to the continuous improvement process applied in the department according to the ABET criteria there are different levels of assessments and reviews:

1) Semester review by course instructor and the department subject committee
2) Annual review by the Program Committee

The inputs for such assessments and reviews come from all stake holders for the M.Sc. and the outputs are decisions and recommendations for improvement as detailed in the documents describing the educational continuous improvement process in the department.