University of Maryland, College Park
Mechanical Engineering Department
ENME436 Renewable Energy
--an interdisciplinary course in design and analysis of alternative/renewable energy conversion technologies
Spring Semester 2015

Classroom:	**KEB 1200**
Instructors:	Dr. Michael Ohadi (MO), with Contributing Lectures from Dr. Brian Valentine (BV) from U.S. DOE
Teaching Assistant:	Mr. Stefan Bangerth
Office Hours:	Dr. Ohadi: Mon 3:00 – 4:00 PM; Tuesday 11 Am-12Noon. Room No 4164C, Engineering Classroom Bldg. Questions by e-mail welcome any time; will get back to you within 24 hours when in town. Dr. Valentine: By e-mail or through advance appointment. Stefan Bangerth: Mon. 10-11 AM, Wed. 12:45-1:45 PM; or by appointment. Room No. 2121, Engr. Classroom Bldg.
Contact Info:	Dr. Michael Ohadi (MO): 301.405.5263; **ohadi@umd.edu** Dr. Brian Valentine (BV): 202-586-9741; **Brian.Valentine@ee.doe.gov** Stefan Bangerth: 301-405-5343, **sbangert@umd.edu**
Textbook:	No required textbook. Class notes and Reference Books will serve as the text. However, the following book is highly recommended and some of our lecture material will come from it.
Reference Books:	Highly recommended: **Kreith, Frank: "Principles of Sustainable Energy Systems", ISBN: 9781466556966, 2nd edition, 2014.** Michael Ohadi, Jianwei Qi, Harish Ganapathy, "Alternative Energy Technologies: Price Effects", In: Encyclopedia of Energy Engineering and Technology, 2nd edition, Taylor & Francis, New York, 2014. Duffie and Beckman, "Solar Engineering of Thermal Processes", ISBN 0-471-69867-9, John Wiley and Sons INC., 2006.

Course Description:
This course will provide students with the fundamentals, design/analysis tools, and state of the art alternative energy technologies. The course will begin with discussions on the energy resources and global perspective of current and future energy demand/consumption trends, followed by prime alternative energy technologies, including wind, solar, hydro, geothermal, and ocean thermal energy conversion. The course also will cover supportive topics such as economics of alternative energy, energy conservation opportunities, CO2 capture and storage, and thermal energy storage. Particular focus and design projects will be assigned in solar and wind energy conversion technologies. The course is open to senior-level undergraduate students and all graduate students.

Course Schedule:
The following course schedule may change during the semester as circumstances arise. Consult the course web site for the last updated version. Any deviation in Quizzes and/or

Exams dates will be announced in advance.

TOPICS COVERED	Date	Week No
• Introduction to the course and review of fundamentals applicable to the course (AS)	1/27	1
• Thermal Energy Storage (AS); **HW # 1 assigned**	1/29	1
• U.S. and World Energy Resources and Demographics (MO)	2/3	2
• Geothermal Energy I (BV) **HW 1 Solutions posted; HW # 2 assigned**	2/5	2
• Geothermal Energy II (MO)	2/10	3
• Regulatory and Price Incentives to promote Renewable Energy (BV) **HW 2 Solutions posted, HW #3 assigned**	2/12	3
• CLASS CACELLED—SNOW DAY	2/17	4
• Ocean Thermal Energy Conversion (MO); Also Wind Power I (MO)**; Project Part I Assigned**	2/19	4
• Wind Power II (MO)**, Also Quiz 1**	2/24	5
• CLASS CACELLED—SNOW DAY	2/26	5
• Wind Power (Cont.); Solar Energy Fundamentals. Also Models for Predicting Solar Flux on a Surface (MO); **HW 3 Solutions posted.**	3/3	*6*
• CLASS CACELLED—SNOW DAY	3/5	6
• Solar Energy(Cont.), Daylight harvesting/solar shading (MO)	3/10	7
• ***Hour Exam, Comprehensive (AS/MO);***	3/12	7
• SPRING BREAK	3/17, 3/19	8
• Hydro Power Generation I (AS);	3/24	9
• Solar Photovoltaic Systems, Solar Photo thermal Systems; (BV); Also Project discussions/questions session (SB); **HW # 4 Assigned;**	3/26	9
• Hydro Power (Cont.); Design and Performance Evaluation of Solar Collectors I. **Projects Part I due; Projects Part II Assigned**	3/31	10
• Design and Performance Evaluation of Solar Collectors II (MO)	4/2	10
• Design and Performance Evaluation of Solar Collectors III (MO); **HW 4 Solutions posted, HW # 5 assigned**	4/7	11
• Problem solving session and project discussions.	4/9	11
• Solar Cooling—Fundamentals and Applications (MO); Also **Quiz 2,**	4/14	12
• Bio Energy as Alternative Fuel and for Power Generation I (BV)**;**	4/16	12
• Large scale Solar Thermal/Power Applications (MO); **HW 5 Solutions posted, Projects Part II and comprehensive report Due**	4/21	13
• **Project Presentations (Note: Presentations will begin at 8:15 am and continue to 10:45 am)**	**4/23**	**13**
• Bio Fuels II (BV).	4/28	14
• Smart Grid principles and its infrastructure impact (BV),	4/30	14
• Emerging Applications in Alternative Energy/Energy Conservation—CO2 Capture and Storage (MO);	5/5	15
• Course Overview and projects outcome discussions (MO)	5/7	15
• No Class (in lieu of extra session presentations on 4/30/2014)	5/12	16
• **Final Exam (MO). 8:00-10:00 am**	**5/15**	**16**

GRADING

- Each instructor will give quiz questions for his lecture materials.
- Tentative grade weights are as follows:

Homework	Will not be collected
Quizzes	20%
Projects	35%
Midterm	20%
Final Exam	25%

- Note: All exams should be viewed as comprehensive where it applies.
- For additional details feel free to contact Dr. Ohadi (course leader) or other instructors

Quizzes:
Quizzes are normally designed for duration of 25 minutes. They may include both statement type as well as problems to solve. Quizzes are normally closed books/notes, but you are allowed to have a reference sheet (earlier in the semester one side of 8.5" by 11" sheet and later in the semester both sides of 8.5" by 11" sheet). Necessary tables will also be provided. Every quiz might involve some calculations, thus you need to have your calculator with you. You are urged to properly indicate the units of the calculated variables to receive partial credits for your solutions. This is important for all quizzes, exams, projects, and other assignments to avoid losing points that otherwise are deserved. Grading error due to lack of clarity of the paper will be strictly your responsibility.

Midterm and Final Exams:
Midterm and final exams may typically consist of two parts: the first part will focus on statement type questions and the 2nd part on problems to solve. They are normally closed-book and closed-notes. However, you are allowed to have a reference sheet (earlier in the semester one side of 8.5" by 11" sheet and later in the semester both sides of 8.5" by 11" sheet). Necessary tables are provided or you are asked ahead of time to bring them with you to the exam. You need to have your calculator with you. The Final Exam will be cumulative and will test the knowledge gained in the entire course. Mid-term will be an hour exam (60 minutes duration) and Final will be for 90 minutes.

Make Up Policy:
No makeup will be given for quizzes. If you miss a Quiz and your excuse is accepted then the weight of that Quiz will be distributed on the remaining Quizzes. Make up for midterm or final examinations will only be given in the exceptional cases when the individual can demonstrate with proper documentations that the emergency involved was beyond his/her control. In case of any religious observance, the student must personally hand over a written notification of the projected absence in the first week of the semester.

Academic Honesty:
All students are expected to uphold the highest ethical and professional of academic honesty (see the University Of Maryland Code Of Academic Integrity). A violation of the UMD Code of Academic Integrity includes (but is not limited to) intentionally using or attempting to use unauthorized materials, information, or study aids in any academic exercise. Please be advised that a failure to accept and exhibit the fundamental value of academic honesty may result in a course grade of 'XF'

Course Website:
We will use ELMS (https://elms.umd.edu) as the primary site to archive lecture notes and course related materials and share information. If you are unfamiliar with ELMS Learning System, it would be a good idea to familiarize yourself with its features now. In case of any technical difficulty, please send an email to elms@umd.edu. Should you prefer assistance over the phone, you can call the OIT Help Desk at 301-405-1400. You are required to check the course website on a regular basis.

Path to Success in ENME 436:
The key factors for success in this course are to stay focused and fulfill your responsibilities. The course material is inherently cumulative such that the material learned in one session will be used in

the following sessions. If you lose your focus for a day or two, it will be difficult for you to come back to the track. Please feel free to send your questions by e-mail at any time. We will be happy to assist you as necessary.