A. **Academic Division:** Business, Industry, and Technology

B. **Discipline:** Engineering

C. **Course Number and Title:** ENGR1220 - Solar Power - Thermal Energy

D. **Course Coordinator:** Randy Storms  
   **Assistant Dean:** Daniel Wagner

**Instructor Information:**
- **Name:** Click here to enter text.
- **Office Location:** Click here to enter text.
- **Office Hours:** Click here to enter text.
- **Phone Number:** Click here to enter text.
- **E-Mail Address:** Click here to enter text.

E. **Credit Hours:** 2  
   Lecture: 1 hour  
   Laboratory: 2 hours

F. **Prerequisites:** ELET2240, EMMT1050

G. **Syllabus Effective Date:** Fall 2017

H. **Textbook(s) Title:** None

I. **Workbook(s) and/or Lab Manual:** None

J. **Course Description:** This course teaches the background, essential theory, principles and future of “Solar Thermal Systems”. Topics covered are: solar fundamentals, solar water heating systems and components, systems installation, check-out and commissioning procedures, troubleshooting and repair, solar pool heating systems, and code and safety issues.

K. **College-Wide Learning Outcomes**

<table>
<thead>
<tr>
<th>College-Wide Learning Outcome</th>
<th>Assessments - - How it is met &amp; When it is met</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication – Written</td>
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<td>Communication – Speech</td>
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<td>Intercultural Knowledge and Competence</td>
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<td>Critical Thinking</td>
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<td>Information Literacy</td>
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<td>Quantitative Literacy</td>
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Updated: 2/14/2017
**L. Course Outcomes and Assessment Methods:**

Upon successful completion of this course, the student shall:

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Assessments – How it is met &amp; When it is met</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Create sun path charts and a site solar irradiance audit.</td>
<td>Weeks 4-10: Reading assignment from NAPCEP Solar Heating Installer Resource Guide: Ch 5 Prepare for Project, Ch 6 Evaluate the Site &amp; Ch 7 Plan System Installation. 4 weekly quizzes, Midterm and Final Exam. Download and install the NREL Homer Optimization Modeling software, and use it on 2 case studies. Use the Solar Pathfinder, and a compass, to complete site survey for the Kehoe Center. Given a compass, azimuth-tilt-angle tables and magnetic declination data, calculate ideal panel angles for peak power. Prepare load analysis in Excel showing power rating in W/m² and BTU/m².</td>
</tr>
<tr>
<td>2. Explain how an active solar thermal system works.</td>
<td>Week 2: Reading assignment from NAPCEP Solar Heating Installer Resource Guide: Ch 4 Collectors, Systems, and Application. Lab, Quiz, Midterm and Final Exam.</td>
</tr>
<tr>
<td>5. Determine the best location for collector roof mounting.</td>
<td>Weeks 4-10: Reading assignment from NAPCEP Solar Heating Installer Resource Guide: Ch 5 Prepare for Project, Ch 6 Evaluate the Site &amp; Ch 7 Plan System Installation. 4 weekly quizzes, Midterm and Final Exam. Download and install the NREL Homer Optimization Modeling software, and use it on 2 case studies. Use the Solar Pathfinder, and a compass, to complete site survey for the Kehoe Center. Given a compass, azimuth-tilt-angle tables and magnetic declination data, calculate ideal panel angles for peak power. Prepare load analysis in Excel showing power rating in W/m² and BTU/m².</td>
</tr>
<tr>
<td>6. Explain the concepts of wind loading, and collector and piping freeze protection.</td>
<td>Week 9: Written research paper, quiz; final exam.</td>
</tr>
<tr>
<td>7. Size a solar thermal system based on family size and local solar irradiance.</td>
<td>Weeks 4-10: Reading assignment from NAPCEP Solar Heating Installer Resource Guide: Ch 5 Prepare for Project, Ch 6 Evaluate the Site &amp; Ch 7 Plan System Installation. 4 weekly quizzes, Midterm and Final Exam. Download and install the NREL Homer Optimization Modeling software, and use it on 2 case studies. Use the Solar Pathfinder, and a compass, to complete site survey for the Kehoe Center. Given a compass, azimuth-tilt-angle tables and magnetic declination data, calculate ideal panel angles for peak power. Prepare load analysis in Excel showing power rating in W/m² and BTU/m².</td>
</tr>
</tbody>
</table>
8. Install, test and troubleshoot AC and DC water pumps, electronic controllers, and temperature sensors.

9. Describe the latest federal solar tax credits.

Weeks 8-15: Reading assignment from NAPCEP Solar Heating Installer Resource Guide: Ch 8 Install System, Ch 9 Commission System, and Ch 10 Service and Maintain the System. Labs: Install, test and troubleshoot both active and passive solar water and solar air systems.

Week 2: Use DOE DSIRE website to determine the latest Federal and State Tax credits and incentives. Quiz, Midterm and Final Exam.

M. Topical Timeline (Subject to Change):

1. Solar Concepts
2. Passive Solar Heating Systems
3. Active Solar Heating Systems
4. Solar Water Heating
5. Equipment Familiarization
6. Basic Electrical Concepts
7. Introduction to soldering for plumbers,
8. Installation of Solar Water Heating System
9. Solar Water Heating System Troubleshooting
10. Solar Swimming Pool Heating Systems
11. System sizing examples
12. Disassemble the Solar Water Heating System
13. Electronic Controllers
14. Passive Hot Air Heating Systems
15. Active Hot Air Heating Systems
16. Installation of Passive Hot Air Heating System
17. Installation of Active Hot Air Heating System

N. Course Assignments:

1. Homework: Weekly reading assignments must be completed.
2. Labs: Installation of passive and active, water and air solar systems.
3. Quizzes, Midterm and Final

O. Recommended Grading Scale:

<table>
<thead>
<tr>
<th>NUMERIC</th>
<th>GRADE</th>
<th>POINTS</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>93–100</td>
<td>A</td>
<td>4.00</td>
<td>Superior</td>
</tr>
<tr>
<td>90–92</td>
<td>A-</td>
<td>3.67</td>
<td>Superior</td>
</tr>
<tr>
<td>87–89</td>
<td>B+</td>
<td>3.33</td>
<td>Above Average</td>
</tr>
<tr>
<td>83–86</td>
<td>B</td>
<td>3.00</td>
<td>Above Average</td>
</tr>
<tr>
<td>80–82</td>
<td>B-</td>
<td>2.67</td>
<td>Above Average</td>
</tr>
<tr>
<td>77–79</td>
<td>C+</td>
<td>2.33</td>
<td>Average</td>
</tr>
<tr>
<td>73–76</td>
<td>C</td>
<td>2.00</td>
<td>Average</td>
</tr>
<tr>
<td>70–72</td>
<td>C-</td>
<td>1.67</td>
<td>Below Average</td>
</tr>
<tr>
<td>67–69</td>
<td>D+</td>
<td>1.33</td>
<td>Below Average</td>
</tr>
<tr>
<td>63–66</td>
<td>D</td>
<td>1.00</td>
<td>Below Average</td>
</tr>
<tr>
<td>60–62</td>
<td>D-</td>
<td>0.67</td>
<td>Poor</td>
</tr>
<tr>
<td>00-59</td>
<td>F</td>
<td>0.00</td>
<td>Failure</td>
</tr>
</tbody>
</table>

Updated: 2/14/2017
P. Grading and Testing Guidelines:
Click here to enter text.

Q. Examination Policy:
Click here to enter text.

R. Class Attendance and Homework Make-Up Policy:
Click here to enter text.

S. Classroom Expectations:
Click here to enter text.

T. College Procedures/Policies:

Attendance Requirements: All students are required to attend all scheduled classes and examinations. Each faculty member has the right to establish regulations regarding attendance that he/she considers necessary for successful study.

Students who do not attend classes may be administratively withdrawn from those classes. However, failure to attend classes does not constitute withdrawal, and students are expected to process a formal withdrawal though the Student Records Office in Kee Hall.

Student engagement requirements: Student engagement is based on the “active pursuit” of learning which can be measured by class attendance, class participation (in class or online), taking required quizzes/examinations, and submission of work assignments or papers. Student engagement consists of a student attending at least 60% of the class sessions (there should be attendance throughout the term) and/or completing 75% of the assignments listed on the syllabus at the midpoint in the term. Exceptions can be made when there is on-going communication between the student and faculty member. The communication must be documented and the faculty member and student must be in agreement regarding the exception. Students not meeting the expectation will be administratively withdrawn from class. If a student believes he/she was administratively withdrawn in error, he/she may file an appeal. Being administratively withdrawn may have program and financial aid implications.

Academic Misconduct is any activity that tends to compromise the academic integrity of the college, or subvert the educational process. Examples of academic misconduct include, but are not limited to:

1. Violation of course or program rules as contained in the course syllabus or other information provided to the student; violation of program requirements as established by departments and made available to students.

2. Plagiarism including, but not limited to, submitting, without appropriate acknowledgment, any written, visual or oral material that has been copied in whole or in part from the work of others (whether such source is published or not) even if the material is completely paraphrased in one’s own words. This includes another individual’s academic composition, compilation, or other product, or a commercially prepared paper. Plagiarism also includes submitting work in which portions were substantially produced by someone acting as a tutor or editor.

Such practices constitute plagiarism regardless of motive. Those who deny deceitful intent, claim not to have known that the act constituted plagiarism, or maintain that what they did was inadvertent are nevertheless subject to penalties when plagiarism has been confirmed.
3. **Cheating** and dishonest practices in connection with examinations, papers and projects, including but not limited to using unauthorized notes, study aids or information on an examination; obtaining help from another student during an examination; taking an exam or doing work for another student; providing one’s own work for another student to copy and submit as his/her own; or allowing another student to do one’s work and then submitting the work as one’s own. Also included would be altering a graded work after it has been returned, then submitting the work for re-grading; or submitting identical or similar papers for credit in more than one course without prior permission from the course instructors.

4. **Fabrication** including but not limited to falsifying or inventing any information, data or citation; presenting data that were not gathered in accordance with defined appropriate guidelines, and failing to include an accurate account of the method by which data were collected.

5. **Obtaining an Unfair Advantage** including, but not limited to stealing, reproducing, circulating, or otherwise gaining access to examination materials prior to the time authorized by the instructor; unauthorized collaborating on an academic assignment; taking, hiding or altering resource material; or undertaking any activity with the purpose of creating or obtaining an unfair advantage over another student’s academic work.

6. **Aiding and Abetting Academic Dishonesty** including, but not limited to providing material, information or other assistance to another person with the knowledge that such aid could be used in any of the violations stated above, or providing false information in connection with any inquiry regarding academic integrity.

7. **Alteration of Grades or Marks** including but not limited to, action by the student in an effort to change the earned credit or grade.

In addition, cases of academic dishonesty may involve photocopied materials. Materials used may fall under the Copyright Act. Violations of said Act may subject the user and/or the College to sanctions.

**Statement on Disabilities:** Any student who requires reasonable accommodations related to a disability should inform the course instructor and the Coordinator of Specialized Services (Room 138 in Kee Hall; phone 419-755-4727).

Students who encounter difficulty in any of their courses are encouraged to visit the Tutoring Resource Center (Room 119 in Fallerius Technical Education Center) for tutoring assistance, and the Student Success Center (Room 136 in Kee Hall) for academic assistance, advising services, referrals for personal counseling and Learning Disability (LD) Testing.

**Statement on Withdrawals:** As a student, you are expected to attend class. If you are unable or choose not to attend class, or if for whatever reason you are unable to keep up with the requirements of a course, you need to officially drop the class at the Student Records Office. Refund dates and withdrawal dates will vary slightly from term to term. Contact the Student Records Office for applicable dates. Additionally these dates are posted on the academic calendar available on the college’s website, [www.ncstatecollege.edu](http://www.ncstatecollege.edu), under the Academics heading on the home page and are available at the Student Records Office in Kee Hall. Students should go to the Student Records Office (Room 142 in Kee Hall) to process their withdrawal from any class.

If you choose to walk away from your class without officially withdrawing from it, the faculty member teaching the class must grade your classroom performance on the material available to him or her. This normally results in an “F” grade. An "F" grade can lower your grade point average considerably depending on the total credits accumulated.