 

**SELECTED TOPICS IN MECHANICAL ENGINEERING I (AME 4940)  
(ReNEWABLE ENERGY)**

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| **Course Objectives** | After successfully completing this course, the student should:  1. Gain an understanding of the available solar energy and the current solar energy conversion and utilization processes  2. Why and how to harness the energy from sun.  3. Design solar cell based energy systems.  4. How to design solar to thermal conversion systems  5. How to utilize solar radiance in lighting.  6. How to store sun-derived energy.  7. Components of solar systems.  8. Solar energy applications: Water heating, Desalination, Refrigeration, Power generation.  9. Methods of solar collection, solar collectors: Flat plate, concentrating parabolic, photovoltaic.  10. Wind energy distribution, Wind power, Wind turbines, and Wind farms.  11. Energy generation, Hydrogen: Energy generation, Hydrogen energy transfer.  12. Fuel cells, Types of fuel cells.  13. Hydropower, Ocean thermal energy conversion; Biomass; Geothermal energy, Tidal energy, Wave energy. |
| **Course Outcomes** | 1. Understanding of fundamental principles of solar energy 2. Apply principles of thermodynamics and heat transfer to analyze and design solar energy systems 3. Acquire practical applications of solar energy 4. Acquire about how solar energy systems work and how to improve their design 5. Develop knowledge of some energy topics such as systems integration, heat recovery and environmental issues. |
| **Course**  **Activities and Assessment** | From time to time I shall give you home assignments to inculcate critical thinking ability. There will be one Mid Term examinations and two quizzes. |
| **Make-up Policy** | I shall not conduct any make-up examination except for those who provide public sector hospital certificate within one week. |
| **Attendance**  **Policy** | All students are advised to attend all of my classes punctually. If your attendance is below 75% of scheduled classes then you will not be allowed to sit in final examination. |
| **Books:** | “Solar Energy Renewable Energy and the Environment” Robert Foster, Majid Ghassemi and Alma Cota , 2010. ( or any latest version) |
| **Grading Policy** | |  |  |  |  | | --- | --- | --- | --- | | No. | Assessment task | Date due  (Academic Week) | Proportion of Final Assessment | | 1 | Assignments/Class participation | After every main topics | 5% | | 2 | Quizzes (2) | 4th & 10th | 10% | | 3 | Project | 11th | 20% | | 4 | Mid-term Examination | 7th | 25% | | 5 | Final Examination | As scheduled by the university | 40 % | |

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| 1 Topics to be Covered | | |
| **Topic** | **No of**  **Weeks** | **Contact hours** |
| Solar radiation spectrum; Global distribution; Seasonal variation; Effect of tilt angle; Resource estimation. | 2 | 6 |
| Flat plate collectors | 1 | 3 |
| Solar Concentrators **Q1** | 1 | 3 |
| Photovoltaics;PV Cell Characteristics, Modules, Arrays and system types | 2 | 6 |
| Introduction to Wind energy distribution. **M1** | 1 | 3 |
| Wind power, Wind turbines, Wind farms and energy generation | 2 | 6 |
| Hydrogen: Energy generation, Hydrogen energy transfer; **Q2** | 2 | 6 |
| Fuel cells, Types of fuel cells, | 1 | 3 |
| Hydropower, Ocean thermal energy conversion, | 1 | 3 |
| Biomass; Geothermal energy, Tidal energy, Wave energy **FE** | 2 | 6 |