# COURSE DESCRIPTION

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| **Faculty** | Engineering | | | | |
| **Department** | Renewable Energy Engineering | | | **NQF level** | 7 |
| **Course Title** | Solar Energy System and Technology | **Code** | 703432 | **Prerequisite** | |
| **Credit Hours** | 3 | **Theory** | 3 | **Practical** | 0 |
| **Course Leader** | Dr. Rana A. Haj Khalil | **Email** | R.Hajkhalil@jadara.edu.jo | | |
| **Lecturers** | Dr. Amer Al-Canaan | **Email** | a.alcanaan@jadara.edu.jo | | |
| **Lecture time** | 08:30- 09:45 Sun-Wed | **Classroom** | D 403 | **Attendance** | On campus |
| **Semester** | Summer 2021/2022 | **Production** | October 2021 | **Updated** | July 2022 |

| **Short Description** |
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| This course introduces students to solar energy systems and their applications. The topics covered in this course include solar radiation, selected heat transfer topics, flat-plate collectors, solar heater power system, solar cooling and design of solar thermal and photovoltaic systems. |
| **Course Objectives** |
| 1. explain the technical and physical principles of solar cells and solar collectors,<br>2. measure and evaluate different solar energy technologies through knowledge of the physical function of the devices,<br>3. calculate the required size of solar cell systems and solar collectors from a given power need by using appropriate tools/software,<br>4. make critical comparisons of different solar energy systems,<br>5. communicate technological and environmental issues related to solar energy in a concise and accessible way to a target group with basic technical skills. |

| **Course Intended Learning Outcomes (CILOs)** |
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| **A. Knowledge - Theoretical Understanding** |
| **a.1 Explain/understand** the fundamentals/physical principles of solar systems and their applications. (K1) |
| **B. Knowledge – Practical Applications** |
| **a.2 Compare** different solar energy systems in terms of design and performance criteria. (K2) |
| **C. Skills - Generic Problem Solving and Analytical Skills** |
| **b.1 Calculate** the required design parameters of thermal/photvoltaic solar energy systems from a given power need by using appropriate equations/software. (S1) |
| **D. Skills - Communication, ICT, and Numeracy** |

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| **b.3 Work in groups** and **Write** technical **report** and perform **oral presentations** related to fundamentals of solar energy systems and their applications. (S3) |
| **Teaching and Learning Methods** |
| E-learning (Blackboard), Engaged learning, Problem-based learning (PBL), and Project-based learning: |
| **Assessment Methods** |
| Class Participation and Assignments |
| Term Project/Presentation |
| HW |
| Quizzes |
| Midterm Exam |
| Final Exam |

| **Course Contents** | | | | | |
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| **Week** | **Hours** | **CLOs** | **Topics** | **Teaching & Learning Methods** | **Assessment Methods** |
| 1. | 5 | a1 | Introduction<br>1- Solar radiation<br>2- Available Solar radiation | Lectures, presentations | |
| 2. | 5 | a1 | 3- Selected heat transfer topics<br>4- Radiation characteristics of opaque materials<br>5- Radiation through glazing absorbed radiation | Lectures, presentations | |
| 3. | 4.5 | a2, b1, b3 | 6- Flat-plate collectors<br>7- Concentrating collectors | Lectures, presentations | **Group work #1**<br>**Quiz #1** |
| 4. | 4 | a1, a2, b1 | 12-- Solar water heating<br>15-- Solar cooling<br>**Midterm exam** | Lectures, presentations | **Midterm exam** |
| 5. | 4.5 | a1, a2, b1 | 17—Solar Power Thermal System<br>18—Solar ponds | Lectures, presentations | **Quiz #2** |
| 6. | 5 | a1, a2, b1, b3 | 19-- Simulation in Solar Process Design<br>20—Design of active systems: f-Chart | Lectures, presentations | **Group work #2** |
| 7. | 5 | a1, a2, b1 | 22-- Design of passive and hybrid heating system<br>23—Design of photovoltaic system | Lectures, presentations | |
| 8. | 2 | a1, a2, b1 | Review<br>**Final Exam** | Lectures | **Final exam** |

| Infrastructure | |
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| **Textbook** | 1. Solar Engineering of Thermal Processes, Photovoltaics and Wind, John A. Duffie, William A. Beckman, 5th Edition, Wiley, 2020 |
| **References** | 1. A Comprehensive Guide to Solar Energy Systems With Special Focus on Photovoltaic Systems, 1st Edition - May 17, 2018, Editors: Trevor Letcher, Vasilis M. Fthenaki.<br>2. Morton, Oliver (6 September 2006). "Solar energy: A new day dawning?: Silicon Valley sunrise". Nature. 443 (7107): 19–22. Bibcode:2006 |
| **Required reading** | "Radiation Budget". NASA Langley Research Center. 17 October 2006. Retrieved 29 September 2007. |
| **Electronic materials** | Ppt, book, lec, charts, tables |
| **Other** | NErL |

| Course Assessment Plan | | | | | | |
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| **Assessment Method** | | **Grade** | **CLOs** | | | |
| | | | **a1** | **a2** | **b1** | **b3** |
| **First (Midterm)** | | **30%** | 12 | 10 | 8 | |
| **Second (if applicable)** | | | | | | |
| **Final Exam** | | **50%** | 25 | 15 | 10 | |
| **Coursework** | | **20%** | | | | |
| **Coursework assessment methods** | Assignments | | | | | |
| | Case study | | | | | |
| | Discussion and interaction/participation | | | | | |
| | Group work activities | | | | | 10 |
| | Lab tests and assignments | | | | | |
| | Presentations/attendance | | | | | |
| | Quizzes | | | 5 | 5 | |
| **Total** | | **100%** | 37 | 30 | 23 | 10 |

| Plagiarism |
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| Plagiarism is claiming that someone else's work is your own. The department has a strict policy regarding plagiarism and, if plagiarism is indeed discovered, this policy will be applied. Note that punishments apply also to anyone assisting another to commit plagiarism (for example by knowingly allowing someone to copy your code).<br>Plagiarism is different from group work in which several individuals share ideas on how to carry out the coursework. You are strongly encouraged to work in small groups, and you will certainly not be penalized for doing so. This means |

that you may work together on the program. What is important is that you have a full understanding of all aspects of the completed program. To allow proper assessment that this is indeed the case, you must adhere strictly to the coursework requirements as outlined above and detailed in the coursework problem description. These requirements are in place to encourage individual understanding, facilitate individual assessment, and deter plagiarism.