**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification. |

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| University of Baghdad | 1. Teaching Institution |
| College of Engineering / Energy Engineering | 2. University Department/Centre |
| Optimization of Energy Systems | 3. Course title/code |
| BSc. | 4. Programme(s) to which it contributes |
| weekly | 5. Modes of Attendance offered |
| year | 6. Semester/Year |
| 90 Hour | 7. Number of hours tuition (total) |
| 15/05/ 2016 | 8. Date of production/revision of this specification |
| 9. Aims of the Course | |
| |  | | --- | | 1. Cognitive development of students by recognizing the energy systems. | | |
| |  | | --- | | 1. Engineering skills development for students to learn how to modelling the energy systems. | | |
| |  | | --- | | 1. Identify the special mathematical models of energy systems. | | |
| |  | | --- | | 1. Design methods of energy systems. | | |
| |  | | --- | | 1. Types of energy extraction systems. | | |
| |  | | --- | | 1. Learn how to calculate the efficiency and performance of energy systems. | | |
| |  | | --- | | 1. Identification of energy systems optimization. | | |
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| 10· Learning Outcomes, Teaching, Learning and Assessment Method. |
| 1. Knowledge and Understanding   A1. The student recognizes the basics of energy sources and how to be extract it.  A2. The student recognizes the modeling of energy systems.  A3. The student recognizes the many of energy systems and its design.  A4. The Student recognizes how to optimize the energy systems. |
| B. Subject-specific skills  B1. Solve fundamental problems of energy systems.  B2. The use of videos of energy systems.  B3. Hold many monthly periodic homework about energy systems. |
| Teaching and Learning Methods |
| The method of lecturing.  Team Project.  Video learning.  The method of discussion and weekly assignments. |
| Assessment methods |
| A daily and monthly tests of the theoretical point of view, as well as the commitment and respect for the students to attend lectures and interaction during which. |
| C. Thinking Skills  C1. Inference.  C2. Solving the applied problems of energy systems.  C3. Directing students to specific sites on the Internet to follow the latest developments in these systems.  C4. Ask students to write reports on specific topics for energy systems. |
| Teaching and Learning Methods |
| The lecture / discussion / solve Applied Engineering problems / writing codes in MATLAB language for specified energy systems. |
| Assessment methods |
| Daily and monthly tests of the theoretical point of view, as well as the commitment and respect for the students to attend lectures and interaction during which. |

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| D. General and Transferable Skills (other skills relevant to employability and personal development)  D1. Giving students the knowledge and skill of the process for energy systems.  D2. Solving engineering problems in a scientific way by students.  D3. Showing videos for energy systems via Seminars, contributes to an increase of perception and understanding of these systems  D4. Claim the students to write a specified reports about the energy systems. |

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| 11. Course Structure | | | | | |
| Assessment Method | Teaching  Method | Unit/Module or Topic Title | ILOs | Hours | Week |
| A theoretical tests and reports | The lecture, discussion, and videos, | introduction about wind turbines (WTs) | identify the types of wind turbines | 3 hours | 1 |
| A theoretical tests and reports | The lecture, discussion, and videos, | General introduction of (WTs) | Identify the main component of (WTs) | 3 hours | 2 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Power regulation of WTs | Power regulation and speed control of WTs | 3 hours | 3 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling and designing of WTs | identify the modeling and designing of WTs | 3 hours | 4 |
| A theoretical tests and reports | The lecture, discussion, and videos, | practical problems for WTs | Identify many of solved problems for WTs | 3 hours | 5 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Designing of WTs blades | Identify the aerodynamics theories and design of WTs blades. | 3 hours | 6 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Wind farms | Identify the importance of wind farms environmentally and economically, also its design, distributed, and its optimization layout | 3 hours | 7 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Optimization of WTs designing and its performance | identify the optimization methods of WTs | 3 hours | 8 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Analysis of wind data and wind energy potential | Identify the analysis of wind data, wind energy potential, and WTs energy potential | 3 hours | 9 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Introduction about soar collectors | identify the solar collectors and its types | 3 hours | 10 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling and designing of (FPSCs) | Flat plate solar collectors (FPSCs) | 3 hours | 11 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Optimization of (FPSCs) performance | (FPSCs) | 3 hours | 12 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Types of Concentrating solar collectors | Concentrating solar collectors | 3 hours | 13 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling and designing of (CPSCs) | Compound parabolic solar collectors (CPSCs) | 3 hours | 14 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Optimization of (CPSCs) performance | Compound parabolic solar collectors (CPSCs) | 3 hours | 15 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling and designing of (PTSCs) | Parabolic trough solar collectors (PTSCs) | 3 hours | 16 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Optimization of (PTSCs) performance | Parabolic trough solar collectors (PTSCs) | 3 hours | 17 |
| A theoretical tests and reports | The lecture, discussion, and videos, | solar water heating systems | Active and passive solar water heating systems | 3 hours | 18 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling and designing of Solar pool heating systems | Solar pool heating systems | 3 hours | 19 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Solar energy storage system | Thermal storage of solar energy | 3 hours | 20 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Effectiveness of heat exchanger | Heat exchanger in solar energy systems | 3 hours | 21 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling, designing of solar ponds systems and its optimization | Solar ponds | 3 hours | 22 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling, designing, and optimization of solar cooling and heating systems | Space heating and cooling by solar energy | 3 hours | 23 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling, designing, and optimization of solar cooling and heating systems | Space heating and cooling by solar energy | 3 hours | 24 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Introduction to solar cells | Solar cells, technologies, grids, and applications | 3 hours | 25 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Characteristics and performance of solar cells | Grids, applications, and optimization of Solar cells | 3 hours | 26 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling, designing, and optimization of geothermal energy systems | Geothermal energy systems | 3 hours | 27 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling, designing, and optimization of wave and tidal energy systems | Wave and tidal energy systems | 3 hours | 28 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Modeling, designing, and optimization of (OTECs) | Ocean thermal energy convertors (OTECs) | 3 hours | 29 |
| A theoretical tests and reports | The lecture, discussion, and videos, | Performance of Power plants which used concentrating solar collectors | Power plants of concentrating solar collectors | 3 hours | 30 |

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| 12. Infrastructure | |
| * Solar Energy Engineering, Processes and Systems by (Soteris A. Kalogirou) (2009).   Wind Energy Engineering by (Pramod Jain) (2011).  Wind and Solar Power Systems, 2nd ed, by Mukund R. Patel, (2006).   * Fundamentals of renewable energy processes, 2nd edition, by Aldo V. Da Rosa, (2009)   In addition, others references from an internet. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER |
| Distribution of comprehensive questions on the subject and ask the student solve | Special requirements (And include, for example, to solve basic and applied engineering issues) |
| Joint cooperation | Community-based facilities  (including, for example, awareness of a specific segment of the community on the importance of energy systems, as well as help some graduate students from the college and beyond in their own research, in addition to cooperation with some of the staff in the Ministry of Science and Technology in the area) |

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| 13. Admissions | |
|  | Pre-requisites |
| 10 | Minimum number of students |
| 30 | Maximum number of students |