هيئة تقويم التعليم
Education Evaluation Commission
المركز الوطني للتقويم والاعتماد الأكاديمي
National Center for Academic Accreditation and Evaluation

**ATTACHMENT 5.**

# T6. COURSE SPECIFICATIONS (CS)

**(PHYS 545)**

**Heat transfer and its applications in solar energy**

**by**

**Dr. Samah El-Bashir**
**2018**

هيئة تقويم التعليم
Education Evaluation Commission

# Course Specifications

| | |
|---|---|
| Institution: King Saud University | Date: 1/1/2018 |
| College/Department: College of Science, Physics and Astronomy Department | |

## A. Course Identification and General Information

1. Course title and code: Heat transfer and its applications in solar energy (PHYS 545)
2. Credit hours: **2(2+0)**
3. Program(s) in which the course is offered.
(If general elective available in many programs indicate this rather than list programs)
Physics and other science and engineering programs
4. Name of faculty member responsible for the course
Dr. Samah El-Bashir
5. Level/year at which this course is offered: 3rd level (post-graduate)
6. Pre-requisites for this course (if any): Phys 506 (Statistical Physics)
7. Co-requisites for this course (if any):
8. Location if not on main campus:
Main campus in Diriyah , College of Science, Department of Physics & Astronomy (Boys and Girls sections)
9. Mode of Instruction (mark all that apply):

| | | | |
|---|---|---|---|
| a. traditional classroom | √ | What percentage? | 60% |
| b. blended (traditional and online) | √ | What percentage? | 40% |
| c. e-learning | | What percentage? | |
| d. correspondence | | What percentage? | |
| f. other | | What percentage? | |

Comments:

## B Objectives

1. What is the main purpose for this course?
   - The student should be informed with the fundamentals of heat transfer theories and their applications.
   - The student should be able to apply this course in his/her future research work, as heat transfer theories are important for solar thermal energy conversion.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)
   - Electronic materials and computer based programs have been utilized to support the lecture course material.
   - The course material was posted on the Website that could be accessed by the students enrolled in the course.

## C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:
Heat transfer mechanisms, Forced convection heat transfer, Natural convection heat transfer, Thermal radiation, Heat treatment and techniques, Thermal applications in solar energy.

1. Topics to be Covered

| List of Topics | No. of Weeks | Contact hours |
|---|---|---|
| Chapter 1: Introduction to Heat Transfer Models | 1.5 week | 3 |
| Chapter 2: Heat conduction concepts | 1.5 week | 3 |
| Chapter 3: Heat exchanger design | 1.5 week | 3 |
| Chapter 4: Heat conduction for steady state one dimensional problems | 1.5 week | 3 |
| Chapter 5: Transient and multidimensional heat conduction | 1.5 week | 3 |
| Chapter 6: Connective heat transfer | 1.5 week | 3 |
| Chapter 7: Forced convection | 1.5 week | 3 |
| Chapter 8: Natural convection in single-phase fluids | 1.5 week | 3 |
| Chapter 9: Heat transfer in phase change configurations | 1.5 week | 3 |
| Chapter 10: Radiative heat transfer | 1.5 week | 3 |

2. Course components (total contact hours and credits per semester):

| | | Lecture | Tutorial | Laboratory/ Studio | Practical | Other: | Total |
|---|---|---|---|---|---|---|---|
| Contact Hours | Planed | 30 | | | | | 30 |
| | Actual | 30 | | | | | 30 |
| Credit | Planed | 30 | | | | | 30 |
| | Actual | 30 | | | | | 30 |

| 3. Additional private study/learning hours expected for students per week. | 2 hours |
|---|---|

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

**On the table below are the five NQF Learning Domains, numbered in the left column.**

**First**, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

| Code # | NQF Learning Domains And Course Learning Outcomes | Course Teaching Strategies | Course Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge** | | |
| | - To understand the properties of heat transfer<br>- To get acquainted with heat transfer mechanisms<br>- To get an experience heat transfer and measurements.<br>- To use different models to determine the heat transfer for one dimension and multidimensional problems | •Introducing the basic links between theory and applications in heat transfer mechanisms.<br>•Homework assignments<br>•Lecture discussions | - In-class quizzes<br>- Midterms and final exams |
| **2.0** | **Cognitive Skills** | | |
| | - The daily life applications of the studied topics.<br>- The most famous and useful instruments build on the studied topics.<br>- How technology is built from simple to advanced present states<br>- some interesting topics on heat transfer and their applications in solar energy conversion | - Defining duties for each chapter<br>- Advising students to search on some of the mentioned technologies (in the course) either on the websites or in the library and make reports. | * The interaction during the lectures and discussions<br>* The reports of different asked tasks<br>* Part of the Exams should focus on the understanding |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| | - Collecting the materials of the course<br>-Writing reports<br>- Developing the English language<br>- Thinking in solving problems<br>- Searching on the internet<br>- Dealing with the lectures that the student missed.<br>- Also, the students should know how to do that independently and through discussions with others. | -Learning how to search on the internet and use the library<br>-Learning how to cover missed lectures<br>-Learning how to summarize lectures or to collect materials of the course<br>-Learning how to solve difficulties in learning: solving problems – enhance educational skills | -Through discussions in the lectures<br>-Checking reports<br>-Asking questions<br>-Quizzes and Exams |

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|---|---|---|---|
| | | -Developing his interest in Science through :( field trips, visits to scientific and research institutes).<br>- Encouraging the student to attend lectures regularly by giving bonus marks for attendance<br>- Giving students tasks and duties<br>- Learning how to write reports: some of them in English language. | |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| | - Communication with others: the lecturer – students in the class<br>- Information Technology through: the Internet – the computer skills<br>- Numerical skills through: solving problems- computation – data analysis) | - Advising the students to: help each other in education.<br>-communicating with the lecturer to discuss difficulties.<br>- Asking students to: make search on the internet for some related interesting topics.<br>-writing reports on the computer<br>- Asking for solving some problems and recalculating some examples. | - Discussing reports on: problems solutions - internet searching<br>- Making discussion on some explored points<br>- Exams |
| **5.0** | **Psychomotor** | | |
| | Not applicable | Not applicable | Not applicable |

5. Schedule of Assessment Tasks for Students During the Semester

| | Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
|---|---|---|---|
| 1 | Weekly Homework assignments | | 10% |
| 2 | Attendance and Participation in the class | | 5% |
| 3 | First Mid-term exam | 6th week | 20% |
| 4 | Second Mid-term exam | 10th week | 25% |

## D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

- Office hours 2 hr/ week

## E Learning Resources

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| 1. List Required Textbooks<br>1- J. H. Lienhard IV and J.H. Lienhard V, "A Heat Transfer Textbook"; 4th Ed. (2017).<br>2- K.Rolle, "Heat and Mass Transfer"; 2nd Ed. (2016).<br>3- F. Kreith and R. M. Manglik, "Principles of Heat Transfer"; 8th Ed.(2016).<br>4- J. P. Holman, "Heat Transfer"; 10th Ed. (2010).<br>5- G. S. Sawhney, "Heat and Mass Transfer"; 2nd Ed. (2010).<br>6- R.Z.Wang and T.S.Ge,"Advances in Solar Heating and Cooling"; (2016).<br>7- I. Sarbu, C. Sebarchievici "Solar Heating and Cooling Systems"; (2017). |
| 2. List Essential References Materials (Journals, Reports, etc.)<br>[1] N. Tay, M. Liu, M. Belusko, F. Bruno, Review on transportable phase change material in thermal energy storage systems, Renewable and Sustainable Energy Reviews, 75 (2017) 264-277.<br>[2] A. Saraswat, R. Bhattacharjee, A. Verma, M.K. Das, S. Khandekar, Investigation of diffusional transport of heat and its enhancement in phase-change thermal energy storage systems, Applied Thermal Engineering, 111 (2017) 1611-1621.<br>[3] A. Saraswat, R. Bhattacharjee, A. Verma, M.K. Das, S. Khandekar, Investigation of diffusional transport of heat and its enhancement in phase-change thermal energy storage systems, Applied Thermal Engineering, 111 (2017) 1611-1621.<br>[4] M. Chandrashekara, A. Yadav, Water desalination system using solar heat: A review, Renewable and Sustainable Energy Reviews, 67 (2017) 1308-1330.<br>[5] L.F. Cabeza, A. Solé, C. Barreneche, Review on sorption materials and technologies for heat pumps and thermal energy storage, Renewable Energy, 110 (2017) 3-39. |
| 3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.<br>Websites on the internet that are relevant to the course topics |
| 4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.<br>Multimedia associated with the text book and the relevant websites |

## F. Facilities Required

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| Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.) |
| 1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)<br>• Lecture room with at least 25 seats<br>• Auditorium of a capacity of not less than 25 seats for large lecture format classes |
| 2. Technology resources (AV, data show, Smart Board, software, etc.)<br>• Computer room containing at least 15 systems<br>• Scientific calculator for each student. |

## G Course Evaluation and Improvement Processes

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| 1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching<br>• Course evaluation by student<br>• Students- faculty meetings |
| 2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department<br>• Peer consultation on teaching<br>• Departmental council discussions<br>• Discussions within the group of faculty teaching the course |
| 3. Processes for Improvement of Teaching<br>• Conducting workshops given by experts on the teaching and learning Methodologies.<br>• Periodical departmental revisions of methods of teaching.<br>• Monitoring of teaching activates by senior faculty members. |
| 4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)<br>• Providing samples of all kinds of assessments in the departmental course portfolio of each course<br>• Assigning group of faculty members teaching the same course to grade same questions for various students.<br>• Faculty members from other institutions are invited to review the accuracy of the grading policy. |
| 5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.<br>• The course material and learning outcomes are periodically reviewed and the changes to be taken are approved in the departmental meetings and higher councils.<br>• The head of department and faculty dean take the responsibility of implementing the proposed changes. |

Name of Course Instructor: **Dr. Samah El-Bashir**

Signature: _____ Date Specification Completed: **1-1-2018**

Program Coordinator: _____

Signature: _____ Date Received: _____