**ATTACHMENT 5.**

# Kingdom of Saudi Arabia

# The National Commission for Academic Accreditation & Assessment

## Course Specifications
## (CS)

# Material Science

## PHYS 478

Revised: 2018

# Course Specifications

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

A. Course Identification and General Information

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| 1. Course title and code: Material Science (PHYS 478) |
| 2. Credit hours: 3(3+0+0) |
| 3. Program(s) in which the course is offered.<br>(If general elective available in many programs indicate this rather than list programs)<br>Physics and other science and engineering programs |
| 4. Name of faculty member responsible for the course<br>Dr. |
| 5. Level/year at which this course is offered: Eighth level |
| 6. Pre-requisites for this course (if any): Solid State Physics (PHYS 371) |
| 7. Co-requisites for this course (if any): |
| 8. Location if not on main campus<br>1. Main campus in Diriyah , College of Science, Department of Physics & Astronomy |

9. Mode of Instruction (mark all that apply)

| | | | |
|---|---|---|---|
| a. traditional classroom | √ | What percentage? | 80% |
| b. blended (traditional and online) | √ | What percentage? | 20% |
| c. e-learning | | What percentage? | |
| d. correspondence | | What percentage? | |
| f. other | | What percentage? | |

Comments:

B Objectives

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| 1. What is the main purpose for this course?<br>a) Introducing the concepts of material science and studying the states of matter<br>b) The student should be acquainted with the crystal structure and defects in metals.<br>c) Introducing the different preparation methods of samples preparations and microscopic investigations.<br>d) Performing the heat treatment and forming for metals |
| 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)<br>• Assigning extra hours for solving selected problems that are of particular interest.<br>• The course material is discussed during tutorials<br>• Using the internet resources to access particular advanced topics |

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

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| Course Description:<br>States of matter (liquid, crystalline & vitreous); Crystal structure of metals; Metallography (reflecting optical microscope, transmission electron - microscope) specimen preparations; Mechanical testing (hardness & tensile test); Defects in crystals (point defects and dislocations); Diffusion in solids; (Phase transformation and Phase diagrams) Strengthening mechanisms (alloying, cold work, precipitation & fiber strengthening); Heat treatment of steel & TTT curves. |

1. Topics to be Covered

| List of Topics | No. of Weeks | Contact hours |
|---|---|---|
| Introduction to Materials Science: The importance of different types of materials and the position of various types of metals in the periodic table. | 1 | 3 |
| States of matter: Liquid -Vitereous (Glassy/ Amorphous ) and crystalline | 1 | 3 |
| crystallography: Space lattice- unit cells- Crystal systems- Bravais lattices. Miller indices-Crystal planes and orientations. X-ray diffraction methods –Crystal structure of metals. | 3 | 9 |
| Metallography: Reflecting optical microscope- Transmission electron microscope and specimen preparations. | 1.33 | 4 |
| Mechanical testing: Hardness and tensile tests | 1.33 | 4 |
| Defects in Crystals: Points defects (Schottly and Frenkel) -Concentration and energy of vacancies and interstitials. Line defects ( Dislocations)-Edge and Screw dislocations – Dislocation energy. | 2 | 6 |
| Diffusion in Solids: Diffusion mechanisms – Measurement of diffusion coefficient. Solution to diffusion equations. | 2 | 4 |
| Phase transformations and phase diagrams: Binary Phase diagram- Lever rule- Examples of binary phase diagrams (Cu-Ni, Ag-Cu, Al-Si, Pb-Sn, Cu-Zn & Fe-C). Generation of pearlite from austenite and the properties of steel. | 2 | 6 |

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|---|---|---|
| Strengthening mechanisms : alloying- cold work- precipitation & fibre strengthening. | 1 | 3 |
| Heat treatment of steel: Time-temperature-transformation curves (TTT curves) | 1 | 3 |

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

| | Lecture | Tutorial | Laboratory or Studio | Practical | Other: | Total |
|---|---|---|---|---|---|---|
| Contact Hours | 45 | | | | | 45 |
| Credit | 45 | | | | | 45 |

3. Additional private study/learning hours expected for students per week. 3 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** | | |
| | •The student should review the basic concepts of materials science.<br>•The student should get acquainted with the basic concepts of Metallography and crystallography.<br>•The student should get acquainted with defects in crystals and diffusion in solids<br>•The student should understand the methods of Phase transformations and phase diagrams | •Introducing the basic links between theory and applications in materials science.<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 | - Through lectures by focusing on the above mentioned points<br>- Define duties for each chapter | * Their interaction with the lectures and discussions<br>* The reports of different asked tasks<br>* Part of the Exams should |

| | | | |
|---|---|---|---|
| | - some interesting experiments and applications in the field of the studied course. | - Advise students to search on some of the mentioned technologies either on websites or in library and make reports. | focus on the understanding |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| | - Writing reports<br>- Develop his English language<br>- Think in solving problems<br>- Search on the internet<br>- Collect the material of the course<br>- Deal with the lost lectures that he missed.<br>Also the students should know how to do that independently and through discussions with the others. | -Learn how to search the internet and use the library<br>-Learn how to cover missed lectures<br>-Learn how to summarize lectures or to collect materials of the course<br>-Learn how to solve difficulties in learning: solving problems<br>– enhance educational skills<br>-Develop his interest in Science through :(lab work, field trips, visits to scientific and research institutes).<br>- Encourage the student to attend lectures regularly by giving bonus marks for attendance<br>- Give students tasks of duties<br>- Learn how to write reports: some of them in English language. | -Through discussions in the lectures<br>-Checking reports<br>-Asking questions<br>-Quizzes and Exams |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| | - Communication with others: the lecturer – students in the class<br>- IT through: the Internet – computer skills<br>- Numerical skills through: solving problems- computation – data analysis – feeling physical reality of results. | - Advise the students to: help each other in education, -communicate with the lecturer to discuss difficulties.<br>- Ask students to: make search on the internet on some related interesting topics, writing reports on the computer<br>- Asking for solving some problems and recalculating some examples. | - Discussing reports on: problems solved - internet search<br>- Comments on some resulting numbers<br>- Exams |
| **5.0** | **Psychomotor** | | |
| | Not applicable | Not applicable | Not applicable |

| 6. Schedule of Assessment Tasks for Students During the Semester | | | |
|---|---|---|---|
| | Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
| 1 | First Mid-term exam | | 15% |
| 2 | Second Mid-term exam | | 15% |
| 3 | Home works, Assignments, and Experimental | | 30% |
| 4 | Final Exam | | 40% |

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 3 hr/ week

E Learning Resources

1. List Required Textbooks

1- Materials Science and Engineering, An Introduction, ninth Edition, William D. Callister, Jr., John Wiley and Sons, Inc., 2014.
2- Foundations of Materials Science and Engineering, 4th Ed. by W.F. Smith & J. Hashemi, McGraw Hill, 2005.

2. List Essential References Materials (Journals, Reports, etc.)

1- Materials Science and Engineering, An Introduction, ninth Edition, William D. Callister, Jr., John Wiley and Sons, Inc., 2014.

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

1- Materials Science and Engineering, An Introduction, ninth Edition, William D. Callister, Jr., John Wiley and Sons, Inc., 2014.
2- Foundations of Materials Science and Engineering, 4th Ed. by W.F. Smith & J. Hashemi, McGraw Hill, 2005

4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

Websites on the internet that are relevant to the course topics

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

Multimedia associated with the text book and the relevant websites

F. Facilities Required

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.)

- Lecture room with at least 25 seats

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| 2. Computing resources (AV, data show, Smart Board, software, etc.)<br>• Computer room containing at least 15 systems |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)<br>• Availability of demonstrative materials relevant to the course material<br>• Safety facilities |

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 its 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 the same questions for various students. |
| 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 and higher councils.<br>• The head of department and faculty take the responsibility of implementing the proposed changes in the course materials. |

Name of Instructor: _____

Signature: _____ Date Report Completed: _____

Name of Field Experience Teaching Staff _____

Program Coordinator: _____

Signature: _____ Date Received: _____