



Course Syllabus (Academic Year 2023)

School of Interdisciplinary Studies, Kanchanaburi Campus, Mahidol University

1. **Course No. and Title** : KAED 121 Engineering Materials
Credit (study hours) : 3 (3-0-6)
2. **Program Name** : Bachelor of Engineering in Environmental Engineering and Disaster Management
3. **Course Module** : Major Required Course
Pre/co-requisite : No
4. **Class Semester** : 1st Semester 2nd Semester Academic Year 2023
5. **Class Schedule & Venue** : 13.30-16.30 on Friday, Mahidol University Salaya Campus,
Onsite course (MUKA e-learning)
6. **Class Coordinator** : Dr. Watcharapol Wonglertarak
watcharapol.won@mahidol.ac.th, Tel 085 849 3199

7. Course description

Crystallinity and non-crystallinity of materials, imperfections in crystal structure, meaning and testing of materials properties, equilibrium phase diagram and its applications, macro and microstructures, properties and applications of metals, ceramics, plastic, polymers, asphalt, wood, concrete and composites, introduction to fracture, corrosion and degradation of materials; case studies on materials selection.

8. Course Objectives / Course Learning Outcomes (CLOs)

| No. | Objectives/CLOs | Expected Skills/ Knowledge | | | |
|-----|---|----------------------------|-------------|----------------|------|
| | | Specific (S) | Generic (G) | Knowledge (K) | PLOs |
| 8.1 | Understand type of engineering materials including other smart and advanced materials used in various applications | S1 | G1, G2 | K1 | 1 |
| 8.2 | Understand characteristics, and analyze engineering properties, including applications of engineering materials; atomic crystal structure of materials including heat treatment and diffusion process; production process of engineering materials including corrosion and degradation of materials | S2, S3, S4 | G1 | K1, K2, K3, K5 | 1 |
| 8.3 | Understand phase and phase equilibrium and interpret phase diagram of metal systems for their applications | S5 | G1 | K4 | 1 |

| No. | Objectives/CLOs | Expected Skills/ Knowledge | | | |
|-----|--|----------------------------|-------------|---------------|------|
| | | Specific (S) | Generic (G) | Knowledge (K) | PLOs |
| 8.4 | Ability to select suitable materials for applications in production process especially in environmental engineering work | S6 | G1 | K1-K5 | 1 |

Specific Competences

- S1 Understand type of engineering materials
- S2 Analyze properties of materials, particularly mechanical properties
- S3 Understand differences of various atomic crystal structure of materials
- S4 Explain production process of different type of engineering materials
- S5 Interpret phase diagram of material systems
- S6 Select suitable engineering materials for production process

Generic Competence

- G1 Systematic thinking, problem solving, and analytical skills
- G2 Life-long learning and technology updating

Knowledge Competence

- K1 Material chemistry and physics
- K2 Characteristics and properties of materials
- K3 Atomic crystal structure of materials
- K4 Phase and phase diagram
- K5 Production process of materials

9. Class instructor list

Dr. Watcharapol Wonglertarak

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10. Course Outline

| Week | Date | Contents | CLOs | Teaching & Learning method | Instructor |
|------|-----------|---------------------------------------|----------|--|------------|
| 1 | 12/1/2024 | Introduction to engineering materials | 8.1 | Course Syllabus and Lecture | WW |
| 2 | 19/1/2024 | The Structure of Crystalline Solids | 8.1, 8.2 | Presentation, Activity, and Assignment | WW |
| 3 | 26/1/2024 | Mechanical Properties of Metals | 8.1, 8.2 | Presentation, Activity, and Assignment | WW |
| 4 | 2/2/2024 | | | | |
| 5 | 9/2/2024 | Phase Diagrams | 8.3 | Presentation, Activity, and Assignment | WW |
| 6 | 16/2/2024 | | | | |
| 7 | 23/2/2024 | Forming process of materials | 8.1, 8.2 | Presentation, Activity, and Assignment | WW |

| Week | Date | Contents | CLOs | Teaching & Learning method | Instructor |
|------|---------------------|--|----------|--|------------|
| 8 | 1/3/2024 | Ferrous, non-ferrous metals, and alloys | 8.1, 8.2 | Presentation, Activity, and Assignment | WW |
| 9 | 4-8/3/2024 | Mid-term Examination | | | |
| 10 | 15/3/2024 | Structures and Properties of Ceramics | 8.1, 8.2 | Presentation, Activity, and Assignment | WW |
| 11 | 22/3/2024 | Structures and Properties of Polymers | 8.1, 8.2 | Presentation, Activity, and Assignment | WW |
| 12 | 29/3/2024 | | | | |
| 13 | 5/4/2024 | Composites and construction materials, Corrosion and degradation of materials | 8.1, 8.2 | Presentation, Activity, and Assignment | WW |
| 14 | 12/4/2024 | Electrical, magnetic and optical properties of materials; Thermal and chemical properties of materials | 8.1, 8.2 | Presentation, Activity, and Assignment | WW |
| 15 | 19/4/2024 | Final project report and discussion | 8.1-8.4 | Presentation, Q&A | WW |
| 16 | 26/4/2024 | | | | |
| 17 | 29/4/2024-10/5/2024 | Final Examination | | | |

11. Course Assessment

| No. | Methods/Activities | Regulations | CLOs | Week | Weight Distribution (%) |
|--------------|---|---|--------------------|------|-------------------------|
| 1 | Class participation and Class attention | Learner must attend the class more and 80% of course. | - | All | 5 |
| 2 | Quiz | Learner must be testing the knowledge of previous week | 8.1, 8.2, 8.3, 8.4 | All | 10 |
| 3 | Assignment | - Learner must practice the engineering skills via exercises and assignments form each topic. - The score will be evaluated according to the quality and details of work by instructors of those topics. | 8.1, 8.2, 8.3, 8.4 | All | 10 |
| 4 | Final project | | | 15 | 15 |
| 5 | Midterm Examination | The scope of exam will be cover topics of the 1 st -7 th week in this course. | 8.1, 8.2, 8.3 | 9 | 30 |
| 6 | Final Examination | The scope of exam will be cover topics of the 8 th -15 th week in this course. | 8.2, 8.4 | 16 | 30 |
| Total | | | | | 100 |

12. Grading system

| Grade | Score | Grade | Score |
|-------|-----------|-------|------------|
| A | ≥ 80% | B+ | 75-79.99 % |
| B | 70-74.99% | C+ | 65-69.99% |
| C | 60-64.99% | D+ | 55-59.99% |
| D | 50-54.99% | F | <50 |

13. References

1. W.D. Callister, D.G. Rethwisch (2013) Materials Science and Engineering: An Introduction, John Wiley & Sons Inc., 9th Edition.
2. W.D. Callister, D.G. Rethwisch (2012) Fundamentals of Materials Science and Engineering: An Integrated Approach, John Wiley & Sons Inc.
3. D.R. Askeland, P.P. Fulay, W.J. Wright (2011) The Science and Engineering of Materials, Cengage Learning, 6th Edition.
4. J. M. Allwood and J. M. Cullen (2015) Sustainable Materials Without the Hot Air, Green Books, UIT Cambridge.
5. W.D. Callister (2548) วัสดุศาสตร์และวิศวกรรมวัสดุพื้นฐาน (Materials Science and Engineering: An Introduction, 6th Edition) แปลและเรียบเรียงโดย สุวรรณชัย พงษ์สุกิจวัฒน์, เอกสิทธิ์ นิสารัตนพร, มาวิน สุประดิษฐ์ ณ ออยุธยา, กอบบุญ หล่อทองคำ, ธาชาย เหลืองวรานันท์ และปฐมมา วิสุทธิพิทักษ์กุล. กรุงเทพฯ: สำนักพิมพ์ท็อป. ณรงค์ศักดิ์ ธรรมโชติ (2558) วัสดุวิศวกรรม. กรุงเทพฯ ซีเอ็ดดูเคชั่น.
6. William F. Smith and Javad Hashemi. วัสดุวิศวกรรม (Foundations of Materials Science and Engineering 4/e แปลและเรียบเรียงโดย รศ.แมน อมรสิทธิ์ รศ.ดร.สมชัย อัครทิวา และ อ.ธรรมบุญ อุดมมัน. กรุงเทพฯ: สำนักพิมพ์แมครอ-ฮิล.