

EASTERN MEDITERRANEAN UNIVERSITY
DEPARTMENT OF CHEMISTRY

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| COURSE CODE | CHEM212 | COURSE LEVEL | Freshman |
| COURSE TITLE | Physical Chemistry-II | COURSE TYPE | Area Core |
| CREDIT VALUE | (4,1) 4 | ECTS VALUE | 7 |
| PREREQUISITES | Chem211 | COREQUISITES | None |
| DURATION OF COURSE | One semester | Semester and year | SPRING 2022-23 |

Attention: All information and rules provided in this syllabus is subject to change in accordance with the new decisions of academic boards of EMU.

| | Group(s) | Name | e-mail | Office | Telephone |
|--|----------|------------------|--|--------|-----------|
| Instructor | 1 | Osman YILMAZ | osman.yilmaz@emu.edu.tr | AS 227 | 2925 |
| Responsible Assistants (labs and tutorials) | 1 | Selma Ustürk | selma.usturk@emu.edu.tr | AS 231 | 2091 |
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| COURSE WEB PAGE | Online platforms: Moodle: lms.emu.edu.tr MS Teams Follow the link for (CHEM212) on: https://lms.emu.edu.tr - Following information/tools will be provided to the students all-over the semester through Chem212 web page or MS Teams: 1. Links to lecture class meetings on MS Teams 2. Links to lecture video recordings of online classes (if any). 3. Important dates, exam schedules and announcements 4. Downloadable files of: - An updated copy of this course outline in pdf format, - Lecture handouts (Lecture notes), - Answer keys of exams, - Sample exam papers (if any) - Printable Periodic table of elements, - Others... 3. Links to pages with useful learning tools (movies, wikies etc) |
| | Announcements/ Posts All important news and announcements are published on MS Teams. Some announcements are also posted in Moodle LMS as well. It is your responsibility to make sure that you check your MS Teams account as well as your mail accounts regularly. |

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| TEXTBOOK | Atkins' Physical Chemistry by Peter Atkins, Julio de Paula, James Keeler Oxford University Press; 11th edition (2018) |
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COURSE DESCRIPTION

Physical transformations of pure substances (Phase diagrams of pure substances, thermodynamic aspects of phase transitions);
Simple mixtures (Thermodynamic description of mixtures, The properties of solutions, Phase diagrams of binary systems - Liquids, Phase diagrams of binary systems - Solids, Activities);
Chemical equilibrium (The equilibrium constant, The response of equilibria to the conditions);

AIMS & OBJECTIVES**(Relationship of Course to Program Outcomes)**

This course is the second one-semester course of three Physical Chemistry courses for Chemistry or related major students. By taking and successfully completing the physical chemistry courses:

- Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories in Physical Chemistry.
- Students will develop systematic problem solving skills as well as critical thinking and analytical reasoning skills as applied to scientific problems by solving numerous conceptual and algebraic/numerical problems.
- With the background and skills gained in these courses, students will be able to comprehend and interpret the concepts, and solve the problems with ease in other branches of chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

LEARNING OUTCOMES**Upon completion of Chem212:**

- Students should be able to explain the meaning and significance of chemical potential as a fundamental thermodynamic property to understand the nature of phase transitions, mixtures and chemical equilibrium.
- Students should be able to predict new thermodynamic properties upon the change in others in different states of matter as pure substances or mixtures, or reaction medium.
- Students should be able to predict the amounts of products or reactants under equilibrium conditions.
- Students should be able to present laboratory findings in a clear, concise laboratory report.

COURSE CONTENT AND LECTURE SCHEDULE

| Week | Date | Focus-4. Physical transformations of pure substances 4a- Phase diagrams of pure substances |
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| 1 | 1-4 March | 4a- Phase diagrams of pure substances 4b- Thermodynamic aspects of phase transitions |
| 2 | 6-10 March | 4b- Thermodynamic aspects of phase transitions |
| 3 | 13-17 March | Focus. 5- Simple mixtures 5a- Thermodynamic description of mixtures |
| 4 | 20-24 March | 5a- Thermodynamic description of mixtures 5b- The properties of solutions, |
| 5 | 27-31 March | 5b- The properties of solutions, |
| 6 | 3-7 April | 5c- Phase diagrams of binary systems - Liquids, |
| 7 | 10-14 April | MIDTERM PERIOD |
| 8 | 17-20 April | 5d- Phase diagrams of binary systems - Solids, |
| 9-10 | 24 April-8 May | 5f- Activities |
| 11 | 9-12 May | Focus-6. Chemical equilibrium 6a- The equilibrium constant, |
| 12 | 15-18 May | 6a- The equilibrium constant, |
| 13 | 22-26 May | 6b- The response of equilibria to the conditions |
| 14 | 29 May-2 June | 6b- The response of equilibria to the conditions |
| 15 | 5-8 June | FINAL EXAM PERIOD |

METHOD OF ASSESSMENT:

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| Two Midterms | 60% (30% each) |
| Final | 30% |
| Laboratory | 10% |

Some Important Exam Policies:

Regular Exams:

- All students should have a **non-programmable** scientific calculator, which can be used in exams. Mobile phones or similar electronic tools will not be allowed to use as calculator.
- Mobile phones and tablets are not allowed in the exams for any purpose.
- The ANSWER KEY of midterm and final exams will be posted in the LMS page right after the exam. Answer keys to make-up and resit exams are not posted.
- It is the student's responsibility to follow the detailed exam announcements LMS as well as the announcements made in the class sessions or on MS Teams.

Online Exam Policies (if online exams are needed):

- It is the student's responsibility to use a problem free computer with a proper internet browser and a sufficiently fast internet connection. Students that can't connect to the system during the exam due to the related problems may not be allowed to the makeup exams.
- Online exams may be done by using "open camera-open microphone" settings of MS Teams, together with ID verification before, during or after the exam. Under suspicious cases, the instructors of this course may do a video-call to the students for further ID verification and elimination of cheating suspicions.
- The University or the instructors of this course may impose other exam-security measures.

- Make-up Exams:

- Students having not attended only the Midterm (only one midterm) or Final exam are entitled to enter the Make-up Exam. One CAN NOT sit for the make-up exam to improve his/her already existing regular exam mark.
- There will be a single make-up session with different question sets for midterm and final exams.
- The date of makeup exams will be right after the "Final Exams" period. It will be announced on the course web page and/or your portal.
- No medical report is needed for the make-up exam.
- No application is needed to sit in the make-up exam.
- There will be no make-up for lab quizzes and reports.
- There will be no make-up of make-up exams.

Caution:

- The experience of the course instructors and statistics show that the averages of make-up exams are almost always lower than those of regular exams due to several reasons. Therefore, **we strongly recommend** the student not to miss the exams on their regularly scheduled dates.
- Not attending **two midterms** or **one midterm+final** exams will result with an NG grade. No makeup and resit exam will be given to such students.

Resit Exams

Those with a letter grade of D- or F can sit in resit exams. Also, those having an academic standing of "Warning" (irrespective of letter grade) can also sit in the resit exam. Online application may be necessary. Resit exam mark replaces the sum of the marks of quiz, midterm and final exams (90% in Chem212). Students with an NG grade are not allowed to take resit exams.

Revision/Inspection of Exam Papers and Objections to Exam Grading:

Students are strongly advised to examine answer keys to the exams that will be posted on LMS right after the exam. They are also advised to examine the feedback provided by the online exam platform (LMS). According to the by-laws, students can request for revision within 10 days of announcement of marks, after which the instructor may refuse inspection requests. Objections to any grade must first be made to the instructors. If still unsatisfied students may apply to the head of department.

GRADING CRITERIA

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| A to F | Letter grades are determined by a "curve system". No fixed letter-grade templates apply. |
| NG nil grade | Conditions that will lead to NG grade. Each of these conditions is independent. i) Not attending two midterms or one midterm+final exams ii) Not attending 50% of classes iii) Missing the lab sessions |

ATTENDANCE POLICY

- The students are expected to attend all the lectures (maximum of %50 absence). Failure to fulfil this criterion will result with an “NG” grade. (See the Grading Criteria).
- Attendance check is done in every class including the lab and tutorial sessions.
- Each student can follow his/her attendance records from the on-line attendance tracking system in portal.
- Missed classes before the **late registration** date are recorded as “absent”.
- Unanswered name calls during lectures other than the attendance check will also be recorded as absence in online classes.

- Missing lab sessions results in failure from Chem212 with an NG grade.

Laboratory sessions will be video demonstration-movie supported online classes if Covid-19 pandemic persists.

- Face-to-face **lectures** (4 hours/week).
- Lab sessions
- Tutorial sessions

Cheating is copying from others or providing information, written or oral, to others. Plagiarism is copying without acknowledgement from other people's work. According to university by laws cheating and plagiarism are serious offences punishable by disciplinary committee ranging from simple failure from the exam or project, to more serious action (letter of official warning, suspension from the university for up to one semester). Disciplinary action is written in student records and may appear in student transcripts.

| Periodic Table of Elements | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|
| 1 1A | | | | | | | | | | | | 13 3A | | | | | 14 4A | 15 5A | 16 6A | 17 7A | 18 8A | |
| 1 | 1 H 1.008 | 2 2A | | | | | | | | | | | | | | | | | | | 2 He 4.003 | |
| 2 | 3 Li 6.94 | 4 Be 9.01 | | | | | | | | | | | 5 B 10.81 | | | | | 6 C 12.01 | 7 N 14.01 | 8 O 16.00 | 9 F 19.00 | 10 Ne 20.18 |
| 3 | 11 Na 22.99 | 12 Mg 24.30 | | | | | | | | | | | 13 Al 26.98 | | | | | 14 Si 28.09 | 15 P 30.97 | 16 S 32.07 | 17 Cl 35.45 | 18 Ar 39.95 |
| 4 | 19 K 39.10 | 20 Ca 40.08 | 21 Sc 44.96 | 22 Ti 47.88 | 23 V 50.94 | 24 Cr 52.00 | 25 Mn 54.94 | 26 Fe 55.85 | 27 Co 58.93 | 28 Ni 58.69 | 29 Cu 63.54 | 30 Zn 65.39 | 31 Ga 69.72 | 32 Ge 72.61 | 33 As 74.92 | 34 Se 78.96 | 35 Br 79.90 | 36 Kr 83.80 | | | | |
| 5 | 37 Rb 85.47 | 38 Sr 87.62 | 39 Y 88.91 | 40 Zr 91.22 | 41 Nb 92.91 | 42 Mo 95.94 | 43 Tc 98.91 | 44 Ru 101.07 | 45 Rh 102.91 | 46 Pd 106.42 | 47 Ag 107.87 | 48 Cd 112.41 | 49 In 114.82 | 50 Sn 118.71 | 51 Sb 121.75 | 52 Te 127.6 | 53 I 126.90 | 54 Xe 131.29 | | | | |
| 6 | 55 Cs 132.91 | 56 Ba 137.33 | 57 La 138.91 | 72 Hf 178.49 | 73 Ta 180.95 | 74 W 183.85 | 75 Re 186.2 | 76 Os 190.2 | 77 Ir 192.22 | 78 Pt 195.08 | 79 Au 196.97 | 80 Hg 200.59 | 81 Tl 204.38 | 82 Pb 207.2 | 83 Bi 208.98 | 84 Po 208.98 | 85 At 209.99 | 86 Rn 222.02 | | | | |
| 7 | 87 Fr 223.02 | 88 Ra 226.03 | 89 Ac 227.03 | 104 Rf 261.1 | 105 Db 262.1 | 106 Sg 263.1 | 107 Bh 264.1 | 108 Hs 265.1 | 109 Mt 266.1 | 110 Ds 271 | 111 Rg 272 | 112 Cn 285 | 113 Uut 284 | 114 Fl 289 | 115 Uup 288 | 116 Lv 292 | 117 Uus | 118 Uuo 294 | | | | |
| Lanthanides | | | | 58 Ce 140.12 | 59 Pr 140.91 | 60 Nd 144.24 | 61 Pm 146.92 | 62 Sm 150.36 | 63 Eu 151.97 | 64 Gd 157.25 | 65 Tb 158.93 | 66 Dy 162.50 | 67 Ho 164.93 | 68 Er 167.26 | 69 Tm 168.93 | 70 Yb 173.04 | 71 Lu 174.97 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 90 Th 232.04 | 91 Pa 231.04 | 92 U 238.03 | 93 Np 237.05 | 94 Pu 244.06 | 95 Am 243.06 | 96 Cm 247.07 | 97 Bk 247.07 | 98 Cf 251.08 | 99 Es 252.08 | 100 Fm 257.10 | 101 Md 258.10 | 102 No 259.10 | 103 Lr 260.11 | | | | | |

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| R = 0.0821 (L.atm)/(mol.K) or | 8.314 J/mol.K | $N_A = 6.022 \times 10^{23}$ items/mol | $h = 6.63 \times 10^{-34}$ J.s |
| $c = 3.00 \times 10^8$ m/s | 1 atm = 760 mmHg | 1 in = 2.54 cm | 1 cal = 4.184 J |