


PLEASE KEEP THIS COURSE SYLLABUS FOR FUTURE REFERENCE AS IT CONTAINS IMPORTANT INFORMATION
EASTERN MEDITERRANEAN UNIVERSITY
DEPARTMENT OF CHEMISTRY

COURSE CODE	CHEM248	COURSE LEVEL	Undergraduate
COURSE TITLE	Analytical Chemistry II	COURSE TYPE	Faculty Core – Physical/Natural Sciences
CREDIT VALUE	(3,1) 3	ECTS VALUE	4
PREREQUISITES	CHEM247	COREQUISITES	none
DURATION OF COURSE	One semester	Semester and year	SPRING 2022-2023

Attention: All information and rules provided in this syllabus is subject to change in accordance with the new decisions of academic boards of EMU in parallel to the developments in Covid-19 Pandemic.

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COURSE WEB PAGE	<p>-Login to the Learning Management System (https://lms.emu.edu.tr) for the web page of Analytical Chemistry II (CHEM248). -By using your Office 365 mail account you will be able to access the course web page. -Following information/tools will be provided to the students all-over the semester through the CHEM248 web page and/or MS Teams:</p> <ol style="list-style-type: none"> 1. Important dates, exam schedules, and announcements. 2. Downloadable files of: <ul style="list-style-type: none"> - An updated copy of this course outline in pdf format - Lecture presentation slides (Lecture notes) - Practical Problems with answers <p>Printable Periodic table of elements</p>
ONLINE COMMUNICATION	 MICROSOFTS TEAMS: CHEM248-01_2022-23-2 (General)
PERSONAL e-MAILS	<p>All the important news and announcements will be published on the web page of the course (https://lms.emu.edu.tr). Usually, a copy of the news and announcements is also sent to your Office365 EMU e-mail address indicated in your student portal. It is your responsibility to make sure that this e-mail address you provided during your registration is active. Be sure to check your email address regularly.</p>
TEXTBOOK	<p><u>Textbook:</u> Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch: ‘Fundamentals of Analytical Chemistry’, 9th Ed. CENGAGE Learning, 2014. (ISBN-13: 978-0-495-55828-6, ISBN-10: 0-495-55828-1)</p> <p><u>Supplementary:</u> Analytical Chemistry 2.1 (2016) by David Harvey, dpquadweb.depauw.edu/harvey_web/etextproject/AC2.1Files/AnalChem2.1.pdf</p>
CATALOGUE DESCRIPTION CHEM248 Analytical Chemistry II (3,1) Electrochemistry and electrochemical methods of analysis: potentiometry, coulometry and voltammetry. Introduction to spectrochemical methods of analysis. Optical spectrometry: molecular absorption and fluorescence. Atomic absorption and emission spectroscopy. Introduction to analytic separations: solvent extraction and gas/liquid chromatography.	
AIMS & OBJECTIVES This course is the second of the two Analytical Chemistry courses offered to Pharmacy students. It aims to help the student to develop: <ul style="list-style-type: none"> - A rigorous background in the fundamentals of electrochemical and instrumental analytical chemistry. - Knowledge and familiarity with electrochemistry and its application to analytical problems. - Knowledge and familiarity with the interaction of matter with electromagnetic radiation and how this is used in spectroscopic methods. - Ability to select and use appropriate instrumental technique for solving specific analytical problems. - Practical laboratory skills in the use and application of electrochemical and instrumental techniques and acquisition of high-quality analytical data. 	

- Systematic problem-solving skills through conceptual and numerical problems requiring critical and analytical thinking skills.
- Skills to present the results of analyses in a coherent and clear manner.

LEARNING OUTCOMES

- Formulate electrochemical cells from balanced redox reactions, and identify the various components making up a cell.
- Given standard electrode potentials, use the Nernst equation to calculate quantities such as cell potential, E ; free energy ΔG and equilibrium constant K for redox systems of known composition.
- Given standard electrode potentials, and the cell potential or free energy of a redox system, use the Nernst equation to calculate its composition.
- Describe and explain the chemical, physical and procedural principles upon which electrochemical methods of analysis are based on.
- Explain how electrochemical methods can be used to solve some analytical problems.
- Explain how the different ranges of the electromagnetic spectrum interact with atoms and molecules.
- Describe absorption process in terms of Beer's Law and use it to calculate the concentration or absorptivity of an analyte from experimental data.
- Describe the differences and similarities in the instrumentation as well as in the application of the three categories of spectrophotometry, namely, Absorption, Emission and Fluorescence.
- List potential sources of systematic and random errors involved with electrochemical and spectroscopic methods of analyses and explain ways to avoid or minimize them.
- Explain the different methods for separating and purifying components from mixtures.
- Derive an expression to calculate the equilibrium concentration of a solute distributed between two immiscible phases (solvent extraction)
- Describe qualitatively the main principles of chromatography and categorize the various types that are currently used.
- Find/select a suitable method for the analysis of an analyte; obtain a representative sample and conduct the analysis by the chosen method.
- Process the raw data with appropriate statistical treatment and report the results with estimates of accuracy and precision.
- Write a lab report for the analysis and present results in concise and comprehensible format, with correct symbols and units.
- Handle all chemicals and apparatus correctly and safely in the laboratory.
- Use correct scientific English for written and oral communication.

RELATIONSHIP WITH OTHER COURSES

The course draws on concepts & theories from General Chemistry (CHEM105); Biostatistics (MATH212) and Analytical Chem. I (CHEM247).

ASSESSMENT (Exams) (See also Grading Criteria)

Regular Exams:

Midterm (30 %):

- Midterm exam will be held in the Midterm Exam Period on the academic calendar. The exact date will be announced by the University administration through the student portal.
- The exam will be face-to-face.
- Multiple choice and/or classical (essay) type questions will be asked.
- All students should have a non-programmable scientific calculator for use in exams.
- Mobile phones may not be used in exams as a calculator.
- There will be no questions from the lab experiments in the midterm exam.

Quiz I (5 %):

- The exact date of Quiz I is announced in the 'Exam Schedule' section of this course outline.
- The exam will be face-to-face.
- Multiple choice and/or classical (essay) type questions will be asked.
- All students should have a non-programmable scientific calculator for use in exams.
- Mobile phones may not be used in exams as a calculator.
- There will be no questions from the lab experiments in the quiz I exam.

Quiz II (5 %):

- The exact date of Quiz II is announced in the 'Exam Schedule' section of this course outline.
- The exam will be face-to-face.
- Multiple choice and/or classical (essay) type questions will be asked.
- All students should have a non-programmable scientific calculator for use in exams.
- Mobile phones may not be used in exams as a calculator.
- There will be no questions from the lab experiments in the quiz II exam.

Final Exam (40 %):

- Final exam will be held in the Final Exam period on the academic calendar. The exact date will be announced by the University administration through the student portal.
- The final exam will include questions from all topics covered in the whole semester.
- The exam will be face-to-face.
- Multiple choice and/or classical (essay) type questions will be asked.
- All students should have a non-programmable scientific calculator for use in exams.
- Mobile phones may not be used in exams as a calculator.
- There will be no questions from the lab experiments in the final exam.

Other Important Exam Policies:

- Exams regarding the lab sessions are explained in the Laboratory section of this course outline.
- All assessment marks will be announced via the student portal; they will not be announced on notice boards or elsewhere.
- Within the first ten days following the announcement of the results of the examinations, each student can examine his / her exam papers with their instructors.

Make-up and Resit Exams:**Midterm and Final Make-up Exams:**

- Students who have not attended the regular **Midterm and Final** exams 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.
- The date will be right after the "Final Exams" period. It will be announced on the course web page.
- 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 make-up exams.
- Not attending any two exams (midterms or final), including make-up exams will result with an NG grade.

Resit Exam:

Those students with a "D-" or "F" grade can attend the resit exam. An online application is necessary. Resit exams will be held on **13 – 19 July 2023**. The exam program will be announced. The letter grade of the course will be assigned according to the RESIT score. However, the weight of the Resit Exam will be equal to the total weight of quizzes, midterms and final exams (85 %). Attendance and Lab will also be considered in the letter grade calculation. Students with an **NG** grade are not allowed to take the resit exam. There is NO MAKE-UP examination for the RESIT EXAMINATION.

Caution:

- *The experience of the course instructors and statistics show that the average make-up and resit exams are almost always lower than those of regular exams due to several reasons. Therefore, we strongly recommend the students not to miss the exams on their regularly scheduled dates.*

Objections

- Students may inspect their marked exam papers from their course instructors. According to by-laws, these requests should be made within 10 days of the announcement of marks. Objections to any grade must first be made to the instructors. If still unsatisfied students may apply to the head of the department.

Method of Assessment:

Midterm	30 %
Quiz I	5 %
Quiz II	5 %
Final	40 %
Attendance	5 %
Lab	15 %
	Lab Reports 10 % (5 Reports, 2 % each)
	Lab Quizzes 2 % (2 Quizzes, 1 % each)
	Lab Final 3 %

GRADING CRITERIA

A to F	Letter grades are determined by a "curve system". No fixed letter-grade templates apply
NG nil grade	1- Not attending any two exams (midterm or final), including make-up exams will lead to NG grade. 2- Not attending 3 or more lab sessions. 3- Not attending 50 % of the whole academic activities (theoretical lectures, applications, labs, quizzes and all exams).

ATTENDANCE POLICY

The attendance policy of the Faculty of Arts and Sciences in the Spring Semester of 2022-2023 will be as follows:

The net attendance rate from the whole academic activities (theoretical lectures, applications, labs, quizzes, and all exams) should be a minimum of 50% in order not to get an NG grade. The details will be explained in classes.

Lectures:

- The students are expected to attend all the face-to-face lectures.
- Attendance is taken regularly and it is 5 %. The instructor may take in the first or the second hour or both hours of a two-period session.
- Each student can follow his/her attendance records from the online attendance follow-up system in the portal.

Lab sessions:

- Missing 3 or more lab sessions results in failure from the CHEM248 course with an NG grade.
- **ATTENDANCE** is taken regularly and will be added to the net attendance.
- Each student can follow his/her attendance records from the online attendance follow-up system in the portal.

Tutorial sessions:

- **ATTENDANCE** is taken regularly and will be added to the net attendance.
- Each student can follow his/her attendance records from the online attendance follow-up system in the portal.

Examinations:

- **ATTENDANCE** is taken regularly and will be added to the net attendance.
- Each student can follow his/her attendance records from the online attendance follow-up system in the portal.

LABORATORY

- Laboratory work is compulsory.
- The laboratory work includes 5 experiments during the semester with two-week intervals. Missing three or more experiments will result in failure from the CHEM248 course with an NG grade. "Missing 3 or more experiments" means HAVING NO LAB REPORTS for 3 or more experiments.
- Do not copy a previously submitted report or submit someone else's report as your own. Those reports will receive a zero mark.
- **Lab grade will be counted in determining the course grade as 15 %.**
- Students are expected to own a copy of the CHEM248 Lab Manual, which is available on the course web page (<https://lms.emu.edu.tr/>).
- Students who are late by 10 or more minutes will NOT BE ALLOWED into the LAB.
- Students must attend lab only on the dates allocated to their group.
- There will be two lab quizzes about the experiments that will be performed. First lab quiz will be from Experiment 1 and Experiment 2 on the day that Experiment 2 (**27 March**) is performed. Second lab quiz will be from Experiment 3, Experiment 4 and Experiment 5 on the day that Experiment 5 (**29 May**) is performed.
- There will be a lab final exam from all experiments immediately after the final exam of this course.
- Students are not allowed to the lab without a lab coat. Lab coats must be worn at all times in the lab. Lab coats are available in the Deniz Shop or the shops around the Campus.
- Long hair must be neatly tied up.
- Eating, drinking, chewing gum and smoking are hazardous and NOT ALLOWED in the LAB.
- Mobile phones are strictly forbidden and must be turned off.
- Each student is expected to submit a lab report after the experiment. No excuses are accepted for a late submission.
- Do not leave the lab sessions without informing the Lab instructors.
- Lab report marks will be announced via the student portal.
- Rules and regulations are summarised in more detail in the lab manual. Lab assistants will provide further information and guidance.

Exemption from the lab for students repeating CHEM248:

See the "Repeating Students" section of this course outline.

LEARNING / TEACHING METHOD

- Regular **FACE-to-FACE lectures** (3 hours/week)
- Data projector will be used during the lectures.
- **Tutorials** (2 hours/week on the designated weeks)
- **Lab sessions** (2 hours/week on the designated weeks)
- Online self-study materials
- See the "Laboratory/Tutorial Section" to see the weekly schedule for lab and tutorial sessions

COURSE CONTENT AND LECTURE SCHEDULE

Week	Date	Topics
1	6 – 10 March	Introduction to Instrumental Methods and Introduction to Electrochemistry (Chapter 18)
2	13 – 17 March	Introduction to Electrochemistry (Chapter 18)
3	20 – 24 March	Applications of Standard Electrode Potentials (Chapter 19)
4	27 – 31 March	Applications of Oxidation/Reduction Titrations (Chapter 20)
5	03 – 07 April	Potentiometry (Chapter 21)
5	03 April	QUIZ I
6	10 – 14 April	Electrogravimetry and Coulometry (Chapter 22)
7	17 – 19 April	Introduction to Spectrochemical Methods (Chapter 24)
8, 9	24 April – 08 May	MIDTERM PERIOD
10	09 – 12 May	Introduction to Spectrochemical Methods (Chapter 24)
11	15 – 18 May	Instruments for Optical Spectrometry (Chapter 25)
12	22 – 26 May	Molecular Absorption Spectroscopy (Chapter 26)
13	29 May – 02 June	Molecular Fluorescence Spectroscopy (Chapter 27) and Atomic Spectroscopy (Chapter 28)
13	29 May	QUIZ II
14	05 – 09 June	Introduction to Analytical Separations (Chapter 31)
15, 16	12 – 26 June	FINAL PERIOD

LAB / TUTORIAL SCHEDULE	
Experiment	GROUP-01 Monday 08:30-10:20
Experiment 1	13 March
Experiment 2	27 March
Experiment 3	10 April
Experiment 4	15 May
Experiment 5	29 May
LAB Final Exam	WILL BE RIGHT AFTER THE FINAL EXAM.
Lab Make-up Week	The week of 05 – 09 June <ul style="list-style-type: none"> - Make-up for Experiment-1 and/or only one other missed experiment is allowed. - Follow the announcements on the web/lab for the dates of specific experiments.
	NOTE: Lab sessions are performed FACE-to-FACE in the General Chemistry Lab (ASG07) which is in the basement of the Faculty of Arts & Sciences Building.
Topic	GROUP-01 Monday 08:30-10:20
Tutorial 1	20 March
Tutorial 2	03 April
Tutorial 3	17 April
Tutorial 4	22 May
Tutorial 5	05 June

EXAM SCHEDULE	
Midterm	Midterm Exams Period: 24 April – 08 May (Follow your portal for the exact date, time & place)
Quiz I	Quiz I Exam Date & Time: 03 April Monday 15:30 (Follow your portal for the exact date, time & place)
Quiz II	Quiz II Exam Date & Time: 29 May Monday 15:30 (Follow your portal for the exact date, time & place)
FINAL	Final Exams Period: 12 – 26 June (Follow your portal for the exact date, time & place)

REPEATING STUDENTS

Students repeating the course for a better grade (to improve CGPA):

- Whatever grade you receive at the end of this semester will replace your previous grade. This may result in a lower grade. In such instances, no appeals will be accepted to keep the old mark.

Exemption from the lab:

- **Laboratory exemptions will only be given if the lab has been successfully completed (receiving a Pass grade).**
- Passing old lab marks (9/15) of repeating students (with the condition that they attended at least 3 lab sessions) are transferrable; therefore they don't have to repeat the lab work. Their old lab mark will be transferred as the normalised grade.
- **The exempted student list will be announced through the course web page.**
- The Students who are not in the exemption list and do not attend Lab sessions will fail the whole CHEM248 course and will receive an **NG** grade.

ACADEMIC HONESTY – PLAGIARISM

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																18 8A	
1	1 H 1.008	2 2A											13 3A	14 4A	15 5A	16 6A	17 7A	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	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	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 44.24	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	