Course Specification
(Bachelor)

Course Title:	**Chemical Calculations**
Course Code:	**CHM 1131**
Program:	**Bachelor of Science in Chemical Laboratories**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	**1446-10 v1**
Last Revision Date:	**17 September 2024**

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A. General information about the course:

-1. Course Identification

1. Credit hours: 2 (1, 3, 0)					
2 (1 Lectures, 3 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 2/ First year					
4. Course general Description:					
The course contains the basic chemical calculations, which is very important to any chemist. It includes significant figures, stoichiometric calculations, definitions and calculations of different concentration terms, pH calculations, chemical equilibria, basics of kinetics calculations, and finally how to apply some software in chemical calculations.					
5. Pre-requirements for this course (if any)**:**					
General Chemistry- CHM 1101					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
By the end of this course, the student should be able to: • Express different quantities using significant figures. • calculate molecular weight and mole for atoms and molecules • deduce the empirical and molecular formula and perform stoichiometric calculations • know the different concentration terms, especially Molarity and strength, and how to convert between them. • Calculate pH for acids, based, buffer, and any other type. • Use different software in chemical calculations; e.g. applying calibration curve for concentration determination. Also, using other software as sigmaplot® and origin® in drawing curves.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**60**	**100%**
2	E-learning	**0**	**0**
3	Hybrid • Traditional classroom • E-learning	**0**	**0**

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**15**
2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recognize the basic knowledge of Statistics and data analysis using significant figures**	**K1; K2; K4**	lecturing	Short quizzes
1.2	**To define the stoichiometric calculations done on chemical reactions**	**K1; K2; K4**	Lecturing, group discussions, Homework and assignment	Oral test, Homework and assignment marks and written exams
1.3	**To describe the chemical equilibria calculations as well as Concentrations terms and pH calculations**	**K1; K2; K4**	Lectures and laboratory experiments.	Participation, Quizzes and MCQs, laboratory reports
2.0	**Skills**			
2.1	**To calculate the chemical equilibria, Concentrations**	**S1; S2**	Lecture and oral discussions	Solved problem marks

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	terms and pH calculations			Short quizzes and homework assignment
2.2	**To demonstrate the significants figures**	**S1; S2**	Brain storming and self-study, laboratory	Work portfolio and homework
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S4**	Motivate students to ask questions and to give response.	Participation marks
2.4	**To diagram and explain experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	**S2; S2; S4**	• Seminars • Laboratory • Encourage students to use blackboard and electronic mail to submit works and assignments.	• Lab reports • Assignments and homework
3.0	**Values, autonomy, and responsibility**			
3.1	**To appraise teamwork, and create awareness to maintain scientific integrity during different assessments, projects, and mini reports.**	**V1, V2**	• Group discussion and assignments • homework	• Oral tests Assignments • homework marks

C. Course Content

No	List of Topics	Contact Hours
1.	Statistics and data analysis: Experimental Errors, Significant Figures, Significant Figures in arithmetic, Addition and Subtraction, Multiplication and Division. Graphs, logarithms and antilogarithms, Types of Errors, Systematic and Random Errors, Precision and Accuracy, Absolute and Relative Uncertainty.	4
2.	Stoichiometric calculations (molecular weight and mole calculations, empirical formula, molecular formula, balanced chemical equations, empirical calculations)	4
3.	Chemical equilibria and its calculations (equilibrium constant, solubility product, acid-base dissociation, and Henderson-Haselbalch equation)	3
4.	Concentrations terms and pH calculations (Molarity, Normality, Strength, weight and volume percent, molality, ppm, ppb, p-function)	4
No	**List of Experiments**	**Contact hours**
1	Significant figures and unit conversion.	3
2, 3	the ideal gas equation, pressure, volume, temperature, amount of substance, the gas constant Learning outcome	6
4, 5	empirical formula, molecular formula, molar mass, mole and stoichiometric calculations.	6
6, 7	Balanced chemical reactions, molecular reaction equation, ionic reaction equation, net ionic reaction, limiting reagents, yield in chemical reactions.	6
8, 9	activity and concentration, equilibrium constant, solubility product and common ion effect.	6
9, 10	pH and pOH calculations, buffer solutions, buffer equation (Henderson-Hasselbalch), preparation of buffer solutions Learning outcome	6
11, 12	Concentration terms of molarity, normality, strength, molality and percent composition	6
13	kinetics, the rate of a reaction, rate constant, half-life, the Arrhenius equation, and activation energy.	3
14,15	Revision, Lab.reports overview	3
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1	6th/ 7th week	10 %
2.	Midterm 2	11th/ 12th week	10 %
3.	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4.	Laboratory	All the semester	30 %
5.	Final Exam	16thweek	40 %
6.	Total	All weeks	100 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	1. Skoog West, Stanley R. Crouch, Donald M. West , Douglas A. Skoog, ***Fundamentals of analytical chemistry***, 9th edition, Cengage India; (January 1, 2014), ISBN-10 : 8131522695, ISBN-13 : 978-8131522691 2. Gary D. Christian, Purnendu (Sandy) Dasgupta, Kevin Schug, ***Analytical Chemistry***, Wiley; 7th edition (September 27, 2013) , ASIN : B00I8XF5JC
Supportive References	Blackboard
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students. • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses.

Items	Resources
	• **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs**
Technology equipment (projector, smart board, software)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other equipment (depending on the nature of the specialty)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders)** • **Appropriate fine chemicals and solvents (distilled Water ammonium nitrate)** • **Analytical balance (3 digits), Set gas laws with the glass jacket Data acquisition set for gas laws with glass jacket, PC, Windows® 95 or higher, calorimeter, thermometer, Filter papers , clamps, stands**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of Students assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Quality of learning resources	**Students**	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.

Assessment Areas/Issues	Assessor	Assessment Methods
The extent to which CLOs have been achieved		
Lab Performance	**Students**	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**3 (NO. 1/3)**
DATE	**5/3/1446- 8/09/2024**