IPB UNIVERSITY
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
DEPARTEMEN KIMIA

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ONE SEMESTER COURSE PLAN (RPS)

KIM 1253
MATHEMATICAL CHEMISTRY
SKS 3(2-1)

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INSTRUCTIONAL ANALYSIS

Course Learning Outcomes:

1. Able to use mathematical concepts and calculus in solving cases on the topic of EQUILIBRIUM
2. Able to use mathematical concepts and calculus in solving cases on the topic of STRUCTURE
3. Able to use mathematical concepts and calculus in solving cases on the topic of CHANGE
4. Able to use mathematical concepts and calculus in solving cases on the topic of SURFACE PHENOMENA

8. Able to utilize the concept of INTEGRAL TRANSFORMATION IN SPECTROSCOPY to complete chemical calculations

7. Able to utilize the concept of STATISTICAL THERMODYNAMICS to solve chemical calculations

10. Able to utilize the concept of PARTIAL DIFFERENTIAL EQUATION to solve cases in chemical calculations

9. Able to utilize the concept of ORDINARY DIFFERENTIAL EQUATIONS to solve cases in chemical calculations

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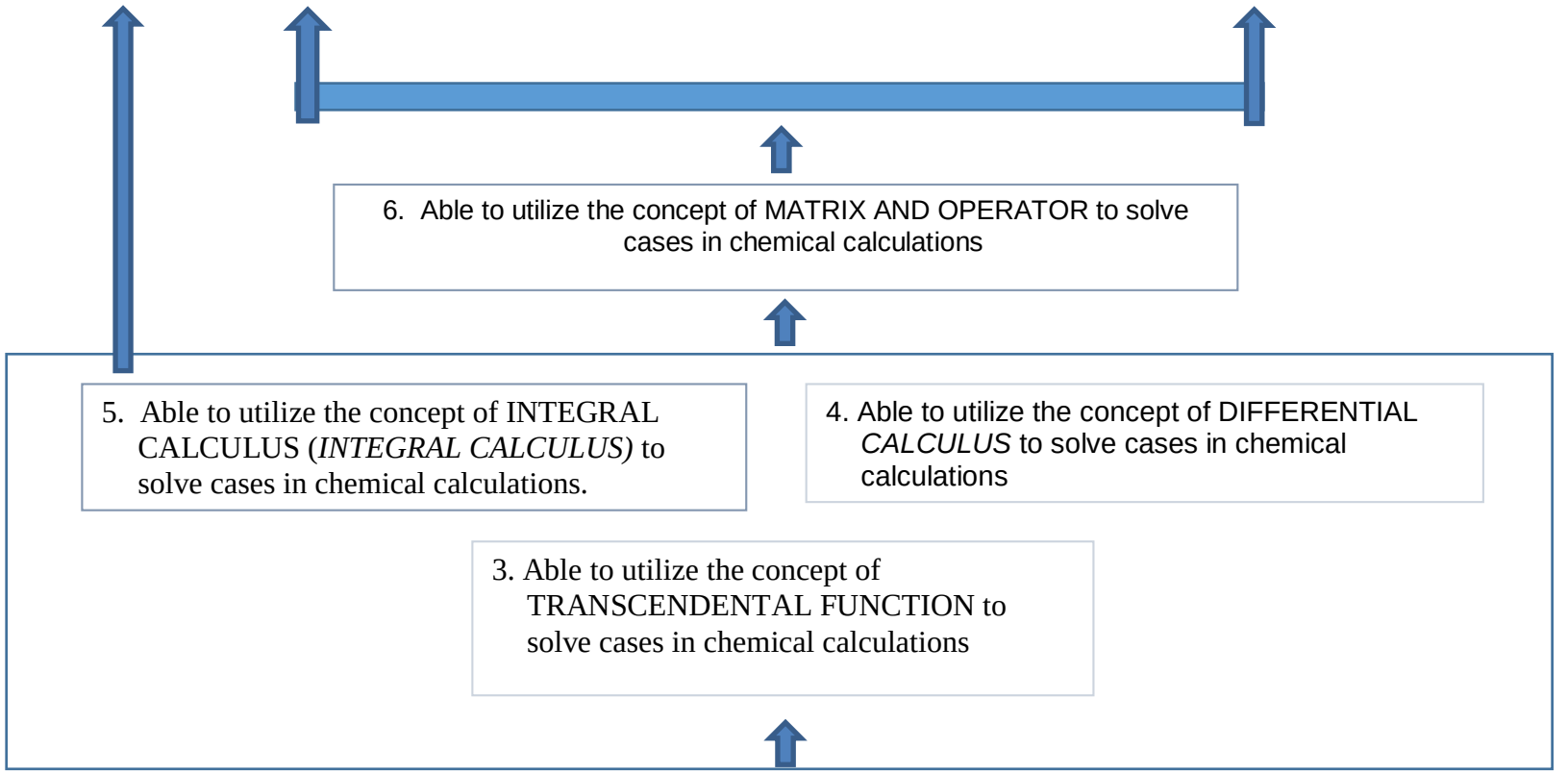

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SEMESTER LEARNING PLAN (RPS)

Course Name	:	Mathematical Chemistry
Code/Credit	:	KIM1253/3(2-1)
Semester	:	Odd (Semester 3)
Description	:	This Mathematical **Chemistry course** is a compulsory subject of the Undergraduate Chemistry Study Program related to the Mathematics and Logical Thinking courses obtained by students in semesters 1 and 2, as well as supporting other courses, especially the Chemical Thermodynamics, Chemical Equilibrium, Quantum Chemistry, and Spectroscopy courses, and Chemical Kinetics. This course is given to equip students to be able to solve calculations in chemistry related to the use of basic concepts of mathematics and calculus, algebraic functions, differential calculus, integral calculus, statistical thermodynamics and its applications, Fourier series and transformations, integral transformations in spectroscopy, operators and matrices, ordinary and partial differential equations. The scope of the discussion and learning process is to use active learning through lectures, *small group discussions*, cooperative *learning, and problem-based* learning. The language of instruction used in this lecture is Indonesian
Prerequisites course	:	MAT1102
Learning Outcomes	:	1. Able to use mathematical concepts and calculus in solving cases on the topic of EQUILIBRIUM 2. Able to use mathematical concepts and calculus in solving cases on the topic of STRUCTURE 3. Able to use mathematical concepts and calculus in solving cases on the topic of CHANGE 4. Able to use mathematical concepts and calculus in solving cases on the topic of SURFACE PHENOMENA
Scope and Curriculum map of the Royal Society of Chemistry Curriculum (RSC)	:	• *Statistical thermodynamics; laws of thermodynamics (zeroth, first, second, third)*
Division/Field	:	The Department of Chemistry/Kimia

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Lecturers	:	1. Dr. Henny Purwaningsih, SSi, MSi (Koordinator) - HPS 2. Dr. Mohammad Khotib, SSi, MSi - MKH 3. Dr. Trivadila, SSi, MSi - TVD 4. Teduh Wulandari Mas'oed, MSi - TWM 5. Fendy Septyanto, BSc, MSi - FEN

[1)]Response/practicum activities are expressed in credits, not in the number of hours

[2)]see Excel file of the Chemistry Curriculum Map from RSC

Graduate Learning Outcomes charged to Course Learning Outcomes

Learning Outcomes	A1	A2	A3	B1	B2	B3	B4	C1	C2
A. Knowledge	✕	✕	---						
B. Speciafic skills				✕	✕	---	✕		
C. General Attitudes and Skills								✕	✕

I. PLAN FOR STUDY

WEEK OF	LEARNING OUTCOMES	TOPIC	METHOD	DURATION	STUDY EXPERIENCE	PENILAIAN			REFERENCES
						CRITERION	INDICATOR	WEIGHT (%)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1 (HPS)	Able to utilize the concepts of NUMBERS, MODIFIERS, AND UNITS that are appropriate in solving cases in chemical calculations	- Basic concepts of numbers, modifiers, and units - Scientific Notation - Basic arithmetic operations - SI Units	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion c. Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of NUMBERS, MODIFIERS, AND UNITS through visual learning b. Interaction between:	**Hard Skills:** Completeness and truth about: - Using precise numbers, modifiers, and units in chemical measurements and calculations - Using basic arithmetic operations in	a. >90% of students correctly answered the correct numbers, variables, and units in chemical measurements and calculations b. >90% of students correctly answered basic	=1/7*40 %=6%	1-5

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					(i) Students and teaching materials (ii) Students and lecturers (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	chemical calculations Convert units of measurement to other units of measurement **Soft Skills:** 1. Activeness 2. Cooperation 3. Responsibility 4. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	arithmetic operations in chemical calculations c. >80% of students answered correctly about converting units of measurement to other units of measurement		
2 (TWM/ FEN)	Able to utilize the concept of ALGEBRAIC FUNCTIONS to solve cases in chemical calculations	- Basic concepts of algebraic functions - Algebraic manipulation - Graph as a representation of functions - Inverse function - Polynomial equations: linear equations, and; Quadratic equations - Rational equation - Partial fraction	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion c. Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of ALGEBRAIC FUNCTIONS through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturers (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	- Using basic concepts of algebraic functions in chemical calculations - Perform algebraic manipulations in simplifying complex algebraic equations - Able to draw graphs from a simple function - Solve chemical calculations that utilize the rule of inverse functions - Complete chemical calculations that utilize the rules of	a. >90% of students answered correctly about the basic concepts of algebraic functions in chemical calculations b. >90% of students answered correctly about algebraic manipulation in simplifying complex algebraic equations c. >80% of students correctly answered the problem of drawing a graph	6%	1-5

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						polynomial equations - Complete chemical calculations that utilize the rules of rational equations - Complete chemical calculations that utilize the rule of partial fractions **Soft Skills:** 1. Activeness 2. Cooperation 3. Responsibility **4.** Discipline accuracy and thoroughness in making questions and statements during interactive discussions	from a simple function d. >80% of students answered correctly the question-solving chemical calculations that utilize the rule of inverse functions e. >80% of students answered correctly about chemical calculations that use the rules of polynomial equations f. >80% of students answered correctly about chemical calculations that utilize the rules of rational equations g. >80% of students answered correctly about chemical calculations that use the rule of partial fractions		
3 (TWM/ FEN)	Able to utilize the concept of TRANSCENDENTAL FUNCTION to solve	- Basic concepts of transcendental function - Trigonometric Functions	Synchronous-Off-Network/Offline Face-to-Face Lectures include: *a.* Lectures	2 x 50 min	a. Gain insight and explanation of TRANSCENDENTAL FUNCTIONS	- Using basic concepts of transcendental functions in	a. > 80% of students answered correctly about the basic	6%	1-5

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	cases in chemical calculations	- Inversion of Trigonometric Functions - Polar coordinates - Exponential Function - Logarithmic Functions - Hyperbole Function	b. Class Interactive Discussion c. Review of Discussion Results		through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	chemical calculations - Complete chemical calculations that utilize the rules of trigonometric functions & inverse trigonometric functions - Complete chemical calculations that utilize the rules of trigonometric functions & inverse trigonometry - Complete chemical calculations that utilize polar function rules - Complete chemical calculations that utilize exponential function rules - Complete chemical calculations that utilize logarithmic function rules - Complete chemical calculations that utilize the rules of hyperbolic functions **Soft Skills:** 1. Activeness 2. Cooperation 3. Responsibility	concepts of transcendental functions in chemical calculations b. > 80% of students answered correctly about chemical calculations that utilize the rules of trigonometric functions &; inverse trigonometric functions c. > 80% of students answered correctly about chemical calculations that utilize the rules of trigonometric functions &; inverse trigonometry d. > 80% of students answered correctly about chemical calculations that utilize the rules of polar functions e. > 80% of students answered		

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						4. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	correctly about chemical calculations that utilize the exponential function rule f. > 80% of students answered correctly about chemical calculations that utilize the rules of logarithmic functions g. > 80% of students answered correctly about chemical calculations that utilize the rules of hyperbolic functions		
4 (TWM/ FEN)	Able to utilize the concept of DIFFERENTIAL *CALCULUS* to solve cases in chemical calculations	- Basic concepts of differential functions - *The Tangent Line* and Derivative Functions - Finite Value Function: *L'Hopital's Rule* - Differential Rules - Logarithmic Differential - Applications of Differential Calculus: a. Linear Motion	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion *c.* Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of DIFFERENTIAL *CALCULUS* through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) College students	- Using basic concepts of differential functions in chemistry - Carrying out the differentiation process - Using the concept of *L'Hopital's Rule* in solving chemical calculations - Using differential rules in solving	a. > 80% of students answered correctly about the basic concepts of differential functions in chemistry b. > 80% of students answered correctly about the differentiation process	6%	1-5

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		b. Angular Motion			c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	chemical calculations - Using logarithmic differential equations in solving chemical calculations - Using differential calculus applications in cases of linear and angular motion **Soft Skills:** 1. Actiness 2. Cooperation 3. Responsibility 4. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	c. > 80% of students answered correctly about the concept of *L'Hopital's Rule* in solving chemical calculations d. > 80% of students answered correctly about differential rules for solving chemical calculations e. > 80% of students correctly answered logarithmic differential equations in solving chemical calculations f. > 80% of students answered correctly about the application of differential calculus in cases of linear and angular motion		
5 (TWM/ FEN)	Able to utilize the concept of INTEGRAL CALCULUS (*INTEGRAL CALCULUS)* to solve cases in chemical calculations	- Basic concept of integral: Anti-Derivative Function - Integral of Course and Indeterminate - Integration Method	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion	2 x 50 min	a. Gain insight and explanation of INTEGRAL *CALCULUS* through visual learning b. Interaction between:	a. Explain the concept of anti-derivative functions b. Perform the integration process c. Distinguishing between definite	a. > 80% of students answered correctly about the concept of anti-derivative function b. > 80% of students answered	6%	1-5

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		- Applications of Integral Calculus: a. Dynamics b. Working Pressure-Volume c. Probabilities Distribution Average rating	*c.* Review of Discussion Results		(i) Students and teaching materials (ii) Students and lecturer (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	and indefinite integrals d. Describe the different integration methods e. Using the concept of integral calculus in solving cases of dynamics in chemical calculations f. Using the concept of integral calculus in solving volume-pressure work cases in chemical calculations g. Using the concept of integral calculus in solving cases of probability distribution in chemical calculations h. Using the concept of integral calculus in solving mean values in chemical calculations **Soft Skills:** a. Activeness b. Cooperation c. Responsibility d. Discipline accuracy and thoroughness in	correctly about the integration process c. > 80% of students answered correctly the question of distinguishing between definite and indefinite integrals d. > 80% of students answered correctly about various integration methods e. > 80% of students answered correctly about the concept of integral calculus in solving dynamic cases in chemical calculations f. > 80% of students answered correctly about the concept of integral calculus in solving volume-pressure work cases in chemical calculations g. > 80% of students answered correctly about		

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						making questions and statements during interactive discussions	the concept of integral calculus in solving cases of probability distribution in chemical calculations h. > 80% of students answered correctly the problem of the concept of integral calculus in solving the average score in chemical calculations		
6 (TWM/ FEN)	Able to utilize the concepts of OPERATORS AND MATRICES to solve cases in chemical calculations	- Operator dan algebra operator - Symmetric operator - Matrix algebra - Application vectors of operators and matrices in quantum mechanics	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion *c.* Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of OPERATORS AND MATRICES through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	- Using basic operations in operator algebra - Identifying and using symmetry operators in molecular symmetry studies - Using basic matrix algebra operations - Explain determinants and properties of determinants - Describe vectors - Utilizing the concepts of operators and matrices in quantum mechanics	a. > 80% of students correctly answered basic operations questions in operator algebra b. > 80% of students answered correctly about identifying and using symmetry operators in molecular symmetry studies c. > 80% of students answered correctly the basic operations of matrix algebra d. > 80%	6%	1-5

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						Soft Skills: a. Activeness b. Cooperation c. Responsibility d. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	of students answered correctly the determinant question and determinant properties e. > 80% of students answered correctly the vector question f. > 80% of students answered correctly about the concepts of operators and matrices in quantum mechanics		
7 (TWM/ FEN)	Able to utilize the concept of COMPLEX NUMBERS to solve cases in chemical calculations	- Basic Concepts of Complex Numbers - Algebra of Complex Numbers - Graphic Representation - Euler's formula - Periodicity - Integral Evaluation	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion *c.* Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of NUMBERS, MODIFIERS, AND UNITS through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) College students c. Obtain conformity /understanding of opinions, agreements, and	- Explain the basic concepts of Complex Numbers - Explaining the Algebra of Complex Numbers - Using Euler's Formula - Explaining Periodicity - Evaluating Integrals **Soft Skills:** a. Activeness b. Cooperation	a. > 80% of students answered correctly about the basic concepts of Complex Numbers b. > 80% of students answered correctly the Complex Number Algebra problem c. > 80% of students answered correctly about Formula Euler	6%	1-5

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					joint decisions on a problem	c. Responsibility d. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	d. > 80% of students answered correctly about Periodicity e. > 80% of students answered correctly the Integral evaluation question		
MIDTERM EXAM									

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8&9 (TVD)	Able to utilize the concept of STATISTICAL THERMODYNAMICS to solve cases in chemical calculations	- Basic Concepts of Statistical Thermodynamics - Thermodynamic Functions - Molecular Partition Function - Applications of Statistical Thermodynamics a. Average Energy b. Heat Capacity c. Equation of State d. Molecular Interactions in Solution e. Entropy - Chemical Equilibrium	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion *c.* Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of STATISTICAL THERMODYNAMICS through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	- Explain the basic concepts of statistical thermodynamics - Explain thermodynamic functions - Explain the function of molecular partitioning - Using applications of statistical thermodynamics in solving average energy cases in chemical calculations - Using the application of statistical thermodynamics in solving heat capacity cases in chemical calculations - Using the application of statistical thermodynamics in solving equations of state in chemical calculations - Using statistical thermodynamic applications in solving molecular	a. > 80% of students answered correctly about the basic concepts of statistical thermodynamics b. > 80% of students answered correctly about thermodynamic functions c. > 80% of students answered correctly about the molecular partition function d. > 80% of students answered correctly about the application of statistical thermodynamics in solving average energy cases in chemical calculations e. > 80% of students answered correctly about the application of statistical thermodynamics in solving cases of heat capacity in chemical calculations f. > 80%	=1/4*40 %=10%	1-5

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						interactions in solutions in chemical calculations - Using the application of statistical thermodynamics in solving cases of entropy in chemical calculations - Using the application of statistical thermodynamics in solving cases of chemical equilibrium in chemical calculations **Soft Skills:** a. Activeness b. Cooperation c. Responsibility d. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	of students answered correctly the problem of the application of statistical thermodynamics in solving equations of state in chemical calculations g. > 80% of students answered correctly about the application of statistical thermodynamics in solving molecular interactions in solutions in chemical calculations h. > 80% of students answered correctly about the application of statistical thermodynamics in solving entropy cases in chemical calculations i. > 80% of students answered correctly about the application of statistical thermodynamics in solving cases of		

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							chemical equilibrium in chemical calculations		
10 (TVD)	Able to utilize the concept of INTEGRAL TRANSFORMATION IN SPECTROSCOPY to solve cases in chemical calculations	- Periodic function - Fourier series - Fourier transformation - Simple Laplace transformation - Derivative of the Average Value transformation	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion *c.* Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of INTEGRAL TRANSFORMATIONS IN SPECTROSCOPY through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	a. Explain periodic functions and the notion of the Fourier series b. Determining the Fourier coefficient c. Complete Fourier transformations of various basic functions d. Complete Laplace transformations of various basic functions e. Solving the manipulation of Laplace's transformations with various theorems **Soft Skills:** a. Activeness b. Cooperation c. Responsibility d. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	a. > 80% of students answered correctly about periodic functions and the definition of the Fourier series b. > 80% of students answered correctly about the Fourier coefficient c. > 80% of students correctly answered the Fourier transform of basic functions d. > 80% of students correctly answered the Laplace transformation of basic functions e. > 80% of students correctly answered the problem of manipulating Laplace's transformation with various theorems	10%	1-5

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11&12 (MKH)	Able to utilize the concept of ORDINARY DIFFERENTIAL EQUATIONS to solve cases in chemical calculations	- Basic operations in operator algebra - Symmetry operators in the study of molecular symmetry - Matrix algebra - Determine vector - The concept of operators and matrices in quantum mechanics	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion *c.* Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of ORDINARY DIFFERENTIAL EQUATIONS through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	a. Using basic operations in operator algebra b. Identifying and using symmetry operators in molecular symmetry studies c. Using basic matrix algebra operations d. Explain determinants and properties of determinants e. Describe vectors f. Utilizing the concepts of operators and matrices in quantum mechanics **Soft Skills:** a. Activeness b. Cooperation c. Responsibility d. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	a. > 80% of students correctly answered basic operations questions in operator algebra b. > 80% of students answered correctly about symmetry operators in molecular symmetry studies c. > 80% of students answered correctly the basic operations of matrix algebra d. > 80% of students answered correctly the determinant question and determinant properties e. > 80% of students answered correctly the vector question f. > 80% of students answered correctly about the concepts of operators and matrices in quantum mechanics	10%	1-5

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13&14 (MKH)	Able to utilize the concept of PARTIAL DIFFERENTIAL EQUATIONS to complete chemical calculations	- Basic concepts of partial differential equations - Vibrating string - Harmonic oscillator - Particles in a rectangular box - Particles in a circular box - Hydrogen atoms	Synchronous-Off-Network/Offline Face-to-Face Lectures include: a. Lectures b. Class Interactive Discussion *c.* Review of Discussion Results	2 x 50 min	a. Gain insight and explanation of PARTIAL DIFFERENTIAL EQUATIONS through visual learning b. Interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) College students c. Obtain conformity /understanding of opinions, agreements, and joint decisions on a problem	- Explain the basic concepts of partial differential equations - Describe vibrating strings - Defining and Distinguishing Particles in Rectangular and Circular Boxes - Utilizing partial differential equations in quantum mechanics **Soft Skills:** a. Activeness b. Cooperation c. Responsibility d. Discipline accuracy and thoroughness in making questions and statements during interactive discussions	a. > 80% of students correctly answered the basic concepts of partial differential equations> 80% of students correctly answered the basic concepts of partial differential equations *b.* > 80% of college students correctly answer *the vibrating string* c. > 80% of students correctly answered particles in rectangular and circular boxes d. > 80% of students correctly answer partial differential equations in quantum mechanics	10%	1-5
FINAL EXAM									

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II. ASSESSMENT DESIGN

No	Learning outcomes	ASSIGNMENTS (Resume/Papers/Presentations/Small Projects, others[3)]	Project Based Learning	Assignment	Practicum /Tutorial	Test		
						Midterm	Final	Quiz
1	Able to use mathematical concepts and calculus in solving cases on the topic of EQUILIBRIUM	Group projects/assignments working on problems applying mathematics in chemical calculations	√	√	Tutorial	√	√	----
2	Able to use mathematical concepts and calculus in solving cases on the topic of STRUCTURE	Group projects/assignments working on problems applying mathematics in chemical calculations	√	√	Tutorial	√	√	----
3	Able to use mathematical concepts and calculus in solving cases on the topic of CHANGE	Group projects/assignments working on problems applying mathematics in chemical calculations	√	√	Tutorial	√	√	----
4	Able to use mathematical concepts and calculus in solving cases on the topic of SURFACE PHENOMENA	Group projects/assignments working on problems applying mathematics in chemical calculations	√	√	Tutorial	√	√	----

[3)]Choose one

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III. ASSESSMENT WEIGHTS

Evaluation Criteria	Score Range	Weighting (%)	Assessment	Description
I. Participatory Activities	75-85	15	Individual score	Student creativity and activities in the classroom, such as answering questions in class, responses to lecturer questions, case method learning, etc. Assessment includes activities in lectures and tutorial
II. Project Results	50-100	35	Individual score	Groups of 3-4 students - Target Project Outcome: Mathematical Chemistry Problem Bank - Project Details: 5 questions and their solutions per study material - Project Results Assessment Rubric Component • Accuracy in completing project results; • Completeness in completing project results; • Clarity in completing project outcomes; • Suitability of project results with study materials
Cognitive/Knowledge:				
Midterm	0-100	20	Individual score	Midterm Question Type • The cognitive abilities of students in this course are evaluated based on the level of knowledge/introduction (C1), understanding (C2), application (C3) and analysis (C4). • The composition of questions in the student cognitive ability evaluation activity for each level is 25%, with the assessment weight for the C4 > C3 > C2 > C1 question models • The form of exam questions is elective questions, short fill questions, active questions, or a combination of the three
Final	0-100	20	Individual score	Final exam Question Type/Type • The cognitive abilities of students in this course are evaluated based on the level of knowledge/introduction (C1), understanding (C2), application (C3) and analysis (C4).

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				• The composition of questions in the student cognitive ability evaluation activity for each level is 25%, with the assessment weight for the C4 > C3 > C2 > C1 question models • The form of exam questions is elective questions, short fill questions, active questions, or a combination of the three
Quiz	-----	-----	-----	-----
Structured Tasks	50-100	10	Group score	Groups of 3-4 students - Weekly Tasks: Questions and Solving - Task Grading Rubric Component • Accuracy in completing tasks; • Completeness in completing tasks; • Clarity in completing tasks; - Compatibility of how to complete the task with the material given in class
Practicum/ Assessment	-----	-----	-----	
Final Grades KIM 1253 Mathematical Chemistry Credits 3(2-1)		**100**		

FINAL ASSESSMENT OF COURSES

The final assessment results of KIM 1253 Mathematical Chemistry 3(2-1) are expressed by quality letters (HM) and quality scores (AM)
The final assessment of the course can be done in 3 (three) ways, namely:

1. Primary Standard Assessment System (PAP)
2. Normal Reference Assessment System (PAN)
3. Combination of Primary Standard and Normal Reference Systems

KIM 1253 Mathematical Chemistry 3(2-1) uses a combined assessment of PAP and PAN, with **the minimum passing criterion is 40 (*forty*) or the lower limit of D grades.**

Examples of Final assessments are as follows.

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Quality Letter (HM)	Score Range
A	> 75
AB	> 70−75
B	> 65−70
BC	> 60−65
C	> 50−60
D	> 40−50
E	< 40

IV. ASSESSMENT RUBRIC

A. PROJECT RESULTS

Score Range	Group Project Assessment Criteria
A (90-100)	If students can: - Complete group projects **on time** - Projects are carried out neatly**, clearly, and systematically** in their stages of work - The entire Project is done **100% true and clear** - How to complete the Project in accordance with the rules / principles of Study Materials - Problems are made creatively in the form of analysis and comprehensive
AB (70-<90)	If students can: - Complete group projects **on time** - Projects are carried out neatly**, clearly, and systematically** in their stages of work - All Projects are done **80-<100% right** - How to Complete the Project in accordance with the rules / principles of Study Materials - Problems are made creatively in the form of analysis and comprehensive
B (50-< 70)	If students can: - Completing group projects **beyond** the agreed time

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	- The project **is not** done neatly, clearly, and systematically in its stages - Project correctness is **50-<80% correct** - How to Complete the Project **is not in accordance** with the rules / principles of Study Materials - The questions are not comprehensive
Not rated	Project results that are late in submission or their correctness is below < 50%

B. STRUCTURED ASSIGNMENT

Score Range	Group Project Assessment Criteria
A (90-100)	If students can: - Complete group tasks **on time** - Tasks are carried out neatly**, clearly, and systematically** in the stages of work - All tasks are done **100% true and clear** - How to solve according to what is delivered in class
AB (70-<90)	If students can: - Complete group tasks **on time** - Tasks are carried out neatly**, clearly, and systematically** in the stages of work - All tasks are done **80-99% correct** - How to solve according to what is delivered in class
B (50-< 70)	If students can: - Complete group tasks **beyond** the agreed time - Tasks **are not** done neatly, clearly, and systematically in the stages of work - The correctness of the task **is 50-80% correct** - The method of completion **is not in accordance** with what is conveyed in class
Not rated	Late tasks are collected and their correctness is below < 50%

C. PARTICIPATORY ACTIVITIES

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Score Range	Structured Task Assessment Criteria
A (85)	If students can: - Actively involved in class discussion activities lectures and tutorials - Become **a leader in a small group** - Resolving given cases **correctly and appropriately** - Attendance in lecture classes ≥ 80% and class response 100%
AB (80)	If students can: - Actively involved in class discussion activities lectures and tutorials - Become **a member in a small group** - Resolving given cases **correctly and appropriately** - Attendance in lecture classes ≥ 80% and class response 100%
B (75)	If students can: - Actively involved in class discussion activities lectures and tutorials - Become **a member in a small group** - There are cases that are **not resolved** correctly and appropriately - Attendance in lecture classes ≥ 80% and class response 100%

V. References

Required and Supporting Textbook:

1. Steiner E. 2008. *The Chemistry Maths Book*. 2nd Ed. New York:Oxford University Press.
2. Mortimer RG. 2005. *Mathematics for Physical Chemistry*. 3rd Ed. New York:Elsevier Inc
3. Barrante J.R. 1998. *Applied Mathematics for Physical Chemistry*. 2nd Ed. New Jersey:Prentice-Hall,Inc.
4. McQuarrie DA. 2008. *Mathematics for Physical Chemistry*. New York:University Science Books
5. Atkins P dan de Paula J. 2006. *Physical Chemistry*. 8th Ed. New York: WH Freeman and Co.