

Republic of the Philippines

**SULTAN KUDARAT STATE UNIVERSITY**

Isulan, Sultan Kudarat

College of Industrial Technology

S.Y. 2023-2024



**GEC 002**

## **MATHEMATICS IN THE MODERN WORLD**

### **Syllabus**

1<sup>st</sup> Semester  
A.Y 2024 – 2025





Republic of the Philippines  
**SULTAN KUDARAT STATE UNIVERSITY**  
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### UNIVERSITY VISION

A trailblazer in arts, science and technology in the region.

### UNIVERSITY MISSION

The University shall primarily provide advanced instruction and professional training in science and technology, agriculture, fisheries, education and other relevant fields of study.

It shall also undertake research and extension services, and provide progressive leadership in its areas of specialization.

### UNIVERSITY GOAL

To produce graduates with excellence and dignity in arts, science and technology.

### UNIVERSITY OBJECTIVES

- a. Enhance competency development, commitment, professionalism, unity and true spirit of service for public accountability, transparency and delivery of quality services;
- b. Provide relevant programs and professional trainings that will respond to the development needs of the region;
- c. Strengthen local and international collaborations and partnerships for borderless programs;
- d. Develop a research culture among faculty and students;
- e. Develop and promote environmentally-sound and market-driven knowledge and technologies at par with international standards;
- f. Promote research-based information and technologies for sustainable development;
- g. Enhance resource generation and mobilization to sustain financial viability of the university.

### Program objectives and its relationship to University Objectives:

PROGRAM OBJECTIVES (PO)	OBJECTIVES	a	b	c	d	e	f	g
A graduate of Bachelor of Science in Industrial Technology can:								
a) assume professional, technical, managerial and leadership roles in industrial organizations with the desired competence in the fields of practiced such as Automotive, Architectural Drafting, Civil, Electrical, electronics, food and its allied discipline.		✓	✓					
b) innovate explicit and modern technologies in the advancement of economy, society, technology and environmental sustainability.		✓	✓	✓		✓	✓	✓
c) generate research-based information and technologies at par from international standards; and		✓	✓	✓	✓	✓	✓	
d) promote and transfer knowledge and technologies for effective and efficient school-industry partnership.			✓	✓		✓	✓	✓

- 1. Course Code** : GEC 002  
**2. Course Title** : Mathematics in the Modern World  
**3. Pre-requisites** : None  
**4. Credit** : 3 units

**5. Course Description:**

This course deals with nature of mathematics, appreciation of its practical, intellectual and aesthetic dimensions, and application of mathematical tools in daily life.

The course begins with an introduction to the nature of mathematics as an exploration of patterns (in nature and the environment) and as an application of inductive and deductive reasoning. By exploring these topics, students are encouraged to go beyond the typical understanding of mathematics as merely a set of formulas but as a source of aesthetics in patterns of nature, for example, and a rich language in itself (and of science) governed by logic and reasoning.

The course then proceeds to survey ways in which mathematics provides a tool for understanding and dealing with various aspects of present-day living, such as managing personal finances, making social choices, appreciating geometric designs, understanding codes used in data transmission and security, and dividing limited resources fairly. These aspects will provide opportunities for actually doing mathematics in a broad range of exercises that bring out the various dimensions of mathematics as a way of knowing, and test the students' understanding and capacity. (CMO No. 20, series of 2013)

**6. Course Learning Outcomes and Relationships to program Educational Objectives**

Course Learning Outcome	Program Objectives			
	a	b	c	d
At the end of the semester, the students can:				
a) Discuss and argue about the nature of mathematics, what it is, how it is expressed, represented, and used.	✓	✓	✓	✓
b) Discuss the language and symbols of mathematics.	✓	✓	✓	✓
c) Use different types of reasoning to justify statements and arguments made about mathematics and mathematical concepts.	✓	✓	✓	✓
d) Apply strategies for effective problem solving	✓	✓	✓	✓
e) Use a variety of statistical tools to process and manage numerical data, and be able to formulate significant decision.	✓	✓	✓	✓
f) Analyze codes and coding schemes used for identification, privacy, and security purposes;	✓	✓	✓	✓
g) Use mathematics in other areas such as finance, voting, health and medicine, business, graphs, environment, arts and design, and recreation.	✓	✓	✓	✓
h) Appreciate the nature and uses of mathematics in everyday life.	✓	✓	✓	✓
i) Affirm honesty and integrity in the application of mathematics to various human endeavor.	✓	✓	✓	✓

## 7. Course Content

Course Objectives, Topics, Time Allotment	Desired Student Learning Objectives	Outcome-Based Assessment (OBA) Activities	Evidence of Outcomes	Course Outcomes	Program Objectives	Values Integration
<b>Topic: VMGO, Classroom Policies, Course Overview, Course Requirements, Grading System (1.5 hour)</b>						
Explain VMGO of the SKSU, classroom policies, scope of the course, course requirements and grading system.	Student can be aware of the SKSU VMGO, classroom policies, scope of the course, course requirements and grading system.	<ul style="list-style-type: none"> <li>Class Discussion</li> <li>Student's Feed backing</li> </ul>	<ul style="list-style-type: none"> <li>Individual Recitation</li> </ul>			Value of Responsibility
<b>Section 1: The Nature of Mathematics (22 hours)</b>						
<i>Part I. Mathematics in our World (4 hours)</i>						
1.1 Identify the mathematical patterns and numbers found in nature and the World such as symmetry in snowflake and tessellation in honeycomb; tiger's stripes and hyena's spots; Fibonacci sequence in the sunflower, snail's shell, flower petals; Exponential Growth Model in world's population, the weather, fractals in ferns ,etc.	The students can identify nature that exhibits different patterns and regularities in the world.	<ul style="list-style-type: none"> <li>Video-watching</li> <li>Heads Together: Small-Group Sharing</li> </ul> <p>Assignment for topics (1.2 A &amp; B): Individual Collage</p>	<ul style="list-style-type: none"> <li>Group Output Presentation of Selected Pattern Rubric</li> </ul>	a, h, i	a, b, c, d	Value of Self-confidence, Open-mindedness and Insightfulness
1.2 A. Articulate how Mathematics helps organize patterns and regularities and predict behaviour of nature and phenomena and control its occurrences	The students can articulate the importance of mathematics in one's life.	<ul style="list-style-type: none"> <li>Option 1: Collage of daily life, new discoveries, technological discoveries, phenomenon</li> </ul>	<ul style="list-style-type: none"> <li>Individual Output Presentation Rubric</li> </ul>			Value of Creativity, Hardwork, Patience

1.2	B. Perform numerous applications of Mathematics in the world making it indispensable.	The students can perform numerous applications of Mathematics and express appreciation for mathematics as a human endeavour.	Option 2: Concept Mapping Group 1: daily Life Group 2: New Discoveries Group3: Technological Breakthroughs Group 4: Natural Phenomenon	<ul style="list-style-type: none"> <li>• Group Output Presentation Rubric</li> </ul>				Value of Responsiveness, Collaboration
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**Part II. Mathematical Language and Symbols (10 hours)**

1.3	Explain the characteristics of mathematical language (precise, concise, powerful), formality and convention	The students can discuss the language, symbols, and convention of mathematics and explain and appreciate the nature of mathematics as a language.	<ul style="list-style-type: none"> <li>• Heads Together: Individual or small group exercises including games</li> </ul>	<ul style="list-style-type: none"> <li>• Group Output Rubric</li> </ul>	b, h, i	a, b, c, d	Value of Activeness and Teamwork
1.4	Perform the proper translation and writing of mathematical expressions and sentences	The students can perform operations on mathematical expressions correctly and acknowledge that it is a useful language	<ul style="list-style-type: none"> <li>• Heads Together-Divergent Thinking: Concept Map</li> </ul> <p>Group Report Assignment: Group 1: Sets Group2: Relations Group 3: Functions Group 4: Binary Operations</p>	<ul style="list-style-type: none"> <li>• Group Report Rubric</li> </ul>			Value of Participation, Teamwork and Unity
1.5	Explain the four basic concepts: sets, functions, relations, and binary operations	The students can explain the four basic concepts such as sets, functions, relations and binary operations.	<ul style="list-style-type: none"> <li>• Group Reporting</li> </ul>	<ul style="list-style-type: none"> <li>• Group Output Rubric</li> </ul>			Value of Accountability and Teamwork

1.6 Apply elementary logic: connectives, quantifiers, negation and variables	The students can correctly apply connectives, quantifiers, negation and variables in making valid arguments.	<ul style="list-style-type: none"> <li>Board work</li> </ul>	<ul style="list-style-type: none"> <li>Quiz</li> </ul>				Value of Self-reliance
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### Part III. Problem Solving and Reasoning (8 hours)

1.7 Use the two types of reasoning-inductive and deductive to justify statements and arguments	The students can use different types of reasoning to justify statements and arguments made about mathematics and mathematical concepts.	<ul style="list-style-type: none"> <li>Group Activity (Brainstorming and Argument-Construction)</li> </ul>	<ul style="list-style-type: none"> <li>Group Presentation of Constructed Arguments Rubric</li> </ul>	c, d, h, i	a, b, c, d		Value of Collaboration
1.8 Writing basic kinds of mathematical statements and construction of their logical proofs.	The students can write clear and logical proofs.	<ul style="list-style-type: none"> <li>Sticky Notes Graph: Organizing Statements in Forming the Proof of Mathematical Statement</li> </ul>	<ul style="list-style-type: none"> <li>Students' Organized Proof</li> </ul>				Value of Logical Thinking
1.9 Solve different mathematical and recreational problems and following Polya's four steps of problem solving strategies	<p>The students can solve problems involving patterns and recreational problems following Polya's four steps.</p> <p>The students can organize one's methods and approaches for proving and solving problems.</p>	<ul style="list-style-type: none"> <li>Cooperative Learning (Group Effort in Solving Problems)</li> </ul>	<ul style="list-style-type: none"> <li>Presentation of Group Output Rubric</li> </ul>				Value of Cooperation and Interdependence

### Section 2: Mathematics as a Tool (27.5 hours)

#### Part I. Data Management (12 hours)

2.1 Perform the basic concepts in Descriptive Statistics, and discuss Normal Distribution, Hypothesis Testing, Regression and Correlation, Least Squares Lines and Chi-square	The students can use variety of statistical tools to process and manage numerical data.	<ul style="list-style-type: none"> <li>Practical Activity: Data Gathering and Data Description/Interpretation with Computer Application</li> </ul>	<ul style="list-style-type: none"> <li>Survey Result</li> <li>MS Excel Output</li> </ul>	e, h, i	a, b, c, d	Value of Persistence and Effective Communication
2.2 Plan or conduct an experiment or study (optional)	The students can plan or conduct their own experiment or study and make important decisions with the use of statistical data.	Group Action Research	<ul style="list-style-type: none"> <li>Group Output Rubric</li> </ul>			Value of Accuracy and Exploration

*Part II. Mathematics as a Tool Choose 2-3 topics only. (15.5 hours)*

<b>2.3 GEOMETRIC DESIGNS</b>						
2.3.a Recognize and analyze geometric shapes	The students can apply geometric concepts in describing and creating designs	<ul style="list-style-type: none"> <li>Brainstorming</li> </ul>	<ul style="list-style-type: none"> <li>Output may be in a form of stitching, drawing or any form of artwork</li> </ul>	g, h, i	a, b, c, d	Value of Awareness
2.3.b Identify different transformations, patterns and diagrams, designs, arts and culture	The students can identify different transformations of geometric figures and contribute to the enrichment of the Filipino culture and arts using the concepts in Geometry	<ul style="list-style-type: none"> <li>Create geometric designs using transformations</li> </ul>	Rubric			Value of Creativity and Hardwork
<b>2.4 CODES</b>						
Define binary codes, integers in computers, logic and computer addition, text data, errors and error correction, error detecting codes, repetition and hamming codes	<p>The students can define bits and binary systems and decipher binary codes.</p> <p>The students can convert decimal numbers to binary and vice versa.</p>	<ul style="list-style-type: none"> <li>Games: Code-Cracking, Cryptography</li> </ul>	<ul style="list-style-type: none"> <li>Individual Student Output</li> </ul>	Rubric		Value of Perseverance and Confidentiality

	<p>The students can use coding schemes to encode and decode different types of information for identification, privacy, and security purposes.</p>				
<p><b>2.5 LINEAR PROGRAMMING</b> Determine Linear Inequalities, Geometry of Linear Programming</p>	<p>The students can determine of linear inequalities and systems of linear inequalities.</p> <p>The students can determine the optimal solution of a linear programming problem using the graphical method and the simplex method.</p>	<ul style="list-style-type: none"> <li>• Boardwork &amp; Quiz</li> </ul>	<p>Individual Student Output</p>		<p>Value of Self-Reliance</p>
<p><b>2.6 THE MATHEMATICS OF FINANCE</b> Compute simple and compound interest, credit cards and consumer loans, stocks, bonds and mutual funds and home ownership</p>	<p>The students can apply the different concepts of mathematics of finance in making wise decisions related to personal finance.</p> <p>The students can support the use of Mathematics in financial aspects and endeavors in life.</p>	<ul style="list-style-type: none"> <li>• Pair-Share Activity (Problem Solving)</li> </ul>	<ul style="list-style-type: none"> <li>• Pair Output Presentation</li> </ul>		<p>Value of Teamwork</p>
<p><b>2.7 APPORTIONMENT AND VOTING</b> Introduce apportionment and voting and discuss weighted voting systems</p>	<p>The students can describe the basic notions of apportionment and voting, and apply the different</p>	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Survey</li> </ul>	<ul style="list-style-type: none"> <li>• Student Individual Quiz</li> <li>• Pair Output</li> </ul>		<p>Value of Self-Confidence</p>

<p><b>2.8 THE MATHEMATICS OF GRAPHS</b></p> <p>2.8.a Define graphs and basic concepts</p> <p>2.8.b Construct connectedness in graph</p> <p>2.8.c Apply the Euler's path and Euler's circuit in solving real-world problems</p> <p>2.8.d Find Hamiltonian circuit in weighted graph</p> <p>2.8.e Verify planarity and Euler's formula in a graph</p> <p>2.8.f apply the concept of graph coloring</p>	<p>methods of apportionment and different voting systems.</p> <p>The students can define basic terms and concepts in graph theory.</p> <p>The students can construct the graph of the given information involving connectedness.</p> <p>The students can apply the concepts of Euler's path and Euler's circuit in solving real-world problems.</p> <p>The students can find Hamiltonian circuit in a weighted graph.</p> <p>The students can verify planarity in a given graph and verify Euler's formula for the planar graphs</p> <p>The students can use the concepts of graph to color a map, determine the chromatic number of a graph and apply the concepts of graph coloring in making schedules or events</p> <p>The students can recognize that graph theory has many</p>	<ul style="list-style-type: none"> <li>• Lecture/ Quiz</li> <li>• Pair-Share</li> <li>• Small Group Activity (Seatwork)</li> <li>• Problem Set</li> </ul>	<ul style="list-style-type: none"> <li>• Group Output</li> <li>• Group Accomplished Output</li> <li>• Group Output Report</li> <li>Rubrics</li> </ul>			<p>Value of Self-Reliance</p> <p>Value of Cooperation</p> <p>Value of Dependability</p> <p>Value of Diligence and Collaboration</p>
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<p><b>2.9 MATHEMATICAL SYSTEMS</b></p> <p><b>2.9.a Understand and solve modular arithmetic and its applications</b></p> <p><b>2.9.b Introduce Group Theory</b></p>	<p>varied applications in our world.</p> <p>The students can understand the basics of modular arithmetic.</p> <p>The students can recognize the mathematical systems as tools which can be used in real-world contexts.</p> <p>The students can solve arithmetic operations using modular arithmetic rules.</p> <p>The students can solve application problems involving modular arithmetic.</p> <p>The students can encrypt and decrypt secret messages using modular arithmetic.</p> <p>The students can solve problems relating to cryptology.</p> <p>The students can verify the properties of a group.</p> <p>The students can perform operations of a symmetry group.</p> <p>The students can perform an operation in a permutation group.</p>	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Small Group Problem Solving</li> </ul>	<ul style="list-style-type: none"> <li>• Students' Output</li> </ul>			<p>Value of Cooperation and Hardwork</p> <p>Value of Responsiveness and Diligence</p>
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<b>2.10 LOGIC</b>	The students can determine the validity of different propositions						
2.10.a Determine propositions and its validity	The students can apply the concepts of logic in real-life arguments	• Critiquing					
2.10.b Apply logic in real-life							Value of Critical-thinking
<b>TOTAL: 54 hours</b>							
Lectures: 51 hours							
Examination (Midterm and Final): 3 hours							

## 8. Course Evaluation

### Course Requirements:

- Attendance
- Major Exams (Midterm and Final)
- Recorded Problem Sets, Quizzes and all other outputs
- Research Paper (Optional)

### Grading System:

#### MIDTERM

- |  |               |
|--|---------------|
| 1. Quizzes                                       | - 30 %        |
| 2. Class Participation/Seatworks/<br>Assignments | - 15 %        |
| 3. Midterm Exam                                  | - 50 %        |
| 4. Attendance                                    | - 5 %         |
| <b>Total</b>                                     | <b>- 100%</b> |

#### FINAL TERM

- |  |               |
|--|---------------|
| 1. Quizzes                                       | - 30 %        |
| 2. Class Participation/Seatworks/<br>Assignments | - 15 %        |
| 3. Final Exam                                    | - 50 %        |
| 4. Attendance                                    | - 5 %         |
| <b>Total</b>                                     | <b>- 100%</b> |

$$(\text{Midterm Grade} + \text{Final Term Grade})/2 = \text{Final Grade}$$

### Schedule of Examination

Midterm	-
Final Term	-

## 9. References:

### Textbooks:

1. Calingasan, R., et al (2018). *Mathematics in the Modern World*. C & E Publishing Inc.
2. Earnhart, R. & Adina, E. (2018). *Mathematics in the Modern World (Outcome-Based Module)*. C & E Publishing Inc.
3. Aufmann, R., et al. (2013). *Mathematical Excursions* (3<sup>rd</sup> ed.) USA: Brooks/Cole, Cengage Learning
4. Alejan, R., et al. (2018). *Mathematics in the Modern World*. Philippines, Mutya Publishing House, Inc.
5. Bluman, A. G. (2012). *Elementary Statistics: A Step-by-Step Approach (Eighth Edition)*. New York, NY: McGraw-Hill Companies, Inc.
6. Capitulo, F.M. & Cruz, C.U., Mathematics of Investment: A Simplified Approach
7. Diaz, E., Lectures on Mathematics of Voting and Apportionment
8. Douglas, B. West, Introduction to Graph Theory, 2<sup>nd</sup> ed.
9. Gerstein. Introduction to Mathematical Structures and Proofs
10. Hardy, Richman & Walker, Applied Algebra: Code, Ciphers, and Discrete Algorithm
11. Koshy, T. (2007). *Elementary Number Theory with Applications*. 2<sup>nd</sup> ed. USA: Elsevier Inc.
12. Levine, Berenson & Stephan (2002). Statistics for Managers Using Microsoft Excel (3rd edition). Upper Saddle River, NJ: Prentice Hall
13. Rosen, K. (2005). *Number Theory and Its Application*. 5<sup>th</sup> ed. USA: Pearson Addison Wesley
14. Tapot, M.F.L. (2022) Mathematics in the Modern World. Dasmariñas, Cavite: IM Innovative Book Publishing House.
15. Walpole, R(1982), Introduction to Statistics (Third Edition), Macmillan Publishing Co., Inc.

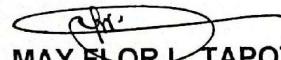
### Supplemental:

1. Hersh, R. What is Mathematics Really?
2. Stewart, Ian, Natures Number
3. Jamison R. E. (2000) Learning the Language of Mathematics, Language and Learning Across the Disciplines
4. Averbach and Chein. *Problem Solving through Recreational Mathematics*
5. Sundstrom. Mathematical Reasoning: Writing and Proofs
6. Moser and Chen, Student's Guide in Coding and Information Theory
7. Paar & Pelzl, Understanding Cryptography
8. [http://www.onemathematicalcat.org/cat\\_book.htm](http://www.onemathematicalcat.org/cat_book.htm)
9. <https://wac.colostate.edu/llad/v4n1/jamison.pdf>

**Videos:**

1. <https://youtu.be/kkGeOWYOFoA>
2. <https://vimeo.com/9953368>
3. The Math Mystery: Mathematics in Nature and Universe (Youtube Video)

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