COURSE OUTLINE Math 1115 Fundamental Mathematics for the General Sciences I GROUP 1

Course Staff

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Level

First level undergraduate service course

Semester

Semester I, II and Summer

No. of Credits

3 Credits

Pre-requisites

None. Students with any two units of Cape advanced level mathematics (or equivalent), AGRI 1003 (Mathematics for Scientists) and/or MATH 0100 (Pre-Calculus) will **not receive credits** for this course.

Course Rationale

Over the years, we have observed that students entering the Faculty of Science and Technology without having done Cape Advanced level mathematics have a general deficiency in basic mathematical skills. This course has been specially crafted to address this problem. This foundation course is designed to meet the demands of several disciplines within the Faculty of Science and Technology that do not have their own courses in basic mathematics. The Faculty of Science and Technology has seen it necessary to ensure that entering students possess the necessary mathematical skills to excel in their chosen discipline within the Faculty, without having to take courses specifically designed for students of Mathematics.

Students wishing to enter the Faculty of Science and Technology without the necessary CSEC Mathematics qualifications will be given the option to take and pass the course "Fundamental Mathematics for the General Sciences I" during the summer semester in order to matriculate into the Faculty.

Students with any two units of Cape Advanced Level Mathematics or equivalent will not receive credits for this course. It should be noted that this course **cannot be considered** as a substitute or a pre-requisite for any of the courses offered by the Department of Mathematics and Statistics.

Course Description

The main objective of this course is to provide entering undergraduate students with a set of mathematical tools and methods that can be applied to their scientific field of choice.

The major topics will be prefixed by typical mathematical problems that arise frequently in practical applications of the varying fields of science. As a service course in Mathematics, it should be considered as a broad introduction of the typical methods utilized in the applied sciences for solving problems. Little attention will be given to the underlying concepts of mathematical theory during lecture hours. Emphasis will be placed on the use of Microsoft Excel as a tool for the presentation of data in Laboratory Reports.

A sound knowledge of all concepts from CSEC Mathematics will be assumed. It should be stressed that it is **not meant to be** a pre-requisite for any other mathematics course offered by the Department of Mathematics and Computer Science.

Learning Outcomes

Upon successful completion of the course, students will be able to:

- Solve problems that arise in their own field of study, by making use of the basic mathematical concepts outlined in the course.
- Recognize types of numbers (Naturals, Integers, Rationals, Reals, Complex).
- Determine the number of significant figures in an answer.
- Round off numbers to a given number of decimal places.
- Utilize scientific notation.

- Maintain precision and accuracy in numerical calculations.
- Solve simple equations and inequalities.
- Manipulate numbers: negatives, absolutes, fractions, decimals and percentages.
- Calculate ratios and proportions.
- Evaluate factorials, reciprocals and exponentials.
- Utilize the basic rules of indices and logarithms.
- Find the inverse of a function.
- Manipulate trigonometric functions and their graphs.
- Utilize common trigonometric identities.
- Solve trigonometric equations, quadratics and polynomial equations.
- Utilize the remainder theorem.
- Simplify fractions via the rules of partial fractions.
- Calculate gradients and intercepts.
- Produce a suitable graphical representation of data using Microsoft Excel (e.g. box and whisker plots, contour plots, log-log plots, histograms, scatter plots).
- Calculate percentage errors and determine error propagation in calculations.
- Determine the mean and standard deviation for a set of data.
- Interpret measures of central tendency.
- State and use the basic rules of probability.
- Interpret normal and binomial distributions.
- Utilize the chi-squared test.

Course Content

Algebra, Functions, Numerical Concepts:

- Types of numbers (Naturals, Integers, Rationals, Reals, Complex). Significant figures, decimal places, scientific notation. Precision and accuracy. Negative numbers. Absolute numbers. SI system of units, usage and prefixes (Examples: surface area, volume etc.)
- Manipulating numbers: fractions and decimals. Adding, subtracting, multiplying and dividing fractions. Calculating percentages, ratios and proportions. Factorials. Solving simple inequalities.
- Rules of indices, logarithms (example: calculating pH scales) and exponentials. Functions and inverse functions. Solving simultaneous equations.
- Trigonometric functions and their graphs. Common trigonometric identities. Solution of trigonometric equations.
- Partial fractions. Solving quadratic equations.
- Remainder theorem. Solving polynomial equations.

Data Analysis:

- Calculation of gradients and intercepts. Dependent and independent variables. Extrapolation techniques. Line of best fit.
- Error analysis.

Basic Statistics:

- Introduction to descriptive statistics. Common types of graphical data representation.
- Mean, median, mode and standard deviation.
- The normal and binomial distributions. The chi-squared test.

Teaching Methodology

Lectures: Two (2) lectures each week (50 minutes each).

- <u>Please see the online timetable with the respective lecture time for your ASSIGNED GROUP.</u> <u>http://www2.sta.uwi.edu/timetable/m17329.pdf</u>
- <u>GROUP ALLOCATIONS can be found on the Notice boards of the Department of Mathematics and Statistics</u>

<u>**Tutorials**</u>: One (1) tutorial each week (50 minutes each) – These tutorials will serve as a forum for discussing concrete example, solution to assignment problem sheets and coursework exams.

- <u>Please see the timetable with the respective tutorial times for your ASSIGNED GROUP.</u>
- Each group has 3 tutorials assigned to it, for example, G1 T1, G1 T2 and G1 T3 means there are three (3) tutorial groups for Group 1.
- You will be assigned **ONE** tutorial time to attend. Please attend the tutorial time assigned to you.
- Tutorials begin in Week of September 19th 2016.

Computer Labs: Two mandatory 2- hour practical computer lab sessions in EXCEL.

- <u>Please see the timetable with the respective lab times.</u>
- You will be assigned ONE lab session to attend for EACH lab
- <u>Labs begin in October (Week 7 or 8, depending on the group you are placed in -2 Wednesdays or 2</u> <u>Saturdays).</u>

Assessment

Final Examination (one 2-hour written paper) – 50% Coursework – 50%

- Two 1-hour coursework examinations each worth 15% (total of 30%)
- Six problem sheets 10% total
- Two computer lab worksheets 10% total

Approximate Course Calendar

Week	Lecture subjects	Assessment
1	Algebra, Functions, Numerical Concepts: Types of numbers (Naturals, Integers, Rationals, Reals, Complex). Significant figures, decimal places, scientific notation. Precision and accuracy. Negative numbers. Absolute numbers. SI system of units, usage and prefixes (Examples: surface area, volume etc.). Rules for Rounding off after calculations.	None
2	Algebra, Functions, Numerical Concepts: Manipulating numbers: fractions and decimals. Adding, subtracting, multiplying and dividing fractions. Calculating percentages, ratios and proportions. Factorials. Solving simple inequalities.	Assignment 1
3	Algebra, Functions, Numerical Concepts: Rules of indices, logarithms (example: calculating pH scales) and exponentials. Functions and inverse functions. Solving simultaneous equations.	
4	Functions: Functions, relations, and inverse functions. Composition of functions. Logarithmic and exponential functions and their graphs.	Assignment 2
5	Algebra, Functions, Numerical Concepts: Trigonometric functions and their graphs. Common trigonometric identities. Solution of trigonometric equations.	Assignment 3
6	Algebra, Functions, Numerical Concepts: Partial fractions. Solving quadratic equations.	Coursework Exam #1
7	Algebra, Functions, Numerical Concepts: Remainder theorem. Solving polynomial equations.	Assignment 4
8	Data Analysis: Dependent and independent variables. Extrapolation techniques. Coordinate Geometry. Line of best fit. Error.	
9	Probability: Sample spaces. Mutually exclusive events. Combinations. Calculation of probabilities.	Computer Lab #1
10	Statistics : Introduction to descriptive statistics. Frequency distributions. Measures of central tendency. Mean, median, mode and standard deviation	Assignment 5
11	Statistics: The binomial and normal distribution.	Computer Lab #2 Coursework Exam #2
12	Statistics: The chi-squared test.	Assignment 6

Required Reading

Essential Text

• Fundamental Mathematics for the General Sciences'' by Dr. Dayle Jogie and Dr. Donna Comissiong (Available in the Department of Mathematics and Statistics).

Other Suggested Texts / References

• E. Campbell, **Pure Mathematics for CAPE Vol.1**, LMH Publishing Ltd, 2007. (Available in the UWI Bookstore).

- M. Aitken, B. Broadhurst, S. Hladky, **Mathematics for Biological Scientists**, Garland Science Textbooks, Taylor & Francis Group, 2009.
- P. Tebbutt, **Basic Mathematics for Chemists**, (2nd Edition) Wiley, 1998.
- D. W. Ball, Essential Algebra for Chemistry Students, Brooks Cole, 2nd Edition, 2005.
- A. D. Polyanin, A. V. Manzhirov, Handbook of Mathematics for Engineers and Scientists, Chapman and Hall/CRC; (1st Edition), 2006.
- D. W. Ball, Essential Algebra for Chemistry Students, Brooks Cole, 2nd Edition, 2005.