THE UNIVERSITY OF THE WEST INDIES
ST. AUGUSTINE, TRINIDAD AND TOBAGO
**COURSE OUTLINE**

## SECTION A. GENERAL COURSE INFORMATION

**Faculty:** Faculty of Social Sciences
**Department:** Department of Economics
**Course Code and Title:** ECON 1004 – Mathematics for Economics II
**Semester:** 1 & 2
**Level:** Undergraduate, Level I

**Pre-requisites:** ECON 1003 (*or equivalent exemption*)
**Co-requisites:** None
**Anti-requisites:** None

**Course Type:** Core
**Credits:** 3
**Mode of Delivery:** Face-to-Face (F2F)

## SECTION B. LECTURER INFORMATION

**Lecturer**: Dr. Benjamin Ramkissoon
**Contact Office Hours**: Mondays 12-1pm, Fridays 12-1pm
**Email address**: Benjamin.Ramkissoon@uwi.edu

## SECTION C. COURSE DESCRIPTION

**Letter to the Student**
Welcome to Mathematics for Economics II.

This course will be delivered with the support of the myeLearning website (The UWI's Learning Management System (LMS)/Virtual Learning Environment (VLE)). This website should be visited frequently by each student to access things such as Tutorial Registration, Course Resources, Forum Messages from the Lecturer(s), Coursework Grades, Tutorial Assignments, Links to Videos, Solutions to Coursework Examinations and Course Notices.

You are reminded that courses such as Mathematics require a mix of learning approaches. You will be required to read the materials from the course texts prior to the lecture, participate in the in-class discussion of that material and supplement both these activities with a second reading and group discussion of the course text and related materials provided via links on the course website. Such reading and discussion must be followed by the solving of problems on the tutorial assignments. Cooperative learning is a MUST for a course such as ECON 1004. In this course, you must be able to develop logical solutions to problems utilizing the course content, knowledge

of some Level I Economics concepts and the jargon of mathematics. This requires retooling, commitment, perseverance and practice. Please ensure that you allocate an adequate amount of your time and effort to developing your problem-solving and critical-thinking skills. Remember to apply yourself consistently from the first week!

## 1. Course Description

The course is organized around two areas of Mathematics for Economics namely, Linear Algebra and Calculus. This course builds on students' understanding of mathematics as gained at the upper-secondary/advanced-secondary level or in ECON 1003 and exposes them to mathematical concepts that underpin the mathematical models that will be encountered in the Level II/III courses in the B. Sc. Economics Major and Special Programmes.

## 2. Rationale

Economics relies on mathematical methods to represent relationships, analyse change, solve optimisation problems, and study systems of interdependent variables. Mathematics for Economics II builds on the foundation developed in ECON 1003 or equivalent advanced-secondary mathematics and strengthens students' ability to use calculus and linear algebra in economic analysis. The course is designed as a bridge between introductory mathematical methods and the more technical requirements of Level II and Level III courses in Economics, including Statistical Methods, Matrix Algebra, Mathematics for Economics III, and Econometrics. Emphasis is placed on mathematical reasoning, problem setup, interpretation, and the communication of solutions in economic contexts.

## 3. Course Aims/Goals

This course aims to strengthen students' ability to understand and use the mathematical symbols, terminology, and methods commonly used in economic analysis. It aims to develop students' ability to interpret mathematical notation, apply calculus and linear algebra to economic problems, solve structured quantitative problems, and communicate mathematical reasoning clearly. The course also aims to prepare students for subsequent quantitative courses in the Economics programme by emphasizing the use of mathematics to analyse change, accumulation, optimisation, and systems of relationships.

## 4. UWI Graduate Outcomes Targeted by this Course

- A Critical and Creative Thinker
- An Effective Communicator with Good Interpersonal Skills
- IT-skilled and Information Technology Literate
- Innovative and Entrepreneurial
- Socially, Culturally and Environmentally Responsible and Guided by Strong Ethical Values

## 5. Course Learning Outcomes

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

1. Calculate limits of functions and identify points of discontinuity.
2. Apply differential calculus to analyse function behaviour and solve single-variable optimization problems in economic contexts.
3. Evaluate definite and indefinite integrals and apply integration to economic applications including consumer and producer surplus and the recovery of functions from their marginal counterparts.
4. Solve selected first-order differential equations and interpret their role in simple dynamic economic models.
5. Perform matrix and vector operations and solve simultaneous systems of linear equations using Gauss-Jordan elimination and Cramer's Rule.
6. Analyse selected properties of matrices and vectors, including linear independence, definiteness, eigenvalues and eigenvectors.
7. Compute and interpret partial derivatives and total differentials in multivariate functions.
8. Solve selected optimisation problems for functions of two variables.

## 6. Teaching & Learning Strategies

The course will be delivered by way of lectures, in-class problem solving activities, tutorials, Q&A sessions, graded activities, and consultations with the Lecturer(s) and Tutor(s) between successive classes. Students will be provided with four contact hours weekly; two for lectures on new material; one for in-class problem solving/CW assessment and one for tutorials. In addition, the Course Lecturer(s) will be available for Office Hours/Consultations during specified hours or by appointment. Participation in class discussions and problem-solving activities is a critical input to the feedback process within a lecture or tutorial. The rules of engagement for these discussions will be defined by the Course Lecturer(s) and/or Tutor(s) at the first lecture and first tutorial respectively. Q&A sessions will be administered from time to time by the Course Lecturer(s) during each lecture. These are aimed at assisting the student to focus on and clarify key concepts discussed during the previous lecture or the current lecture.

Across all topics, students will be guided through a common problem-solving routine: identify the problem, set up the relevant function/equation/system, apply the appropriate method, check the logic of the solution. This routine will be reinforced in lectures, tutorials, and coursework feedback.

Tutorial assignments are designed to help students flesh out concepts and practice the application of the logic and concepts to a range of problem situations. These are important in this course since they provide the basis for formal practice and assist in reinforcing the concepts introduced in lectures. It is expected that students will also use the texts and recommended references. Every effort should be made to complete each tutorial sheet within the time indicated on the sheet.

Students are advised to read through each tutorial assignment to identify the concepts required for its solution prior to revising the concepts so identified; it is only after such revision that you should proceed to attempt the solutions. Some questions in an assignment sheet will be solved in one attempt; others will require more than one attempt. Students are encouraged to adopt co-operative learning approaches (i.e. working with another student or students) to solve the more challenging questions in the tutorial sheet. A student should not come to a tutorial class unprepared to contribute to the class proceedings. If after the individual effort and the co-operative learning effort, the student feels challenged by a question(s), they owe it to themselves to seek out the Course Lecturer(s) or Tutor(s) for guidance and assistance.

| # | Method/Strategy | Description |
|---|---|---|
| 1 | Lectures | These weekly sessions will be interactive sessions in which the course content will be explained and demonstrated. Students will also be able to apply and practice the skills learnt in the lecture. |
| 2 | Tutorials | These sessions are designed to help students flesh out concepts and practice the application of the logic and concepts to a range of problem situations. |

**Contact Hours**

| Type | Number of Weeks | Contact Hours | Credit Hours |
|---|---|---|---|
| Lectures | 12 | 36 | 2 |
| Tutorials | 11 | 11 | 1 |
| **Total** | 12 | 47 | 3 |

## 7. Course Assessments Description

Students will be assessed through a combination of continuous assessment and a final written examination. The coursework component is worth 40% of the overall course grade. The coursework component is comprised of the following activities: a Diagnostic Exercise, Graded In-Class Assessments, and a Participation Grade. The final examination is worth the remaining 60%. Students will be expected to demonstrate the Learning Outcomes of the course during the final examination. Detailed information about coursework is given below:

Diagnostic & Reflective Activity (4%): Each student is required to complete a Diagnostic Exercise. This activity will provide first-time students reading the course with an opportunity to revisit key concepts and methods captured in earlier mathematics courses. For repeating students, the Diagnostic Exercise will provide an opportunity to review their strengths and weaknesses in the content of ECON 1004. There are two (2) deliverables for this diagnostic activity:

- Deliverable #1: Students will have two weeks from the start of classes to attempt and submit the solutions to a previous ECON 1003 Final Examination Paper (for first-time students), or to a previous ECON1004 Final Examination Paper (for repeating students). Note that this activity is Open Book and you are encouraged to go back to

your lecture notes, tutorials and textbooks, and revisit the material for each question before attempting to solve the question. In this way, you will benefit from some much-needed revision and priming in preparation for the delivery of ECON 1004.

- Deliverable #2: Students will be provided with a soft copy of the Solutions to the Examination Paper. On receipt of the solutions, students must access their submissions, undertake their own evaluation of their solutions, identify their errors and areas of weakness. Students will be required to write a concise summary (1/2 page to 1 page) of the weaknesses identified and the corrective strategy. This is to be handed up via hard copy in class in Week 4.

In-Class Assessments (26%): Students will complete four scheduled in-class assessments, each no longer than 45 minutes. Assessments 1-3 will be closed-book tests based on selected material from Units 0-3. The best two scores from Assessments 1-3 will count for 20% of the course grade. Assessment 4 will be an open-book in-class assessment based primarily on Unit 4 of the course and will count for 6% of the course grade. The dates of these assessments are tentatively scheduled in the course calendar. Students will be encouraged to review the solutions to the assessments and subsequently engage the Lecturer(s) and Tutor(s) by way of consultation consistently over the semester for discussion on concepts and approaches to problem solving. Experience has shown that students, who are so engaged, perform well.

In-Class Participation (10%): Students will be awarded a participation grade based on their attendance/punctuality, weekly preparation of tutorial sheets, and for contribution to class discussions. Contribution does not require giving perfect answers; it includes asking relevant questions, attempting assigned problems, explaining steps, participating in any group work, and responding constructively during tutorial discussions.

## 8. Course Assessment Type and Course Learning Outcome Matrix

| # | Assessment Title & Type | Learning Outcomes | Assessment Weight % |
|---|---|---|---|
| 1 | Diagnostic Activity | n/a | 4% |
| 2 | In-Class Assessments | 1-8 | 26% |
| 3 | Tutorial Participation Grade | 1-8 | 10% |
| 4 | Final Exam | 1-8 | 60% |

## 9. University Grading Scheme (Undergraduate Level)

| Grade | Percent |
|---|---|
| A+ | 90 – 100 |
| A | 80 – 89 |
| A- | 75 – 79 |

| Grade | Percent |
|---|---|
| B+ | 70 – 74 |
| B | 65 – 69 |
| B- | 60 – 64 |

| Grade | Percent |
|---|---|
| C+ | 55 – 59 |
| C | 50 – 54 |

| Grade | Percent |
|---|---|
| F1 | 40 – 49 |
| F2 | 30 – 39 |
| F3 | 0 – 29 |

## 10. Readings/Learning Resources

*Required/Essential*

- Haeussler, Ernest F., Richard S. Paul, and Richard J. Wood. 2022. Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences. 14th ed. Pearson. **OR**
- Barnett, Raymond A., Ziegler, Michael R., Byleen, Karl E., and Christopher J. Stocker. 2019. College Mathematics for Business, Economics, Life Sciences, and Social Sciences. 14th ed. Pearson Education.

*Highly Recommended*

- Sydsæter, Knut, Peter J. Hammond, Arne Strøm, and Andrés M. Carvajal. 2016. Essential Mathematics for Economic Analysis. 5th ed (or most recent). Pearson.

*Complementary Problems Books*

- Todorova, Tamara. 2011. Problems Book to Accompany Mathematics for Economists. John Wiley & Sons.
- Dowling, Edward T. 2001. Schaum's Outline of Introduction to Mathematical Economics. 3rd ed. McGraw-Hill.
- Peña-Lévano, Luis Moisés. 2022. Schaum's Outline of Mathematical Methods for Business, Economics, and Finance. 2nd ed. McGraw-Hill.

*Reference Texts*

- Hoy, M., Livernoir, J., McKenna, C., Rees, R., and T. Stengos. 2011. Mathematics for Economics. 3rd ed. MIT Press.
- Turkington, Darrell. 2009. Mathematical Tools for Economics. 2nd ed. Blackwell Publishing.
- Anthony, Martin, and Norman Biggs. 1996. Mathematics for Economics and Finance: Methods and Modelling. Cambridge University Press.
- Sydsæter, Knut, Peter J. Hammond, Atle Seierstad, and Arne Strøm. 2008. Further Mathematics for Economic Analysis. 2nd ed (or most recent). Pearson.
- Chiang, Alpha C., and Kevin Wainwright. 2005. Fundamental Methods of Mathematical Economics. 4th ed. McGraw-Hill/Irwin.
- Simon, Carl P., and Lawrence Blume. 1994. Mathematics for Economists. W. W. Norton & Company.

Sydsæter's "Further" text, Chiang & Wainwright, and Simon & Blume provide more rigorous treatments of several topics and are recommended for students who want deeper mathematical preparation (useful for higher-level math courses, or preparation for postgraduate study in Econ).

## STUDENT SUCCESS & SUPPORT

### 11. University Policies and Expectations

#### A. Academic Integrity

The UWI is committed to five fundamental values: honesty, trust, fairness, respect and responsibility (The UWI Turnitin Policy). Similarly, students are required to practice these values and are therefore required to be cognizant of and adhere to the UWI policies regarding academic integrity and plagiarism as outlined in its regulations found at https://sta.uwi.edu/resources/policies/Anti-Plagiarism.pdf and in the Faculty Regulations and Syllabuses.

"The UWI anticipates that faculty and students will preserve its reputation through the maintenance of high standards of academic integrity. For students this means that the presentation of work for evaluation, whether or not for credit, will result from sincere individual effort and genuine learning and will uphold expected standards for acknowledging the work of others. Infractions will be addressed according to the UWI Examination Regulations and the **UWI Regulations on Plagiarism (First Degrees, Diplomas, Certificates).**

*Consistent with UWI's policies Turnitin may be used in this course to compare assignment submissions with Internet sources. Submissions will be made via the eLearning system and m*ay be retained in the global Turnitin repository. *When submitting papers to Turnitin, do not include identifying information such as your name and ID number. The system will automatically show this information when the instructor is viewing your submission, but the information will not be retained in the Turnitin database.*"

**Artificial Intelligence (AI) Use**

Given that the current assessments consist of supervised in-class exams and oral/tutorial participation, the use of generative AI tools is not applicable to most of the assessed components. The use of AI-generated content in the submission of the Diagnostic Exercise, however, is prohibited.

For tutorial work, students may use AI tools only for explanation, additional practice, or checking their understanding after making a genuine attempt. AI-generated answers must not be submitted or presented as the student's own tutorial preparation. Students must be able to reproduce, explain, and defend any solution they present in class without relying on AI output. To be a responsible user of AI tools, your work must reflect your own intellectual inputs, and you must assume responsibility for the integrity of your contributions.

#### B. Attendance and Examination Policy

All registered students are required to attend prescribed lectures, practical classes, tutorials, or clinical instructions. Students with ***unsatisfactory class attendance*** or who have failed to submit any assessments set by his/her Examiner are subject to debarment by the relevant Academic Board, on the recommendation of the relevant Faculty Board, from taking any University examination. ***Procedures to be used to measure attendance and assessments shall***

***be prescribed by the Faculty*** (The UWI Assessment Regulations for First Degrees, Associate Degrees, Undergraduate Diplomas and Certificates: Including GPA and Plagiarism Regulations 2017-2018, p. 3).

**C. Accommodations for Students with Disabilities**

Students should refer to the University of the West Indies St Augustine Campus, Student Disability Policy. https://sta.uwi.edu/resources/policies/Student_Disability.pdf

**D. Student Expectations**

As a student enrolled in Mathematics for Economics II, your lecturers expect that you bring to the course all the Learning Outcomes of ECON1003. In addition, it is expected that you will be fully engaged in personal (individual) learning, the classroom activities and cooperative learning (or study group) activities. Research has shown that students learn best through collaboration and interaction; accordingly, you are encouraged to participate in and complete all assignments and classroom activities. The success of such activities depends significantly on the quality of the relationships that you establish and maintain with your Lecturer(s), Tutor(s) and Peers.

**E. Where Can I Go for Further Assistance?**

- Health Services Unit
- Careers, Co-Curricular and Community Engagement
- Counselling and Psychological Services
- Financial Advisory Services
- Guild Administrative Office
- Student Accommodation Office (On and Off-Campus)
- Student Activities, Facilities and Commuting Students
- Student Engagement Unit
- Student Life and Development
- Campus IT Services

**12. End of Course Evaluation Procedures:**

*At the end of this course, students are required to complete a course evaluation questionnaire – Course Experience Review (CER). This is an online form that students fill in anonymously to rate various aspects of their course experience and offer suggestions for improvement. The Dean, Heads of Department, and individual instructors review course evaluation reports to plan changes to future courses/programmes and make decisions related to teaching skills development, teaching methods and teaching appointments.*

## 13. Course Calendar

| Week | Lecture Topic | Reading/Learning Resources | Learning Activities | Assignments | |
|---|---|---|---|---|---|
| | | | | Name | Due Date |
| 1. (Sep 4th) | Course Orientation & Unit 0 – Preliminaries | Barnett et al. Chs. 1 & 8, **OR** Haeussler et al. Chs. 0-4 & 10 | Lecture | Diagnostic, part 1<br>Tutorial Sheet 1 | Start of Week 3<br>Weeks 2-3 |
| 2. (Sep 11th) | Unit 0 – Preliminaries & Unit 1 – Differential Calculus | Barnett et al. Ch. 8, **OR** Haeussler et al. Chs. 10 & 11 | Lecture + Tutorial | Diagnostic, part 2<br>Tutorial Sheet 2 | Start of Week 4<br>Weeks 3-5 |
| 3. (Sep 18th) | Unit 1 – Differential Calculus | Barnett et al. Chs. 9 & 10, **OR** Haeussler et al. Chs. 12 & 13 | Lecture + Tutorial | | |
| 4. (Sep 25th) | Unit 1 – Differential Calculus | Barnett et al. Chs. 9 & 10, **OR** Haeussler et al. Chs. 12 & 13 | Lecture + Tutorial | | |
| 5. (Oct 2nd) | Unit 2 – Integration & Economic Dynamics | Barnett et al. Chs. 11 & 12, **OR** Haeussler et al. Chs. 14 & 15 | Lecture + Tutorial | Tutorial Sheet 3 | Weeks 6-7 |
| 6. (Oct 9th) | Unit 2 – Integration & Economic Dynamics | Barnett et al. Chs. 11 & 12, **OR** Haeussler et al. Chs. 14 & 15 | Lecture + Tutorial | In-Class Test 1 | Week 6 |
| 7. (Oct 16th) | Unit 3 – Linear Algebra | Sydsæter (Essential) Chs. 12 & 13<br>Sydsæter (Further) Ch. 1 **OR**<br>Hoy et al. Chs. 7-10 | Lecture + Tutorial | Tutorial Sheet 4 | Weeks 8-10 |
| 8. (Oct 23rd) | Unit 3 – Linear Algebra | Sydsæter (Essential) Chs. 12 & 13<br>Sydsæter (Further) Ch. 1 **OR**<br>Hoy et al. Chs. 7-10 | Lecture + Tutorial | In-Class Test 2 | Week 8 |
| 9. (Oct 30th) | Unit 3 – Linear Algebra | Sydsæter (Essential) Chs. 12 & 13<br>Sydsæter (Further) Ch. 1 **OR**<br>Hoy et al. Chs. 7-10 | Lecture + Tutorial | | |
| 10. (Nov 6th) | Unit 4 – Introduction to Multivariable Calculus | Barnett et al. Ch. 13, **OR** Haeussler et al. Ch. 17 | Lecture + Tutorial | In-Class Test 3<br>Tutorial Sheet 5 | Week 10<br>Weeks 11-12 |
| 11. (Nov 13th) | Unit 4 – Introduction to Multivariable Calculus | Barnett et al. Ch. 13, **OR** Haeussler et al. Ch. 17 | Lecture + Tutorial | | |
| 12. (Nov 20th) | Applications & Wrap Up | *Stated by Lecturer* | Lecture + Tutorial | In-Class Test 4 | Week 12 |
| 13. | Study Week | | | | |