**MTH201A** Mathematical Analysis 1 *Prerequisite* MTH101A *Prerequisite to* MTH202A

 **Instructor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

 **Consultation Hours: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Contact details: \_\_\_\_\_\_\_\_\_\_\_\_\_
Class Schedule and Room: \_\_\_\_\_\_\_\_**

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| **Course Description**  |
| **This is the first course in the calculus series for majors. It covers limits, continuity, derivatives of algebraic and transcendental functions, applications of derivatives, differentials, antiderivatives, definite integrals, the Fundamental Theorem of Calculus, and some applications of the definite integral.** |

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| **Learning Outcomes** |
| On completion of this course, the student is expected to present the following learning outcomes in line with the Expected Lasallian Graduate Attributes (ELGA) and the outcomes prescribed by the CHED Memorandum Order for the BS Mathematics program.

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| ELGA | Learning Outcome |  Program Outcome |
| Critical and Creative ThinkerEffective CommunicatorLifelong Learner | At the end of the course, the student will  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| apply appropriate pre-calculus concepts, thinking processes, tools, and technologies in the solution to various conceptual or real-world problems. | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  | 🗸 |

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| **Program Outcomes (BS Mathematics)** |
| A graduate of the program should be able to |
| 1. Apply analytical, critical and problem solving skills using the scientific method.
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| 1. Carry out basic mathematical and/or statistical computations and use appropriate technologies in the analysis of data, and in pattern recognition, generalization, abstraction, critical analysis, and problem solving.
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| 1. Gain mastery in the core areas of mathematics: algebra, analysis and geometry
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| 1. Demonstrate skills in pattern recognition, generalization, abstraction, critical analysis, problem-solving and rigorous argument.
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| 1. Develop an enhanced perception of the vitality and importance of mathematics in the modern world, including the interrelationships within mathematics and its connection to other disciplines.
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| 1. Appreciate the concept and role of proof and reasoning and demonstrate knowledge in reading and writing mathematical proofs.
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| 1. Make and evaluate mathematical conjectures and arguments and validate their own mathematical thinking
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| 1. Communicate mathematical ideas orally and in writing using clear and precise language
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| **Final Course Output** |
| As evidence of attaining the above learning outcomes, the student is required to submit the following during the indicated dates of the term.

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| Learning Outcome | Required Output | Due Date |
| At the end of the course, the student will be able to apply appropriate differential and integral calculus concepts, thinking processes, tools, and technologies in the solution to various conceptual or real-world problems. | * Carefully crafted compilation of solved problems on integration using various techniques of integration; exploring graphing software in sketching polar curves; power series approximation of certain function values as compared to values generated by scientific calculators.
 | Week 13 |

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| **Rubric for assessment for compilation of solutions to problems** |
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| CRITERIA | Excellent (4) | Good (3) | Satisfactory (2) | Needs Improvement (1) |
| **Understanding****(50%)** | The solution shows a deep understanding of the problem including the ability to identify the appropriate mathematical concepts and information necessary for its solution. | The solution shows that student has a broad understanding of the problem and the major concepts necessary for its solution. | The solution is not complete indicating that parts of the problem are not understood. | There is no solution, or the solution has no relationship to the task. |
| **Strategies and Procedures****(15%)** | Uses a very efficient strategy leading directly to a solution.Applies procedures accurately to correctly solve the problem and verifies the result. | Uses strategy that leads to a solution of the problem. All parts are correct and a correct answer is achieved. | Uses a strategy that is partially useful, leading some way toward a solution but not to a full solution of the problem. Some parts may be correct but a correct answer is not achieved. | No evidence of a strategy or procedure uses strategy that does not help solve the problem. |
| **Communication****(10%)** | There is a clear, effective explanation, detailing how the problem is solved.There is a precise and appropriate use of mathematical terminology and notation. | There is a clear explanation and appropriate use of accurate mathematical representation. | There is some use of appropriate mathematical representation but explanation is incomplete and not clearly presented. | There is no explanation or the solution cannot be understood or it is unrelated to the problem. |
| **Integration****(10%)** | Demonstrates integration of the concepts presented | Demonstrates some integration of the concepts presented | Demonstrates limited integration of the concepts presented | Demonstrates no integration of the concepts presented |
| **Accuracy of Computations/****Solutions****(15%)** | Computations /solutions are correct and explained correctly  | Computations/solutions are correct but not explained well. | Computations/solutions have some errors. | Incorrect computations/solutions  |

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| **Additional Requirements** |
| * **At least 5 quizzes**
* **Final Exam**
* **Learning output**
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| **Grading System** |
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|  | **FOR STUDENTS** **with FINAL EXAM** |
| *with* *no missed quiz* | *With* *one missed quiz* |
| Average of quizzes  | 40% | 30% |
| Midterm Exam | 30% | 35% |
| Final exam | 30% | 35% |

 | **Scale:**95-100% 4.089-94% 3.583-88% 3.078-82% 2.572-77% 2.066-71% 1.560-65% 1.0<60% 0.0 |

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| **Learning Plan** |
| **LEARNING OUTCOMES** | **TOPIC** | **WEEK NO.** | **LEARNING ACTIVITES** |
| At the end of the course, the student will be able to:* Sketch graphs of functions; evaluate limits and determine continuity of different types of functions; and find derivatives of algebraic, trigonometric, exponential and logarithmic as well as inverse trigonometric and hyberbolic functions;
* Apply the concepts of limits, continuity and derivatives in solving various problems like optimization and related rates;
* Evaluate definite integrals and apply the concept in finding area of a plane region, volume of a solid of revolution, and length of arc of a curve, and in solving work problems.
 | 1. **Limits and continuity**
	1. Graphical approach to limits of functions
	2. Definition of the limit of a function and limit theorems
	3. One-sided limits
	4. Infinite limits and vertical asymptotes
	5. Limits at infinity and horizontal and oblique asymptotes
	6. Continuity of a function at a number
	7. Continuity of a function on an interval
	8. The Intermediate Value Theorem
	9. The Squeeze Theorem and continuity of trigonometric functions

**Quiz 1** | Weeks 1-2(6.5 + 1) hrs | * Cooperative Learning
* Skills Exercises
* Seatwork/Homework
 |
| 1. **The derivative and differentiation**
	1. The tangent line and the derivative
	2. Differentiability and continuity
	3. Theorems on differentiation and higher-order derivatives
	4. Chain rule and implicit differentiation
	5. Rectilinear motion and the derivative as a rate of change
	6. Related rates
	7. Derivatives of trigonometric functions

**Quiz 2** | Weeks 2 – 4(9.5 + 2) hrs |  |
| 1. **Behavior of functions and their graphs, extreme function values, and approximations**
	1. Maximum and minimum function values
	2. Applications involving an absolute extremum on a closed interval
	3. Rolle’s Theorem and the Mean Value Theorem
	4. Increasing and decreasing functions and the First Derivative Test
	5. Concavity and points of inflection and the Second Derivative Test
	6. Curve sketching
	7. Additional applications of absolute extrema
	8. The differential

**Quiz 3** | Week 4(2.5) hrs |  |
| 1. **Integration**
	1. Anti-differentiation
	2. Some techniques of anti-differentiation
	3. The definite integral and area
	4. The Mean Value Theorem for integration
	5. The Fundamental Theorem of Calculus and its proof
 | Weeks 5 – 6(7.5 + 2.5) hrs |  |
|  | 1. **Applications of the definite integral**
	1. Area of a plane region
	2. Volumes of solids by slicing, disks and washers
	3. Volumes of solids by cylindrical shells
	4. Improper integrals with infinite limits of integration
	5. Other improper integrals

**Quiz 4** | Weeks 6 -8(9 + 2) hrs |  |
| * 1. Length of arc of the graph of a function
	2. Work(spring, pumping fluids)
 | Weeks 8 – 11(15 + 3) hrs |  |
| 1. **Transcendental functions and their derivatives**
	1. The inverse of a function
	2. The natural logarithmic function and its derivative
	3. The natural exponential function and its derivative
	4. Other logarithmic and exponential functions
	5. Logarithmic differentiation
	6. Inverse trigonometric functions and their derivatives

**Quiz 5** | Weeks 11 – 13(11.5 + 4)hrs |  |
| * 1. Hyperbolic functions and their derivatives
 | Week 133.5 hrs |  |
| **FINAL EXAMINATION (3 hrs)** |

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| **References** |
| Anton, H., Biven, I.C., and Davis, S., *Calculus* (10th ed.) Wiley, 2012Edwards, C.H. and Penney, D.E. (2008) *Calculus: Early Transcendentals* (7th ed.) Upper Saddle River, NJ: Pearson/Prentice Hall, 2007**Etgen, G., Salas, S., Hille, E., *Calculus: One and Several Variables,* (10th ed.), John Wiley and Sons, Inc. 2007**Larson, R.E, Hostetler, R. & Edwards, B.H. (2008) *Essential Calculus: Early Transcendental Functions*. Boston: Houghton MifflinLarson, R., Edwards, B., *Calculus* (10th ed.) Brooks/Cole, 2014**Leithold, L. (2002) *The Calculus 7* (Low Price Edition) Addison-Wesley**Simmons, G.F. (1996) *Calculus with Analytic Geometry* (2nd ed.) New York: McGraw-HillSmith, Robert T., Minton, Roland B. (2012), *Calculus* , New York : McGraw Hill Tan, Soo T. (2012) *Applied Calculus for the Managerial, Life, and Social Sciences : A Brief Approach*, Australia : Brooks/Cole Cengage Learning Stewart, J., *Calculus: Early Transcendentals* (8th ed.) Brooks/Cole, 2011 |
| **Online Resources** |
| *Free Calculus Tutorials and Problems* Accessed October 11, 2012 from <http://analyzemath.com/calculus/>*Visual* Calculus Accessed October 11, 2012 from <http://archives.math.utk.edu/visual.calculus> tutorial.math.lamar.eduDawkins, P. (2012) *Paul’s Online Math Notes* Accessed October 11, 2012 from <http://tutorial.math.lamar.edu> |

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| **Class Policies** |
| 1. The required minimum number of quizzes for a 3-unit course is 3, and 4 for 4-unit or 5 unit course. No part of the final exam may be considered as one quiz.
2. Cancellation of the lowest quiz is not allowed even if the number of quizzes exceeds the required minimum number of quizzes.
3. As a general policy, no special or make-up tests for missed exams other than the final examination will be given. However, a faculty member may give special exams for
4. approved absences (where the student concerned officially represented the University at some function or activity).
5. absences due to serious illness which require hospitalization, death in the family and other reasons which the faculty member deems meritorious.
6. If a student missed two (2) examinations, then he/she will be required to take a make up for the second missed examination.
7. If the student has no valid reason for missing an exam (for example, the student was not prepared to take the exam) then the student receives 0% for the missed quiz.
8. Students who get at least 89% in every quiz are exempted from taking the final examination. Their final grade will be based on the average of their quizzes and other prefinal course requirements. The final grade of exempted students who opt to take the final examination will be based on the prescribed computation of final grades inclusive of a final examination. Students who missed and/or took any special/make-up quiz will not be eligible for exemption.
9. Learning outputs are required and not optional to pass the course.
10. Mobile phones and other forms of communication devices should be on silent mode or turned off during class.
11. Students are expected to be attentive and exhibit the behavior of a mature and responsible individual during class. They are also expected to come to class on time and prepared.
12. Sleeping, bringing in food and drinks, and wearing a cap and sunglasses in class are not allowed.
13. Students who wish to go to the washroom must politely ask permission and, if given such, they should be back in class within 5 minutes. Only one student at a time may be allowed to leave the classroom for this purpose.
14. Students who are absent from the class for more than 5 meetings will get a final grade of 0.0 in the course.
15. Only students who are officially enrolled in the course are allowed to attend the class meetings.
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Approved by:

 **DR. JOSE TRISTAN F. REYES**

Chair, Mathematics and Statistics Department

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*March 2019 / R. Ponsones,Y.Lim,E.Nocon,L.Ruivivar,S.Tan,F.Campeña, J.Reyes*