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| 1. **Institution and Course Information**
 |
| Name of Institution | **Navajo Technical University** |
| Department | **Engineering, Mathematics, & Technology** |
| Course Number, Title, Credits | **MTH 162 Calculus I (4)** |
| Co-requisite Course Number and Title, if any |  |
| Is this application for your system (ENMU, NMSU, & UNM)? |  |
| Name and Title of Contact Person | **Gholam Ehteshami, Department Chairperson** |
| Email and Phone Number of Contact Person | **gehteshami@navajotech.edu; 505-786-4100** |

**Was this course previously part of the general education curriculum?**

[x] Yes [ ] No

**This course will fulfill general education requirements for (check all that apply):**

[x] AA/AS/BA/BS [ ]  **AAS**

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| 1. Content Area and Essential Skills
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**To which content area should this course be added?** *Indicate “Other” if the course is not associated with one of the six NM General Education content areas.*

[ ] Communications [x] Mathematics [ ] Science [ ] Social & Behavioral Sciences

[ ] Humanities [ ] Creative & Fine Arts [ ] Other

**Which essential skills will be addressed?**

[x] Communication [x] Critical Thinking [ ] Information & Digital Literacy

[x] Quantitative Reasoning [ ] Personal & Social Responsibility

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| 1. Learning Outcomes
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**This course follows the CCNS SLOs for**

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| **MATH 1510, Calculus 1**  |

**List all learning outcomes that are shared between course sections at your institution.**

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| **Common Course Student Learning Outcomes (find Common Course SLOs at:** [**http://www.hed.state.nm.us/programs/request-a-change-to-the-nmccns.aspx**](http://www.hed.state.nm.us/programs/request-a-change-to-the-nmccns.aspx)**)**  |
| 1. Limits a. Use limit notation. b. Compute limits or determine when a limit does not exist. c. Use limits to decide if a function is continuous. d. Use limits to decide if a function is differentiable. e. Use limits to determine asymptotes. 2. Derivatives a. Determine the derivative of a simple function, at a point as well as more generally, using the definition of the derivative. b. Determine the derivatives of algebraic and transcendental functions using the General Power, Product, Quotient, Chain Rules, implicit differentiation and the linearity of the differential operator. describe the meaning of the derivative as a rate of change in a variety of contexts. d. Use derivatives to sketch graphs of functions with details showing critical points and their natures, inflection points, noting monotonicity, and concavity, connecting these to features found algebraically, such as intercepts and asymptotes. e. Compute local linear approximation. 3. Integrals a. Compute definite integrals using the limit definition and sigma notation. approximate definite integrals using finite sums. c. Compute indefinite integrals by identifying them with antiderivatives. d. Compute definite and indefinite integrals using substitution. e. Describe the meaning of the integral in a variety of contexts. 4. Applications of calculus a. Solve optimization problems, related rate problems and motion problems involving position, velocity, speed and acceleration using differentiation and integration. b. Compute area bounded by functions and vertical lines. c. Be able to apply theorems of calculus such as the Fundamental Theorem, the Intermediate Value Theorem, the Mean Value Theorem, the Mean Value Theorem of Integration, and the Extreme Value Theorem. |

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| **Institution-specific Student Learning Outcomes**  |
| List institution-specific Student Learning Outcomes |

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| 1. Narrative
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**Explain what students are going to do to develop the critical skills** (selected above) **and how you will assess their learning?**

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| **Communication.** *Genre and Medium Awareness, Application and Versatility; Strategies for Understanding and Evaluating Messages; and Evaluation and Production of Arguments.*  |
| In this class, students communicate mathematical ideas through both oral and written expression. They communicate mathematical findings in oral form through discussions in small groups, and in written form through assignments (in-class and for homework) and exams. For both oral and written forms, challenging problems involving applications of the theory of differentiation and integration are assigned. To successfully communicate mathematical findings in written and oral form, students are given time to work individually on the problems and write step-by step solutions. Then the students are asked to discuss their work on their group settings. Each group is asked to present a specific problem assigned by the instructor to be presented, and the instructor and a representative from each group leads the whole class group discussion. In summary, are able to communicate effectively through reading, writing, speaking and listening, prepare written documents in a professional manner, develop oral communication skills to present information in a professional and appropriate manner, and demonstrate appropriate listening skills in one-on-one and small and large group settings. |

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| **Critical Thinking.** *Problem Setting; Evidence Acquisition; Evidence Evaluation; and Reasoning/Conclusion* |
| Critical thinking is reinforced by having students examine mathematical problems from different perspectives. It is assessed in on a weekly basis, depending on the lesson. For example, regarding “continuity and one side limit,” students are asked to verify the existence of the limit for continuity using approaches other than analytical, such as graphical and using tables, or within the scope of finding the limit analytically itself. Students must see that problems can be approached using different techniques but lead to the same solution, as when doing . In other areas, students are given hands-on problems to solve. Examples include the following:* **Functions on the floor.** Students place several axis systems on the floor using adding machine tape. They are provided with a collection of conditions on derivatives and second derivatives. They are also given jump ropes to create graphs with given derivatives.
* **Optimization of a cereal box.** Students create a box with the maximum volume by using one side of the cereal box and cutting squares out of the corners. Students compare volumes by filling their boxes with cereal.
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| **Quantitative Reasoning.** *Communication/Representation of Quantitative Information; Analysis of Quantitative Arguments; and Application of Quantitative Models*  |
| In this class, students apply mathematical skills appropriate to their programs of study. They analyze and solve mathematical problems needed in the workplace, daily life, and school, and interpret data using analytical methods. Students must be able to apply quantitative reasoning in numerical and written language to solve real-world problems involving optimization, motion, and problems. They must be able to communicate symbolically and quantitatively to find limits, differentiation, integration, and to graph functions. In general, students are trained to solve problems using a four-step process. First, students are asked to read the question several times and extract the information given. Second, they are asked what they can do with the given information. In other words, they are asked to devise a problem-solving plan with what they have. Third, they are asked to carry out their plan. Last, they are asked to go back and make sense of their solution.  |

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| **Personal & Social Responsibility***. Intercultural reasoning and intercultural competence; Sustainability and the**natural and human worlds; Ethical reasoning; Collaboration skills, teamwork and value systems; and Civic discourse, civic knowledge and engagement – local and global*  |
| In this box, provide a narrative that explains how the proposed course addresses the outcomes of the third essential skill. 200 – 300 words. |

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| **Information & Digital Literacy.** *Authority and Value of Information; Digital Literacy; Information Structure; and Research as Inquiry* |
| In this box, provide a narrative that explains how the proposed course addresses the outcomes of the third essential skill. 200 – 300 words. |

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| 1. Supporting Documents
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[ ]  **Sample Course Rubric Attached** (recommended)[x]  **Sample Assessment Attached** (required)

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| 1. Assessment Plan (Must be on file with HED by August 1, 2019)
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**Link to Institution’s General Education Assessment Plan** Click here to enter text.

This course meets Navajo Tech's institutional standards for General Education and has been reviewed and approved by our General Education Committee and Assessment Committee. Student learning data will be gathered from the last of the course's project assignments. Data summaries from all sections of the course will be compiled on a semester-by-semester basis by the University's Offices of Assessment and Institutional Research. Departmental faculty will review the data and design course and GenEd program improvements during Assessment Days each semester. An annual summary that includes summaries of program improvement will be prepared by the Assessment Committee and included in the University's Annual Student Learning Report. Curriculum revisions as needed will be designed by the General Education Committee and reviewed and approved by the Faculty Congress.

**This course meets institutional standards for general education.**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** Mar 14 2019

Signature of Chief Academic Officer Date

**HED Internal Use Only**

Presented to NMCC on\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date

[ ] Approved [ ] Denied

If denied, rationale:

Institution Notified on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Date

**Sample Exam for MTH 162**

Find the limit analytically.

Find the derivative of the given functions

1. Use implicit differentiation to find
2. Consider the function
	1. Find any critical numbers if possible
	2. Find the intervals in which is increasing and decreasing
	3. Use the First Derivative test to find the relative minimum and maximum.
3. A rectangular solid, with square base, has a surface area of 455 square centimeters. Find the dimensions that will result in a solid with maximum volume.
4. Find the indefinite integral
5. Find the indefinite integral

Evaluate the following definite integrals

**Sample Hands-on Assignment**

**Optimization of a cereal box**

**Steps**

1. Find the equation, say f(x), in terms of one variable, say x.
2. Find the derivative of that function.
3. Find the critical points of the derivative where f'(x)=0 or is undefined.
4. Test those points with the second derivative to determine how they look on a curve, whether it is concave up or down, and whether the point would then be a minimum or maximum.

**QUANTITATIVE REASONING RUBRIC**

**Adapted from NMHED Quantitative Reasoning rubric • Navajo Technical University**

Student: Date:

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| OUTCOMES | SCALE | SUBTOTALS & COMMENTS |
| Emerging (1 pts) | Developing (2 pts) | Proficient (3 pts) |
| *Express quantitative information* | Student explains the meaning of graphics, numbers, or alge­braic symbols within a given context. | Emerging skill descriptions plus: Translates mathematical graphics and symbolism into written or oral language; translates written or oral lan­guage into mathematical sym­bols and graphics. | Developing skill descrip­tions plus: Integrates writ­ten and symbolic mathe­matical constructs in de­scribing particular contexts. |  |
| *Evaluate a quantitative argument* | Student summarizes quanti­tative arguments presented by others. | Emerging skill descriptions plus: Differentiates and de­scribes the parts of a quanti­tative argument presented by others; compares the conclu­sions of a quantitative argu­ment with conclusions from other reliable sources. | Developing skill descrip­tions plus: Uses appropriate techniques of mathematical proof or statistical analysis, evaluates each component of a quantitative argument for mathematical validity and demonstrates whether an overall quantitative ar­gument is valid, invalid, or questionable. |  |
| *Interpret re­sults to solve a problem* | Student identifies, describes, and classifies quantitative in­formation needed to address contextual problems. | Emerging skill descriptions plus: Identifies appropriate mathematical or statistical models to represent quantita­tive information in contextual problems; applies those mod­els to generate numeric pre­dictions. | Developing skill descrip­tions plus: Assesses the va­lidity of numeric predictions and correct unreasonable findings; analyzes and inter­prets results; uses them in a quantitative argument to support a position or line of reasoning or solve a contex­tual problem. |  |
| TOTAL/COMMENTS |

Scale: 9 points = A; 8 = points = B; 7-6 points = C; 5-4 points = D; less than 4 points = F