MATH499: Applied Mathematical Modeling
Institute of Advanced Mathematics
Course Duration: Fall 2022 - Winter 2023 (Full Year)

Course Overview:
This course involves applying advanced mathematical techniques to model real-world phenomena, such as disease spread, financial markets, or climate change. Students will focus on problem-solving, simulation, and analysis, culminating in a final project report and presentation.

Learning Outcomes:

1. **Mathematical Modeling:** Develop and apply mathematical models to analyze and solve real-world problems.
2. **Simulation Techniques:** Use simulation tools to test and validate models.
3. **Problem Solving:** Demonstrate proficiency in problem-solving and critical thinking through model development and analysis.
4. **Communication:** Effectively communicate modeling results through written reports and presentations.

Course Structure & Schedule:

1. Introduction & Foundations

- **Weeks 1-2: Course Introduction & Team Formation**
  - **Overview:** Introduction to mathematical modeling principles and team formation.
  - **Deliverable:** Team Formation Report (5%)
  - **Due Date:** September 15, 2022

2. Modeling Techniques

- **Weeks 3-5: Fundamentals of Modeling**
  - **Overview:** Overview of mathematical modeling techniques and tools.
  - **Deliverable:** Fundamentals of Modeling Report (10%)
  - **Due Date:** October 15, 2022
- **Weeks 6-8: Application to Real-World Problems**
  - **Overview:** Application of modeling techniques to selected real-world problems.
  - **Deliverable:** Initial Modeling Proposal (15%)
  - **Due Date:** November 15, 2022

3. Mid-Term Project & Analysis

- **Weeks 9-12: Mid-Term Review & Feedback**
  - **Overview:** Presentation and review of preliminary modeling work.
  - **Deliverable:** Mid-Term Presentation (15%)
  - **Due Date:** December 15, 2022

4. Advanced Modeling & Simulation

- **Weeks 13-16: Advanced Techniques & Simulation**
  - **Overview:** Application of advanced modeling techniques and simulations.

    - **Deliverable:** Advanced Techniques Report (15%)
    - **Due Date:** January 31, 2023

5. Finalization & Reporting

- **Weeks 17-20: Final Project Development**
    - **Overview:** Development and refinement of the final modeling project.
    - **Deliverable:** Draft Final Report (15%)
    - **Due Date:** February 28, 2023
- **Weeks 21-24: Final Project Testing & Integration**
    - **Overview:** Testing and integration of the final model and its components.
    - **Deliverable:** Final Testing Report (15%)
    - **Due Date:** March 31, 2023

6. Final Presentation & Submission

- **Weeks 25-27: Final Report & Presentation**
    - **Overview:** Finalization of the project report and preparation for the final presentation.
    - **Deliverable:** Final Presentation (10%)
    - **Due Date:** April 10, 2023
    - **Deliverable:** Final Report (10%)
    - **Due Date:** April 15, 2023

Grading Breakdown:

- **Team Formation Report:** 5%
- **Fundamentals of Modeling Report:** 10%
- **Initial Modeling Proposal:** 15%
- **Mid-Term Presentation:** 15%
- **Advanced Techniques Report:** 15%
- **Draft Final Report:** 15%
- **Final Testing Report:** 15%
- **Final Presentation:** 10%
- **Final Report:** 10%

Total: 100%

Detailed Deliverables:

1. **Team Formation Report (5%)**
    - **Description:** Document detailing team members, roles, and initial modeling ideas.
    - **Due Date:** September 15, 2022
2. **Fundamentals of Modeling Report (10%)**
    - **Description:** Report on basic modeling techniques and their applications.
    - **Due Date:** October 15, 2022
3. **Initial Modeling Proposal (15%)**
    - **Description:** Proposal including initial models, methods, and problem descriptions.
    - **Due Date:** November 15, 2022

4. **Mid-Term Presentation (15%)**
    - **Description:** Presentation covering progress, challenges, and preliminary results.
    - **Due Date:** December 15, 2022
5. **Advanced Techniques Report (15%)**
    - **Description:** Report on advanced modeling techniques and simulation results.
    - **Due Date:** January 31, 2023
6. **Draft Final Report (15%)**
    - **Description:** Draft version of the final report, including detailed model descriptions and preliminary results.
    - **Due Date:** February 28, 2023
7. **Final Testing Report (15%)**
    - **Description:** Final report on testing, validation, and integration of the model.
    - **Due Date:** March 31, 2023
8. **Final Presentation (10%)**
    - **Description:** Presentation of the complete project, including modeling, analysis, and results.
    - **Due Date:** April 10, 2023
9. **Final Report (10%)**
    - **Description:** Comprehensive report covering the entire project, from modeling to final results.
    - **Due Date:** April 15, 2023

This syllabus for MATH499 provides a clear structure for developing and presenting mathematical models, integrating key elements of modeling techniques, project development, and effective communication.