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| **Jerash University**  **Faculty of Science**  **Department of Science/Mathematics**  **First Semester 2020-2021** | **C:\Users\HP\Dropbox\Jarash University\Jarash Logo.jpg** |

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| **Course Information** | |
| **Course Title** | Mathematical Modeling |
| **Course Number** | 303472 |
| **Prerequisites** | 303303 |
| **Instructor** |  |
| **Office Location** |  |
| **Office Hours** |  |
| **E-mail** |  |
| **Course Description** | |
| This course aims to describe and explore real-world phenomena and data. It covers mathematical classification of models, constraints and terminology on models, modeling process, population dynamics models for single species, stability analysis of growth models, Fishing management models, scaling variables, bifurcation analysis of the ordinary differential equation y' = f(y, c); saddle-node, transcritical and Pitchfork bifurcations, models from science and finance, Newton's law of cooling or heating, Chemical Kinetic reactions, modeling by systems of equations, modeling interacting species; model building, different types of interactions models. | |

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| **Text Book** | |
| **Title** | Differential Equations, An Applied Approaches |
| **Author(s)** | Jim Cushing |
| **Publisher** | Pearson - Prentice Hall |
| **Year** | 2004 |
| **Edition** |  |

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| **Assessment Policy** | | |
| **Assessment Type** | **Expected Due Date** | **Weight** |
| **First Exam** | To be announced by the department | 20% |
| **Second Exam** | To be announced by the department | 20% |
| **Final Exam** | To be announced by the department. | 40% |
| **Assignments** | Ten assignments will be considered | 20% |
| **Over all** |  | 100% |

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| **Course Objective** |
| This course is devoted to give as much as possible of applications to linear and nonlinear ordinary differential equations through Mathematical modeling approach. |

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| **Course Outcomes** |
| * Ability to model situations from a variety of settings in differential equations forms. * Ability to express and manipulate mathematical information, concepts, and thoughts using differential equations. * Ability to solve multiple-step problems using differential equations. * Ability to extract quantitative data from a given situation, translate the data into differential equations. |

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| **Topics** | **# of lectures** | **# of weeks** |
| **Introduction**   * Definitions, Uses and Forms of Models * Mathematical classification of Models * Constraints and terminology on Models * Modeling process | 3 | 1 |
| **Population Dynamics Models for Single Species**   * Continuous Growth Models( The exponential and logistic Models) * Stability Analysis of Growth Models | 3 | 1 |
| * Fishing Management Models | 3 | 1 |
| * Scaling Variables | 3 | 1 |
| * bifurcation analysis of the ODE y' = f(y, c); saddle-node, transcritical and Pitchfork bifurcations | 3 | 1 |
| **Models From Science and Finance**   * Modeling Radioactivity Decay, Radicarbon dating * Compound Interest Models | 3 | 1 |
| * Newton's law of cooling or heating * Compartment Models | 3 | 1 |
| * Chemical Kinetic reactions | 3 | 1 |
| * Strange Oscillation in a chemical Reactor | 3 | 1 |
| **Modeling by System of Equations**   * Introduction * Properties of Systems, The fundamental Theorem of Systems | 3 | 1 |
| * Stability Analysis of Linear Systems * Simple Tests to locate the Eigenvalues | 3 | 1 |
| * The Linearization method | 3 | 1 |
| * Modeling interacting species, Model building, Different Types of Interactions. | 3 | 1 |
| * Competition Models * Predator-Prey Models | 3 | 1 |

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| **Year** | **Publisher** | **Author** | **Title** |
| 2004 | Pearson - Prentice Hall | Jim Cushing | Differential Equations, An Applied Approaches |
| 2002 | Springer | Murray, James D. | Mathematical Biology |
| 2004 | Wiley | [Robert L. Borrelli](http://eu.wiley.com/WileyCDA/Section/id-302479.html?query=Robert+L.+Borrelli),  [Courtney S. Coleman](http://eu.wiley.com/WileyCDA/Section/id-302479.html?query=Courtney+S.+Coleman) | Differential Equations, Modeling Perspectives |