** University of Management & Technology**

School of Science

**MA – 402 Simulation and Modeling**

BS (PH/MA)

|  |  |
| --- | --- |
| **Semester** | Spring 2021 |
| **Pre-requisite** | **MA – 230/NS-126/129** |
| **Credit Hours** | 3 |

****

****

**Syllabus Outlines:**

**Concepts of model, modeling and simulation, functions, linear equations, linear-differential equations, nonlinear-differential equations and integral equations as models, introduction to simulation techniques *Ordinary-Differential Equations:* Modeling with first order differential equations: Newton’s law of cooling; radioactive decay; motion in a gravitational field; population growth; mixing problem; Newtonian mechanics. Modeling with second order differential equations: vibrations; application to biological systems; modeling with periodic or impulse forcing functions. Modeling with systems of first order differential equations; competitive hunter model; predator-prey model.*Partial-Differential Equations:* Methodology of mathematical modeling; objective, background, approximation and idealization, model validation, compounding. Modeling wave phenomena (wave equation); shallow water waves, uniform transmission line, traffic flow, RC circuits. Modeling the heat equation and some application to heat conduction problems in rods, lamina, cylinders etc.Modeling the potential equation (Laplace equation), applications in fluid mechanics, gravitational problems.Equation of continuity.**

**Recommended Books:**

1. **Giordano FR, Weir MD (1994), “*Differential Equations: A Modeling Approach”*, 1994,**
2. **Addison-Wesley, Reading, Ma, USA (suggested text)**
3. **Jerri AJ (1985), “*Introduction to Integral Equations with Applications”*, 1985, Marcel Dekker, New York**
4. **Myint UT, Debnath L (1987), “*Partial Differential Equations for Scientists and Engineers”*(3rdedition), North Holland, Amsterdam.**
5. **Zill, Prindle Weber and Schmidt, A first Course in Differential Equations, Latest edition.**
6. **D.G. Zill: *Differential Equations and their Applications,* Latest edition**