1) ES301: System Modeling and Simulation

2) Credits (2 2 3), 2 lecture periods, 1 lab period, 3 credits hours

3) Course coordinator: S.P. Parikh, Assistant Professor

4) Textbook: Close, Frederick, and Newell, "Modeling and Analysis of Dynamic Systems." 3nd Ed. (optional)

5) Specific course information:
   a) The course introduces modeling of physical systems including mechanical, electrical, and fluid systems. Also introduced are standard model representations, such as transfer functions and state space models, along with numerical methods and simulation software. Includes hands-on hardware laboratory exercises.
   b) Prerequisites: ES201, ES202 and EM232, Co-requisite: ES303 or ES303H
   c) This is a required course in the major.

6) Specific goals for this course:
   a. The student will be able to model mechanical, electrical, and hydraulic systems using differential equations and physical principles.
   b. The student will be able to convert these models into transfer function or state-space models.
   c. The student will be able to reason about the behavior of the system that is modeled.
   d. The student will be able to create simulations of these systems in MATLAB and SIMULINK.
   e) The following ABET outcomes are addressed by this course:
      - Outcomes a and e (Identifying, formulating, and solving engineering problems): Deriving Equations of Motion, Calculating System Parameters
      - Outcome b and k (Apply modern engineering tools): Simulation using Matlab and Simulink
      - Outcome c (Design system, component, or process): Analysis of a physical system

7) Brief list of topics to be covered:

Lecture Topics	**Lecture sessions**
1. Deriving Equations of Motion for Mechanical Translation Systems	3
2. Converting Equations of Motion to Transfer Functions, State Space and Simulation Diagrams	4
3. Deriving Equations of Motion for Mechanical Rotational Systems	4
4. Deriving Equations of Motion for Electrical Systems	3
5. Deriving Equations of Motion for Fluid Systems	3
6. Deriving Equations of Motion for Electro-Mechanical Systems	4
7. Deriving Equations of Motion for Non-linear Systems	2
8. Simulating Systems	4
9. Calculating System Parameters from Experimental Data	2

Lab Topics	**Laboratory sessions**
1. Simulation System using Matlab & Simulink	2
2. System Analysis (Simulation)	3
3. System Analysis (Experimental)	3
3. Calculating System Parameters from Experimental Data	5