1. **Course Number and Course Title:**
   ELE 353 – Control Systems I

2. **Credits Hours:**
   3 – 0 – 3

3. **Prerequisites and/or Co-Requisites:**
   Prerequisites: ELE 212 (Electric Circuits II)
   Prerequisite/Concurrent: MCE 224 (Engineering Mechanics-Statics and Dynamics) or MCE 225 (Statics and Dynamics for Computer Engineers)

4. **Name and Contact Information of Instructor:**
   Dr. Shayok Mukhopadhyay
   Office: EB1-232
   Email: smukhopadhyay@aus.edu
   Phone: (06) 515-2651

5. Office Hours: Sunday, Monday, Tuesday, Thursday 12PM to 1PM, or by appointment.

6. **Course Description (Catalog Description):**
   Examines mathematical models of systems, feedback control system characteristics, transient response analysis, performance and stability of feedback control systems, root locus analysis, frequency response analysis and design of feedback control systems.

7. **Textbook and other Supplemental Material:**
   Textbook:
   - N.S. Nise, Control Systems Engineering, 6th edition, Wiley, 2011
   - Other reference material will be handed out as/and if required by the course instructor.

8. **Learning Outcomes:**
   Upon completion of the course, students will be able to:
   1. Identify and utilize appropriate physical principles and laws to derive mathematical models for a given physical system.
   2. Use OPAMP to implement analog controllers.
   3. Describe control systems architectures.
   4. Represent physical systems using block diagrams and apply block reduction techniques.
   5. Identify transient and steady-state time response characteristics of first and second order systems.
   6. Understand pole, zero and gain effects on transient and steady-state responses.
   7. Determine stability of linear systems and Routh-Hurwitz stability criterion.
   8. Sketch the root locus by hand and by Matlab.
   9. Design Lead/Lag and PID controllers using the root locus technique to meet time domain specifications.
   10. Use MATLAB to simulate, analyze and design feedback control systems.

9. Teaching and Learning Methodologies:

Classes will typically include lectures where main points will be highlighted using slides/notes and the detailed description of the content will be worked on a whiteboard. In class discussion is encouraged.

10. Course Topics and Schedule:

Topic	Weeks
Introduction	0.5
Modeling	2
Time response	2
Block diagram reduction	2
Stability	1.5
Root locus	2
PID control/lead/lag	2
Frequency response (as time permits)/Matlab, Simulink based problem solving as preparation for final project	1.5
Analog controller design	0.5
Midterm, final review and finals	2
Total:	**16**

11. Schedule of Laboratory and other Non-Lecture Sessions:

Matlab/Simulink (Control Toolbox) will be used to demonstrate/solve certain complex concepts/problems in class along with traditional whiteboard based teaching.

12. Out-of-Class Assignments with Due Dates:

Assignment	Due Date (tentative)
Quizzes	Surprise quizzes
Homework 1-Modeling, Time response	Week 5
Homework 2-Block diagram reduction, Signal flow	Week 7
Homework 3 - Block diagram reduction, Signal flow, Stability, Routh-Hurwitz	Week 9
Homework 4 -Root locus, PID control, analog controller design	Week 12
Final Project	Last day of classes

13. Student Evaluation:

Assessment	Weight	Due Date (tentative)
Homework and quizzes	15 %	As above
Two Midterm Exams	30 %	Week 8 (Oct. 21), Week 12 (Nov. 18)
Project	15 %	Last day of classes
Final Exam	40 %	As scheduled by Registrar

14. Contribution of Course to Program Outcomes

This course contributes to the accomplishment of the following program outcomes:

Program outcome	Emphasis in this course
(a) an ability to apply knowledge of mathematics, science, and engineering	●
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	◑
(d) an ability to function on multidisciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	●
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	○
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	◑

Emphasis: ● High; ◑ Medium; ○ Low; Blank – Nothing Specific Expected