The University of Jordan
School of Engineering
Department of Mechatronics Engineering
1st Semester – A.Y. 2019/2020

Course:	Automatic Control– 0908353 (3 Cr. – Core Course) **Lecture Time (Mon, Wed: 8:00 – 9:30)**
Instructor:	Prof. Zaer S. Abo-Hammour *Office:* MX, *Telephone:* 5355000 *Ext:* 23026, *Email*: zaer@ju.edu.jo *Office Hours:* (Mon, Wed: 9:30-11:00)
Course Website:	`http://elearning.ju.edu.jo`
Catalog Data:	Introduction to Control Systems, Stability of Linear Control Systems, Time Domain Analysis of Control Systems, Root Locus Analysis, Compensator Design Using Root locus Method, Frequency Domain Analysis, Bode Plot Diagram, Compensator Design using Bode Plot Method, PID Controller tuning, MATLAB Control Toolbox.
Prerequisites by Course:	System Dynamics (0908351).
Prerequisites By Topic:	Students are assumed to have sufficient knowledge pertaining to the following: 1. Signals and Systems 2. Elementary Matrix Theory and Algebra. 3. Laplace transform. 4. Modeling and Simulation of Physical systems. 5. Programming with MATLAB. 6. Ordinary Differential Equations
Textbook:	Automatic Control Systems by Benjamin C. Kuo, Farid Golinaraghi. 9th Edition. Wiley
References:	• *Control Systems Engineering, by Norman S. Nise,* 6th Edition, Johm Wiley • *Modern Control Systems . Richard Drof and Robert Bishop*, 12th Edition, Prentice Hall. • *Modern Control Engineering , Katsuhiko Ogata,* 5th Edition n, Prentice Hall
Schedule & Duration:	15 Weeks, 30 lectures (75 minutes each) plus exams.
Minimum Student Material:	Text book, class handouts, and an access to Personal Computer with MATLAB
Instructional Methods	1. Lecture/Problem solving sessions. 2. Case studies using MATLAB. 3. Bonus homeworks.
Minimum College Facilities:	Classroom with whiteboard and projection display facilities, library, computational facilities with MATLAB and Simulink.
Course Objectives:	1.To teach students the techniques by which the stability of control systems is analyzed in both time and frequency domains. 2. To teach students the techniques by which control systems are designed to meet certain design specifications in both time and frequency domains. 3. To let students use the Matlab control toolbox in the analysis and design of control systems.

ABET SO:

2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

Course Learning Outcomes and Relation to ABET Student Outcomes:

Upon successful completion of this course, a student should:

1. Understand the basic definitions related to Control Systems, classifications of control systems, and their objectives, Know the basic components of control systems, and the advantages of closed loop control systems over open loop control systems.
2. Understand the definition of stability of control systems.
3. Differentiate between the absolute and relative stability concepts.
4. Study the absolute stability of control systems using the Routh-Hurwitz criteria.
5. Use the Routh-Hurwitz criteria for the analysis and design of control systems.
6. Find the steady state errors of stable unity feedback control systems.
7. Determine the error constants and the steady state error for certain input.
8. Understand the basic steps of drawing the root locus of control systems.
9. Understand the effect of addition of poles and/or zeros to the control systems.
10. Design Lead and Lag Compensators using Root locus method to achieve desired transient and steady state performance in time domain.
11. Analyze control systems in frequency domain.
12. Construct the Bode plots of control systems.
13. Design Lead and/or Lag Compensators using Bode diagram to achieve desired performance in frequency domain.
14. Know and apply different configurations of PID controllers, design of PID controller using Open loop tuning methods and closed loop tuning methods
15. Design of PID controller using.
16. Use MATLAB in the analysis and design of control systems.

Course Topics:

Topic Description	Hrs
1. **Introduction to control systems:** Define a Control system and introduce types of control systems Explain why controls systems are important, Introduce the basic components of control system, Give some examples of control system applications.	4
2 **Stability of Linear Control Systems:** Study the stability of control system, Apply th Routh-Hurwitsc criterion to check the stability of linear system.	4
3. **Steady State Error Analyses:** Steady state error of linear system for three basic input function, constant error.	4
4. **Root-Locus Technique:** Define the root locus, Procedure to construct the root locus, Effect of adding poles and zeros,Desing Lead, Lag ,and Lead-lag compensators using root locus method.	9
5. **Frequency-Domain Analysis and Design:** The Definition of Bode plot, Procedure to construct the Bode plot, Desing Lead, Lag, and Lead-Lag compensators using bode plot method.	9
6. **Design of PID Controller:** Determine the controller or compensator configuration, Determine the parameter values of the controller using Open Loop and Closed Loop Methods.	6
7. **MATLAB Programming**	3

Ground Rules:

- **Attendance:**
  Students are expected to attend EVERY CLASS SESSION and they are responsible for all material, announcements, schedule changes, etc., discussed in class. The university policy regarding the attendance will be strictly adhered to.
- **Make up Examinations**
  There will be no make up exams for any exam that will be taken during the course. exceptions to this rule is restricted only to the following cases:-
  1. Death of only first order relatives (father, mother, sister, or brother).
  2. Hospital entry (in-patient) during thr time of the examination.
  Any other cases will be given the zero mark in the corresponding exam.
- **Special Notes**
  1. Seating plan will be as given in the attendance sheet.
  2. Students creativity is welcomed and will receive additional marks

Assessments:
Exams, Quizzes, Projects, and Assignments.

Grading policy:

Assessments	Mark	SOs
MATLAB Programming Exam	10	
Class Activities and HomeWorks	10	
Midterm Exam	30	2
Final Exam	50	
Total	100	

Last Updated:
September. 2019