The University of Jordan

Faculty of Engineering & Technology, Mechanical Engineering Department

System Dynamics and Control (1) (0904418) Fall Semester 2015/2016

2005 Course Catalog
Review of complex variables and Laplace transform .Poles and element transfer function and block diagram. Modeling of physical systems; electrical, mechanical, hydraulic and pneumatic systems. Linearization of nonlinear systems. System representations. Thermal, System block diagrams and signal flow graphs. Overall transfer function, block diagrams reduction techniques and Mason's gain formula. Time response analysis and performance indices of first and second order systems. Dominate poles of high order systems. Routh-Hurwitz stability criterion. Stability analysis using root locus. Bode diagrams and Nyquist stability criterion. Introduction to analysis using state-space equations.

Course	
Name & number	System Dynamics and Control (1) (0904372)
Credits and contact hours	3 credits / Three 50 or two 75 minute lectures each week
Course Prerequisites	
Prerequisites by topic	ODEs, Laplace transforms, statics/dynamics, vibrations, thermodynamics, fluid, heat, circuits
Prerequisites by course	0301202+ (0904222 or 0904312)
Co-requisites by course	-
Prerequisite for	0904419 Control Lab., 0904422 Engineering Measurements, 0904521 Robotics, 0904537 Design of Hydraulic and Pneumatic Systems, 0904580 Modern Control Systems., 0904583 Autotronics

Instructors				
Name	**E-mail**	**Section**	**Office Hours**	
			Sun/Tue/Thu	Mon/Wed
Dr. Musa Abdalla	musa.abdalla@ju.edu.jo	1	TBA	TBA

Text Books		
	Text book 1	**Text book 2**
Title, Author(s)	Modern Control Engineerin K. Ogata,	(Handouts)
Publisher, Year, Edition	Prentice-Hall, latest Edition	-
References		
Books, Author(s)	R Dorf and Bishop, Modern Control System, Prentice Hall B. Kuo, Automatic Control System, Wiley	
Journals		
Internet links	http://fetweb.ju.edu.jo/staff/ME/JuTech	

Measurable Student Outcomes (MSO) and Course Outcomes	
MSO	**Course Outcomes**
MSO1+MSO3	1. Ability to model and write differential equations and transfer functions to model system dynamics using Laplace transform
MSO5	2. Master block diagram manipulation techniques
MSO1	3. Use design approach to model, analyze and control real dynamical systems
MSO1	4. Analyze first, second and higher order systems and time response
MSO5	5. Analyze the stability, performance, and disturbance rejection characteristics of closed loop feedback systems
MSO3	6. Introduction to controller design to alter system behavior using PID controllers
MSO1	7. Utilize the graphical methods of Root locus/Bode plots for analysis and design of feedback loops
MSO9	8. Use of Matlab to simulate a control system's performance
MSO3	9. Mechanical (thermal and applied) system design
MSO4	10. Present control system design and analysis orally and in written format

Topics Covered		
Week	**Topics**	**Chapters in Text**
1	Introduction: What is system dynamics? What is control? Terminologies, objectives of for using controllers. Open and closed loop concepts	Chapter1
2	Dynamical System Modeling: First Order system, System Response Applications: Tank Level, Laplace Transform overview	Chapter 1
3-4	Transfer Functions, System Response Analytically and using Matlab. Laplace Inverse using PFD. Input Testing Signals, Applications: RCL circuits	Chapter 2
5	Poles and Zeroes Concepts and their relation to response, S-Plane, Applications: Cruise	Chapter 2
6-7	First Order System Performance Measures, 2^{nd} Order Systems Performance	Chapter 3
8	Thermal Systems Modeling and Applications	Chapter 4
9-10	Dynamical Systems Stability. Stability theorems Applications	Chapter5
11-12	Root Locus Analysis and Matlab based design, Introduction to P-Controllers Design	Chapter 7
13	PID Controller Design	Chapter8
14	Introduction to Frequency Domain	Chapter 9
15	Frequency Domain Analysis and Controllers Design	Chapter11

Evaluation		
Assessment Tool	**Expected Due Date**	**Weight**
Homework	One week after homework problems are assigned	5%
Quizzes	Three to five quizzes.	10%
Midterm Exam	According to the department schedule	35 %
Final Exam+Project	According to the University final examination schedule	40 %+10%

Contribution of Course to Meeting the Professional Component
The course contributes to build the fundamental basic concepts of design and analysis of dynamical systems.

Relationship to Program Outcomes (%)

PO #	1	2	3	4	5	6	7	8	9	10
%	H		M		M				L	

Relationship to Mechanical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO 4	PEO 5
√	√		√	

Prepared by: Dr Musa Abdalla, February, 2014