مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

Course Syllabus

1	**Course title**	System Modelling and Vibrations	
2	**Course number**	0908381	
3	**Credit hours**	3	Obligatory Course
	Contact hours (theory, practical)	3 Theoretical Hours	
4	**Prerequisites/corequisites**	0301202 0903211 0904222	
5	**Program title**	B.Sc. in Mechatronics Engineering	
6	**Program code**	08	
7	**Awarding institution**	The University of Jordan	
8	**School**	Engineering	
9	**Department**	Mechatronics	
10	**Course level**	3	
11	**Year of study and semester (s)**	2nd Semester 2021/2022	
12	**Other department (s) involved in teaching the course**		
13	**Main teaching language**	English	
14	**Delivery method**	✓ Face to face learning ☐Blended ☐Fully online	
15	**Online platforms(s)**	✓ Moodle ✓ Microsoft Teams ☐Skype ☐Zoom ☐Others……	
16	**Issuing/Revision Date**	10/10/2021	

17 Course Coordinator:

Name: Dr. Adham Alsharkawi	**Contact Hours:** Sunday-Thursday from 12:00 – 13:00
Office: Mechatronics Eng. Dep.	**Phone Number:** 5355000 Ext. 23030
e-mail: a.sharkawi@ju.edu.jo	

18 Other instructors:

19 Course Description:

Introduction to system dynamics, nonlinearities and linearization, Laplace transform, solution of linear differential equations using Laplace transform, transfer function of linear systems, dominant poles, block diagram and signal-flow graph, state diagrams, state-space representation of linear systems, time response analysis of first-order and second-order, mathematical modelling of electrical networks, translational mechanical systems, and electromechanical systems, undamped one-degree of freedom vibration of a rigid body using the equation of motion and energy methods, analysis of undamped force vibration and viscous damped forced vibration.

20 Course aims and outcomes:

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A. Aims:

The primary aim of this course is to interpret and analyze the dynamical behavior of a physical system. Some reliance will be placed on the use of MATLAB and Simulink to reinforce student understanding.

B. Student Learning Outcomes (SLOs):

Upon successful completion of this course, students will be able to:

SLO(s) / SO(s)	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)	SO (6)	SO (7)
Understand the concept of a dynamic system							
Solve LTI differential equations using the Laplace Transform method							
Apply the block diagram representation to a dynamic system							
Apply Mason's rule to determine the transfer function of a dynamic system							
Construct state diagrams from differential equations							
Formulate the state-space representation of a dynamic system							
Formulate mathematical models for physical systems							
Demonstrate understanding of basic vibration theory							
Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions						✓	

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21. Topic Outline and Schedule:

Week	Lecture	Topic	SLO	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1						
	1.2						
	1.3	Course Overview					
2	2.1	Introduction to System Dynamics					
	2.2	The Laplace Transform (I)					
	2.3						
3	3.1	The Laplace Transform (II)					
	3.2	The Laplace Transform (III)					
	3.3						
4	4.1	The Laplace Transform (IV)					
	4.2	Transfer Function Approach to Modelling Dynamic Systems					
	4.3						
5	5.1	Simplifying Complex Block Diagrams / Block Diagram Reduction (I)					
	5.2	Simplifying Complex Block Diagrams / Block Diagram Reduction (II)					
	5.3						
6	6.1	Mason's Rule and the Signal-Flow Graph (I)					
	6.2	Mason's Rule and the Signal-					

		Flow Graph (II)					
	6.3						
7	7.1	Signal-Flow Graph of State Equations (I)					
	7.2	Signal-Flow Graph of State Equations (II)					
	7.3						
8	8.1	Obtaining a Transfer Function from a State-Space Representation					
	8.2	Time Response Analysis (I)					
	8.3						
9	9.1	Time Response Analysis (II)					
	9.2	Time Response Analysis (III)					
	9.3						
10	10.1	Time Response Analysis (IV)					
	10.2	Time Response Analysis (V)					
	10.3						
11	11.1	Time Response Analysis (VI)					
	11.2	Mathematical Modelling of Electrical Systems (I)					
	11.3						
12	12.1	Mathematical Modelling of Electrical Systems (II)					
	12.2	Mathematical Modelling of Translational Mechanical Systems (I)					
	12.3						
13	13.1	Mathematical Modelling of Translational Mechanical					

		Systems (I)					
	13.2	Mathematical Modelling of Translational Mechanical Systems (II)					
	13.3						
14	14.1	Mathematical Modelling of Electromechanical Systems (I)					
	14.2	Mathematical Modelling of Electromechanical Systems (I)					
	14.3						
15	15.1	Nonlinear Dynamic Systems					
	15.2	MATLAB					
	15.3						

22 Evaluation Methods:

Opportunities to demonstrate achievement of the SLO(s) are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	SLO(s)	Period (Week)	Platform
Midterm Exam	30	Topics Covered in the First 10 Weeks		10th Week	On-Campus
Quiz	10	Mathematical Modelling (Electrical, Mechanical, Electromechanical)		13th Week	Moodle
MATLAB	10	MATLAB for SMV		15th Week	On-Campus
Final Exam	50	All Topics			

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23 Course Requirements

(e.g: students should have a computer, internet connection, webcam, account on a specific software/platform…etc):

Each student should have a computer (with MATLAB installed) and stable internet connection.

24 Course Policies:

- **Attendance:**

Students are expected to attend EVERY CLASS SESSION and they are responsible for all materials, announcements, schedule changes, etc., discussed in class.

- **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 (inpatient) during the time of the examination.

Any other cases will be given the zero mark in the corresponding exam.

25 References:

Required book:

- System Dynamics by Katsuhiko Ogata. 4th Edition, Prentice Hall.

Recommended books:

- Control Systems Engineering, by Norman S. Nise, 6th Edition, Johm Wiley.
- Modern Control Systems. Richard Dorf and Robert Bishop, 12th Edition, Prentice Hall.
- Modern Control Engineering, Katsuhiko Ogata, 5th Edition n, Prentice Hall.

26 Additional information:

	Name	Signature	Date
Course Coordinator:	Dr. Adham Alsharkawi		
Head of Curriculum Committee/Department:			
Head of Department:			
Head of Curriculum Committee/Faculty:			
Dean:			