Jordan University of Science and Technology

Faculty of Engineering

Biomedical Engineering Department

BME431 Physiological Modeling And Control Systems - JNQF Level: 6

First Semester 2023-2024

Course Catalog
3 Credit Hours. Design of system elements, case studies of physiological system examples, design of subsystems, Dynamic modeling and control of selected biological and physiological processes. Lumped / distributed/ compartmental models, particular and complementary solution, analytical and numerical solutions, Respiratory/ Cardiovascular/Muscular / gas exchange/ transport Modeling, transient response, Laplace, time and frequency responses and analysis, open and closed-loop systems, negative feedback, Forward feedback, impulse and step response of physiological control systems and transfer function, state-space design and control.

Text Book	
Title	Mathematical and Computer Modeling of physiological systems
Author(s)	Vincent C.Rideout
Edition	1st Edition
Short Name	REF1
Other Information	Textbook1

Course References

Short name	Book name	Author(s)	Edition	Other Information
REF2	Physiological Control Systems - Analysis, Simulation, and Estimation	Michael C.K Khoo	1st Edition	Textbook2

Instructor	
Name	**Prof. ENAS ABDUL HAY**
Office Location	C5 L1
Office Hours	Sun : 12:45 - 13:30 Mon : 11:30 - 14:30 Tue : 12:00 - 12:15 Wed : 11:30 - 13:30

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Class Schedule & Room
Section 1: Lecture Time: Mon, Wed : 10:00 - 11:30 Room: E2010

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
282300	BME230 Tools For Biomedical Engineers	Prerequisite / Study
283212	BME321 Biomedical Signals And Systems	Prerequisite / Pass

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Weeks 1, 2	Mathematical Modeling	
Weeks 3, 4	Static analysis of physiological systems	
Week 5	First Exam	
Weeks 6, 7	Dynamic analysis of physiological systems	
Weeks 8, 9	Cardiovascular modeling	
Week 10	Second Exam	
Weeks 11, 12	Respiratory system modeling	
Weeks 13, 14	Mass Transport :Compartment Modeling	
Week 15	Multiple Modeling	
Week 16	Final Exam	

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
To provide the students with a guide to mathematical modeling techniques [1,2]: -Learn how to describe systems using Laplace transform and differential equations -Solving the mathematical models using different numerical and analytical method. -Understand state-space and transfer function -Understand linear and nonlinear, lumped and distributed models -Understand generalized models [50SO1, 50SO2] [17L6K1, 17L6K2, 17L6S1, 16L6S2, 16L6C1, 17L6C4]	34%	

Understand how to build, analyze and develop models for physiological systems [1,2,8,7,9]: -Develop and build engineering models that describe pressure flow systems such as cardiovascular and respiratory function -Develop and build engineering models that describe chemical ventilation, Glucose balance, muscle reflex. [34SO1, 33SO2, 33SO7] [34L6S1, 33L6S2, 33L6C4]	33%	
Understand the simulation and control of selected physiological processes and biological systems [1,2,5,8]: -Simulate Respiratory, cardiovascular systems and Mass-Transport compartment modeling -Understand control systems (types, feedback, stability, transient and steady state, Impulse and step responses) [45SO1, 45SO2, 10SO5] [20L6K1, 20L6S1, 20L6S2, 20L6C1, 20L6C4]	33%	

Relationship to Program Student Outcomes (Out of 100%)						
SO1	SO2	SO3	SO4	SO5	SO6	SO7
43.07	42.74			3.3		10.89

Relationship to NQF Outcomes (Out of 100%)					
L6K1	L6K2	L6S1	L6S2	L6C1	L6C4
12.38	5.78	23.6	22.93	12.04	23.27

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