هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	System Dynamics & Control
Course Code:	452-MEC-3
Program:	Bachelor of Science in Engineering
Department:	Mechanical Engineering
College:	College of Engineering
Institution:	Najran University
Version:	1.0
Last Revision Date:	27 February 2024

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Fifth Year \ Level 10)					
4. Course general Description:					
This course is an introduction to the dynamics of lumped-parameter models of mechanical systems. Laplace Transforms. Transfer Function. Block diagrams. State Space Equations of Control Systems. Mathematical Modeling of Dynamic Systems; Mechanical, Electrical, Electromechanical, Liquid Level, Thermal, and Pressure systems. Industrial Automatic Controllers; Basic Control Actions, Tuning Methods. Transient Response Analysis. Root Locus. Frequency Response1 (Bode Plot). Frequency Response2 (Nyquist Plot), State Space Modeling and Analysis, Controllability and Observability.					
5. Pre-requirements for this course (if any)**:**					
205-GEC-3 (Dynamics), 204-MATH-3 (DIFFERENTIAL EQUATION)					
6. Co-requisites for this course (if any)**:**					
NIL					
7. Course Main Objective(s):					
1.Demonstrate knowledge of the fundamental assumptions related to the derivation of simple dynamic models. 2.Demonstrate ability to identify dynamic characteristics: natural frequency, damping, time constant, settling time, etc. of simple dynamic systems. 3.Demonstrate ability to perform computer simulations of basic control actions as applied to simple dynamic systems, and to show the effect of varying controller's parameters on stability and performance. 4.Demonstrate ability to perform laboratory experiments to demonstrate the basic control actions as applied to simple mechanical, electromechanical, thermal, and fluid systems.					

5.Demonstrate knowledge of how control systems are crucial to the functionality and performance of dynamic systems.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	15
3.	**Field**	
4.	**Tutorial**	15
5.	**Others (specify)**	
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Modeling of mechanical systems both translational and rotational Transient and steady state analysis of	1	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials	-Test performance evaluation -Evaluation of participation in discussion and group assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	electrical and mechanical system.		TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes for each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	-Written Assessment.
1.2	Stability analysis of systems using frequency analysis Frequency analysis using polar plot, Nyquist plot Design of PID controllers.	1	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Giving more assignment for each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	-Test performance evaluation -Evaluation of participation in discussion and group assignments -Practical Assessment
2.0	**Skills**			
2.1	Capabilities are developed to model basic mechanical systems. Check the system performance overshoot, over	6	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based	•Locally Developed Exams such as Quiz, Mid & Final Exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	damped, under damped and Matlab commands		learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes for each chapter TS: 5 – Discussion with the students in the class hours	with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes
2.2	An ability to recall and apply the concepts in solving problems. Students are asked to do and practice independently for a longer retention period in mind thus practice oriented learning is valued.	2	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes for each chapter TS: 5 – Discussion with the students in the class hours	•Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes
3.0	**Values, autonomy, and responsibility**			
3.1	Allocating group based assignment, giving challenging problems so that they share with classmates and teachers, help of internet for solving it.	5	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each	Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			chapter with the CLO. TS:4 – Conducting midterm and Final Exam for each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	logical thinking questions •Quizzes
3.2	Group tasks, projects to work in teams	5	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting midterm and Final Exam for each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to control systems.	6
2.	The Laplace Transform	6
3.	Mathematical Modeling of Dynamic Systems	6
4.	Block Diagram representation	6
5.	Transient and steady state response analysis	6
6.	Root locus Analysis	6
7.	Control system Design by Rouths stability criterion	6
8.	Frequency response analysis- polar and Nyquist plot analysis of an un damped system.	6
9.	Control system design by frequency response	6
10.	Proportional, Proportional plus derivative control, proportional plus integral, and PID.	6
Total		60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	1-12	10%
2.	Quizzes	1-12	10%
3.	Mid-term	6-12	20%
4.	labs	2-10	10%
5.	Final exam	15	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Katsuhiko Ogata, Modern Control Engineering, 5th Edition, 2009,
Supportive References	System Dynamics, William J. Palm III, McGraw-Hill, 2005.
Electronic Materials	NA
Other Learning Materials	NA

2. Required Facilities and equipment

Items	Resources
Facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms and laboratories
Technology equipment (projector, smart board, software)	--
Other equipment (depending on the nature of the specialty)	--

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Program Leaders and Peer Reviewer	Direct and Indirect
Effectiveness of Students assessment	Students & Faculty	Direct and Indirect
Quality of learning resources	Students & Faculty	Direct and Indirect
The extent to which CLOs have been achieved	Students & Faculty	Direct and Indirect
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**DEPARTMENT OF MECHANICAL ENGINEERING**
REFERENCE NO.	
DATE	**27/02/2024**