MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Advanced Control Systems**			**Module Delivery**	
Module Type	**Core**			☒**Theory** ☐**Lecture** ☒**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	**UOMU0202064**				
ECTS Credits	5				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	CET		**College**	EETC	
Module Leader	**Mujtaba abdulkadhim**		**e-mail**	**mujtaba_abdulkadhim@uomus.edu.iq**	
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	29/10/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**UOMU022052**	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To define the stability analysis techniques applicable to control systems. 2. To develop problem-solving skills and an understanding of different stability criteria. 3. To understand the principles and conditions under which a system is stable or unstable. 4. To introduce students to stability margins, such as gain margin and phase margin. 5. To emphasize the importance of stability in feedback control systems. 6. To highlight the relationship between stability and system performance.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Define poles and zeros of a transfer function. 2. Analyze the stability of the control system from the pole-zero plot. 3. Analyze the stability of the control system using Routh-Hurwitz criteria. 4. Identify the special cases of Routh's criterion. 5. Sketch the locus of roots in the s-plane as a parameter is varied. 6. Obtain G(s) H(s) from characteristic equation 7. Comment on the stability of the system based on the complete Root Locus. 8. Solve Root Locus problems. 9. Define the frequency response of a system. 10. Use the logarithmic scales. 11. Identify the standard factors of G(JW)H(JW). 12. Plot a graph of the system's frequency response using a Bode plot. 13. Comment on the stability of the system based on the Bode plot. 14. Obtaining the Transfer function from the Bode plot
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Stability of Control System</u> Poles and zeros of a transfer function, pole-zero plot, stability condition about s-plane, Hurwitz's criterion, Routh's stability criterion, special cases of Routh's criterion: special case 1 and special case 2. [10 hrs] Revision problem classes [6 hrs] <u>Part B – Root Locus Method</u>

	Definition of Root Locus, Rules of construction of Root Locus, General steps to solve the problem in Root Locus, obtaining G(s)H(s) from the characteristic equation. [14 hrs]. Revision problem classes [8 hrs] Part C – Bode Plot Method Basics of frequency domain analysis, Magnitude plot, Phase angle plot, Logarithmic scales, frequency domain O.L.T.F., standard factors of G(JW)H(JW), steps to sketch the Bode plot, stability analysis using Bode plot. [16 hrs] Revision problem classes [8 hrs] Transfer function from Bode plot [8 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module focuses on fostering active student engagement during exercises, fostering the development of critical thinking skills, and encouraging participation. This will be accomplished through a combination of classroom instruction, interactive tutorials, and the inclusion of engaging experiments that involve sampling activities that capture students' interest. The aim is to refine and enhance students' critical thinking abilities while ensuring their active involvement in the learning process.

Student Workload (SWL) الحمل الدراسي للطالب موزع على (15) اسبوع			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	64	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.26
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	61	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.06
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	3, 12	LO # 1, 2, LO# 3- 11
	Assignments	2	10% (10)	6, 11	LO # 1-5, LO# 6-10
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 9-13
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO # 1-7
	Final Exam	4hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Stability of Control Systems
Week 2	Routh-Hurwitz Criterion
Week 3	Special Cases of Routh's Criterion
Week 4	Root Locus Method
Week 5	Rules of Root Locus
Week 6	Solve Root Locus Problems
Week 7	Stability Analysis Using Root Locus
Week 8	Mid-term Exam
Week 9	Stability Analysis Using Bode plot
Week 10	Basics of Frequency Domain Analysis
Week 11	Bode Plot Method
Week 12	Bode Plot of Standard Factors of G(jw)H(jw)
Week 13	Stability Analysis Using Bode plot
Week 14	Transfer Function from Bode Plot
Week 15	Design of control systems and Compensation concepts.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: introduction to MATLAB commands
Week 2 , 3 & 4	Lab 2: Responses to different input signals
Week 5 , 6 & 7	Lab 3: Pole- Zero Plot and stability analysis
Week 8 , 9, 10 & 11	Lab 4: Root locus in MATLAB
Week 12 ,13 , 14 & 15	Lab 5: Bode plot in MATLAB

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Modern Control Engineering, K. Ogata, 2010 Pearson Education	Yes
Recommended Texts	1. Control Systems Engineering, U.A. Bakshi and S.C. Goyal, 2007 Technical Publications. 2. Modern Control Systems, R. Dorf and R. Bishop, 2011 Pearson Education	No

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.