MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Control Engineering Fundamentals (CET3102) أساسيات هندسة التحكم
5th Semester الفصل الأول

Module Information معلومات المادة الدراسية					
Module Title	**Control Engineering Fundamentals**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CET3102**				
ECTS Credits	5				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**	5	
Administering Department	CET		**College**	IUC	
Module Leader	Hamza Abbass Al-Sewadi		**e-mail**	Hanza.ali@iuc.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	10/07/2023		**Version Number**	1.0	

Relation with other Modules العالقة مع المواد الدراسية ألخرى			
Prerequisite module	None	**Semester**	
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 control systems. 2. To develop mathematical models that accurately represent the behavior of the system 3. To simplify the representation of a control system. 4. To examine the system's behavior during the transient period and the steady state. 5. To design controllers that can manipulate the system or process to achieve desired objectives.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Define the control system. 2. classify the different types of control systems. 3. Describe a physical system in terms of differential equations 4. Use Laplace Transform in solving differential equations of the Control System. 5. Derive Transfer Function for describing the work of servomotors. 6. Reduce a block diagram of multiple subsystems to a single block representing the Transfer Function of the system. 7. Understand steady state and transient time response analysis. 8. Find error Coefficients and steady-state error (e_{ss}) according to system type. 9. Find the time response of the 1st order system. 10. Find the time response of the 2nd order system. 11. Understand the effect of damping ratio ξ on 2nd order system. 12. Identify Transient response specifications. 13. Define PID controllers. 14. Reduce the effect of Steady-state error (e_{ss}) and settling time (T_s) on time response using PID controller.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: <u>Part A – Basics of Control Systems and Transfer Function</u> Control System definitions, Classification of Control Systems, Comparison of Open Loop and Closed Loop Control Systems, Use Laplace Transform in Control System, Mathematical Modelling of Control Systems: Electrical Systems and Mechanical Systems (Translational and Rotational), Servomotors, Rules of Block diagram reduction. [24 hrs]

	Part B – Time Response Analysis of Control Systems Definitions: time response, transient response and steady state response, standard test inputs, steady state analysis, static error coefficient method, analysis of type 0,1 and 2 systems, transient response analysis: 1st order and 2nd order systems. [30 hrs] PID controllers: PD controller, PI controller, PID controller and output derivative controller [20 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 الدرا يالمنتظم للطالب خالل الفصل	64	**Structured SWL (h/w)** الحمل الدرا يالمنتظم للطالب أسبوعيا	4.26
Unstructured SWL (h/sem) الحمل الدرا يرغ يالمنتظم للطالب خالل الفصل	61	**Unstructured SWL (h/w)** الحمل الدرا يرغ يالمنتظم للطالب أسبوعيا	4.06
Total SWL (h/sem) الحمل الدرا يالك إلطالب خالل الفصل	125		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	6, 10	LO #1-5, LO #6-9
	Assignments	2	10% (10)	8, 13	LO #1-7, LO #7-10
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	14	LO #1-13
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 االسبوعي النظري

	Material Covered
Week 1	Introduction – Basics of Control Systems
Week 2	Use of Laplace Transform in Control System
Week 3	Mathematical Modelling of Control System: Electrical System
Week 4	Mathematical Modelling of Control System: Translational Mechanical System
Week 5	Mathematical Modelling of Control System: Rotational Mechanical System
Week 6	Servomotors
Week 7	Block Diagram Reduction
Week 8	Mid-term Exam
Week 9	Time Response Analysis of Control Systems
Week 10	Analysis of Type 0, 1, and 2 systems
Week 11	Transient Response Analysis
Week 12	Analysis of 2nd order system
Week 13	Transient response specifications
Week 14	PID controllers
Week 15	Rate feedback controller

Delivery Plan (Weekly Lab. Syllabus)

المنهاج السبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction to MATLAB Simulink
Week 2	Lab 2: Laplace Transform / Verifying Algebraic functions
Week 3	Lab 3: Laplace Transform / Verifying Sine functions
Week 4	Lab 4: Block Diagram Reduction
Week 5	Lab 5: Steady State Error
Week 6	Lab 6: 1st Order System
Week 7	Lab 7: 2nd Order System
Week 8	Lab 8: Proportional Controller/ P Controller Used in Closed-Loop DC Servo Motor Speed Control System
Week 9	Lab 9: Proportional Controller/ P Controller Used in Closed-Loop DC Servo Motor Position Control System
Week 10	Lab 10: Integral Controller/ I Controller Used in Closed-Loop DC Servo Motor Speed Control System
Week 11	Lab 11: Integral Controller/ I Controller Used in Closed-Loop DC Servo Motor Position Control System
Week 12	Lab 12: Derivative Controller/ D Controller Used in Closed-Loop DC Servo Motor Speed Control System
Week 13	Lab 13: Derivative Controller/ D Controller Used in Closed-Loop DC Servo Motor Position Control System
Week 14 & 15	Lab 14: PID Controller

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.