

وزارة التعليم العالي والبحث العلمي  
جهاز الاشراف والتقويم العلمي  
دائرة ضمان الجودة والاعتماد الأكاديمي

استمارة وصف البرنامج الأكاديمي للعام الدراسي ٢٠٢٥-٢٠٢٦ للكليات والمعاهد

الجامعة : جامعة شط العرب الاهلية

الكلية \المعهد : الكلية التقنية الهندسية

القسم العلمي : قسم هندسة تقنيات الحاسوب

تاريخ ملء الملف : ٢٠٢٥/٩/١١

التوقيع

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اسم المعاون العلمي : م. د. عصام خليل ابراهيم

اسم رئيس القسم : م. د. عبد الجبار عبد الرزاق

التاريخ :

التاريخ : ٢٠٢٥ / ٩ / ١١

م. د. عصام خليل ابراهيم  
معاون العميد للشؤون العلمية

دقق الملف من قبل

شعبة ضمان الجودة والأداء الجامعي

اسم مدير شعبة ضمان الجودة والأداء الجامعي

التوقيع

٢٠٢٥ / ٩ / ١١

التوقيع

مصادقة السيد العميد

أ. م. د. هازن عبداللّه علوان

عميد الكلية التقنية الهندسية

## MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                           |                               |                                                                                                                                                                                                                                          |
|------------------------------------|-------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| معلومات المادة الدراسية            |                                           |                               |                                                                                                                                                                                                                                          |
| Module Title                       | Advanced Control Systems                  |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | Core                                      |                               | <input checked="" type="checkbox"/> Theory<br><input type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | CET3201                                   |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 5                                         |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 125                                       |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 3                                         | Semester of Delivery          | 6                                                                                                                                                                                                                                        |
| Administering Department           | CET                                       | College                       | EETC                                                                                                                                                                                                                                     |
| Module Leader                      | Hadeel Shakir Mahmood                     | e-mail                        | Hadeel.shakir@mtu.edu.iq                                                                                                                                                                                                                 |
| Module Leader's Acad. Title        | Lecturer                                  | Module Leader's Qualification | MSc                                                                                                                                                                                                                                      |
| Module Tutor                       | Asst. Prof. Dr. Oras Ahmed Shareef        | e-mail                        | dr.oras@mtu.edu.iq                                                                                                                                                                                                                       |
| Peer Reviewer Name                 | Asst. Prof.<br>Alhamzah Taher<br>Mohammed | e-mail                        | alhamza_tm@mtu.edu.iq                                                                                                                                                                                                                    |
| Scientific Committee Approval Date | 29/10/2025                                | Version Number                | 1.0                                                                                                                                                                                                                                      |

| Relation with other Modules       |         |          |  |
|-----------------------------------|---------|----------|--|
| العلاقة مع المواد الدراسية الأخرى |         |          |  |
| Prerequisite module               | CET3102 | Semester |  |
| Co-requisites module              | None    | Semester |  |

| <b>Module Aims, Learning Outcomes and Indicative Contents</b><br><b>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module Aims</b><br><b>أهداف المادة الدراسية</b>                                                                               | <ol style="list-style-type: none"> <li>1. To define the stability analysis techniques applicable to control systems.</li> <li>2. To develop problem-solving skills and an understanding of different stability criteria.</li> <li>3. To understand the principles and conditions under which a system is stable or unstable.</li> <li>4. To introduce students to stability margins, such as gain margin and phase margin.</li> <li>5. To emphasize the importance of stability in feedback control systems.</li> <li>6. To highlight the relationship between stability and system performance.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <ol style="list-style-type: none"> <li>1. Define poles and zeros of a transfer function.</li> <li>2. Analyze the stability of the control system from the pole-zero plot.</li> <li>3. Analyze the stability of the control system using Routh-Hurwitz criteria.</li> <li>4. Identify the special cases of Routh's criterion.</li> <li>5. Sketch the locus of roots in the s-plane as a parameter is varied.</li> <li>6. Obtain <math>G(s)H(s)</math> from characteristic equation</li> <li>7. Comment on the stability of the system based on the complete Root Locus.</li> <li>8. Solve Root Locus problems.</li> <li>9. Define the frequency response of a system.</li> <li>10. Use the logarithmic scales.</li> <li>11. Identify the standard factors of <math>G(j\omega)H(j\omega)</math>.</li> <li>12. Plot a graph of the system's frequency response using a Bode plot.</li> <li>13. Comment on the stability of the system based on the Bode plot.</li> <li>14. Obtaining the Transfer function from the Bode plot</li> </ol> |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p>Indicative content includes the following.</p> <p><u>Part A – Stability of Control System</u></p> <p>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]</p> <p>Revision problem classes [ 6 hrs]</p> <p><u>Part B – Root Locus Method</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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

### Learning and Teaching Strategies

#### استراتيجيات التعلم والتعليم

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b> | <p>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.</p> |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Student Workload (SWL)

#### الحمل الدراسي للطالب موزع على (15) اسبوع

|                                                                                |     |                                                                            |      |
|--------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------|------|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 64  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعياً       | 4.26 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 61  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعياً | 4.06 |
| <b>Total SWL (h/sem)</b><br>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 $G(j\omega)H(j\omega)$ |
| Week 13                         | Stability Analysis Using Bode plot                      |
| Week 14                         | Transfer Function from Bode Plot                        |
| Week 15                         | Design of control systems and Compensation concepts.    |

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

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

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