

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

التوقيع

اسم المعاون العلمي : م. د. عصام خليل ابراهيم

اسم رئيس القسم : م. د. علي جبار 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

٢٠٢٥ / ٩ / ١١

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                       | RealTime Systems                           |                               | Module Delivery                                                                                                                                                                                                                          |
| Module Type                        | E                                          |                               | <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                        | CET3106                                    |                               |                                                                                                                                                                                                                                          |
| ECTS Credits                       | 5                                          |                               |                                                                                                                                                                                                                                          |
| SWL (hr/sem)                       | 125                                        |                               |                                                                                                                                                                                                                                          |
| Module Level                       | 3                                          | Semester of Delivery          | 5                                                                                                                                                                                                                                        |
| Administering Department           | CET                                        | College                       | EETC                                                                                                                                                                                                                                     |
| Module Leader                      | Osama Abbas Hussein                        | e-mail                        | Osama.abbas@mtu.edu.iq                                                                                                                                                                                                                   |
| Module Leader's Acad. Title        | Lecturer                                   | Module Leader's Qualification | PhD                                                                                                                                                                                                                                      |
| Module Tutor                       | Asstt. Prof. Dr. Dalal Abdulmohsin Hammood | e-mail                        | dalal.Hammood@mtu.edu.iq                                                                                                                                                                                                                 |
| Peer Reviewer Name                 | Dr. Mahmoud Shuker Mahmoud                 | e-mail                        | mahmoud.shukur@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               | None | 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 teach the students about Real-time scheduling and schedulable analysis.</li> <li>2. To enable the students to Formally specify and verify the timing constraints</li> <li>3. Design methods for real-time systems</li> <li>4. Development and implementation of new techniques to advance the state-of-the-art real-time systems research.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Module Learning Outcomes</b><br><b>مخرجات التعلم للمادة الدراسية</b>                                                          | <ul style="list-style-type: none"> <li>• correctly and precisely reason about times, events, and action</li> <li>• list and reason about the sources of error and inexactitude in time interval measurement, execution time prediction, and scheduling</li> <li>• empirically estimate the accuracy of a real time clock</li> <li>• measure the execution time of a piece of code</li> <li>• empirically estimate the accuracy and overhead of a real-time scheduler</li> <li>• describe and apply commonly used abstract models and terminology for real-time scheduling and resource management</li> <li>• recognize, classify, and formulate the hard and soft timing requirements of a software system</li> <li>• select an appropriate software architecture and combination of scheduling techniques to satisfy a set of timing requirements</li> <li>• understand and apply the proofs of the fundamental theorems of deadline and fixed priority real-time scheduling</li> <li>• carry out schedulability analysis using deadline and fixed-priority approaches</li> <li>• implement a set of tasks with periodic and aperiodic timing requirements, using C threads and a real-time variant of the Linux operating system</li> <li>• evaluate the suitability of an operating system for real-time applications</li> </ul> |
|                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Indicative Contents</b><br><b>المحتويات الإرشادية</b>                                                                         | <p>Indicative content includes the following.</p> <p>Part-A [20 Hrs]</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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|  | <p>Introduction to RTS: what is system, what is RT, what is the concept of time in systems, classification, specs of each type, how and when,</p> <p>Part-B [20Hrs]</p> <p>Scheduling: the concept of scheduling, types, clock, priority, aperiodic, sporadic tasks, resource access, resource control</p> <p>Part-C [20 Hrs]</p> <p>Multi-processor scheduling: coordination, resource sharing, temporal constraints.</p> <p>Part-D [10 hrs]</p> <p>RTOS, Datastores, timers, kernels</p> |
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### 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 | 4.26 |
| <b>Total SWL (h/sem)</b>                                                       | 125 |                                                                            |      |

|                                       |  |
|---------------------------------------|--|
| الحمل الدراسي الكلي للطلاب خلال الفصل |  |
|---------------------------------------|--|

| 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 #5-9          |
|                       | Assignments     | 2           | 10% (10)         | 8, 13      | LO #1-6, LO #6- 10        |
|                       | Projects / Lab. | 1           | 10% (10)         | Continuous |                           |
|                       | Report          | 1           | 10% (10)         | 14         | LO # 1- 12                |
| Summative assessment  | Midterm Exam    | 2 hr        | 10% (10)         | 7          | LO # 1-6                  |
|                       | 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 RTs                                                                                      |
| Week 2                          | Hard Versus Soft Real-Time Systems                                                                       |
| Week 3                          | A Reference Model of Real-Time Systems                                                                   |
| Week 4                          | Commonly Used Approaches to Hard Real-Time Scheduling                                                    |
| Week 5                          | Clock-Driven Scheduling                                                                                  |
| Week 6                          | Priority-Driven Scheduling of Periodic Tasks                                                             |
| Week 7                          | Midterm Exam                                                                                             |
| Week 8                          | Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems. Resources and Resource Access Control |
| Week 9                          | Clock sync, timers, Kernels                                                                              |
| Week 10                         | RT in distributed Systems                                                                                |
| Week 11                         | Scheduling in multi-processors                                                                           |
| Week 12                         | Clock Sync.                                                                                              |
| Week 13                         | Hardware, timers, Kernels                                                                                |

|                |                       |
|----------------|-----------------------|
| <b>Week 14</b> | RTOS                  |
| <b>Week 15</b> | Real Time data stores |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br>المنهاج الاسبوعي للمختبر |                      |
|-------------------------------------------------------------------------|----------------------|
|                                                                         | Material Covered     |
| <b>Week 1</b>                                                           | Arduino UC           |
| <b>Week 2</b>                                                           | Static loops         |
| <b>Week 3</b>                                                           | Dynamic loops        |
| <b>Week 4</b>                                                           | Watchdog             |
| <b>Week 5</b>                                                           | Timers               |
| <b>Week 6</b>                                                           | Arduino RTOS         |
| <b>Week 7</b>                                                           |                      |
| <b>Week 8</b>                                                           |                      |
| <b>Week 9</b>                                                           |                      |
| <b>Week 10</b>                                                          |                      |
| <b>Week 11</b>                                                          | Network app (client) |
| <b>Week 12</b>                                                          | Network app (server) |
| <b>Week 13</b>                                                          | Network app (UDP)    |
| <b>Week 14 &amp; 15</b>                                                 | Proto-typing         |

| <b>Learning and Teaching Resources</b><br>مصادر التعلم والتدريس |                                                                                                                                                                                                                                                                                                                                                              |                           |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                                                                 | Text                                                                                                                                                                                                                                                                                                                                                         | Available in the Library? |
| <b>Required Texts</b>                                           | Real-Time Systems, Jane W. S. Liu, 2000                                                                                                                                                                                                                                                                                                                      | NO                        |
| <b>Supporting Texts</b>                                         |                                                                                                                                                                                                                                                                                                                                                              | No                        |
| <b>Online resource</b>                                          | <a href="https://www.youtube.com/watch?v=yShUSwskUNA&amp;list=PL1iLu2CSC9EU4mMByEhBp9CcYgAliDs_v">https://www.youtube.com/watch?v=yShUSwskUNA&amp;list=PL1iLu2CSC9EU4mMByEhBp9CcYgAliDs_v</a><br><br><a href="https://personal.utdallas.edu/~cxl137330/courses/fall13/RTS/RTS.html">https://personal.utdallas.edu/~cxl137330/courses/fall13/RTS/RTS.html</a> |                           |

|  |                                                                                                                                             |  |
|--|---------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <a href="http://www.cs.fsu.edu/~baker/realtime/syllabus.html#Objectives">http://www.cs.fsu.edu/~baker/realtime/syllabus.html#Objectives</a> |  |
|--|---------------------------------------------------------------------------------------------------------------------------------------------|--|

| <b>Grading Scheme</b><br>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. |                         |                     |           |                                       |