# MODULE DESCRIPTION FORM

# نموذج وصف المادة الدراسية

| Module Information<br>معلومات المادة الدراسية | | | | | |
|---|---|---|---|---|---|
| **Module Title** | **Digital Electronics** | | | **Module Delivery** | |
| **Module Type** | **Core** | | | ☒ **Theory**<br>☒ **Lecture**<br>☒ **Lab**<br>☐ **Tutorial**<br>☐ **Practical**<br>☐ **Seminar** | |
| **Module Code** | | | | | |
| **ECTS Credits** | **8** | | | | |
| **SWL (hr/sem)** | **Its hours** | | | | |
| **Module Level** | | | **Semester of Delivery** | | |
| **Administering Department** | Type Dept. Code | | **College** | Type College Code | |
| **Module Leader** | Name | | **e-mail** | E-mail | |
| **Module Leader's Acad. Title** | Professor | | **Module Leader's Qualification** | | Ph.D. |
| **Module Tutor** | Name (if available) | | **e-mail** | E-mail | |
| **Peer Reviewer Name** | Name | | **e-mail** | E-mail | |
| **Scientific Committee Approval Date** | 01/06/2023 | | **Version Number** | 1.0 | |

| Relation with other Modules<br>العلاقة مع المواد الدراسية الأخرى | | | |
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| **Prerequisite module** | None | **Semester** | |
| **Co-requisites module** | None | **Semester** | |

| Module Aims, Learning Outcomes and Indicative Contents<br>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية | |
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| **Module Objectives**<br>أهداف المادة الدراسية | The objectives of a logic circuit course may vary depending on the specific curriculum and educational institution. However, here are some common objectives you might find in a logic circuit course:<br><br>Understand the fundamental concepts: The course aims to provide students with a solid understanding of the basic concepts of logic circuits, including Boolean algebra, logic gates, truth tables, and logical operations.<br>Analyze and design logic circuits: Students should be able to analyze and design combinational and sequential logic circuits. This includes understanding the behavior of logic gates and their interconnections to achieve desired logic functions.<br><br>Apply problem-solving skills: The course should develop students' problem-solving abilities by presenting various logic circuit design problems and challenges. This involves breaking down complex problems into smaller components and applying logical reasoning to find solutions.<br><br>Gain practical experience: The course should provide hands-on experience with constructing and testing logic circuits using hardware components such as logic gates, flip-flops, and other digital building blocks. This practical experience helps students reinforce their theoretical knowledge and develop troubleshooting skills.<br><br>Foster teamwork and collaboration: Many logic circuit designs are complex and require collaborative efforts. The course may encourage teamwork through group projects or lab exercises, fostering skills in communication, collaboration, and division of work.<br><br>. Develop critical thinking and logical reasoning: The course should promote critical thinking skills by challenging students to analyze and evaluate different circuit design approaches and their implications. It should also emphasize the importance of logical reasoning in designing reliable and efficient logic circuits.<br><br>Understand practical applications: Students should explore the practical applications of logic circuits in various fields, such as computer architecture, digital systems, telecommunications, and control systems. This helps students understand the relevance and significance of logic circuits in real-world scenarios. |

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| | These objectives aim to provide students with a comprehensive understanding of logic circuits, enabling them to apply their knowledge in designing, analyzing, and troubleshooting digital systems. |
| **Module Learning Outcomes**<br><br>مخرجات التعلم للمادة الدراسية | By the end of a logic circuit course, learners should be able to achieve the following learning outcomes:<br><br>Understand the fundamentals of logic circuits: Students should grasp the basic concepts of logic gates, Boolean algebra, truth tables, and logic circuit design.<br><br>Analyze and simplify logic expressions: Learners should be proficient in simplifying logic expressions using Boolean algebra laws and theorems, including De Morgan's laws, distributive laws, and Boolean identities.<br><br>Design combinational logic circuits: Students should be able to design and implement combinational logic circuits using various logic gates, multiplexers, decoders, and encoders. They should understand how to analyze and synthesize logic circuits based on given specifications.<br><br>Apply knowledge to real-world applications: Learners should be able to apply their understanding of logic circuits to solve real-world problems and design practical applications. This may include digital systems, arithmetic circuits, memory circuits, or control circuits.<br><br>. Demonstrate effective communication and teamwork skills: Students should be able to communicate their ideas, designs, and analysis effectively, both orally and in written form. They should also be able to work collaboratively in teams, participating in group projects or lab exercises.<br>. Develop a critical and analytical mindset: Learners should develop the ability to analyze complex problems, think critically, and apply logical reasoning in solving circuit design challenges. They should be able to evaluate the performance, efficiency, and trade-offs of different circuit design choices.<br><br>These learning outcomes provide a broad overview of the expected knowledge and skills that students should acquire during a logic circuit course. However, specific courses may have additional or slightly different learning outcomes based on their curriculum and objectives. |

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| **Indicative Contents**<br>المحتويات الإرشادية | A course on logic circuits typically covers the fundamentals of digital logic design and analysis. The following are indicative contents that may be included in such a course:<br><br>Introduction to Digital Logic:<br>Number systems: binary, decimal, and hexadecimal<br>Binary arithmetic: addition, subtraction, and multiplication<br>Logic gates: AND, OR, NOT, XOR, NAND, NOR<br>Boolean algebra: laws and theorems<br>Combinational Logic:<br>Boolean functions and truth tables<br>Logic gate implementation of Boolean functions<br>Karnaugh maps and simplification techniques<br>Combinational circuit design and analysis<br>Multiplexers and demultiplexers<br>Encoders and decoders<br><br>Please note that the actual content and depth of each topic may vary depending on the specific course, instructor, and educational institution. This list provides a general overview of the main concepts typically covered in a logic circuit course. |

| **Learning and Teaching Strategies**<br>استراتيجيات التعلم والتعليم | |
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| **Strategies** | When it comes to strategies for a logic circuit course, there are several approaches you can take to enhance your understanding and improve your performance. Here are some effective strategies:<br><br>Master the Fundamentals: Logic circuit courses build upon foundational concepts. Make sure you have a strong understanding of basic logic gates, Boolean algebra, truth tables, and logic expressions. Take the time to thoroughly grasp these concepts before moving on to more complex topics.<br>Practice with Real-Life Examples: Logic circuits are prevalent in various electronic devices and systems. Look for practical examples in everyday life, such as digital clocks, calculators, or traffic light control systems. Try to understand how logic gates are used in these applications. This approach will help you bridge the gap between theory and practical applications.<br>Create Truth Tables: Truth tables are an essential tool for understanding the behavior of logic circuits. Create truth tables for different |

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| | combinations of inputs and observe the outputs. This practice will help you identify patterns and gain insights into the functioning of logic gates.<br>Solve Problems Step-by-Step: Logic circuit problems often involve multiple steps and require a systematic approach. Break down complex problems into smaller, manageable steps. Solve each step methodically, making sure to apply the relevant logic rules and techniques. This approach will help you avoid mistakes and build confidence in problem-solving.<br>Utilize Circuit Simulation Software: Use circuit simulation software, such as Logisim or Proteus, to simulate and visualize the behavior of logic circuits. These tools allow you to experiment with different circuit designs, input combinations, and observe the corresponding outputs. Simulation software can be an invaluable resource for understanding and verifying your circuit designs.<br>Collaborate and Discuss: Engage in discussions with your classmates or join study groups to share knowledge and exchange ideas. Explaining concepts to others and discussing problem-solving strategies can reinforce your understanding and help you see different perspectives.<br>Seek Additional Resources: Apart from your course materials, explore additional resources such as textbooks, online tutorials, video lectures, and interactive learning platforms. Different resources can present concepts in different ways, providing alternative explanations that may resonate with you better.<br>Review and Practice Regularly: Dedicate regular study sessions to review previous topics and solve practice problems. Logic circuits require practice to develop an intuition for circuit design and analysis. Consistency is key to reinforcing your understanding and building fluency.<br>Seek Help When Needed: If you encounter difficulties or have specific questions, don't hesitate to seek help from your instructor, teaching assistants, or online communities dedicated to electronics or logic circuits. They can provide clarification, additional resources, or guidance to help you overcome challenges.<br><br>Remember, learning logic circuits is a gradual process that requires patience and persistence. By implementing these strategies, you can enhance your understanding and excel in your logic circuit course. |

| **Student Workload (SWL)** |
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| الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا |

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| **Structured SWL (h/sem)**<br>الحمل الدراسي المنتظم للطالب خلال الفصل | 109 | **Structured SWL (h/w)**<br>الحمل الدراسي المنتظم للطالب أسبوعيا | 7 |
| **Unstructured SWL (h/sem)**<br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 91 | **Unstructured SWL (h/w)**<br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 6 |
| **Total SWL (h/sem)**<br>الحمل الدراسي الكلي للطالب خلال الفصل | **200** | | |

## Module Evaluation
تقييم المادة الدراسية

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

## Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

| | **Material Covered** |
|---|---|
| **Week 1** | positional number system,<br>binary digits(bits), convert from binary to decimal and from decimal to binary, hexadecimal (hex) and octal numbering systems |
| **Week 2** | Converting between the four numbering systems (decimal, binary, Hex and octal), fraction of number system |
| **Week 3** | Signed and un signed binary numbers, two's complement, binary addition and subtraction |
| **Week 4** | Binary coded decimal (BCD) codes, ASCII code, Gray code. |
| **Week 5** | switching algebra, properties of switching algebra, |
| **Week 6** | the development of a truth table, manipulating algebraic functions, sum of products (SOP), product of sum (POS), |
| **Week 7** | implementation of switching functions using networks<br>of AND, OR, and NOT gates. DeMorgan's theorem |
| **Week 8** | From truth table to algebraic expression, Exclusive-OR, simplifying algebraic expressions, consensus operator |
| **Week 9** | 2, 3, and four-variable Karnaugh map, |

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| **Week 10** | minimum SOP expressions using the Karnaugh map, finding a minimum product of sums (POS) expression |
| **Week 11** | Five and six-variable Karnaugh map, economize by sharing gates |
| **Week 12** | Design 1-bit and 2-bits full adder design 1-bit subtractor, subtractor/ adder |
| **Week 13** | comparators, binary decoders, binary encoder, |
| **Week 14** | multiplexe and demultiplexe, |
| **Week 15** | D, S-R, T and J-K flip flops, flip flop with clear and preset inputs, timing for flip flop, Moore model circuit and Mealy model analysis |
| **Week 16** | **Mid term exam** |

| **Delivery Plan (Weekly Lab. Syllabus)**<br>المنهاج الاسبوعي للمختبر | |
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| | **Material Covered** |
| **Week 1** | Lab 1: basic logic gates |
| **Week 2** | Lab 2: logic circuit analysis |
| **Week 3** | Lab 3: logic circuit design |
| **Week 4** | Lab 4: Karnaugh map |
| **Week 5** | Lab 5: Full adder/subtractor |
| **Week 6** | Lab 6: Multiplexer |
| **Week 7** | Lab 7: decoder and encoder |

| **Learning and Teaching Resources**<br>مصادر التعلم والتدريس | | |
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| | **Text** | **Available in the Library?** |
| **Required Texts** | Digital Fundamentals 11th Edition, Thomas L. Floyd, Pearson Education India | Yes |
| **Recommended Texts** | Text book 1: M. Morris Mano. ," Digital Design", 3rd edition 2004, Published by McGraw-Hill | No |
| **Websites** | https://www.tutorialspoint.com/index.htm | |

| **Grading Scheme**<br>مخطط الدرجات | | | | |
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| **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 |

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| **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 |
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**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.

Logic circuit course **Strategies**