MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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| **Module Information****معلومات المادة الدراسية** |
| **Module Title** | Physics and Electronic Circuits Design | **Module Delivery** |
| **Module Type** | B | * **☒ Theory**
* **☐ Lecture**
* **☒ Lab**
* **☒ Tutorial**
* **☒ Practical**
* **☐ Seminar**
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| **Module Code** | PECD123 |
| **ECTS Credits**  | 6 |
| **SWL (hr/sem)** | 150 |
| **Module Level** | UGx11 UG1 | **Semester of Delivery** | 2 |
| **Administering Department** | Type Dept. Code |  **College** |  Type College Code |
| **Module Leader** | DR. Nihad Ibrahim Abbas |  **e-mail** | Nihad ,I.abbas@uotechnology.edu.iq |
| **Module Leader’s Acad. Title** | Lecturer | **Module Leader’s Qualification** | Ph.D. |
| **Module Tutor** | Dr. Nibras Sabih Abbas  |  **e-mail** | Sabeehnibras@gmail.com |
| **Peer Reviewer Name** | Name |  **e-mail** | E-mail |
| **Scientific Committee Approval Date** |  | **Version Number** |  |

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

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| **Module Aims, Learning Outcomes and Indicative Contents****أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** |
|  **Module Objectives****أهداف المادة الدراسية** | 1. To understand the concepts of semiconductor materials physics and the electronic components constructed using semiconductor materials such as diodes, bipolar junction transistors and unipolar field effect transistors.
2. Develop problem solving skills and understanding the electronic circuit analysis through different analysis techniques.
3. Study the characteristics and applications of semiconductor components (diodes and transistors).
4. Study the fundamentals of electronic circuit design.
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| **Module Learning Outcomes****مخرجات التعلم للمادة الدراسية** | 1. Define and explain different types of semiconductor materials used in manufacturing of electronic components.
2. Study atomic structure of semiconductor’s materials and comparing them with conductors and insulators materials in terms of conductivity, electric bonds, and energy levels.
3. Descried the doping effects on the semiconductor materials to construct n-type and p-type semiconductors and form p-n diode junction.
4. Study DC diode characteristics and discuss different of diode equivalent models.
5. Study and explain DC and AC diode application (clipper, clamper, rectifiers, voltage multipliers and diodes logic gate circuits.
6. Define special kinds of semiconductor diodes (Zener diodes, tunnel diodes, and varactor diodes).
7. Define bipolar junction transistors (BJTs) such as npn and pnp transistors and their inputs and outputs DC characteristics.
8. Identify different configuration connections (CB, CE, CC, ~~and~~ CE with RE )
9. Analysis various DC biasing circuits.
10. Discuss BJT Transistor Modeling.
11. Ac small signal analysis for BJT.
12. Introduction to junction Field Effect Transistors (JFETs) and metal oxide semiconductor field effect transistors (MOSTETs) (construction and characteristics).
13. Discuss different biasing circuit configurations.
14. Explain FET ac small signal circuits.
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| **Indicative Contents****المحتويات الإرشادية** | Indicative content includes the following.Semiconductor materials Define: atomic structure of silicon and germanium semiconductor materials. Covalent bonds of silicon and Germanium semiconductors, Intrinsic materials, extrinsic materials conductivity and resistivity. Energy levels, temperature effects on semiconductors materials. impurity atoms and doping process. Effect of donor impurities on the energy band structure. N-type and p-type formed by doping process. majority and minority carriers, deletion region in semiconductor diodes. [20 hrs.].Semiconductor DiodeSemiconductor diode construction, external biasing effects on depletion region. Forward and revers bias conditions. Silicon and Germanium diode characteristics, diode chaceristics equation definition, define different parts of diode characteristics (saturation current, breakdown point, forward and reverse bias regions). Temperature effects on the characteristics of a silicon semiconductor diode, diodes resistance levels (DC or static resistance, dynamic resistance, and average ac resistance). diode equivalent circuits. [20 hrs.]Special semiconductor diodes:Zener Diodes, light-emitting diodes (LEDs), varactor diodes, and tunnel diodes. [ 10 hrs.]Diode ApplicationsDiode Approximations, Series, Parallel and Series–Parallel Configurations, Full and half wave rectifiers, clipping circuits, clamping circuits, voltage multiplier circuits. [30 hrs.]Revision problem classes [10 hrs.]Bipolar Junction Transistors (BJTs)Introduction, transistor construction, transistor operation, transistor configurations, input-output characteristics, DC biasing circuits, ac small signal analysis. [40 hrs.]field-effect transistor (FET)Introduction, construction and characteristics of JFETs, transfer characteristics, Introduction to MOSTET transistors, FET biasing circuits. [20 hrs.] |

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| **Learning and Teaching Strategies****استراتيجيات التعلم والتعليم** |
| **Strategies** | Teaching strategies adopted in electronic circuit analysis class encourage students to stimulate their imagination in understanding electronic component operations in different circuits and electronic systems. Also, help them to improve skills in discovering electronic systems fault diagnosis. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students. |

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| **Student Workload (SWL)****الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا** |
| **Structured SWL (h/sem)****الحمل الدراسي المنتظم للطالب خلال الفصل** | 100 | **Structured SWL (h/w)****الحمل الدراسي المنتظم للطالب أسبوعيا** | 6 |
| **Unstructured SWL (h/sem)****الحمل الدراسي غير المنتظم للطالب خلال الفصل** | 50 | **Unstructured SWL (h/w)****الحمل الدراسي غير المنتظم للطالب أسبوعيا** | 3 |
| **Total SWL (h/sem)****الحمل الدراسي الكلي للطالب خلال الفصل** | **150** |

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| **Module Evaluation****تقييم المادة الدراسية** |
| **As** | **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) |  |  |

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| **Delivery Plan (Weekly Syllabus)****المنهاج الاسبوعي النظري** |
| **Week**  | **Material Covered** |
| **Week 1** | Introduction to semiconductor materials |
| **Week 2** | Energy Levels and impurity atoms and doping process |
| **Week 3** | Extrinsic Materials—*n*- and *p*-Type and Semiconductor Diode construction |
| **Week 4** | Diode V-I characteristics and diode equivalent circuits |
| **Week 5** | Diode applications I  |
| **Week 6** |  Diode applications II |
| **Week 7** | Special types of diodes |
| **Week 8** | BJT construction and operations |
| **Week 9** | BJT characteristics and configurations |
| **Week 10** | DC biasing circuits |
| **Week 11** | Introduction to FET, construction and operations. |
| **Week 12** | Junction JFET characteristics and configuration  |
| **Week 13** | DC biasing circuits |
| **Week 14** | BJT ac small signal analysis |
| **Week 15** | FET ac small signal analysis |
| **Week 16** | **Preparatory week before the final Exam** |

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| **Delivery Plan (Weekly Lab. Syllabus)****المنهاج الاسبوعي للمختبر** |
| **Week**  | **Material Covered** |
| **Week 1** | Lab 1: Dc diode characteristics |
| **Week 2** | Lab 2: parallel-series diode circuits |
| **Week 3** | Lab 3: AND-OR logic gates |
| **Week 4** | Lab 4: rectifier circuits(half and full wave rectifiers) |
| **Week 5** | Lab 5: capacitor smoothing filter. |
| **Week 6** | Lab 6: clipper |
| **Week 7** | Lab 7:clamper  |
| **Week**  | Lab 8: Zener diode as limiter |
| **Week 9** | Lab 9: BJT dc input - output characteristics |
| **Week 10** | Lab 10: DC biasing circuits  |
| **Week 11** | Lab 11: introduction to FET operation |
| **Week12**  | Lab12: JFET biasing circuits |
| **Week13** | Common Emitter (CE) Amplifier |
| **Week14** | Common Base (CB) Amplifier |
| **Week15** | Common collector (CC) Amplifier |

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| **Learning and Teaching Resources****مصادر التعلم والتدريس** |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | Robert Boylestad and Louis Nashelsky, “ELECTRONIC DEVICES AND CIRCUIT THEORY” 7TH Edition, PRENTICE HALL, Columbus, Ohio. | Yes |
| **Recommended Texts** | Thomas L. Floyd, “Electronic devices: electron flow version”, 9th ed., 2012, Prentice Hall | yes |
| **Websites** | [https://www.coursera.org/browse/physical-sience-and-engineering/electronic](https://www.coursera.org/browse/physical-science-and-engineering/electronic)  |

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|  **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 |
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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. |