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|  | Ministry of Higher Education and  Scientific Research - Iraq  University of Diyala  College of Engineering  Department of Materials Engineering | D:\منهج بولونيا\تنزيل.jpg |

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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| **Module Information**  **معلومات المادة الدراسية** | | | | | | | |
| **Module Title** | Powder Metallurgy | | | | **Module Delivery** | | |
| **Module Type** |  | | | | * **☐ Theory** * **☒ Lecture** * **☐ Lab** * **☐ Tutorial** * **☐ Practical** * **☐ Seminar** | | |
| **Module Code** | ME‎ | | | |
| **ECTS Credits** |  | | | |
| **SWL (hr/sem)** |  | | | |
| **Module Level** | | UGx11 | **Semester of Delivery** | | | | 2 |
| **Administering Department** | | Materials Engineering | **College** | College of Engineering | | | |
| **Module Leader** |  | | **e-mail** |  | | | |
| **Module Leader’s Acad. Title** | |  | **Module Leader’s Qualification** | | | |  |
| **Module Tutor** | None | | **e-mail** | None | | | |
| **Peer Reviewer Name** | | None | **e-mail** | None | | | |
| **Scientific Committee Approval Date** | | 19/9/2023 | **Version Number** | | | 1.0 | |

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

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| **Module Aims, Learning Outcomes and Indicative Contents**  **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** | |
| **Module Objectives**  **أهداف المادة الدراسية** | This module aims to   1. Apply the mechanism and the applications of Powder metallurgy. 2. Apply the different methods for production powders. 3. Apply different technique for pressing the powders. 4. Apply different technique for sintering. 5. Study the Sintered Metal Carbides. |
| **Module Learning Outcomes**  **مخرجات التعلم للمادة الدراسية** | 1. Understanding the basic of Powder metallurgy. 2. Understanding the physical and mechanical properties of Powder metallurgy. 3. Understand the effect of pressure on the physical and mechanical properties of Powder metallurgy. 4. Understand the effect of sintering on the physical and mechanical properties of Powder metallurgy. 5. Understand the production of the Sintered Metal Carbides. 6. Understand applications of the Sintered Metal Carbides. 7. Ability to Formulate different engineering applications in powders technology 8. Ability to identify the problem method of synthesis of powders. 9. Identify and describe different methods of production of powder 10. Ability to select and apply appropriate methods for powder metallurgy |
| **Indicative Contents**  **المحتويات الإرشادية** | This course description provides a summary of the most important characteristics of the course and the learning outcomes that the student is expected to achieve, demonstrating whether he or she has made the most of the learning opportunities available. It must be linked to the program description |

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| **Learning and Teaching Strategies**  **استراتيجيات التعلم والتعليم** | |
| **Strategies** | The main strategy that will be adopted in delivering this module is to encourage students’ participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive seminars and by considering types of simple experiments involving some sampling activities that are interesting to the students.   * + - 1. Lectures where the students write information presented to them via slide show or written by the lecturer.       2. Feedback given to students during tutorials.       3. Small group in tutorial sessions.       4. Question and answer sessions during lectures or staff office hours. |

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| **Module Evaluation**  **تقييم المادة الدراسية** | | | | | |
| **As** | | **Time/Number** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 6 | 5% (5) | 2, 4, 6, 8, 10, 12 | LO #1 to #15 |
| **Assignments** | 3 | 5% (5) | 3, 7, 13 | LO #1 to #15 |
| **Projects / Lab.** | 2hrs. | 10% (10) | Continuous | All |
| **Group Presentation** | 1 | 10% (10) | 15 | LO #1 - #12 |
| **Summative assessment** | **Midterm Exam** | 2hrs. | 20% (20) | 6 and 12 | LO #1 - #8 |
| **Final Exam** | 3hrs. | 50% (50) | 15 | All |
| **Total assessment** | | | 100% (100 Marks) |  |  |

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| **Delivery Plan (Weekly Syllabus)**  **المنهاج الاسبوعي النظري** | |
| **Week** | **Material Covered** |
| **Week 1** | **General steps in the P/M process**  1.1 Introduction |
| **Week 2 & 3** | **Powder Production**  2.1 Chemical methods  2.2 Physical methods  2.3 Mechanical methods  2.4 Selection of Metal powder production method |
| **Week 4** | **Powder characteristics**  4.1 Chemical composition and structure  4.2 Particle size and shape  4.3 Compressibility  4.4 Apparent and Tap density  4.5Surface area |
| **Week 5 & 6** | **Powder compaction**  **Die compaction:**  5.1 Pressing Operation  5.2 Compaction pressing  5.3 Factor affecting tooling design  5.4 Tooling Material  **Cold Isostatic compaction**  5.5 Isostatic press equipment  5.6 Isostatic pressing cycle  5.7 Defects due to tooling limitation |
| **Week 7** | **Mid -term test** |
| **Week 8** | **Sintering process of powder compacts**  8.1 introduction  8.2 Liquid phase and activated sintering  8.3 Loose sintering  8.4 Process variables  8.5 Material variables  8.6 Dimensional changes  8.7 Microstructural changes |
| **Week 9** | **Secondary Treatment**  9.1 Machining  9.2 Surface engineering (Coating)  9.3 Heat treatment (Hardenability, case hardening, age hardening) |
| **Week 10 & 11** | **Powder Injection Molding**  10.1 Selection and Production of Metal Powders  10.2 Mixing  10.3 Moulding  10.4 Debinding  10.5 Sintering |
| **Week 12** | **Sintered Metal Carbides** |
| **Week 13** | **Application of powder technology** |
| **Week 14** | **Advantage and disadvantage of powder technology** |
| **Week 15** | Final Exam |

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| **Delivery Plan (Weekly Lab. Syllabus)**  **المنهاج الاسبوعي للمختبر** | |
| **Week** | **Material Covered** |
| **Week 1** | Lab 1: |
| **Week 2** | Lab 2: |
| **Week 3** | Lab 3: |
| **Week 4** | Lab 4: |
| **Week 5** | Lab 5: |
| **Week 6‎** | Lab 6: |
| **Week 7** | Lab 7: |
| **Week 8** | Lab 8: |
| **Week9** | Lab 8: |

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| **Learning and Teaching Resources**  **مصادر التعلم والتدريس** | | |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | * POWDER METALLURGY TECHNOLOGY   G. S. Upadhyaya Department of Materials and Metallurgical Engineering Indian Institute of Technology, Kanpur, India CAMBRIDGE INTERNATIONAL SCIENCE   * POWDER TECHNOLOGY Handling and operations, process instrumentation and working Hazard. By Hiroaki Masuda 2007 | Yes |
| **Recommended Texts** | * POWDER TECHNOLOGY Handbook Third Edition (2007) By Hiroaki Masuda. |  |

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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. | | | | |