



Jordan University of Science and Technology
Faculty of Engineering
Industrial Engineering Department/ Product
Design and Development Engineering (PDDE)



Course Number and Name	PDDE 451: Tools Design
Course Description	The course includes Tool design in manufacturing, design of cutting tools, design of dies for various manufacturing processes, clamping and work holding principles, and design of jigs and fixtures.
Credits and contact hours	3 Credit hours; 3 hours of lectures
Pre- or Co-requisites	PDDE 323: Geometric Dimensioning and Tolerancing
Compulsory/ Elective	Compulsory

Instructor	TBA
Office Location	TBA
Office Phone	TBA
Email	TBA
Office Hours	TBA

Text Book(s)	• "Fundamentals of Tool Design" by Society of Manufacturing Engineers (SME)
Software tools	• SolidWorks
References	• "Metal Cutting Theory and Practice" by David A. Stephenson and John S. Agapiou • "Die Design Handbook" by David Alkire Smith • "Jig and Fixture Design" by Edward G. Hoffman

Course Objectives	1. Understand the fundamentals of tool design and its importance in manufacturing.
	2. Learn the principles of designing cutting tools for various applications.
	3. Study the design and application of dies for different manufacturing processes
	4. Explore clamping and work holding principles and their application in tool design.

	5. Gain proficiency in designing jigs and fixtures for manufacturing processes.
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Mapping the course outcomes with the **Jordanian National Qualifications Framework (JNQF)** Level 7 descriptors:

Course Outcomes	JNQF Descriptor
1. Understand the fundamentals of tool design and its importance in manufacturing.	7K1
2. Learn the principles of designing cutting tools for various applications.	7S2
3. Study the design and application of dies for different manufacturing processes	7S3
4. Explore clamping and work holding principles and their application in tool design.	7S1
5. Gain proficiency in designing jigs and fixtures for manufacturing processes.	7C4

Evaluation		
Assessment Tool	Expected Due Date	Weight
Mid Exam	According to the University Mid examination schedule	40 %
Project	A project focused on a specific aspect of manufacturing supervision, presented during Week 13.	20%
Final Exam	According to the University's Final examination schedule	40 %

Class Schedule	
week	Description
1	Introduction to Tool Design - Overview of Tool Design - Importance of Tool Design in Manufacturing - Tool Design Process and Methodologies
2	Fundamentals of Manufacturing Tools Types of Manufacturing Tools

	• Materials Used in Tool Design • Tool Life and Wear
3	Design of Cutting Tools • Principles of Cutting Tool Design • Types of Cutting Tools: Single-Point and Multi-Point • Tool Geometry and Its Impact on Performance
4	Advanced Cutting Tool Design • Design of Drills, Reamers, and Taps • Design of Milling Cutters and Inserts • Coating and Surface Treatment of Cutting Tools
5	Introduction to Dies in Manufacturing • Types of Dies: Cutting, Forming, and Drawing • Materials for Die Design • Die Life and Maintenance
6	Design of Cutting Dies • Principles of Cutting Die Design • Design of Simple and Compound Dies • Design of Progressive Dies
7	Design of Forming Dies • Principles of Forming Die Design • Design of Bending and Drawing Dies • Design Considerations for Deep Drawing
8	Design of Extrusion and Injection Molding Dies • Principles of Extrusion Die Design • Design of Injection Molding Dies • Troubleshooting Common Issues in Die Design
9	Clamping and Work Holding Principles • Importance of Clamping and Work Holding in Manufacturing • Types of Clamping Devices • Principles of Work Holding
10	Design of Clamping Systems • Design of Vices, Chucks, and Fixtures • Hydraulic and Pneumatic Clamping Systems • Modular Clamping Systems

11	Introduction to Jigs and Fixtures • Difference Between Jigs and Fixtures • Importance of Jigs and Fixtures in Manufacturing • Types of Jigs and Fixtures
12	Design Principles for Jigs and Fixtures • Design Considerations for Jigs and Fixtures • Material Selection for Jigs and Fixtures • Design of Drilling Jigs and Welding Fixtures
13	Advanced Fixture Design • Design of Modular Fixtures • Computer-Aided Design (CAD) of Fixtures • Case Studies and Industry Examples
14	Integration of Tool Design in Manufacturing Systems • Tool Design for Automated and CNC Systems • Cost Analysis and Optimization in Tool Design • Future Trends in Tool Design and Manufacturing
15	Project Work and Presentations • Student Presentations on Tool Design Projects • Peer Review and Feedback • Final Project Submission and Evaluation