

Course syllabus
330:113(g). Manufacturing Tooling
Spring Semester 2011

Department of Industrial Technology
University of Northern Iowa
Cedar Falls, IA 50614--0178

Instructor: Dr. Nageswara Rao Posinasetti
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Catalogue description: Principles of cutting tools, jigs, fixtures, progressive dies, and gaging; tool geometry, tool life, cost analysis, ergonomics, and safety in tooling design applications. Lecture and lab. Prerequisite(s): [330:008](#); [330:009](#); [330:017](#); [330:024](#); [330:132](#); [330:170](#); junior standing.

Course web page: www.uni.edu/~rao/Course10.htm

CLASS SCHEDULE: T Th F 8:00 - 9:50 a.m. Room 24, ITC
T Th F 8:00 - 9:50 a.m. Room 17, ITC

OFFICE HOURS: W 8.00 am – 11.50 am or by appointment

Synopsis:

The course starts with an introduction to the manufacturing processing requirements in industrial practice. The concepts of accuracy and errors of manufacturing are introduced with reference to the practical manufacturing processes. The importance of tooling in manufacturing will be related with the various design aspects related to some of the most widely used tooling such as jigs and fixtures, press tools, cutting tools, inspection gages and welding jigs.

Method of Instruction:

Lectures on the tooling design are given with enough practical and standard information to validate the basic concepts and their application. Design exercises would be used to demonstrate the principles.

Graduate students: Graduate students registered for this course need to complete additional work as part of the department policy. Contact the instructor within the first week to get the additional work allocation.

Text book

J G Nee (Managing Editor), Fundamentals of Tool Design, Sixth Edition, 2010, SME, ISBN 0-87263867-7

References:

1. Donaldson, Lecain and Goold - "Tool Design", McGraw Hill, New York, 1976.
2. SME - Tool and Manufacturing Engineers Handbook, Volume 1: Machining 1,494 pages, 1983
3. SME - Die Design Handbook, 3rd Edition 928 pages, 1990
4. E. K. Henriksen - "Jig and Fixture Design Manual", Industrial Press, New York, 1973

Proposed Course Schedule:

Week	Date	Topics	Textbook
1	1/11 1/13	Introduction to the subject. Objectives of Tool Design, Economics of Design, Analysis of Small Tool Costs. Some typical examples. P1: Economic analysis of tooling	Chapt. 1
2	1/18 1/20	Ferrous Tool Materials, Nonferrous Tool Materials, Heat Treating Lab session	Chapt. 2
3	1/25 1/27	Cutting Tool Design. Metal cutting principles, cutting tool selection, Chip Formation, Tool Wear, Cutting Forces, Control of the Causes of Tool Wear and Failure P2: Cutting tool selection	Chapt. 3
4	2/1 2/3	Work holding Principles, General Considerations, Locating Principles, Work piece Surfaces, Types of Location, Degrees of Freedom, Basic Locating Rules, Locational Tolerances, Fool proofing, Basic Types of Locators, Clamping Principles, types of clamps, standard components, Other elements	Chapt. 4
5	2/8 2/10	Jig Design, General Considerations, Developing the Preliminary Jig Design, Drill Jigs, Designing a Jig P3: Design and fabricate a Jig	Chapt. 5
6	2/15 2/17	Test 1 Lab session	
7	2/22 2/24	Fixture Design, General Considerations, Developing the Preliminary fixture Design, Various types of fixtures, Designing a fixture Lab session	Chapt. 6
8	3/1 3/3	Design of Press working Tools, Power Presses, Cutting (Shearing) Operations, Die and Punch design, P4: Design a blanking die	Chapt. 7
9	3/8 3/10	Bending, Forming, and Drawing Dies Lab session	Chapt. 8
10	SPRING BREAK		
11	3/22 3/24	Forming Dies, P5: Design a bending die	Chapt. 8
12	3/29 3/31	Test 2 Lab session	
13	4/5 4/7	Design of Tools for Inspection and Gaging Lab session	Chapt. 9, 13
14	4/12 4/14	Tool Design for the Joining Processes P6: Design a welding fixture	Chapt. 10
15	4/19 4/21	Lab session Lab session	
16	4/26 4/28	Lab session Lab session	
17	5/3	Final examination	

Laboratory Work

S. No.	Project title	Date of submission	Weightage %
1	P1: Economic analysis of tooling	January 20	5
2	P2: Cutting tool selection	February 3	5
3	P3: Design a Jig (CAD) and fabricate	Design - March 3 Jig – April 28	15 25
4	P4: Design a blanking (progressive) die (CAD)	April 7	20
5	P5: Design a bending die	April 14	10
6	P6: Inspection	April 21	10
7	P7: Design a welding fixture (CAD)	April 28	10

Projects are a means by which you will be able to appreciate how the principles will be applied in practice. A number of projects are therefore included as a part of this course with substantial weightage. Use of CAD and standard components is an essential element of modern tool design in industry. It is therefore suggested that as far as possible, Internet and the facilities that have been developed in Lab. 19/24 for the purpose may be made use of. Projects are evaluated based on individual's effort and imagination. However, it is suggested that a brainstorming with colleagues in the initial stages would be useful. This will help in identifying possible solutions and pitfalls in specific approaches.

Each of the project, after completion needs to be submitted electronically on the due date specified through eLearning. No reminders! Late submissions are not accepted. The report is to be word processed. All the drawings are to be made by a CAD program following the national standards and utilizing standard components where needed. Submission should include the following:

- Drawings preferably plotted on a D size sheet (use plotter in Lab 24).
- Also submit the complete electronic version (models and drawings in native CAD format) of the project.
- For the written portion use the following settings:
 1. Margins: 1" all around
 2. Font: New Times Roman or Arial 12pt
 3. Use a cover page giving the following information
 - a. Name of the project
 - b. Project due date
 - c. To: Nageswara Rao Posinasetti
 - d. From: Your name
 4. Use 1.5 to double space in the body of the document.
 5. Staple in upper left corner.
 6. The use of spell checking is required.

If there is a justifiable reason for late submission, please explain it to me well in advance so that I may consider it.

Grading Policies:

Course grade will be based on the following components:

Examinations (3):	40%
Projects (7)	50%
Class participation	10%

Participation (attitude, punctuality, attendance, etc.) in the class in terms of regular attendance is an important component for your evaluation. As a responsible and mature individual you are expected to be present in all classes. The work in the class requires your continued attention in maintaining the regular flow of information to you. If you miss any particular class, then it becomes your responsibility to checkup with your colleagues about the coverage of that missed class. I will not be repeating the subject already covered, and would expect all to be up-to-date to follow the subsequent classes. If you miss more classes, without any prior intimation or justification, then your final grade may be affected.

Please be attentive in the class and try to participate by being dynamic. Do your homework and reading regularly. That will not only help you to be up-to-date with the subject, it will go a long way in getting a good grade in the end.

Examinations during the semester are not comprehensive. Questions may be in the form of problems, short answers, fill in the blank and/or True/False. The coverage of the examinations will be announced in the class prior to the tests and generally cover the lectures, text, homework, etc. There will be no chance to makeup for the missed examinations, unless arrangements have been made **before** the examination that is considered reasonable by the professor.

Grade scale:

Percentage range	Grade	Percentage range	Grade
95 – 100	A	74 – 76	C
90 – 94	A-	70 – 73	C-
87 – 89	B+	67 – 69	D+
84 – 86	B	64 – 66	D
80 – 83	B-	60 – 63	D-
77 – 79	C+	< 60	F

Academic dishonesty: Cheating of any kind on examinations and/or plagiarism of papers or projects is strictly prohibited. Any one caught passing off the work of others as their own (i.e., copying from a book/journal or cut and pasting from internet sources without appropriate citation) runs the risk of immediately failing the course and expulsion from the class and the University. For more institutional rules regarding academic dishonesty, please see the University catalogue on “Academic Ethics Policies” (<http://www.uni.edu/policies/301>).

Special needs: The Americans with disability Act of 1990 provides protection from illegal discrimination for qualified individuals with disabilities. Students requesting instructional accommodations due to disabilities must arrange for such accommodation through the Office of Disability Services. The ODS is located at 103 Student Services Center, and the phone number is (319) 273 2677 (<http://www.uni.edu/resources/disability>).