Instructor:  
Dr. E. A. Lehtihet  
361 LB, 863-2350  
Office Hours: To be announced next week  
lvo@psu.edu

Teaching Assistants:  
Nicole Capriles Urena

Meeting Times/Place:  
M/W 9:05-9:55 102 LB

Laboratory Sections:  
M, W, Th, F Refer to your schedule

Pre or co requisite:  
MatSc 259

Course Description: An introduction to Manufacturing Engineering with an emphasis on the tools, standards and methods used for Product and Part representation, Specifications and Qualification. Integrated hands on laboratory in CAD and Metrology.

Course Outcomes:

- 1.5 Understand information contained in typical product specifications and methods of product verification and conformance to specifications.
- 3.1 Present Engineering study results in technical reports
- 3.2 Demonstrate independent learning by synthesizing information from several sources
- 4.1 Work effectively in groups on case study projects

Course Evaluation:

Midterm Examination: 30%  
Mon, Oct 24, 6:30 – 8:30 pm  
112 Chambers Bldg.

Final Examination: 30%
Laboratory Assignments: 15%
CAD Modeling Project: 20%
Class Attendance: 5%
### Course Content:

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<th>VIDEO LECTURES</th>
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<td><strong>1. Historical Timeline of major manufacturing developments</strong>&lt;br&gt;The Beginning&lt;br&gt;Interchangeability&lt;br&gt;Scientific Management&lt;br&gt;Sequenced Assembly&lt;br&gt;Statistical Quality Control&lt;br&gt;Lean Production System&lt;br&gt;Flexible Production Systems&lt;br&gt;Globalization</td>
<td>L1-3</td>
<td>HANDOUT_1</td>
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<td><strong>2. Working with Manufactured Dimensions</strong>&lt;br&gt;Functional Relations&lt;br&gt;Vector Loop Method&lt;br&gt;Deterministic Model Equations &amp; Solution&lt;br&gt;Probabilistic Model Equations &amp; Solution</td>
<td>L4-8</td>
<td>HANDOUT_2 Lect. Chapt.</td>
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<td><strong>3. Elements of Product Definition</strong>&lt;br&gt;Interchangeability Models: Complete&lt;br&gt;Interchangeability, Selective Assembly, Unit&lt;br&gt;Assembly, Adjustment at Assembly Models&lt;br&gt;and Solution&lt;br&gt;Product Definition&lt;br&gt;Anatomy of a Part Print</td>
<td>L9-16</td>
<td>HANDOUT_3 Lect. Chapt.</td>
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<td><strong>4. Elements of Product Specifications</strong>&lt;br&gt;The ASME Y14.5M-2009 Standard&lt;br&gt;Dimensional and Geometric Constraints&lt;br&gt;Standardized Limits and Fits&lt;br&gt;Geometric constraints: Specifications, and&lt;br&gt;Interpretation&lt;br&gt;Surface Constraints: Specifications, Interpretation and Measurement</td>
<td>L17-22</td>
<td>HANDOUT_4</td>
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<td><strong>5. Introduction to Product Qualification</strong>&lt;br&gt;Fundamental Principles of Metrology&lt;br&gt;Measurement Uncertainty (GUM)&lt;br&gt;Metrology of a Simple Work piece&lt;br&gt;Attribute Metrology&lt;br&gt;Variables Metrology</td>
<td>L23-29</td>
<td>HANDOUT_5 References</td>
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Course material:


Notes: Power Point packets (in pdf format) for sections 1, 2, 3, 4 and 5 of the course content will be posted on the course ANGEL site for students to download. It is the student’s responsibility to download and bring the appropriate packet to class.

Lab: Some Laboratory assignments will be handed out during the Laboratory session while others will be posted electronically on the course ANGEL web site for students to download. Each student is expected to download his/her copy and study it prior to coming to the Laboratory session. Lab attendance is MANDATORY. Any unexcused absence from Lab will result in a zero for that Lab. We do not provide make up Labs for wedding attendances, birthdays, brother and sister graduations, bar mitzvahs and other such occasions. If you choose to skip Lab in order to attend such functions, you will get a zero for that Lab. You must come to LAB ON TIME. If you arrive 15 mins late to the Lab, you will get a zero for that Lab. Late stragglers (< 15 mins. 3 or more times) will be penalized one full lab mark.

Other: References to publicly available documents on the web or in the library will be given, at appropriate times throughout the course or posted on the course ANGEL web site. The students are expected to obtain and study these references as they are part and parcel of examinable material.

Class Attendances: Class attendance will be randomly sampled as I see fit. The results of the sampling will be used to allocate the 5% of the grade devoted to class attendance. Five (5) or more unexcused absences will trigger the loss of the 5% attendance in the final grade.

Homework: Homework for each section of the syllabus will be posted, with solutions, on your ANGEL site. Homework will not be collected. It is up to you to practice and be ready for exams. Taking a look at homework solutions just before the exam is not an effective preparation strategy.

Laboratory Activities:

LAB_1: To be determined
LAB_2: CAD with SolidWorks
LAB_3: CAD with SolidWorks
LAB_4: CAD with SolidWorks
LAB_5: CAD with SolidWorks
LAB_6: CAD with SolidWorks
LAB_7: CAD with SolidWorks
LAB_8: Introduction to Metrology equipment
LAB_9: Measurement data acquisition, analysis and presentation
LAB_10: Variability of manufactured products / Hand measurement tools
LAB_11: Instrument calibration
LAB_12: Measurement of size and position constraints (Hand tools)
LAB_13: Measurement of Surface Characteristics (Surface texture and Hardness)
LAB_14: Measurement Uncertainty (GUM procedure)
LAB_15: CMM Contact and non-contact measurement (Form, Orientation and Location)

**Academic Integrity:**

Academic dishonesty includes, but is not limited to, cheating, facilitating acts of academic dishonesty by others, unauthorized prior possession of exams, projects and recitations, submitting work of another person or work previously used, or tampering with the academic work of other students. Any attempt at academic dishonesty will be prosecuted to the fullest possible extent. Pay special attention to the following points:

a. The sharing of CAD computer files, retrieval and submission of other people’s files as your own work will result in a zero for ALL THE CAD WORK PORTION of the course and will be prosecuted as per University and College rules.

b. The sharing and unauthorized collaboration (among groups) for group metrology labs will result in a zero for ALL THE LAB METROLOGY PORTION of the course and will be prosecuted as per University and College rules.

c. Signing the attendance sheet on behalf of another person is a violation of academic integrity, will result in a loss of 10% of the grade for the course and will be prosecuted to the fullest.

**Key Instructor Expectations for this class:**

1. I expect you to attend all classes. It is difficult to miss class and do well in the exams and project of this class. Laboratory attendance is mandatory. Any unexcused absence will result in a **zero** for that session. There will be no make up for unexcused absences. It is the student’s responsibility to make arrangements with the instructor for an excused absence make up session. These arrangements must be made prior to the absence or no later than 2 days upon return on campus after the absence. Failure to do so will result in a zero
2. I expect you to be in class on time. Late stragglers are disruptive. No food or 
drinks (except for water bottles in class only, not in the Lab) are allowed 
during class or in the Laboratory.

3. I expect you to make full use of my office hours. Trying to catch up on all 
unanswered questions the day before the exam is not an effective learning 
strategy.

4. I expect you to ask lots of questions in class. There is no such thing as a stupid 
question and I do not mind repeating explanations.

5. I expect you to make a serious effort at self learning. A number of activities in 
this course have been designed to give you an opportunity to practice and 
demonstrate your self learning ability. It is an ability that will serve you well 
in the future.

6. I expect you to be ready to apply material and concepts acquired in other 
courses to the concepts and problems encountered in this course. We do not 
have time to redo what was already covered in previous or even concurrent 
classes.

7. CELL PHONES: Fidgeting with your cell phone in class is DISRUPTIVE: 
First, to your own learning, next to the people around you and last to me as 
your instructor. I am asking that you refrain from using your cell phone in 
class. If you absolutely need to monitor it or answer a text, then WALK OUT 
and do it.