

**NORTHEAST COMMUNITY COLLEGE  
COURSE SYLLABUS**

**INDT 1140  
METROLOGY**

**SPRING 2016**

**NORTHEAST COMMUNITY COLLEGE  
METROLOGY  
COURSE SYLLABUS**

**I. CATALOG DESCRIPTION:**

**COURSE NUMBER:** INDT 1140

**COURSE TITLE:** Metrology

**PRE-REQUISITES:** INDT 1065

**CO-REQUISITES:** None

**DESCRIPTION:** Studies the principles of measurement and calibration as applicable to quality assurance and quality control. Students will gain knowledge in determining appropriate levels of accuracy for inspection, understand datum identification, and gain skills in the interpretation of GT&D.

**CREDIT/CONTACT HOUR DESIGNATION:**

Credits: 2   Lecture: 30   Lab: 0   Clinical: 0   Coop: 0

**TERM:** Spring 2016

**II. COURSE OBJECTIVES:**

Course will:

1. Introduce students to a variety of gaging devices and instrumentation used to support quality assurance and quality control.
2. Familiarize students with the proper selection and usage of gaging instruments.
3. Educate students on linear, angular, and diameter measurements.
4. Present a study of contact and non-contact inspection and measurement processes and the effects of thermal properties and physical variables.
5. Illustrate the interface of metrology with machine controls and in-line inspection.
6. Acquaint students with the application of GT&D to inspection applications.

**III. STUDENT LEARNING OUTCOMES:**

The student will be able to:

1. Select the appropriate gaging for a given tolerance specification and perform calibration and adjustments of those instruments.
2. Perform English-Metric conversions to satisfy inspection requirements.
3. Interpret and apply GD&T to inspection set ups and piece part inspection.

4. Understand the concepts and apply non-contact inspection methods.
5. Inspection material stresses using proper gaging.
6. Determine the appropriate application for in-line inspection.
7. Perform process inspection and corresponding machine compensations.
8. Construct inspection set-ups using multiple datum selection.
9. Apply methods of cleaning, maintenance, and repair of instruments.

#### **IV. CONTENT/TOPICAL OUTLINE:**

##### **A. SYLLABUS AND COURSE INFORMATION**

1. Examine the Course Syllabus
2. Review Course Requirements
3. Succeeding in Class

##### **B. INTRODUCTION TO METROLOGY**

1. History of metrology
2. Advancements in metrology

##### **C. GAGING METHODS**

1. Linear, angular, and diameter gaging
2. Standards and calibration
3. Non-contact gaging methods and measurement
4. In-line gaging and data collection

##### **D. UNIT CONVERSIONS**

1. English-Metric conversion and application
2. English-Metric Instrumentation

##### **E. GD&T AND INSPECTION**

1. Understanding datum and datum selection
2. Geometric characteristics and applications
3. Application modifiers
4. Interpretation and application of multiple datum control frames

##### **F. CONCEPTS OF GAGE SELECTION AND GD&T**

1. Gage selection process considerations
2. Gage selection GD&T considerations
3. Gage selection part configuration

##### **G. INSPECTION VARIABLES**

1. Thermal impact on inspection
2. Material stability influence
3. Part configuration influence

##### **H. CASE STUDIES OF QUALITY ASSURANCE**

1. Quality assurance and control failures

##### **I. CONCEPTS OF NON-CONTACT INSPECTION**

1. Lasers

2. Optical comparators and vision systems
3. Industrial radiography
4. Non-destructive testing

J. PROCESS INTERFACE TO INSPECTION

1. Process adjustment and compensation
2. In-line inspection

K. ELEMENTS OF GAGING CARE AND CALIBRATION

1. Calibration and Adjustments
2. Cleaning and Maintenance
3. Repair and re-calibration

L. ELEMENTS OF QUALITY PLANS AND METROLOGY

1. Control plan for calibration
2. Identification and documentation
3. Traceability

Note: The course schedule and topic order is subject to change at any time without advance notice.

**V. INSTRUCTIONAL MATERIALS:**

A. Required Text:

1. Fundamentals of Dimensional Metrology, 6<sup>th</sup> Ed.  
Author: Dotson  
ISBN-10: 1133600891  
Publisher: Cengage

B. Required Materials:

1. Scientific Calculator
2. Notebook
3. Writing Utensil
4. Three Ring Binder
5. An active e-mail account
6. The [Adobe Flash Player](#) needs to be installed.

**VI. METHOD OF PRESENTATION:**

A. Methods of presentation typically include a combination of the following:

1. Presentation Methods
  - a. Lecture
  - b. Demonstration
  - c. Exhibits / Plant Tours
  - d. Indirect Discourse
  - e. Assigned Reading
  - f. Interview

2. Student Verbal Interaction
  - a. Questioning
  - b. Programmed Questioning
  - c. Student Query
  - d. Seminar
  - e. Discussions
  
3. Knowledge Applications
  - a. Performance through student interaction, gaming, equipment interaction, and electronic simulation.
  - b. Case Study

## VII. METHOD OF EVALUATION:

A. Methods of evaluation typically include a combination of the following:

1. Hands-on Practicum
  - a. Computer Simulation and Exercises
  - b. Laboratory or Field Exercises
  - c. Problem Solving
  - d. Reflective Learning Statements
  
2. Written/Oral
  - a. Exams and Quizzes
  - b. Assignments / Presentations
  - c. Field Reports/Forms/Case Studies
  - d. Article Review
  - e. Portfolios and Projects
  
3. Attendance & Participation
  - a. Group Projects
  - b. Contribution and Collaboration
  - c. Attendance
  - d. Professionalism
  
4. Final Exam = 20%

B. Grading Scale:

A+	100.0% - 98%	(4.0)
A	97.9% - 94.0%	(3.75)
B+	93.9% - 90.0%	(3.5)
B	89.9% - 86.0%	(3.0)
C+	85.9% - 81.5%	(2.5)
C	81.4% - 77.0%	(2.0)
D+	76.9% - 72.5%	(1.5)
D	72.4% - 68.0%	(1.0)
F	below 68.0%	(0.0)

C. Grading Criteria:

- |                      |     |
|----------------------|-----|
| 1. Attendance        | 10% |
| 2. Participation     | 10% |
| 3. Practicum         | 20% |
| 4. Assignments/Exams | 40% |
| 5. Final Exam        | 20% |

D. Grading Methods:

The overall grade for the course will be earned by the performance of the student; based on grades earned in accordance with the methods of evaluation identified above. Grades will be calculated based upon the percentage of points received versus the total points available. Grades are based on a 4.0 system.

## VIII. COURSE REQUIREMENTS:

A. Attendance, Participation, Conduct and Safety Policy

1. Attendance: In addition to teaching the basic skills required for entry into the job market, it is the responsibility of the instructional staff to instill students with the proper attitude towards reliability and punctuality. To accomplish this objective, the following policy is used:
  - a. If a class meets twice a week then each student is allowed two absences, if a class meets once a week then each student is allowed one absence. Every absence after may result in **six points** being deducted from their final grade.
  - b. **Being tardy is counted as an absence**. However, if the student uses a Class Pass (2 issued) and calls in prior to class, the tardy is waived. After that the tardy then counts as an absence.
  - c. Absence means the individual is not present to participate in class discussion, group work or any other interaction that might develop. Tardy means coming into the classroom after the official start of class or not returning from breaks. (One minute late to class is considered tardy!)
  - d. The student should contact the instructor to let him know of any absence as a matter of courtesy.
  - e. It is the **responsibility** of the **student** to resolve any action that results from his/her absence. This includes missed assignments and/or tests. If a test is missed the student will have 1 week to make up test. Note: Maximum score attainable for test will be 91% unless the absence has been scheduled prior to the day of the test.
  - f. **No homework will be accepted after due date and score will be a zero with the exception** of a student making arrangements due to an expected absence or calling in prior to the start of class. The

homework will be turned in the day the student returns from the absence or will receive a zero for the homework.

- g. If a student is absent 4 days on classes that meet once a week or 8 days on classes that meet twice a week, the student will fail the course. (This is the equivalent of 25% of the course.)
- h. If a discrepancy is found in grading a student must bring it to the instructor's attention within 2 weeks of entry. If discrepancy is over 2 weeks old and the discrepancy impacts the student's grade negatively the error will stand, as it is the student's responsibility to check Jupiter Grades for errors regarding course work.
- i. The lab will be cleaned at the end of each lab period. As the lab is used by a number of different classes, the lab must be left in a neat, clean and organized state.

#### B. General Lab Safety

1. The student **will follow the instructor's guidance** for safe operation of equipment. These include procedures of lockout/tag out, ladder safety, housekeeping, and machine operation. Students will not wear open toe shoes or short pants to lab. He or she will not be allowed in lab until properly attired and having proper PPE. If a student fails to comply with the instructor's request, the student will be dismissed from the class period and counted absent.
2. If a student fails to comply with a safety request a second time, the student will be expelled from the class. **ANY** Instructor can make a safety request of a student, which must be followed.
3. A student will be dismissed from class for the day if they are suspected of being under the influence of alcohol or drugs unless a predetermined medical condition has been identified and conveyed to the instructor. The student will be counted absent.
4. If a student fails to comply with safe operations while in lab or is observed to be operating equipment or processes in a manner that is unsafe to themselves or others, the instructor may suspend the student from lab until permanent action is determined.

#### C. Participation and Conduct

1. Any student responsible for a class disruption will be dismissed from class. The student will be counted absent.
2. Students are required to have tools for lab classes. No chairs will be brought into the lab area except as approved by instructor. No food or drink products will be brought into the classroom or lab areas. Failure

to abide with this policy will result in the student being dismissed from class and counted absent.

3. A student that fails to take the final test at the scheduled time will receive a zero score unless prior arrangements are made with the instructor.
4. No projects from home will be worked on until being discussed with the instructor.
5. No cell phones will be used during class time unless student notifies instructor of possible calls for a specific situation. (Ex. job interview, family emergency). Cell phones may not substitute for a calculator.
6. Acts of dishonesty relating to academics will not be tolerated. Refer to Student Code of Conduct.
7. Students that are sleeping during class time will be asked to leave class and be marked absent. Making a contribution to the class is part of your responsibilities. If you are asleep you cannot make a contribution to class activities.
8. Impropriety will result in the student losing posting privileges (thus making it impossible to complete certain tasks). Review the most current edition of the [NECC Student Handbook & Planner](#); pay special attention to the Student Code of Conduct.

#### D. Plagiarism

1. Plagiarism is defined as the use of ideas, data, or language of another without providing specific acknowledgement of the work of the author. By presenting someone's words, thoughts, ideas, or data as your own, you are committing plagiarism. No matter where you obtain your information (i.e. Internet, book, journal, etc.), you must cite the original author every time. Students caught plagiarizing may face either academic or disciplinary negative consequences. Instructors who determine that a paper includes plagiarized material can take academic measures, such as giving a failing grade for the paper or taking additional measures as outlined in the student handbook.
2. To avoid plagiarism cite the author each time you (Writing and Humanistic Studies (n.d.):
  - i. Use an author's exact written or spoken words. In this case, you must also identify those words by enclosing them with quotation marks or indenting the quote on both margins if it contains greater than 40 words.
  - ii. Paraphrase someone's written or spoken words.
  - iii. Use facts provided by someone else that are not considered common knowledge.



- iv. Make significant use of someone's ideas or theories.

Reference: MIT. (n.d.). Avoiding Plagiarism. *Writing and Humanistic Studies, MIT*. Retrieved from <http://writing.mit.edu/wcc/avoidingplagiarism>.

## IX. SUPPORT SERVICES:

### A. Disabilities:

Students with a documented disability may be eligible for certain accommodations that support their success in the classroom. Please contact Mary Balaski, Disability Services Coordinator, for further information. Her office is located in CWC- 1263; also, she may be reached at 402-844-7343 or [mary@northeast.edu](mailto:mary@northeast.edu).

### B. Service Center:

Students may get assistance with computer-related problems through the College's Service Center; [help@northeast.edu](mailto:help@northeast.edu). It is strongly advised that a student participate in on-line training via a formal course or the [on-line tutorials](#) available through Northeast Community College's homepage.

**Email:** [help@northeast.edu](mailto:help@northeast.edu)

**Phone number:** 402-844-HELP (4357)

**In person:** The Service Center is located in the Library on the Norfolk campus

**Service Center Hours of Operation:**

Sunday 1:00 p.m. - 9:00 p.m.

Monday - Thursday 7:00 a.m. to 10:00 p.m.

Friday 7:00 a.m. to 5:00 p.m.

*If you have technical questions regarding the My Classes Online environment you need to contact the Service Center. Questions regarding the course content need to be directed to the instructor via My Classes Online Course Mail (email).*

### C. Advising & Academic Support Center (CWC 1284)

This is a one stop shop for all students. Advisors are available to assist with schedules, career planning, transfer questions, change of majors, academic recovery and other issues impacting academic success. Located in CWC 1284, students will find a study space, lounge area and computers. Direct contact information is as follows:

1. Tutoring – CWC 1284
2. Writer's Clinic – CWC 1284
3. 402-844-7125

### D. Library Service:

The Northeast Community College Library Resource Center provides students with tools to conduct scholarly research and increase knowledge. Through the library's subscription databases, students have access to millions of current and credible resources not available through Google, Yahoo, and other search engines. Links to online databases and the library's online catalog can be found at <http://www.northeast.edu/Library-Resources/>. Students who would like assistance in utilizing the library's resources are encouraged to contact the library for further information and personal service at 402-844-7131 or email [marylouise@northeast.edu](mailto:marylouise@northeast.edu).

**E. Title IX:**

While I want you to feel comfortable coming to me with issues you may be struggling with or concerns you may be having, please be aware that I have reporting responsibilities that are part of my job requirements at Northeast Community College.

For example, if you inform me of an issue of sexual harassment, sexual assault, intimate partner violence, stalking and/or discrimination I will keep the information as private as I can, but I am required to bring it to the attention of Northeast's Title IX Coordinator. If you need help, you can also report an incident directly to the Title IX Coordinator, Craig Garrett, Associate Vice President of Human Resources, at 402-844-7046 or you could contact the Deputy Title IX Coordinator, Vice President of Student Services, at 402-844-7273. You can also report incidents or complaints to the Dean of Student Life by calling 402-844-7722.

I do not consider disclosures made in class writing assignments or discussions to require me to report, but I will contact the Title IX Coordinator about such disclosures if you make it clear that you want me to do so. Additionally, Northeast offers many resources and support through the Title IX Coordinator if you are struggling academically as a result of some form of sexual misconduct or discrimination. Title IX also provides you with significant protections if you experience complications with a pregnancy or childbirth. Please contact me as soon as you are able to discuss a plan for successful completion of this course. A secondary contact would be the Disability Services Coordinator at 402-844-7343.

Another common example is if you are struggling with an issue that may be traumatic or unusually stress producing, I will likely inform the Northeast Counseling Services office. If you would like to reach out directly to the Counseling Office, the contact number is 402-844-7277.

Finally, know that if, for some reason, our interaction involves a disruptive behavior or potential violation of policy, I will inform the Director of Student Conduct even when you and I may have reached a resolution to the incident. The purpose of this is to keep the Director apprised of any concerning behaviors and what was done to resolve them.

**F. Applied Technology Division Safety Statement**

Through the course of the semester you will be working with and around equipment that can be dangerous. The inherent dangers include both kinetic and potential energy; examples include, but are not limited to, high voltages, rotating equipment, high pressure hydraulics, compressed air, items that are heavy and/or hot, and the risk of fall or shock. Every effort has been made to minimize these risks and you will receive instruction and training as a part of this course (and related courses) in the proper safety procedures and equipment operation protocols. If you have a health condition or physical limitation that may affect you or another student's safety, you are to consult with the instructor prior to beginning to work with the equipment or undertaking a task involving the equipment. It is the student's responsibility to be able to follow all safety procedures and equipment operation protocols. Failure to abide by safety practices, procedures, or equipment protocols could result in serious injury or death. Failure to follow these safety practices / procedures or equipment protocols will not be tolerated and the student could face student disciplinary action including reduction of grade and possible removal from the course. Removal from the course could also result in loss of credit for the course and affect a student's financial aid.

#### **X. INSTRUCTOR NAME AND CONTACT INFORMATION:**

**Instructor:** Steve Wagner

**Office:** APT 106

**Phone:** 402-844-7723 or 1-800-348-9033 ext. 7223

**Email:** [steve@northeast.edu](mailto:steve@northeast.edu)

**Office Hours:**

7:00am– 8:00am or by appointment Mon-Thurs.

9:00am – 2:00pm Friday by appointment

#### **XI. GRANT STATEMENT:**

This document was developed as part of Trade Adjustment Assistance Community College and Career Training (TAACCCT) Grant Program Round 2 Grant, Innovations Moving People to Achieve Certified Training (IMPACT): TC-23752-12-60-A-31.



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