

# Course Syllabus

## Radiographic Testing - Level II

1. Understand darkroom facilities, techniques and processing.
2. Perform film loading and film processing.
3. Demonstrate radiography using correct film handling and exposure techniques.
4. Understand radiographic viewing and application.
5. Explain indications, discontinuities, and defects.
6. Evaluate radiographs of castings and weldments.
7. Demonstrate the use of ASTM standards, codes and procedures in submission of reports.

Students must meet the requirements of ASNT-CP189 as referenced in ASNT SNT-TC-1A. Students cannot pass this class unless these requirements have been met

### Course Evaluations:

### Grading\_Criteria

Students should complete all performance tasks on time at **REQUIRED MASTERY LEVEL**. Tasks, projects, and various assignments will be scored based on time; accuracy; neatness; completeness; procedure; skill; detail; motivation and attitude; safety practices; clean up; care of manuals, logbooks, and references; and other grading criteria. No task shall be rated until assignment is complete. Complete shall include condition and cleanliness of equipment; clean up of work areas; tool condition and return; all projects, supplies and materials being stored properly. Failure to bring books, notes, notebook, and equipment for a given class may result in a failing grade for that class period.

\*The final composite grade must be 80 percent per ASNT SNT-TC-1A to receive a passing grade.

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Students are responsible for getting notes from other students when absent. Lab activities will continue on schedule. Individuals will not receive credit for making up activities and there will not be special lab sessions. Some work can be caught up during regular lab times. Missing lab activities may prevent individuals from performing advanced lab exercises for safety and expense reasons. **Minimum hour requirement per American Society for Nondestructive Testing (ASNT) must be met to pass the class.**

Required\_Exams Each unit will require a written examination. Each session is subject to testing on previous material.

A comprehensive written final exam will be given along with the last unit performance exam.

Final\_Exams For Level I and II personnel, a composite grade should be determined by simple averaging of the results of the general, specific, and practical examinations. Examinations administered for qualification should result in a passing composite grade of at least 80 percent, with no individual examination having a passing grade less than 70 percent. ~ASNT SNT-TC-1A;8.0

Student outcomes must satisfy the recommended practices of ASNT-CP105 as referenced in the ASNT SNT-TC-1A.

Objectives Upon successful completion students shall be able to demonstrate knowledge of Radiographic Testing II: 1) theory and concepts, 2) standards, 3) equipment calibration and calibration standards, 4) testing process and limitations, 5) indication interpretation and evaluation, and 6) data reporting.

Upon successful completion students shall be able to demonstrate skills in Radiographic Testing II: 1) standards interpretation, 2) equipment calibration, 3) testing, 4) indication interpretation and evaluation, 5) data recording and reporting.

Behavior To better focus on the learning environment, communication during class time should be directed toward class activities and outside communication should be limited to emergencies only. Any means of electronic communication will only be tolerated in emergency

situations. Any abuse of this expected behavior can be subject to removal of the student from class.

### Notebook & Class Equipment

Students are required to take notes during lectures, and to turn in a notebook for grading prior to the final exam. Articles, accumulated information, and useful reference material that pertain to relative course topics will be counted towards the notebook grade. Notebook should contain handouts, formula sheets, test, assignments, and task list. All items will be graded from the notebook. Student shall furnish a scientific calculator and personal protective equipment to include safety glasses. Student shall have their own personal hand tools similar to those on the department service tool list. Student shall furnish necessary computer media for information transfer. Student shall furnish required text and Handyman Pocket Handbook.

### Shop Policy

Read safety handouts provided, use common sense, maintain safe shop practices, keep your Lab clean, and orderly. Keep all safety shields/guards, and equipment in place at all times. Notify your Instructor of faulty wiring/equipment, worn or damaged tools, or missing parts. No horseplay is allowed whatsoever. Academic disciplinary measures will be promptly administered to offending person(s). Please help the Instructor to maintain order so that he can be free to use your time for more effective teaching, and less time housekeeping. We all can enjoy the benefits of an effective and conducive learning environment. Remember to use your safety glasses when entering the shop area. Always perform proper Lock-out / Tag-out.

### Tools, Equipment, and Clothing

Students shall wear appropriate clothing to perform any work task assigned. Tools and equipment specified for this class and any recommended preliminary class in the Nondestructive Testing and Evaluation curriculum are to be furnished by the student. Failure to dress for work or bring needed equipment may count as an absence. All tools should be properly used and cared for, thus allowing for longevity and safety of both the user and the tool.

Supplies

**Tools:** Safety Glasses, PPE, Scientific Calculator, Tool Kit, Three-Ring Notebook, Tools Per Department List, Storage Media, Handyman Pocket Reference, Flashlight, Vernier Calipers, Tape Measure.

**Required ASNT Student Membership and Appropriate Standards**

Textbooks

**All classes require the relevant ASNT - Personal Training Publication applicable to the testing method being studied.**

HANDYMAN IN~YOUR~POCKET  
Young/Glover  
Published by Sequoia  
ISBN 1-885071-29-9

<http://www.asnt.org/index.html>

<http://www.asnt.org/membership/forms/individualmema.ihtml> -Student Membership - \$15

Websites

<http://asnt.org/shop/merchant.ihtml?id=5&step=2> - Textbooks

<http://astm.org/MEMBERSHIP/MemTypes.htm> - Student Membership - Free

<http://astm.org/studentmember/campusstandards.html> - Student \$10 Standards

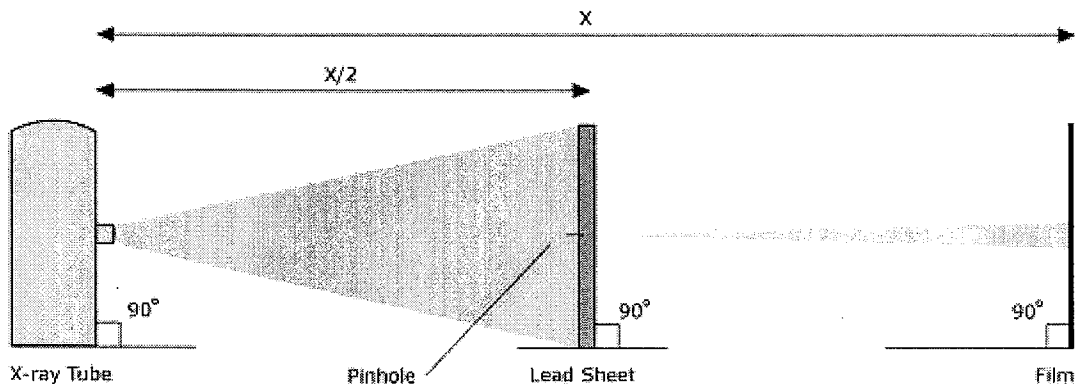
[http://www.ndt-ed.org/index\\_flash.htm](http://www.ndt-ed.org/index_flash.htm) - Education Resources

## ASTM Stds Used in NDT Labs

### Measuring the Focal Spot Size

To develop an understanding of the effective focal spot size of the X-ray generator, have students determine its size. The measurement can be made from a radiograph produced using a flat piece of lead with a small pinhole in it. The image is produced in a mode similar to that of an old box camera. The following is a general procedure for making the measurement, and a more detailed procedure can be found in ASTM E1165.

1. Put a small pinhole in a lead sheet of sufficiently thickness to stop all of the radiation. The smaller the pinhole, the sharper the image.
2. Position the lead sheet directly perpendicular to X-ray beam and exactly half way between the X-ray tube target and the film. Center the pinhole in X-ray beam. This step is very important so use a string, level, plumb bob or other tools to make sure the sheet and hole are properly aligned.
3. Set the X-ray generator amperage (mA) relatively high and the energy (kV) relatively low to produce an exposure where few make it past the lead sheet except through the hole. Try not to saturate the radiograph in the region of the hole.
4. \*Expose and develop the film.
5. Measure the diameter of the focal spot image on the film.



# ASTM Stds Used in NDT Labs

## ASNT Level II Radiographic Testing Syllabus

### Objectives:

#### Terminal Objective-

Given instruction on principles of radiography, manufacturing processes, relevant standards, and specific applications, perform typical radiographic examinations in accordance with industrial Codes and in compliance with Regulatory Agency radiation safety requirements.

#### Enabling Objectives-

- Radiographic Viewing
  - Film-illuminator requirements
  - Background lighting
  - Multiple-composite viewing
  - Penetrameter placement
  - Personnel dark adaptation and visual acuity
  - Film identification
  - Location markers
  - Film-density measurement
  - Film artifacts
  
- Application Techniques
  - Multiple-film techniques
    - Thickness variation parameters
    - Film speed
    - Film latitude
  - Enlargement & Projection
  - Geometrical relationships
  - Geometrical unsharpness
    - Penetrameter sensitivity
    - Source-to-film distance
    - Focal-spot size
  - Triangulation methods for discontinuity location
  - Localized magnification
  - Film handling techniques
  
- Evaluation of Castings
  - Casting method review
  - Casting discontinuities
  - Origin & typical orientation of discontinuities
  - Radiographic appearance
  - Casting codes/standards – applicable acceptance criteria
  - Reference radiographs or pictograms

## ASTM Stds Used in NDT Labs

- Evaluation of Weldments
  - Welding method review
  - Welding discontinuities
  - Origin & typical orientation of discontinuities
  - Radiographic appearance
  - Welding codes/standards – applicable acceptance criteria
  - Reference radiographs or pictograms
  
- Standards, Codes, and Procedures for Radiography
  - ASTM E 94, *Standard Guide for Radiographic Testing*
  - ASTM E 1742, *Standard Practice for Radiographic Examination*
  - ASTM E 999, *Standard Guide for Controlling the Quality of Industrial Radiographic Film Processing*
  - ASTM E 1032, *Standard Test Method for Radiographic Examination of Weldments*
  - ASTM E 2002, *Standard Method for Determining Total Image Unsharpness in Radiology*
  - ASTM E 1165, *Standard Test Method for Measurement of Focal Spots of Industrial X-ray Tubes by Pinhole Imaging*
  - ASTM E 1030, *Standard Test Method for Radiographic Examination of Metallic Castings*
  - ASTM E 2007, *Standard Guide for Computed Radiology (Photostimulable Luminescence (PSL) Method)*
  - ASTM E 1570, *Standard Practice for Computed Tomographic (CT) Examination*
  - ASTM E 1441, *Standard Guide for Computed Tomography (CT) Imaging*
  - AWS D1.1, *Structural Welding Code – Steel*
  - API 1104
  - ASME BPV:
    - Section V, Article 2
    - Section VIII
    - Section IX
    - Section I
  - Acceptable radiographic techniques & setups
  - Applicable industrial sector procedures
  - Procedure for radiographic parameter verification
  - Radiographic data report forms

## ASTM Stds Used in NDT Labs

UT Level I Fall 2007 Lab

1. Thickness measurement

E 797-95 *Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method*

UT Level II Spring 2008 Labs

1. AWS D1.1 calibration and examination at 0 degrees and shear wave. Write calibration report.
2. ASME Section V DAC curve.
3. API RP2X calibration, beam characterization, DAC, transfer correction and beam shape report.
4. Flaw sizing of lab samples.

ASTM zero degree contact; angle beam and contact, immersion zero degree reports.

- E 114-95 *Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method*
- E 1001-99a *Detection and Evaluation of Discontinuities by the Immersed Pulse-Echo Ultrasonic Method Using Longitudinal Waves*
- E 587-00 *Ultrasonic Angle-Beam Examination by the Contact Method*
- E 164-97 *Ultrasonic Contact Examination of Weldments*
- E 1901-97 *Detection and Evaluation of Discontinuities by Contact Pulse-Echo Straight-Beam Ultrasonic Methods*

Flaw sizing after ASTM calibration.

Transducer characterization and comparison with manufacturers data sheet for one quarter, one half, one inch transducers.