

**MATERIALS CONSERVATION: LAB METHODS**

**Course Number:** ARC 385T  
**Schedule:** Wednesday 9:00 am to 12:00 noon  
**Location:** 3.108 WMB Lecture; 3.112 WMB Lab  
**Instructor:** Izabella Z. Nuckels  
izabelladennis@utexas.edu  
**Office Hours:** Monday 6:00 pm to 8:00 pm or by appointment  
3.112 WMB

**Course Summary**

This course provides an introduction to architectural materials conservation and its applicability in the field of historic preservation within the United States. Students will learn how to collect, examine, and provide treatment recommendations for the conservation of historic building materials.

Each class will have a lecture and laboratory component. Lectures will cover the physical and chemical properties of masonry, concrete, metals, mortars, wood, paintings and coatings, and other materials found in historic buildings. Laboratory exercises will cover mortar and historic finish analysis, wood identification, solubility, and micro chemical testing. Testing to determine products for basic conservation treatments, including cleaning and consolidation, will also be covered. Assignments will include laboratory reports, reading responses, a midterm examination, and a final independent project that will evaluate materials for a historic site.

**Prerequisite**

Construction I, or with permission of instructor.

**Course Texts**

Torraca, Giorgio. 2009. *Lectures on Materials Science for Architectural Conservation*. Los Angeles, CA: Getty Conservation Institute. Available at:  
[http://hdl.handle.net/10020/gci\\_pubs/materials\\_science\\_architectural\\_conserv](http://hdl.handle.net/10020/gci_pubs/materials_science_architectural_conserv)

Weaver, Martin E., and F. G. Matero. *Conserving Buildings: Guide to Techniques and Materials*. New York: Wiley, 1997.

Readings and reference in the Course Schedule will be available on Canvas or via the web link provided in the syllabus.

**Required Supplies**

Laboratory Notebook

## Grading Policy

Your final grade will be based on your laboratory reports, midterm examination, final independent research project, reading responses, and attendance and participation.

Attendance and Participation	10%
Reading Responses	10%
Midterm Examination	20%
Laboratory Reports	25%
Independent Research Project	35%

Grades:

A	93 to 100
A-	90 to 92
B+	87 to 89
B	83 to 86
B-	80 to 82
C+	77 to 79
C	73 to 76
C-	70 to 72
D+	67 to 69
D	63 to 66
D-	60 to 62
F	59 and below

Make-up assignments/examinations and grades of "incomplete" are, after prior consultation with the instructor, for exceptional circumstances only.

## Assignments

1. **Reading Responses** | Two questions pertaining to the week's readings will be posted in Canvas and are due before class begins at 9 am on Wednesdays. See Course Schedule for exact deadlines.
2. **Lab Reports** | additional instructions about format will be provided)
  - Lab Report #1: Historic Finish Analysis due April 10, 2019
  - Lab Report #2: Water Absorption due April 10, 2019
  - Lab Report #3: Mortar Analysis due April 10, 2019
  - Lab Report #4: Wood Identification + Treatment due May 1, 2019
  - Lab Report #5: Microchemical + pH Testing due May 1, 2019
  - Lab Report #6: Treatment Evaluation due May 1, 2019
3. **Take Home Midterm Exam** | due March 5, 2019 at 5:00 pm via Canvas
4. **Final Independent Research Project** | due on May 8, 2019

The final project is an independent materials analysis of a building site. A project template and requirements will be provided.

- Written report is due via Canvas at 9:00 am on May 8, 2019
- Oral presentations will be in class on May 8, 2019

**Attendance Policy**

Students are expected to attend all lecture and lab sessions, unless illness, personal emergency, or religious holidays prevent such attendance. Please inform the instructor via email if you are unable to attend a scheduled class session.

**Religious Holidays**

Notify the instructor at least fourteen days prior to the date of observance of a religious holiday or holy day. If this conflicts with a class examination, deadline, or work assignment, an alternative opportunity to complete the missed assignment and/or information will be arranged.

**Academic Integrity***UT Austin Code of Conduct*

"The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community."

*Plagiarism*

Plagiarism is the act of presenting material or work from another source as your own. It is a serious academic violation and will be prosecuted under University rules. Additional information may be found here: <http://deanofstudents.utexas.edu/conduct/>

**Accommodations for Students with Disabilities**

Students with a disability should notify the instructor and present a letter from the Services for Students with Disabilities office (SSD). SSD can be reached at 512-471-6256. Additional information is available here: <http://diversity.utexas.edu/disability/>

**Cell Phones + Computers**

Please limit cell phone and personal computer usage during lecture and lab sessions. Laptops or tablets should not be used for laboratory exercises unless prior arrangements have been made with the instructor.

**Emergency Evacuation**

Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside. Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building. Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class. In the event of an evacuation, follow the instruction of faculty or class instructors. Do not reenter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office. Information regarding emergency evacuation routes and emergency procedures can be found at: [www.utexas.edu/emergency](http://www.utexas.edu/emergency).

**SPRING 2019 COURSE SCHEDULE****WEEK 1 | January 23 | Introduction to Architectural Conservation**

- **Lecture** | This lecture will review course requirements, discuss the role of an architectural conservator and materials conservation within the field of historic preservation, and introduce the applicability of the course material to professional practice.
- **Lab** | The laboratory session will review lab safety and requirements for working in the lab.
- **Readings + Tutorials**

"AIC Code of Ethics." American Institute for Conservation of Historic and Artistic Works.

Available at: [http://www.conservation-us.org/our-organizations/association-\(aic\)/governance/code-of-ethics-and-guidelines-for-practice#.XDtzAs9KjIE](http://www.conservation-us.org/our-organizations/association-(aic)/governance/code-of-ethics-and-guidelines-for-practice#.XDtzAs9KjIE)

Chairi, Giacomo, and Marco Leona. "The State of Conservation Science," *GCI Newsletter* Vol. 20, No. 2 Summer 2005. Available at:

[http://www.getty.edu/conservation/publications\\_resources/newsletters/pdf/v20n2.pdf](http://www.getty.edu/conservation/publications_resources/newsletters/pdf/v20n2.pdf)

"Safety in the Laboratory." AIC Conservation Science Tutorials. Available at:

<http://cool.conservation-us.org/byform/tutorials/conscitut/labsafety/index.html>

- **Additional Readings + Reference**

"Lab Safety Manual." *University of Texas Environmental Health and Safety Office*. Available at: <https://ehs.utexas.edu/programs/labsafety/documents/Lab-Safety-Manual.pdf>

Marshall, Philip C. "Are Architectural Conservators Worth Their Salt?" *APT Bulletin*, Vol. 19, No. 4 (1987), 3-5.

Trentelman, Karen. "Training and Education in Conservation Science," *GCI Newsletter* Vol. 20, No. 2 Summer 2005. Available at:

[http://www.getty.edu/conservation/publications\\_resources/newsletters/pdf/v20n2.pdf](http://www.getty.edu/conservation/publications_resources/newsletters/pdf/v20n2.pdf)

**WEEK 2 | January 30 | Examination and Documentation of Architectural Materials**

- **Lecture** | This lecture will review obtaining and preparing samples of historic building material, using a microscope, and keeping a lab notebook
- **Lab** | During the lab, students will practice collecting representative samples of historic materials, using a stereomicroscope, and accurately describing the physical properties of historic building materials.
- **Readings + Tutorials**

Weaver: Chapter 1 (pages 1 – 2); Chapter 3 (page 12)

"Guidelines for Keeping a Laboratory Record." *Rice University Experimental Biosciences*.

Available at: <https://www.ruf.rice.edu/~bioslabs/tools/notebook/notebook.html>

"Analytical Techniques." AIC Conservation Science Tutorials. Available at:

[http://cool.conservation-us.org/byform/tutorials/conscitut/analytical\\_techniques/analytical\\_main.html](http://cool.conservation-us.org/byform/tutorials/conscitut/analytical_techniques/analytical_main.html)

Nothnagle, Paul E., William Chambers, and Michael Davidson. "Introduction to Stereomicroscopy." *Nikon Microscopy U*. Available at: <https://www.microscopyu.com/techniques/stereomicroscopy/introduction-to-stereomicroscopy>

### WEEK 3 | February 6 | Architectural Paints and Coatings

- **Lecture** | This lecture will discuss the composition of paints and coatings, the laboratory analysis of historic finishes, and how to provide recommendations.
- **Lab** | During this lab exercise, students will begin historic finish analysis and color matching.
- **Deadline** | Two reading responses due on Canvas.
- **Readings + Tutorials**

Weaver: Chapter 10 (pages 216 to 231)

Chase, Sara P. *Preservation Brief 28: Painting Historic Interiors*. Washington, DC: Preservation Assistance Division, National Park Service, 1992. Available at: <https://www.nps.gov/tps/how-to-preserve/briefs.htm>

"Color." *AIC Conservation Science Tutorials*. Available at: <http://cool.conservation-us.org/byform/tutorials/conscitut/color/index.html>

Derrick, Michelle, Luiz Souza, Tanya Kielisch, Henry Florsheim, and Dusan Stulik. "Embedding Paint Cross-Section Samples in Polyester Resins: Problems and Solutions," *Journal of the American Institute for Conservation*, Vol. 33, No. 3 (Autumn-Winter, 1994): 227-245.

Krotzer, Dorothy. "Practice Points 6, Architectural Finishes: Research and Analysis," *APT Bulletin*, Vol. 39, No. 2/3 (2008): 1-6.

- **Additional Readings + Reference**

Matero, Frank G. and Joel C. Snodgrass. "Understanding Regional Painting Traditions: The New Orleans Exterior Finishes Study," *APT Bulletin*, Vol. 24, No. ½ (1992): 36-52

Montgomery Ward & Co. "How to Paint for Beauty and Protection." Montgomery Ward & Co., 1955. Available at: <https://archive.org/details/HowToPaintForBeautyAndProtection/>

### WEEK 4 | February 13 | Experimental Design

- **Lecture** | This lecture will discuss experimental design while adhering to the scientific method.
- **Lab** | During this lab exercise, continue the historic finish analysis lab.
- **Deadline** | Two reading responses due on Canvas.
- **Readings**

Reedy, Terry J. and Chandra L. Reedy. *Principles of Experimental Design for Art Conservation Research*. GCI Scientific Program Report. Los Angeles, CA: Getty Conservation Institute, 1992. On Canvas, read Chapters 1 and 2.

Wolfs, Frank L. H. "APPENDIX E: Introduction to the Scientific Method." *University of Rochester Physics Lab*. Available at:  
[http://teacher.nslr.rochester.edu/phy\\_labs/appendixe/appendixe.html](http://teacher.nslr.rochester.edu/phy_labs/appendixe/appendixe.html)

### **WEEK 5 | February 20 | Measurement of Properties**

- **Lecture** | This lecture will review the physical and chemical properties of historic architectural materials and the value of laboratory testing. The discussion will highlight porous building materials.
- **Lab** | Students will learn to evaluate water absorption of masonry samples using Rilem tubes.
- **Deadline** | Two reading responses due on Canvas.
- **Readings**

Torraco: Part 3 (pages 72 to 95)

Charola, A. Elena. "Salts in the Deterioration of Porous Materials: An Overview," *Journal of the American Institute for Conservation*, Vol. 39, No. 3 (2000): 50-58.

Saldanha, Adrian Gerard and Doris E. Eichberg. "Testing the test: Water Absorption with Rilem Tubes," *The Construction Specifier*, Vol. 66, No. 8 (August 2013): 50-58. Available at: <https://www.constructionspecifier.com/testing-the-test-water-absorption-with-rilem-tubes/>
- **Additional Readings + Reference**

Park, Sharon C., AIA. *Preservation Brief 39: Holding the Line: Controlling Unwanted Moisture in Historic Buildings*. Washington, DC: Technical Preservation Services Division, National Park Service, US Department of the Interior, 1996. Available at: [www.nps.gov/history/hps/tps/briefs/brief39.htm](http://www.nps.gov/history/hps/tps/briefs/brief39.htm)

### **WEEK 6 | February 27 | Cements and Limes Part I**

- **Lecture** | This lecture will review historic concrete, traditional mortars and their properties. Selecting appropriate mortar mixes will be discussed.
- **Lab** | Students will conduct mortar analysis of unknown samples.
- **Deadline** | Two reading responses due on Canvas. The Take Home Midterm posted on Canvas
- **Readings**

Weaver: Chapter 7 (pages 133 to 160)

Schnabel, Lorraine. "Practice Points 05: Mortar Analysis Part 1: Mortar-Making Materials." *APT Bulletin*, Vol. 39, No. 1 (2008): 1-4.

Schnabel, Lorraine. "Practice Points 07: Mortar Analysis Part 2: Analytical Methods." *APT Bulletin*, Vol. 40, No. 2 (2009): 1-7.

### ○ **Additional Readings + Reference**

Ellis, Peter. "The Analysis of Mortar: The Past 20 Years." *Building Conservation*. Available at: <http://www.buildingconservation.com/articles/mortar/mortar.htm>

Gaudette, Paul and Deborah Slaton. *Preservation Brief 15: Preservation of Historic Concrete*. Washington, DC: Technical Preservation Services Division, National Park Service, US Department of the Interior, 2006. Available at: [www.nps.gov/history/hps/tps/briefs/brief15.htm](http://www.nps.gov/history/hps/tps/briefs/brief15.htm)

Mack, R. C. and J. P. Speweick. *Preservation Brief 2: Repointing Mortar Joints in Historic Masonry Buildings*. Washington, DC: Preservation Assistance Division, National Park Service, 1998. Available at: <http://www.nps.gov/tps/how-to-preserve/briefs/2-repoint-mortar-joints.htm>

## **WEEK 7 | March 6 | Cements and Limes Part II**

○ **Lecture** | This lecture will expand on the previous week and review plaster and stucco, patching materials, and developing mortar recommendations.

○ **Lab** | Students will continue mortar analysis and learn to develop matching mortar recommendations.

○ **Deadline** | Take Home Midterm due via Canvas on March 6 by 5:00 pm.

### ○ **Readings**

Torraco: Part 2 (pages 38 to 71)

Weaver: Chapter 5 (pages 58 to 98)

Krotzer, Dorothy and J. J. Walsh. "Analyzing Mortars and Stuccos at the College of Charleston: a Comprehensive Approach," *APT Bulletin*, Vol. 4, No. 1 (2009): 41-48.

Schnabel, Lorraine. "Practice Points 11: Mortar Analysis Part 3: Buying the Right Services." *APT Bulletin*, Vol. 42, No. 1 (2011): 1-4.

### ○ **Additional Readings + Reference**

Goins, Elizabeth S. *Standard Practice for Determining the Components of Historic Cementitious Materials*. National Center for Preservation Training and Technology Materials Research Series, 2002. Available at: <https://www.ncptt.nps.gov/blog/standard-practice-for-determining-the-components-of-historic-cementitious-materials-2002-20/>

Grimmer, Anne. *Preservation Brief 22: The Preservation and Repair of Historic Stucco*. Washington, DC: Technical Preservation Services Division, National Park Service, US Department of the Interior, 1990. Available at: [www.nps.gov/history/hps/tps/briefs/brief22.htm](http://www.nps.gov/history/hps/tps/briefs/brief22.htm)

Hampshire County Council. *Repointing: Principles, Materials, and Methods*. Available at: [http://www3.hants.gov.uk/59544\\_re-pointing.pdf](http://www3.hants.gov.uk/59544_re-pointing.pdf)

**WEEK 8 | March 13 | Architectural Ceramics** [Optional Class: Studio Mexico Trip]

- **Lecture** | This lecture will review the characteristics of architectural ceramics, including brick and terracotta. Appropriate conservation treatments will be discussed.
- **Lab** | During this lab, students will learn how to develop recommendations for brick replacements.
- **Readings**
  - Weaver: Chapter 6 (pages 99 to 132)
  - Gerns, Edward and Rachel Will. "Architectural Terra Cotta," *APT Bulletin*, Vol. 47, No. 2/3 (2015): 1-8.

**Spring Break | March 20 | No Class****WEEK 9 | March 27 | Wood**

- **Lecture** | This lecture will review the properties and structure of wood used in construction.
- **Lab** | Students will identify wood species through magnification. Basic wood treatments will be tested.
- **Deadline** | Two reading responses due on Canvas.
- **Readings**
  - Weaver: Chapter 4 (pages 13 – 57)
  - Anthony, R. W. "Basics of Wood Inspection: Considerations for Historic Preservation," *APT Bulletin*, Vol. 38, No. 2/3 (2007): 1-6.
  - Bond, B. and P. Hamner. *Wood Identification for Hardwood and Softwood Species Native to Tennessee*. Knoxville, TN: Agricultural Extension Service, University of Tennessee.
  - Miller, Regis B. "Chapter 2: Structure of Wood," in *Wood Handbook: Wood as an Engineering Material*. Madison, WI: USDA Forest Service, Forest Products Laboratory, 2010. Available at: <https://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr113/fplgtr113.htm>
  - Simpson, William and Anton TenWolde. "Chapter 3: Physical Properties and Moisture Relations of Wood," in *Wood Handbook: Wood as an Engineering Material*. Madison, WI: USDA Forest Service, Forest Products Laboratory, 2010. Available at: <https://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr113/fplgtr113.htm>
- **Additional Readings + Reference**
  - Glass, Samuel V. and Samuel L. Zelinka. "Conservation of Historic Timber Structures: An Ecologic Approach," *ICOMOS*, 2016. Available at: [http://openarchive.icomos.org/1656/1/Conservation\\_of\\_Historic\\_Timber\\_Structures-2.pdf](http://openarchive.icomos.org/1656/1/Conservation_of_Historic_Timber_Structures-2.pdf)
  - Meier, Eric. *The Wood Database*. Available at: <https://www.wood-database.com/>



Weeks, Kay D. and David W. Look, AIA. *Preservation Brief 10: Exterior Paint Problems on Historic Woodwork*. Washington, DC: Technical Preservation Services Division, National Park Service, US Department of the Interior. Available at: [www.nps.gov/history/hps/tps/briefs/brief10.htm](http://www.nps.gov/history/hps/tps/briefs/brief10.htm)

### **WEEK 10 | April 3 | Metals**

- **Lecture** | This lecture will review the composition of metals used in historic buildings as well as their chemical and physical properties.
- **Lab** | Students will observe and record the physical characteristics of different metals. At the end of the lab period, students may continue testing wood treatments.
- **Deadline** | Two reading responses due on Canvas.
- **Readings + Tutorials**

Torraco: Part 5 (pages 110 to 146)

Weaver: Chapter 9 (pages 175 to 215)

Morris, Jamie Clapper and Deborah Slaton. "Modern Metals: Finishes, Investigation, and Conservation Considerations," *APT Bulletin*, Vol. 46, No. 1 (2015): 29-38.

Waite, John G., AIA. *Preservation Brief 27: The Maintenance and Repair of Architectural Cast Iron*. Washington, DC: Technical Preservation Services Division, National Park Service, US Department of the Interior, 1991. Available at: [www.nps.gov/history/hps/tps/briefs/brief27.htm](http://www.nps.gov/history/hps/tps/briefs/brief27.htm)

### **WEEK 11 | April 10 | Micro Chemical and pH Testing**

- **Lecture** | Micro chemical pH testing are techniques that can help to identify a variety of architectural materials and the success of treatments. The techniques and applicability will be reviewed.
- **Lab** | Students will conduct micro chemical tests to identify metals and paint pigments, and pH tests of masonry materials.
- **Deadline** | The below Lab Reports are at the beginning of class (printed out).
  - Lab Report #1: Historic Finish Analysis
  - Lab Report #2: Water Absorption
  - Lab Report #3: Mortar Analysis
- **Readings**

AIC. "Chapter: 10 Spot Tests," in *AIC Paper Conservation Catalog*. Available at: [https://www.conservation-wiki.com/wiki/Paper\\_Conservation\\_Catalog](https://www.conservation-wiki.com/wiki/Paper_Conservation_Catalog) (Read pages 1-9).

Tse, Season. "Guidelines for pH Measurement in Conservation," Canada: Canadian Conservation Institute Department of Canadian Heritage, 2007.

**Week 12 | April 17 | Solvents and Solubility**

- **Lecture** | Solvents and solubility is essential to basic architectural conservation. Solubility testing is used to identify materials and appropriate conservation treatments.
- **Lab** | During this lab, students will test the solubility of unknown samples.
- **Deadline** | Two reading responses due on Canvas.

- **Readings + Tutorials**

Torraco: Part 1 (pages 30 to 37) and Part 4 (pages 96 to 109)

Weaver: Chapter 8 (pages 161 to 174)

"Chapter 3: Liquids and Solutions," "Chapter 4: Organic Solvents," "Chapter 5: Cleaning with Water," and "Chapter 6: Water Acidity and Alkalinity," in *Science for Conservators: Book 2 Cleaning*, pp. 35-103. London: Crafts Council, 1983. (electronic resource available through UT Libraries).

Jacob, Judith M., Michaela Schmuell, and Federica Villa. "Biofilms and Lichens on Eroded Marble Monuments: Reconsidering Cleaning," *APT Bulletin*, Vol. 49, No. 2/3 (2018): 55-60.

"Soaps, Surfactants, and Detergents," AIC Conservation Science Tutorials. Available at: <http://cool.conservation-us.org/byform/tutorials/conscitut/soapsetc/>

**Week 13 | April 24 | Treatment Evaluation**

- **Lecture** | This lecture will discuss conservation treatments and the importance of laboratory testing in selecting appropriate treatments.
- **Lab** | During this lab, students will conduct treatment evaluations, including measuring physical and chemical properties before and after treatment.
- **Deadline** | Two reading responses due on Canvas.

- **Readings**

Charola, A. Elena. "Laboratory Testing and Evaluation of Proposed Masonry Treatments," *APT Bulletin*, Vol. 26, No. 4 (1995): 35-39.

Doehne, Eric and Clifford A. Price. "Chapter 3: Do They Work: Assessing the Effectiveness of Treatments," in *Stone Conservation: An Overview of Current Research*. Los Angeles: Getty Conservation Institute, 2<sup>nd</sup> Edition, 2010. Available at: [http://www.getty.edu/conservation/publications\\_resources/pdf\\_publications/stone\\_cons\\_2nd\\_edit.html](http://www.getty.edu/conservation/publications_resources/pdf_publications/stone_cons_2nd_edit.html)

Searls, Carolyn L. and David P. Wessel. "Guidelines for Consolidants," *APT Bulletin*, Vol. 26, No. 4 (1995): 35-39.

**Week 14 | May 1 | Advanced Analytical Investigation**

- **Lecture** | This lecture will review other methods of non-destructive evaluation to examine architectural materials. These include x-ray diffraction, SEM, and profilometry.
- **Lab** | This is an open lab session to complete the final project.

- **Deadline** | The below Lab Reports are at the beginning of class (printed out)
  - Lab Report #4: Wood Identification and Treatment
  - Lab Report #5: Microchemical and pH Testing
  - Lab Report #6: Treatment Evaluation

- **Readings**

"Analytical Techniques." AIC Conservation Science Tutorials. Available at:

[http://cool.conservation-us.org/byform/tutorials/conscitut/analytical\\_techniques/index.html](http://cool.conservation-us.org/byform/tutorials/conscitut/analytical_techniques/index.html)

Carson, David and Giacomo Chiari. "New Techniques in the Service of Cultural Heritage."

Getty Conservation Institute Newsletter 25.1 (Spring 2010). Available at:

[http://www.getty.edu/conservation/publications\\_resources/newsletters/25\\_1/technologies.html](http://www.getty.edu/conservation/publications_resources/newsletters/25_1/technologies.html)

Freeland, Joshua L., Brad Shotwell, and Deborah Slaton. "Through the Lens Clearly:

Instrumental Analysis as Applied to Architectural Materials," *APT Bulletin*, Vol. 38, No. 4 (207): 1-4.

### **Week 15 | May 8 | Final Presentations**

- **Deadline** | Written Final Product due via Canvas (PDF format) at the beginning of class. Students will give oral presentations during class.