

WEST VALLEY COLLEGE
Course Outline

Department: Architecture

Course Number and Title: ARCH 041 - Science of Materials in Historic Preservation

Length of course in weeks: 16

Units: 3

Total Class Hours/Week: 3

Lecture Hours/Week: 3

Grade Type: Grade/Credit/No Credit

Catalog Description: This course is a study of traditional and modern materials, including use and properties, the diagnosis of the causes of deterioration, preservation, and restoration methods. This course also covers the mechanical stress effects on rigid materials, the study of corrosive chemicals on porous materials, the atmospheric pollution effects, the settlement of masonries, and the vibrations on the structures as well as the effects of road traffic on the buildings.

Schedule Description: This course is a study of traditional and modern materials, including use and properties, the diagnosis of the causes of deterioration, preservation, and restoration methods.

Course Outcomes: Student Learning Outcomes

Outcome: Given an historic building, students will be able to diagnose deterioration causes and recommend compatible restoration materials and appropriate methods of application and installation.

Assessment: Final presentation on a historic building.

Course Objectives: Upon completion of this course the student should be able to:

1. Understand properties of traditional building materials.
2. Investigate old and modern restoration materials.
3. Recommend various restoration materials suitable for repair, patch, and replacement of the features of a historic building.
4. Explain various restoration methods, use of new assemblies, and installation procedures adequate and reversible for preservation of a historic building.
5. Recognize compatibility of different restoration materials with existing ones.

Assessment: Students in this course will be graded base on the following three categories:

1. **Writing Assignments:** reading report(s)
2. **Problem Solving Demonstrations:** quizzes and exams
3. **Skill Demonstrations:** field work

Repeatability: 1 time

Methods of Instruction: Lecture

Lecture Content:

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| 1. Restoring and Repairing Old Wooden Structures: | 10.00 % |
| Historic Timberwork | |
| A Question of Species | |
| Historic Timber Structures | |
| Log Structures | |
| Unusual Timber Structures | |
| The Nature of Wood | |
| Moisture Contents and Shrinkage | |
| Wood Deterioration | |
| Physical, Chemical, and Mechanical Factors | |
| Bio-deterioration | |
| Bacteria | |
| Fungi | |
| Types of Fungi | |
| Molds | |
| Sap-stains | |
| Insects | |
| Marine Borers | |
| Plants | |
| Animals | |
| The Timber Defects Survey | |
| Repair and Restoration | |
| Wood Restoration and Conservation | |
| Partial or Complete Replacement | |
| Mechanical Reinforcement | |
| Consolidation by Impregnation | |
| Reinforcement Systems and Consolidation | |
| Pesticides and Preservatives | |
| The Development of the Use of Chemicals Against Pests | |
| 2. Restoring Stonework: | 10.00 % |
| The Conservation of Stonework | |
| Building and Monumental Stones of the United States | |
| Names and Descriptions of Stones | |
| Sources | |
| Stone Conservation Case Histories | |
| 3. Architectural Ceramics: | 10.00 % |
| Bricks | |
| Terracotta | |
| Conclusion | |
| 4. Cementitious Materials: | 5.00 % |
| Mortars | |

Concrete	
Plaster	
References	
Plaster Conservation Case History	
5. Cleaning Masonry:	10.00 %
Categories of Masonry Materials	
Categories of Soiling and Solvents	
Pollution Controls	
Future Directions	
6. Architectural Metalwork:	10.00 %
General Introduction	
Origins	
Chemical and Physical Deterioration	
Qualities and Alloys	
Temperature and Pressure Effects	
Atomic Structure	
Galvanic Corrosion	
Cathodic Protection	
Forms of Corrosion	
Iron and Steel	
Repainting	
Sheet Copper work	
Bronzes and Copper Alloys	
7. Paints and Coatings:	10.00 %
Painting Materials	
Pigments	
The Vehicle or Medium	
Paint Systems	
Paint Failure and Common Deterioration Mechanisms	
Paint Investigation and Analysis	
Restoration and Conservation Treatment Techniques	
Removal Methods	
Retention Methods	
Reattachment	
Cleaning	
Replication and Compensation	
8. Architectural Glass:	10.00 %
Glass Materials and Manufacture	
Glass	
Colored Glass	
Glass Types	
Forming the Glass	
Glass Deterioration	
Glass Formulae and their Effects on Durability	
Crizzling and Weeping Glasses	
Lead Glasses and their Deterioration	
Increases in Opacity	
The Deterioration of Painting on Glass	
Describing Different Forms of Deterioration	

Leaded Glass
Durability of Glasses in the Built Environment
The Conservation and Restoration of Glass and Glazing

9. Foundations and Footings: 10.00 %

The Nature and Problems of Old Foundations and Footings
Piling
Soils and Rock
Differential Settlement
Continuous Underpinning
Prestressing and Pretesting
Piled Underpinning
Jacked Piling
Root Piles or Pale Radici
Cantilever Underpinning
Seismic Isolation Retrofitting

10. Restoring Slate Roofing: 5.00 %

Approaching Restoration
The Nature of Slate and Some Inherent Problems
Faults Associated with Quarrying, Transport, and Laying
Failures in Slate Roofing Systems and Fixings
Underlays and Substructures
Restoration Criteria
Dimensions
Textures, Forms, Patterns, and Types
Colors and Sources

11. Synthetic Resins, Polymers, and Preservation: 5.00 %

Plastics
Natural and Historic Synthetic Resins and Polymers
Resins Plus What?
Resins and Plastics in Conservation
Acrylics
Cellulosics
Polyvinyls
Epoxides
Polyesters
Silicones
Siliconates
Silanes
Oligomeric Alkylalkoxysiloxanes
Polymeric Alkylalkoxysiloxanes
Silicic Acid Esters

12. Historic Wallpapers: 5.00 %

The Attachment of Wallpapers
The Care and Preservation of Wallpapers
The Reproduction of Old Wallpapers

Critical Thinking: Evaluate suitability of various restoration materials and methods options for specific applicability within given historic building status.

College Level Required Reading, Writing, and other Outside-of-Class Assignments:

Over a 16 week presentation of the course, three hours per week are required for each unit of credit. Two hours of independent work done out of class are required for each hour of lecture. Outside of the regular class time the students in this class will be doing the following outside of class:

- **Study:** 5.00 additional hours
- **Practice Skills:** 1.00 additional hour

Textbook:

Weaver Martin E. Conserving Buildings: A manual of Techniques and Materials.
Revised ed. John Wiley & Sons, Inc., 1997. ISBN: 0471509448