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:

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
Oligomerous 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:**