

**DLT 114**  
**DENTAL MATERIALS**

**COURSE DESCRIPTION:**

Prerequisites: Enrollment in the Dental Laboratory Technology program

Corequisites: None

This course provides a study of the composition, properties, and uses of non-metal materials as well as the physical and mechanical properties of metal alloys. Topics include gypsums, waxes, acrylics, metals, and policies related to health, safety, and infection control. Upon completion, students should be able to identify gypsums, waxes, acrylics, and metal materials and know the proper procedures for health, safety, and infection control. Course Hours Per Week: Class, 1. Lab, 6. Semester Hours Credit, 3.

**LEARNING OUTCOMES:**

The student will:

- a. Practice proper infection control procedures.
- b. Adhere to all institutional health and safety policies.
- c. Identify the various gypsum products, describe their physical and chemical reactions, and demonstrate their proper usage.
- d. Identify the various impression materials, describe their physical application, and demonstrate their proper usage.
- e. Identify the various dental waxes, describe their physical application, and demonstrate their proper usage.
- f. Describe the purpose for separating materials and demonstrate their proper usage.
- g. Describe the various types of acrylic resins, their physical and chemical properties, and demonstrate their proper usage.
- h. Describe the various dental burs and abrasives, and demonstrate their proper usage.
- i. Utilize all equipment needed to meet the course objectives observing all safety precautions.
- j. Use appropriate terminology with respect to dental materials.
- k. Strive to complete all laboratory projects as scheduled.
- l. Identify alloys used in dentistry.
- m. Define metal structures.
- n. Identify precious metal casting alloys.
- o. Identify precious wrought alloys.
- p. Identify base metal casting alloys.
- q. Identify base metal wrought alloys.
- r. Define dental solders.
- s. Identify dental casting investments.
- t. Identify dental soldering investments.

- u. Define flux.
- v. Describe soldering and welding.
- w. Explain combustion, burners, and blow pipes.
- x. Troubleshoot casting defects.
- y. Fabricate impressions utilizing alginate, rubber base and hydrocolloid impression materials.
- z. Pour and trim master casts form alginate, rubber base and hydrocolloid impressions.
- aa. Fabricate stabilized base plates.
- bb. Fabricate vacuum formed custom impression trays.
- cc. Fabricate a clear acrylic denture base.
- dd. Fabricate a denture base repair.

## **OUTLINE OF INSTRUCTION:**

- I. Overview of institutional policies
  - A. Emergency management
  - B. Hazard control communication
  - C. Reference: handouts/institution policies
  
- II. Introduction to the science of dental materials
  - A. One hour classroom lecture
    - 1) Presentation
      - (a) Historical background
      - (b) ADA specifications
      - (c) Federal regulations and standards
      - (d) Dental laboratory technology
      - (e) Introduction to infection control in the dental laboratory
      - (f) Terminology
    - 2) Application
  - B. References
    - 1) Laboratory and Clinical Dental Materials, pages 3-9
    - 2) Science of Dental Materials, chapter 1
    - 3) Dental Laboratory Technology, AFM, Volume I, glossary, pages 185-205
    - 4) Infection Control In The Dental Laboratory – RR Runnels
    - 5) NADL – Infection Control Program
  
- III. Gypsum products: chemistry of setting, I
  - A. One hour classroom lecture
    - 1) Presentation
      - (a) Gypsum identification
      - (b) Dental plaster and stone
      - (c) Setting reactions of gypsum products
      - (d) Water/powder ratio
      - (e) Setting time

- (f) Calcining and reversal reactions
    - 2) Application
  - B. One hour laboratory demonstration--lab exercise #1A
    - 1) Measuring the water and powder (plaster)
    - 2) Mixing technique
    - 3) Using the Gilmore needles
    - 4) Determining setting times for B-hemihydrate
  - C. References
    - 1) Laboratory and Clinical Dental Materials, pages 56-71
    - 2) Dental Laboratory Technology, AFM, Volume I, Chapter 3, pages 18-24
- IV. Structure of metals, I
- A. Presentation
    - 1) Crystallization
    - 2) Grain size
    - 3) Crystal structure
    - 4) Phase diagrams
  - B. Application
  - C. References
    - 1) Laboratory and Clinical Dental Materials, UNC, pages 115-122
    - 2) Dental Laboratory Technology, USAF, pages 36-39
- V. Gypsum products: chemistry of setting, II
- A. One hour classroom lecture
    - 1) Presentation
      - (a) Setting expansion
      - (b) Control of setting expansion
      - (c) Accelerators and retarders
      - (d) Hygroscopic setting expansion
      - (e) Strength
    - 2) Application
  - B. One hour laboratory demonstration--lab exercise #1B & 1C
    - 1) Measuring and mixing technique for hydrocol
    - 2) Using chemical modifiers
    - 3) Determining the effects of chemical modifiers on a-hemihydrate
  - C. References
    - 1) Laboratory and Clinical Dental Materials, pages 56-71
    - 2) Dental Laboratory Technology, AFM, Volume I, Chapter 3, pages 18-24
- VI. Gypsum products: technical considerations
- A. One hour classroom lecture
    - 1) Presentation
      - (a) Classification of dental stone

- (b) Model and die materials
    - (c) Dies
    - (d) Technique
  - 2) Application
- B. One-half hour laboratory demonstration--lab exercise #1D
- C. References
  - 1) Laboratory and Clinical Dental Materials, pages 69-78
  - 2) Dental Laboratory Technology, AFM, Volume I, Chapter 3, pages 18-24

VII. Impression materials, I

- A. One hour classroom lecture
  - 1) Presentation
    - (a) Characteristics
    - (b) Types and uses
    - (c) Alginate technique
  - 2) Application
- B. One hour laboratory demonstration -- lab exercise #2
  - 1) Proportioning
  - 2) Mixing
  - 3) Making an impression of a cast
  - 4) Pouring the stone cast
  - 5) Trimming the stone cast
- C. References:
  - 1) Laboratory and Clinical Dental Materials, pages 38-56
  - 2) Dental Laboratory Technology, AFM, Volume I, Chapter 3, pages 26-31

VIII. Structure of metals, II

- A. Presentation
  - 1) Properties of metal
  - 2) Mechanical working
  - 3) Deformation of metal
  - 4) Methods of testing
- B. Application
- C. Reference
  - 1) Laboratory and Clinical Dental Materials, UNC, pages 122-125

IX. Impression materials, II

- A. One-half hour classroom lecture
  - 1) Presentation
    - (a) Agar base
    - (b) Compounds
  - 2) Application
- B. One hour laboratory demonstration--lab exercise #3
  - 1) Liquefaction/gelation

- 2) Duplicating technique
- 3) Care of the agar

C. References:

- 1) Laboratory and Clinical Dental Materials, pages 38-56
- 2) Dental Laboratory Technology, AFM, Volume I, Chapter 3, pages 26-31

X. Waxes, separating materials, and debubblizers

A. One hour classroom lecture

- 1) Presentation
  - (a) Waxes
    - (1) Origins
    - (2) Common Properties
    - (3) Types of dental waxes
    - (4) Properties effected by technique
  - (b) Separating materials
    - (1) Uses
    - (2) Types
  - (c) Debubblizers

2) Application

B. Two hour laboratory demonstration - lab exercise #4

- 1) Forming the wax pattern for a clear acrylic denture base
- 2) Flasking the wax pattern

C. References:

- 1) Laboratory and Clinical Dental Materials, pages 79-87
- 2) Removable Prosthodontic Techniques, pages 87-90
- 3) Dental Laboratory Technology, AFM, Volume I, Chapter 3, pages 24-26, 50, and 52.
- 4) Handout, Section 5, Waxes

XI. Metals used in dentistry

A. Presentation

- 1) Gold
- 2) Silver
- 3) Copper
- 4) Platinum
- 5) Palladium
- 6) Zinc
- 7) Mercury
- 8) Tin
- 9) Bismuth
- 10) Chromium
- 11) Cobalt
- 12) Nickel
- 13) Molybdenum
- 14) Beryllium

- B. Application
- C. References:
  - 1) Laboratory and Clinical Dental Materials, UNC, pages 115-141
  - 2) Dental Laboratory Technology, USAF, pages 36-47

XII. Denture base acrylic resin: basic technique

- A. One hour classroom lecture
  - 1) Presentation
    - (a) Introduction
    - (b) Composition
    - (c) General technique for handling the resin
      - (1) Cleanliness
      - (2) Mixing the resin
      - (3) Physical reactions
      - (4) Packing the mold
    - (d) Processing the resin
    - (e) Deflasking and recovery
  - 2) Application
- B. Two hours laboratory demonstration - lab exercise #4 (continued)
  - 1) Boil-out procedures
  - 2) Applying separating media (tin foil and liquid)
  - 3) Mixing the acrylic resin
  - 4) Packing the resin (compression molding)
  - 5) Processing
  - 6) Deflasking and recovery
  - 7) Finishing and polishing
  - 8) Removing polishing materials
- C. References:
  - 1) Laboratory and Clinical Dental Materials, pages 88-114
  - 2) Removable Prosthodontic Techniques, pages 91-97, 106-109
  - 3) Dental Laboratory Technology, AFM, Volume I, Chapter 3, pages 30-34

XIII. Self curing acrylic resins

- A. One hour classroom lecture
  - 1) Presentation
    - (a) Autopolymerization
    - (b) Uses
    - (c) Composition
    - (d) Technical considerations
      - (1) Color stability
      - (2) Effects of time and temperature
      - (3) Methods of application
      - (4) Curing the resin
  - 2) Application
- B. One hour laboratory demonstration - lab exercise #5; stabilized base plates

- 1) Blocking out undercuts
- 2) Forming the wax matrix
- 3) Separating media
- 4) Measuring and mixing the resin
- 5) Forming the base plate
- 6) Trimming the cured base plate

C. References:

- 1) Laboratory and Clinical Dental Materials, pages 88-114
- 2) Removable Prosthodontic Techniques, pages 35-39
- 3) Dental Laboratory Technology, AFM, Volume I, pages 30-34

XIV. Precious metal alloys

A. Presentation

- 1) Casting alloys
- 2) Solders
- 3) Wrought alloys
- 4) Carat
- 5) Fineness
- 6) Conversion

B. Application

C. References:

- 1) Laboratory and Clinical Dental Materials, UNC, pages 126-134
- 2) Dental Laboratory Technology, USAF, pages 36-44 and 541

XV. Acrylic resins; technical considerations

A. One hour classroom lecture

- 1) Presentation
  - (a) Polymerization
    - (1) Define
    - (2) Types
    - (3) Inhibitors
    - (4) Copolymer
    - (5) Cross linking agent
    - (6) Plasticizers
    - (7) Homopolomer
    - (8) Initiator
    - (9) Activator
    - (10) Composite
  - (b) Molding
  - (c) Physical properties
    - (1) Curing shrinkage
    - (2) Porosity
    - (3) Water absorption
    - (4) Crazeing
  - (d) Allergic reactions
- 2) Application

- B. No laboratory demonstration - lab exercise #5 (continued)
- C. References:
  - 1) Laboratory and Clinical Dental Materials, pages 88-114
  - 2) Removable Prosthodontic Techniques, pages 35-39
  - 3) Dental Laboratory Technology, AFM, Volume 1, Chapter 3, pages 30-34

XVI. Base metal alloys

- A. Presentation
  - 1) Casting alloys
  - 2) Wrought alloys
  - 3) Solders
- B. Application
- C. References
  - 1) Laboratory and Clinical Dental Materials, UNC, pages 135-141
  - 2) Dental Laboratory Technology, USAF, pages 45-47

XVII. Dental abrasives and polishing agents

- A. One hour classroom lecture
  - 1) Presentation
    - (a) Description
    - (b) Desirable characteristics of an abrasive
    - (c) Types of abrasives
    - (d) Polishing theory
    - (e) Factors affecting the rate of abrasion
    - (f) Finishing and polishing
    - (g) Electropolishing
    - (h) Dental burs
  - 2) Application
- B. No laboratory demonstration
- C. References:
  - 1) Laboratory and Clinical Dental Materials, pages 178-184
  - 2) Dental Laboratory Technology, AFM, Volume 1, Chapter 3, pages 53-55
  - 3) Handout

XVIII. Dental investments

- A. Presentation
  - 1) Description of investments
  - 2) Function of investments
  - 3) Types and uses
  - 4) Casting
  - 5) Soldering
- B. Application
- C. References
  - 1) Laboratory and Clinical Dental Materials, UNC, pages 142-146

2) Dental Laboratory Technology, USAF, pages 23-24

XIX. Final impressions

A. One hour classroom lecture

1) Presentation

(a) Impression plaster

(1) Rigid when set

(2) Uses

(a) Edentulous patients

(b) Matrices

(3) Low strength

(4) Generates considerable heat on setting

(5) Composition

(a) Plaster of Paris

(b) Starch

(6) Separating medium required

(7) Dissolves in boiling water

(b) Metallic oxide impression paste; ZOE

(1) Rigid when set

(2) Two paste system

(a) Zinc oxide-base

(b) Eugenol-accelerator

(3) Used for edentulous patients only

(4) No separating medium required

(5) May be softened in boiling water

(c) Rubber base (mercaptan/polysulfide)

(1) Elastic when set

(2) Two paste system

(a) Base

(1) Liquid polymer

(2) Calcium sulfate

(b) Accelerator

(1) Lead peroxide

(2) Sulfur

(3) May be used for both dentulous and edentulous patients

(4) No separating medium required

(5) Should be rinsed and poured as soon as possible

(6) Superior to hydrocolloid materials

(d) Custom impression trays

(1) Define

(2) Purpose

(3) Materials used

(a) Autopolymerizing acrylic resin

(b) Vacuum form resin

2) Application

- B. Two hours of laboratory demonstration - lab exercises #6 and #7
  - 1) Prepare casts for impressions
  - 2) Using casts for impressions
  - 3) Trimming the tray material
  - 4) Mixing the impression material
  - 5) Making the impression
- C. References:
  - 1) Laboratory and Clinical Dental Materials, pages 39-43, 53-56
  - 2) Removable Prosthodontic Techniques, pages 16, 17
  - 3) Dental Laboratory Technology, AFM, Volume I, Chapter 3, page 28

XX. Dental amalgam

- A. Presentation
  - 1) Description of amalgam
  - 2) Composition
  - 3) Amalgamation
  - 4) Trituration
  - 5) Condensation
- B. Application
- C. References
  - 1) Laboratory and Clinical Dental Materials, UNC, pages 191-198
  - 2) Dental Laboratory Technology, USAF, page 47

XXI. Master casts

- A. One-half hour classroom lecture
  - 1) Presentation
    - (a) Description
    - (b) Infection control factors
    - (c) Need for accuracy
    - (d) Handling the cast
    - (e) How related to the final impression
    - (f) Poured in stone
    - (g) Techniques for making master casts
      - (1) Beading and boxing the impression
      - (2) Inverting the impression
      - (3) Pouring without boxing or inverting
    - (h) Trimming the casts
      - (1) Base thickness
      - (2) Border dimensions
      - (3) Land areas
      - (4) Model trimmer safety
      - (5) Keying casts
  - 2) Application
- B. One hour laboratory demonstration - lab exercise #8
  - 1) Beading, boxing and pouring impression

- 2) Trimming the casts
  - 3) Model trimmer safety
  - 4) Keying casts
- C. References: Removable Prosthodontic Techniques, pages 23-31

## XXII. Soldering and welding

- A. Presentation
- 1) Description of soldering
  - 2) Fluxes
  - 3) Anti-fluxes
  - 4) General objectives
  - 5) Investment soldering
  - 6) Electric soldering
  - 7) Heat treatment
  - 8) Defects
  - 9) Description of welding
- B. Application
- C. References
- 1) Laboratory and Clinical Dental Materials, UNC, pages 162-167
  - 2) Dental Laboratory Technology, USAF, pages 44 and 49

## XXIII. Practical applications for autopolymerizing acrylic resin

- A. One-half hour classroom lecture
- 1) Presentation
    - (a) Assembling broken denture segments
    - (b) Reinforcing
    - (c) Pouring and preparing the cast
    - (d) Preparing the broken segments
    - (e) Reassembling the segments on the cast
    - (f) Various techniques for applying resin
    - (g) Curing
    - (h) Finishing and polishing
    - (i) Removing the polishing materials
  - 2) Application
- B. One hour laboratory demonstration - lab exercise #9
- 1) Assembling and reinforcing broken denture segments
  - 2) Pouring and preparing the cast
  - 3) Rabbeting
  - 4) Applying resin
  - 5) Curing the resin
  - 6) Finishing and polishing
  - 7) Removing the polishing materials
- C. Reference
- 1) Removable Prosthodontic Techniques, pages 130-133

#### XXIV. Combustion, burners, and blowpipes

- A. Presentation
  - 1) Description
  - 2) Chemical reactions as a source of heat
  - 3) Combustion reactions
  - 4) Fuels
  - 5) Flames
  - 6) Burners
  - 7) Blowpipes
- B. Application
- C. References
  - 1) Laboratory and Clinical Dental Materials, UNC, pages 147-153

#### **REQUIRED TEXTBOOKS AND MATERIALS:**

Sowter, John B., Removable prosthodontic Techniques, University of North Carolina Press, Chapel Hill, NC, revised edition.

Laboratory and Clinical Dental Materials, UNC, 1981.

Dental Laboratory Technology, AFM 162-6, 1991, Department of Air Force.

#### **SUGGESTED REFERENCES:**

Periodicals and Visual Aids.

- A. References
  - 1. Anderson, John N.; Applied Dental Materials, 3rd edition, Blackwell Scientific Publications, 1967.
  - 2. Peyton, Floyd A.; Restorative Dental Materials, 3rd edition, C. V. Mosby, 1968.
  - 3. Phillips, Ralph W.; Elements of Dental Materials for Dental Hygienists and Assistants, W. B. Saunders Co., 1971.
  - 4. Phillips, Ralph W.; Science of Dental Materials, 8th edition, W. B. Saunders, 1982.
  - 5. Roydhouse, Richard H.; Materials in Dentistry; A Discussion for Uses of Dental Materials, Year Book Medical Publishers, 1962.
  - 6. O'Brian, William J., Dental Materials, W.B. Saunders Co., Philadelphia, PA, 2nd edition, 1971.
  - 7. Guide to Dental Materials, American Dental Association, Chicago, IL.
  - 8. Phillips, Ralph W., Elements of Dental Materials, W.B. Saunders Co., Philadelphia, PA, 2nd edition, 1971.
  - 9. Boucher's Clinical Dental Terminology, 1983
  - 10. Dental Materials: Properties & Manipulation, 1996
  - 11. Dental materials and their Selection, 1997
  - 12. Dentistry: An Illustrated History, 1993
  - 13. Ancient Times Until The End Of The Eighteenth Century
  - 14. Infection Control In The Dental Laboratory, 1984
  - 15. Materials In Dentistry principles And Applications, 1995

16. Skinner's Science of Dental Materials, 1973

B. Periodicals:

1. "Journal of Prosthetic Dentistry"
2. "Quintessence of Dental Technology"
3. Journal of Dental Technology
4. Practical Periodontics & Aesthetic Dentistry

**STATEMENT FOR STUDENTS WITH DISABILITIES:**

Students who require academic accommodations due to any physical, psychological, or learning disability are encouraged to request assistance from a disability services counselor within the first two weeks of class. Likewise, students who potentially require emergency medical attention due to any chronic health condition are encouraged to disclose this information to a disability services counselor within the first two weeks of class. Counselors can be contacted by calling 686-3652 or by visiting the Student Development Office in the Phail Wynn Jr. Student Services Center, room 1309.