## NEW YORK CITY COLLEGE OFDEPARTMENT OF RESTORATIVETECHNOLOGYDENTISTRY

COURSE CODE:	RESD 2307
COURSE TITLE:	THE SCIENCE OF DENTAL METALLURGY
COURSE DESCRIPTION:	This course will consist of the study of dental metallurgy, physical and mechanical properties of metals, their internal structure, and types of precious and nonprecious dental casting alloys and metals used in the laboratory. Also covered will be a discussion of soldering, welding, and casting procedures and the associated types of investments and equipment used in these procedures. Polishing agents used for metals will also be discussed.

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HOURS AND CREDITS:	1 lecture hour per week; 1 credit
NUMBER OF WEEKS:	15 Weeks
CURRICULUM LEVEL:	Third Semester
PREREQUISITES:	RESD 1107
TEXTBOOKS:	Dental Laboratory Technology, Basic Science_ Air Force Pamphlet 47-103, Vol. I, Vol. II
	Phillips' Science of Dental Materials 12 <sup>th</sup> ed Anusavice, Kenneth J., Chiayi Shen, and H. Ralph. Rawls St. Louis, MO: Elsevier/Saunders, 2012.
REFERENCES:	Craig, Robert G., John M. Powers, and Ronald L. Sakaguchi. Craig's Restorative Dental Materials. St. Louis, MO: Mosby Elsevier, 2006.

#### **RESTORATIVE DENTISTRY POLICIES**

Students attending Restorative Dentistry in-person, hybrid or online courses will be required to adhere to the following policies

#### ACADEMIC INTEGRITY CUNY Policy on Academic Integrity

Academic dishonesty is prohibited in The City University of New York. Penalties for academic dishonesty include academic sanctions, such as failing or otherwise reduced grades, and/or disciplinary sanctions, including suspension, or expulsion.

Source: NYCCT College Catalog: http://www.citytech.cuny.edu/academics/academic-catalog.aspx

#### NYCCT Academic Integrity

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the college recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity.

Source: NYCCT College Catalog: http://www.citytech.cuny.edu/academics/academic-catalog.aspx

#### **Restorative Dentistry**

- 1. All Restorative Dentistry students must submit completed assignments or projects (in lab or theory) by the assigned due date as stated in the course outline.
- Plagiarism in lectures, laboratory assignments, exams, or projects will not be accepted. Students will not receive a grade if papers, exams, or assignments were done by someone else or completed in ways other than stated in course documentation. The department will follow the Academic Integrity Policy and Procedures as per NYCCT & CUNY Policies.
- 3. Students are responsible for knowing all material covered in reading assignments and handouts for both lecture and laboratory. Students are responsible for knowing information from reading assignments regardless of whether it has been covered during class sessions.
- 4. RESD students are responsible for being in class on time and for observing laboratory demonstrations. Failure to observe laboratory demonstrations may affect student's performance and contribute to the failure of the course.

#### NYCCT REASONABLE ACCOMMODATIONS

Qualified students with disabilities, under applicable federal, state, and city laws, seeking reasonable accommodations or academic adjustments must contact the Center for Student Accessibility for information on City Tech's policies and procedures to obtain such services. Students with questions on eligibility or need for temporary disability services should also contact the Center at: The Center for Student Accessibility, 300 Jay Street, room L-237, 718 260-5143, http://www.citytech.cuny.edu/accessibility/

#### Attendance and Participation

In-class participation and online presence are essential, and failure to review course material promptly will affect the timely completion of assignments and assessments and adversely affect the final grade. Laboratory, clinical, or fieldwork courses may have specific attendance policies.

Source: NYCCT College Catalog: http://www.citytech.cuny.edu/academics/academic-catalog.aspx

#### Restorative Dentistry Professionalism & Participation

The Department of Restorative Dentistry follows NYCCT, CUNY, and Dental Laboratory Technology industry standards to educate, develop, advance, and guide future dental technology professionals, preparing graduates for workplace readiness. In order to complete Restorative Dentistry courses, students must consistently participate in classes and meet deadlines as stated in the course syllabus.

- It is strongly advised that students be present for all classes during the semester, including 30 laboratories and 15 lectures.
- Classes will begin promptly at the scheduled time.
- Students enrolled in the RESD 2307 course must meet all course requirements stated in the course syllabus to pass it. Failure to submit or complete the assignments, tasks, projects, or exams by specified due dates, places, and times will result in a zero (0) grade and possible failure of the course.
- · Make-up exams, projects, and assessments will be issued only under extenuating circumstances.
- If a student requires reasonable accommodations, proper documentation from the Center for Student Accessibility should be submitted to the instructor within a reasonable time to fulfill course requirements before the semester ends.
- The students must observe the course instructor's demonstrations and complete all fabrication tasks under the course instructor's supervision. Laboratory demonstrations are usually conducted at the beginning of the session and will not be repeated. There are videos online that can be viewed under most circumstances.
- When a student is given the instructor's permission to leave the class, the student must return to class in a reasonable time.

#### **GRADING**

Restorative Dentistry courses include lecture or lecture and laboratory sections. In didactic and laboratory sessions, the final grades will be computed based on the grading included in the course syllabus. Most courses are graded based on 60% of the laboratory and 40% of the lecture grades. Students must achieve a passing grade of at least 70% in the laboratory and at least 70% in the lecture sections to receive the minimum passing grade of "C" for the entire course. Failure to meet the minimum of 70% average in either component of the course confirms that the student has not met the minimum requirements for successful completion of the course, and a grade of "D" or "F" will be given based on the student's performance in the failing section of the course. RESD student must repeat any RESD course for which he/she receives a grade below the minimum of "C." For courses with laboratory and lecture components, the student must repeat both the lecture and the laboratory sections, even though the score in one of the sections may have been greater than 70%.

College grading scale

А	=	93-100%
A-	=	90-92.9%
$\mathbf{B}+$	=	87-89.9%
В	=	83-86.9%
B-	=	80-82.9%
C+	=	77-79.9%
С	=	70-76.9%
D	=	60-69.9%
F	=	59.9% and below

#### SATISFACTORY PROGRESS

Students are expected to maintain a 2.0 G.P.A. or higher in all classes. Students whose cumulative G.P.A. falls below the minimum 2.0 G.P.A. will be placed on academic alert or academic probation by the college. Students on academic probation may be subject to attempted credit restrictions, affecting their progress in all courses needed for a semester. Failure to raise cumulative G.P.A. to the appropriate level could result in dismissal from the college. Any students receiving a grade of "D" or "F" in RESD courses will be required to repeat that course. RESD course may only be repeated once, requiring the entire duration and fulfillment of all requirements of the lecture and laboratory sections of the course. Failure to satisfactorily complete a repeated RESD course will be considered a failure to maintain satisfactory progress in the major and will result in dismissal from the major.

#### **PROFESSIONALISM & ETHICS:**

- 1. Since dentistry carries a high degree of responsibility, mature, professional, and ethical conduct is always expected of all students (lecture and laboratory sessions, hybrid and online sessions, externship sites, professional events/seminars.) Unprofessional behavior that shows inattentiveness and disrespect for others will not be tolerated and will affect the student's grade. Points may be deducted at the discretion of any faculty member, regardless of what course is in session. Students will conduct themselves in a professional manner. No offensive language or any other misconduct will be allowed.
- 2. Netiquette: Online Etiquette-Students will conduct their online posts and replies with respect for others, which include courtesy, dignity, and appropriate language at all times. Inappropriate behavior in online settings will not be tolerated and will negatively affect a student's grade.
- 3. All faculty members will be addressed by their proper title.
- 4. Students are required to use proper dental terminology when discussing dental prostheses.
- 5. Students are not permitted to do other students' work, although assistance and teamwork are strongly encouraged.
- 6. Students should plan to attend all department events and professional development seminars in which an invitation is extended. Students are strongly encouraged to attend events, professional development seminars, and meetings sponsored by the department to elevate their knowledge, skills, and understanding of the profession.
- 7. Department offices and stock rooms contain sensitive and personal information, classroom materials, supplies and equipment, and should be used for official use only. Students and unofficial personnel are not allowed in the department offices unless to fulfill official business.

#### DRESS, SUPPLIES, AND TEXTBOOKS

- 1. Laboratory smocks (lab coats) with the Restorative Dentistry Department emblem must always be worn in the laboratory. Emblems are to be attached to the left breast pocket. Smocks must be clean and kept completely buttoned or tied when worn. Failure to wear smocks will necessitate students being barred from the laboratory and marked absent.
- 2. Closed-toe shoes are required while working in the laboratory.
- 3. No hats/caps of any type are to be worn in the laboratories. (*Except for religious reasons*)
- 4. Students must purchase and possess the required tools, supplies, PPE, and textbooks by the second week of scheduled classes. A list of all course materials will be available in the department's main office or in CLT's office. Label all personal tools should with the student's name.
- 5. Students should acquire the required textbooks for each course, read assigned pages, and review procedures before attending lectures and laboratory classes. The required textbooks will be included in all course syllabi.
- 6. RESD students are responsible for their belongings at all times. The Restorative Dentistry Department does not take responsibility for items left in the classrooms.

#### ONLINE CLASS TECHNOLOGY PREREQUISITES

Below are the suggested minimum prerequisites for taking part in an online course:

- 1. You should have access and be able to use the internet browser.
- 2. You need access to a computer with internet connection; computers with internet access are available in numerous locations throughout the college (i.e. Library, Computer Lab G600, etc.)
- 3. You should have access and be comfortable using the college email account provided to each student free of charge. College email will be used as a primary source of course communication.

#### **TEXTBOOKS**

- 1. Students should acquire required textbooks for each course and are expected to read assigned pages and review procedures *prior* to attending lecture and laboratory classes. The list of required textbooks will be listed in all course syllabi.
- 2. RESD students are responsible for their belongings at all times. Restorative Dentistry Department does not take responsibility for left over items.

#### **ATTENDANCE POLICY:**

Attendance is expected for all class sessions. Failure to attend and be on-time for class sessions could result in missing important course information, missing graded activities which could result in below satisfactory scores to successfully meet degree requirements. A weighted course average of 70% or higher is required for this course to meet degree requirements.

#### **Course outline**

Reading selections from:

Dental Laboratory Technology, Air Force Pamphlet, 47-103, Vol. I & II (A. F. manual readings are designated from Vol. I or Vol. II) Philips' Science of Dental Materials 12<sup>th</sup> ed. (Philips')

Торіс	Reading	Wednesday. Date
1. Introduction to metallurgy	Vol. I p 61-63	Aug.28
2. Extraction of metals from ore		Sept. 4
3. Physical and mechanical properties of metals	Vol. I p 63-70 Philips' Chapter 5	Sept. 11

4. Physical and mechanical properties of metals cont.		Sept. 18
5. Quiz		Sept. 25
6. Casting soldering and welding	Vol. I p 73-74;Vol. II pp.171, 192, 199; Philips' Chapter 16	Oct. 9
7. Mid-term		Oct. 16
8. Dental gold alloys.	Vol I p 71 Philips' Chapter 10	Oct. 23
9. Base metal alloys	Vol I p 76-78; Vol. II, p. 169 Philips' Chapter 5, 17	Oct. 30
10. Implants	Vol. II pp. 196-200 Philips' Chapter 20	Nov. 6
11. Implants cont.		Nov. 13
12. Polishing agents	Vol. II pp. 89-91 Philips' Chapter 11	Nov. 20
13. Ceramic metal systems	Vol. II, pp. 133-139 Philips' Chapter 18	Dec. 4
14. Review		Dec. 11
15. Final		Dec. 18

Revised: January, 2025

#### NEW YORK CITY COLLEGE OF TECHNOLOGY DEPARTMENT OF RESTORATIVE DENTISTRY

#### <u>COURSE OUTLINE</u> <u>RESD 2307 - THE SCIENCE OF DENTAL METALLURGY</u>

#### I. INTRODUCTION - ONE LECTURE HOUR

#### A. GENERAL GOALS OF COURSE

- 1. Students will be able to apply theoretical information and terminology to dental laboratory experience.
- 2. The students will be able to demonstrate understanding of the theory during processes of dental laboratory work.

- 3. Analyze changes in working metals based on theory learned
- B. DEFINITIONS: 1. metallurgy; 2. metal; 3. noble metal; 4. native metal, base metal; 6. Ores
- II. EXTRACTION OF METALS FROM ORES ONE LECTURE HOUR, Video, class handouts

## III. PHYSICAL AND MECHANICAL PROPERTIES OF METALS – ONE LECTURE HOUR

- 1. Color
- 2. Density
- 3. Taste
- 4. Odor
- 5. thermal conductivity
- 6. specific heat
- 7. heat of fusion
- 8. electrical conductivity
- 9. thermal coefficient expansion
- 10. melting and freezing points
- 11. tarnish resistance (activity)
- 12. grain growth

### IV. PHYSICAL AND MECHANICAL PROPERTIES OF METALS - ONE LECTURE HOUR

- 1. Force
- 2. Pressure
- 3. Stress
- 4. Strain
- 5. proportional limit
- 6. elastic limit
- 7. yield strength
- 8. ultimate strength
- 9. modulus of elasticity
- 10. malleability
- 11. ductility impact resistance
- 12. hardness tests
  - a. Rockwell
    - b. Brinell
    - c. Bierbaum
    - d. Knoop
- V. QUIZ Ores, Alloy Manufacturing
- VI. CASTING. SOLDERING, WELDING ONE LECTURE

HOUR. Air Force Manual, Vol. II pp.171, 192, 199

- 1. high heat techniques
- 2. low heat techniques
- 3. casting defects
- 4. investments, investment soldering
- 5. free hand soldering
- 6. spot welding
- VII. MID-TERM ONE LECTURE HOUR Mechanical Properties, casting, soldering, welding

#### VIII. DENTAL GOLD ALLOYS – ONE LECTURE HOUR Mechanical Properties Class handouts

- 1. History
- 2. Uses, Production, Consumption
- 3. Measures of weight
- 4. Alloy classifications

#### IX. BASE METAL ALLOYS - ONE LECTURE HOUR - Air Force Manual, Vol. II, p. 169

- 1. origin
- 2. types
- 3. composition
- 4. physical properties
- 5. mechanical properties
- 6. applications

#### X. IMPLANTS –ONE LECTURE HOUR- Class Handouts, Air Force Manual, Vol. II pp. 196-200

- 1. History
- 2. Indications, Classification
- 3. Implant materials
- 4. Clinical training
- 5. Clinical procedures

#### XI. Implant Video- CLINICAL AND LABORATORY PROCEDURES - ONE LECTURE HOUR

- 1. Clinical considerations
- 2. Types of implants
- 3. Materials for implant manufacturing
- 4. Clinical training
- 5. Implant placement
- 6. Crown placement on implants

XII. POLISHING AGENTS - ONE LECTURE HOUR-Air Force Manual, pp. 89-91

- 1. Types of polishing agents
- 2. Rough surface finishing
- 3. Preliminary polishing
- 4. Final polishing

XIII. CERAMIC METAL SYSTEMS - ONE LECTURE HOUR- Air Force Manual, Vol. II, pp. 133-139

- 1. Composition
- 2. Properties
- 3. ceramic restorations
- 4. sub-structure designs and considerations
- XIV. COURSE REVIEW ONE LECTURE HOUR
- XV. FINAL EXAM DURING LAST CLASS SESSION ONE LECTURE HOUR CUMULATIVE

#### NEW YORK CITY COLLEGE OF TECHNOLOGY

#### DEPARTMENT OF RESTORATIVE DENTISTRY

#### INSTRUCTIONAL OBJECTIVES RESD 2307 - THE SCIENCE OF DENTAL METALLURGY

#### I. INTRODUCTION TO DENTAL METALLURGY - ONE LECTURE HOUR

- A. CONDITIONS: Given lectures and discussions on metallurgy and metals
- B. PERFORMANCE: The student should be able to:
  - 1. Define the following terms: metallurgy, metal, ore, native metal, noble metal, precious metals, base metal, alloy, malleability, ductility, specific gravity, tarnish, passivation, solid solution alloys, eutectic alloys, intermetallic compounds, solidus, liquidus.
  - 2. List properties that are characteristic of metals, list the names of all of noble metals used in dentistry. List the common base metals used in dentistry.
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.

#### II. EXTRACTION OF METALS FROM ORES - ONE LECTURE HOUR

A. CONDITIONS: Presented a lecture and discussion on the methods of extraction and refinement of metals from ore

B. PERFORMANCE: The student should be able to:

Define the following terms: concentration, magnetism, amalgamation, hydraulic, oxidation/reduction, and refining.

C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.

#### III. PHYSICAL AND MECHANICAL PROPERTIES OF METALS - ONE LECTURE HOUR

- A. CONDITIONS: Presented a lecture and discussions on various physical and mechanical properties of metals
- **B.** PERFORMANCE: The student should be able to:
  - 1. Define the following terms and describe their significance to dental restorations and procedures: Hardness, yield strength, stress, strain, proportional limit, color, density, thermal conductivity, specific heat, heat of fusion, electrical conductivity, thermal coefficient expansion, melting and freezing points, tarnish resistance, grain growth.
  - Name and describe the types of hardness tests and type of indenter (composition and shape) for each test.
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.

# IV. PHYSICAL AND MECHANICAL PROPERTIES OF METALS ONE LECTURE HOUR A. CONDITIONS: presented a lecture and discussion on the physical and mechanical properties of metals.

**B**. PERFORMANCE: The student should be able to:

Define the following terms and describe their significance to dental restorations and procedures: force, pressure, stress, strain, proportional limit, elastic limit, yield strength, ultimate strength, modulus of elasticity, malleability, ductility, impact resistance, hardness.

- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.
- V. QUIZ #1 ONE LECTURE HOUR
- VI. CASTING, SOLDERING AND WELDING PROCESSES TWO LECTURE HOUR

- A. CONDITIONS: Presented a lecture and discussion on investment and casting processes used in dental laboratory technology casting defects and methods of preventing these defects
- B. PERFORMANCE: The student should be able to:
  - 1. List two types of investment materials used in casting dental alloys.
  - 2. Cite two reasons for venting design.
  - 3. Cite four casting defects and the methods of preventing the defects for gold alloys and Vitallium alloys.
  - 4. Differentiate between shrinkage and gas porosity.
  - 5. List the steps in the procedure for a high heat and low heat casting technique and give the rationale for each step.
  - 6. Identify the low, medium, and high carbon steel according to the carbon content.
  - 7. List two purposes for each heat treatment for steel alloys: annealing, normalizing, hardening, and tempering.
  - 8. List two effects of tempering temperatures on the mechanical properties of a fully hardened alloy.
  - 9. Describe four purposes for alloying steels.
  - 10. Name two types of stainless steel and two applications for each type used in dental laboratory technology.
  - 11. List three ingredients of amalgam and provide one reason for the presence of each ingredient.
  - 12. Describe the effect of the ingredients on the compressive strength of the amalgam.
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of two lecture hours.

#### VII. MIDTERM EXAM - ONE LECTURE HOUR

- VIII. DENTAL GOLD ALLOYS ONE LECTURE HOUR
  - A. CONDITIONS: Presented a lecture and discussion on the carat and fineness of gold, the composition, properties, and applications of four types of gold alloys, clasp gold, heat treatment of gold alloys, and gold solders
  - **B**. PERFORMANCE: The student should be able to:
    - 1. Find the weight, percentage of gold, and fineness in an alloy from the carat value
    - 2. List two important properties and two applications for the four types of gold alloys according to ADA specification No. 5
    - 3. Match the chemical composition and mechanical properties with the four types of gold alloys.

- 4. List three constituents and two properties of a cast gold alloy
- 5. List the methods of production and properties of ordered and disordered gold alloys
- 6. List two types of solders for gold alloys and name two applications for their use
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.

#### IX. BASE METAL CASTING ALLOYS - ONE LECTURE HOUR

- A. CONDITIONS: Presented a lecture and discussion on the origin, types, composition, uses, physical and chemical properties, methods of processing and repairing, trade names, and use of cobalt-chromium and base metal
- B. PERFORMANCE: The student should be able to:
  - 1. List four qualities of an alloy used for dental purposes
  - 2. List three trade names of cobalt-chromium alloys
  - 3. List the names of three elements and describe the reason for their addition in vitallium alloys
  - 4. List three mechanical and physical properties and three applications of Vitallium alloys
  - 5. Name three base metal alloys besides cobalt-chromium alloys and one application for each alloy used in dental technology.
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.

#### X. IMPLANTS

- A. CONDITIONS: Presented a lecture and discussion on dental implants
- **B**. PERFORMANCE: The student should be able to:
  - 1. Discuss the history and evolution of modern-day implants 2. Explain the indications for dental implants for a patient
  - 3. Describe the different types of dental implants.
  - 4. Discuss the advantages and disadvantages of implants
  - 5. Discuss the clinical training for implants
  - 6. Explain the surgical and laboratory procedures for implants
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.

#### XI. IMPLANT VIDEO

A. CONDITIONS: Conducted a video presentation and discussion on dental implants.

#### B. PERFORMANCE: The student should be able to:

- 1. Discuss the clinical criteria for dental implants
- 2. Explain the four bone categories for implant placement
- 3. Describe the surgical procedure for dental implants
- 4. Describe the laboratory procedures for dental implants
- 5. Explain the importance of a sterile environment for implant placement
- 6. Discuss implant maintenance by the patient
- 7. Discuss clinical training requirements for Dentists
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of the one lecture hour

#### XII. POLISHING AGENTS - ONE LECTURE HOUR

- A. CONDITIONS: Presented a lecture and discussion on various polishing agents.
- **B.** PERFORMANCE<sup>-</sup> The student should be able to:
  - 1. Identify reasons for the finishing and polishing of restorations.
  - 2. Characterize the various forms and types of abrasive and polishing agents, specifying which materials achieve the best finish when used with each agent.
  - 3. Discuss polishing theory.
  - 4. Discuss electro-polishing.
  - 5. Select the appropriate cleaning solution for removing various polishing agents from restorations.
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.

#### XIII. CERAMIC METAL SYSTEMS - ONE LECTURE HOUR

- A. CONDITIONS: Presented a lecture and discussion on ceramic metal systems.
- **B**. PERFORMANCE: The student should be able to:
  - 1. Discuss ceramic metal systems in terms of their composition and properties.
  - 2. Describe the advantages, disadvantages, and limitations of ceramic restorations.
- C. EXTENT & CRITERIA: With at least 70% accuracy at the end of one lecture hour.

#### XIV. FINAL REVIEW OF COURSE MATERIAL – ONE LECTURE HOUR

#### XV. FINAL EXAM DURING LAST CLASS SESSION - ONE LECTURE HOUR.