



CDM 3277 - Digital Dentistry:CAD/CAM and 3D Printing Technologies

I. Course Information

Course: CDM 3277 - Digital Dentistry:CAD/CAM and 3D Printing Technologies
Semester and Year: Summer I 2021
Course Start and End Dates: 05/03/2021 - 07/25/2021
Course Reference Number: 50205
Semester Credit Hours: 1.0
Building and Room: HPD-Assembly I Building - 2109MELN

II. Instructor Information

Professor: Marvin B Golberg
Email: golberg@nova.edu
Office Hours:
 T-W-TH 8:30 am-5:00 pm By appointment only.

III. Class Schedule and Location

Day	Date	Time	Location	Building/Room
	05/05/2021 - 05/05/2021	3:10 PM - 6:00 PM	Ft Lauderdale/Davie Campus	HPD-Assembly I Building-2109MELN
W	05/12/2021 - 05/12/2021	4:10 PM - 5:59 PM	Ft Lauderdale/Davie Campus	HPD-Assembly I Building-2109MELN
W	05/19/2021 - 05/19/2021	4:10 PM - 6:00 PM	Ft Lauderdale/Davie Campus	HPD-Assembly I Building-2109MELN
W	05/26/2021 - 05/26/2021	4:10 PM - 5:59 PM	Ft Lauderdale/Davie Campus	HPD-Assembly I Building-2109MELN
W	06/09/2021 - 06/09/2021	4:10 PM - 5:59 PM	Ft Lauderdale/Davie Campus	HPD-Assembly I Building-2109MELN
W	06/16/2021 - 06/16/2021	4:10 PM - 5:59 PM	Ft Lauderdale/Davie Campus	HPD-Assembly I Building-2109MELN
W	07/07/2021 - 07/07/2021	4:10 PM - 5:59 PM	Ft Lauderdale/Davie Campus	HPD-Assembly I Building-2109MELN

IV. Course Description

This combined lecture and laboratory course in digital dentistry presents the theory and practical application of the use of CAD/CAM digital dentistry, 3D Printing and other emerging restorative technologies. Students will learn about the various systems for digital impression making and manufacture of restorations in the digital assisted practice of the 21st century, including the CEREC OmniCam and PrimeScan (Dentsply/Sirona), 3Shape Trios (3M), iTero (Align Technologies), Encode (Zimmer Biomet), Form Labs, EnvisionTec, as well as other emerging systems. The laboratory component of the course will incorporate tooth preparations, digital impressions on natural teeth and implants and completing the final restoration. The student will learn the theory and application of CAD/CAM technologies and 3D printing to fabricate single crowns, inlays, onlays, implant crowns and other prostheses.

V. Course Objectives / Learning Outcomes

Course Learning Outcomes

- 1: Understand the history and concept of CAD/CAM in dentistry.
- 2: Understand the various CAD/CAM systems available for digital impression making and subsequent restoration fabrication.
- 3: Understand the preparation design required for accurate, clinically.
- 4: Prepare and digitally impress teeth for CAD/CAM restorations using the various systems available, to include crowns, inlays, and onlays.
- 5: Become familiar with designing, milling, characterization and glazing of final CAD/CAM restorations.
- 6: Understand the properties of and the selection of the various materials utilized for CAD/CAM restorations.
- 7: Understand the luting procedure for CAD/CAM restorations.
- 8: Become familiar with digitally scanning of implant abutments and designing the implant final restorations.
- 9: Be able to write laboratory prescriptions for the fabrication of the CAD/CAM restorations.
- 10: Be familiar with the theory and process of 3D printing and its use in dental practice.

COLLEGE OF DENTAL MEDICINE COMPETENCY STATEMENTS Faculty Note: Use the most updated version of the CDM Predoctoral Competency document to select the corresponding competencies for this course. Be sure to select the number of the competency statement and the verbatim competency statement as it appears on the competency document. For each competency indicate the type of assessment (formative or summative) that will be employed to measure the attainment of the competency

Core Competencies:

6. Graduates must be competent in the restoration of teeth.

[CODA Predoctoral Standard 2-24(f)]

Formative assessment in preparing 8 typodont teeth and restoring 2 teeth with CAD/CAM restorations. Quizzes.

Summative assessment: Final written exam

7. Graduates must be competent in communicating and managing dental laboratory procedures in support of patient care.

[CODA Predoctoral Standard 2-24(g)]

Formative assessment in writing prescriptions and designing, milling, staining and glazing 2 CAD/CAM crowns. Quizzes.

Summative assessment: Final written exam

27. Graduates must demonstrate competence in the ability to self-assess, including the development of professional competencies and the demonstration of professional values and capacities associated with

self-directed, lifelong learning.
[CODA Predoctoral Standard 2-11]

Formative assessment in self-assessing preparations, scans, designs, mills and final CAD/CAM restorations.

Summative assessment: Final written exam

- This refers to the same as the items in the CDM Competency Document; please see them listed below.

FOUNDATION KNOWLEDGE

STATEMENTS FOR THE GENERAL DENTIST

FK3: Apply knowledge of physics and chemistry to explain the characteristics and use of technologies and materials used in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK-3 include: Basic Radiology, Dental Material Sciences, Biomaterials, Biophysics, etc. Clinical Science areas where FK3 may have relevance include: Prosthodontics, Restorative Dentistry, Oral Diagnostics, Applied Biomaterials, Preventive Dentistry, Laser-Assisted Dentistry, Applied Pharmacology, Radiology, Implant Dentistry, Endodontics, Esthetic Dentistry, Cosmetic Dentistry, Radiation Oncology, Oral Oncology, etc.

FK3-2: Apply knowledge of the principles of chemistry to understand the properties and performance of dental materials and their interaction with oral structures in health and disease. (Encompasses Dental Material Sciences, Biomaterials, etc.).

Select examples include: advantages and disadvantages of biomaterials used in dentistry, compatibility of dental materials both with each other and with biologic systems, substantivity and the adhesion chemicals, drugs, dental plaque, food, etc. to dental materials or to tissues in the mouth.

FK6: Apply knowledge of general and disease-specific pathology to assess patient risk in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK6 include: Cellular and Molecular Pathology, General and Systems Pathology, etc.

Clinical Science areas where FK6 may have relevance include: Periodontology, Oral Pathology, Oral Medicine, Oral Oncology, Oral Cancer, Oral Diagnostics, Diagnosis and Treatment Planning, History and Physical Examination, Endodontics, Emergency Care, Oral Radiology, Oral and Maxillofacial Surgery, Clinical Laboratory Sciences, Prosthodontics, Craniofacial Prosthodontics, Applied Biomaterials, etc.

FK10: Apply quantitative knowledge, critical thinking, and informatics tools in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK10 include: Statistics, Public Health Dentistry, Descriptive and Analytical Epidemiology, Dental and Health Informatics, Evidence-Based Dentistry, Applied Research, etc. Clinical Science areas where FK10 may have relevance include: all major disciplines associated with practicing dentistry including Practice Management.

VI. Materials and Resources

Course Required Texts and Materials:

Rekow D: Digital Dentistry: A Comprehensive Reference and Preview of the Future. Quintessence Publishing, Chicago, 2018.

Rosenstiel SF, Land MF, Fujimoto J: Contemporary Fixed Prosthodontics, Fifth Edition., Mosby, Inc.,

2016. Chapter 25.

Shillingburg, H: Fundamentals of Fixed Prosthodontics, Fourth Edition, Quintessence, Inc, 2012. Chapters 17, 23. Phillip's Science of Dental Materials, edited by Anusavice, 12th Edition, Mosby, Inc, 2012. Chapter 20, Chapter 26, Dental Ceramics. Ascheim, KW and Dale BG: Esthetic Dentistry, a Clinical Approach to Techniques and Materials. 3rd Edition, Mosby, Inc, 2015. Chapter 23, Aesthetics Computer Aided Design Computer Aided Manufacturing (CAD/CAM) Systems. Materials Required for the Laboratory Component of the Course:

1. CAD/CAM Bur Block from KOMET, purchased in the student's Kit.

2. Mandatory purchase of 2 milling blocks (Emax and Lava Ultimate) purchased from Patterson Dental/Henry Schein coordinated with Dr. Marvin Golberg. This will be coordinated prior to the start of the course in April/May, 2021.

Assigned literature and readings on Canvas.

CEREC 4.4.4/5.1.3 Videos electronically on the web, Sharkmedia.

Faculty Note: Please indicate the textbooks that are **required** for the class and if available, a hyperlink to the textbook. Also, indicate if there are articles or links to **required readings** that are required for the class *and* the site where the articles are available for the student (such as: Canvas, library, database).

Course Supplemental Materials:

You Tube Videos from CEREC Doctors on the OmniCam.

- Supplemental, Recommended, Optional, NOT required.

The access to all instructional resources included in this course, such as, lectures, handouts, manuals, PowerPoint presentations, videos, photographs, pictures, articles and web links is limited to students who are enrolled in the course and is not for public distribution. The use of these instructional resources is exclusively for non-commercial and non-profit educational use. Students are recommended to download the instructional resources provided in the course, UNLESS, the course director instructs NOT to download specific files. We recommend that all students download, save, and keep the instructional materials from all the courses. These instructional resources will be very helpful references as you progress from year to year in the program.

VII. Course Schedule and Topic Outline

Course Schedule:

<p>CAD/CAM PRE-DOCTORAL D3 STUDENTS LECTURES SUMMER 2021 / CDM 3277 CRN</p> <p>Marvin B. Golberg, D.D.S. Director CAD/CAM Restorative Dentistry golberg@nova.edu</p>				
DATE	TIME	LOCATION	CONTENT OUTLINE	SPEAKER
5/5/2021	4:00 - 5:00 p.m.	ZOOM	Course Overview and Section Philosophy	Dr. Sharon Siegel

	5:00 - 6:00 p.m.		Preparation of CAD/CAM Teeth for Crowns and Onlays	Dr. Marvin Golberg
5/12/2021	4:00 - 6:00 p.m.	ZOOM	Digital Scanning, Designing, Milling Crowns and Onlays	Dr. Marvin Golberg
5/19/2021	4:00 - 5:00 p.m.	ZOOM	Clinic Protocol Isolation and Cementation	Dr. Evren Kilinc
	5:00 - 6:00 p.m.	ZOOM	CAD/CAM Milling Materials Properties and Composition	Dr. Jeffrey Thompson
5/26/2021	4:00 - 6:00 p.m.	ZOOM	CAD/CAM Applications E4D Planmeca FIT System	Dr. Gary Severance
6/09/2021	4:00 - 5:00 p.m.	ZOOM	Clinic Requirements for CAD/CAM	Dr. Sharon Siegel
	5:00 - 6:00 p.m.		Implant Restorations	Dr. Marvin Golberg
6/16/2021	4:00-6:00 p.m.	ZOOM	3D Printing for Dental Applications	Dr. Leila Ahmadian
7/07/2021	4:00-6:00 p.m.	TBD	Final CAD/CAM Exam	Dr. Sharon Siegel Dr. Marvin Golberg

Topic Outline:

See Course Schedule for Topics.

“Important note – Please note that due to the current Coronavirus pandemic, course schedules and course activities may be modified now and in future.

Faculty and students are responsible for keeping apprised of these changes and adjusting their schedules accordingly.”

VIII. Instructional Methods

In this section of the syllabus you will find information about any course (instructional, assessment, assignments, benchmarks and/or clinical) modifications that were added to the course as a result of COVID-19

Some lectures will be delivered remotely via Zoom as opposed to face to face. Sim lab lectures will be delivered face to face as pre-Covid-19, no change in Sim Lab lectures.

Class was divided in thirds as opposed to half to comply with CDC recommendations (smaller class size per session).

IX. Assignments

Description of Assignments, Point Value and Rubrics

The students will view specific videos prior to attending each laboratory session. Students will have a quiz prior to each laboratory session at 8:00 am that will be based on the videos. The students will complete 8 tooth preparations for CAD/CAM restorations (that will be announced during the course) and then scan and

design the restorations. They will also be required to mill two restorations and characterize, glaze and cement one restoration to completion. This will complete these procedures during their scheduled laboratory rotation. All restorations will be graded by two faculty.

X. Grading Criteria

Provide a List of all the graded work in the course (Assessments, Class Activities, Classwork and Assignments) with Point or Percentage Values, or required Completion item.

Grading Scale:

The evaluation will be Pass, Fail based on the student's ability to complete all assignments/projects to a clinically acceptable level and mandatory attendance. Possible pop quizzes and a final exam on the didactic elements of the course from the lectures and readings will be used to assess didactic knowledge throughout the course. There is mandatory attendance. No patient treatment will be allowed during the laboratory sessions. The students will be graded as follows:

70% Projects (Three CAD/CAM typodont preparation for crowns and three CAD/CAM preparations for onlays, scans and designs for 8 preparations, one Crown and one Onlay CAD/CAM milled final restoration, writing a laboratory prescription), one characterized, glazed and cemented crown restoration.

10% 3 quizzes during the hands-on (must be passed in and of themselves).

20% Final Written Exam (must be passed in and of itself).

Students must register prior to the course to receive credit.

Faculty Assessment Form
CAD/CAM Crown or Onlay Restoration Student I.D.# _____

Case Complexity Factors:

Build up involved? (Y/N)	
Crown (C) vs Onlay (O) (include # walls involved)	
Pt management/attitude (enter class #)	
Margins: Super/Equi/Sub-gingival	
Hygiene: enter plaque score	
Pt's widest opening measurement	

	Start time	End time
Pt Chart review/greet		
Anesthetize		
Prep Tooth		
Scan preparation		
Design prosthesis		
Mill: 15min 25min (circle)		
Fit & Floss check		
Polish		
Characterize		
Pre-cement Radiograph		
Glaze: Y N (circle)		
Cement		
Post-cement Radiograph		
Check occlusion		
Write note		

Attitude class
1: Philosophical - Accepts dentist's judgement and instructions, best prognosis.
2: Exacting - Methodical and demanding, asks a lot of questions, good prognosis.
3: Hysterical - Emotionally unfit, never happy, worst prognosis.
4: Indifferent - Doesn't care about dental treatment and gives up easily.

Scanner used (✓)

Blue Cam	
OmniCam	
Tru Def	

Tooth #	A	B	Average	F	Comments – Ideal Grades (A)
Occlusal Reduction	+5	+3		-3 -6	(Occlusal-Over/Under) 2mm Functional Cusp/1.5 non-F
Anatomic Form	+5	+2		-3	Scoop/Wave; too anatomic
Finish Line	+5	+2		-3 -6	(90 degree butt joint) (Location: high/low)
Axial Reduction Internal box form	+5	+2		-2 -4	(Axial Depth; 1.2-1.5 mm Excessive/Under) Rounded Internal Angles
Path of draw Taper/Retention & Resistance	+5	+3		-3 -6	(Undercut) (Orientation) (Taper/Convergence)
Finish of Preparation	+3	+2		-4	(Sharp Line Angles) (Axial-Margins-Occlusal Rough/Smooth)
Care of Adjacent Tissues	+2	+1		-4	(Proximal Teeth) (Soft Tissue)

GRADE = ()+ () + 70 - () Grade= _____

Date: _____ Evaluator: _____

Course Final Grade Mode for the course (Pass/Fail, PR/NPR or Letter Grade). For a continuum course, please specify the grade mode for each semester.

Grade Mode:

Pass/Fail.

Course Grading Scale

Letter Grade	GPA	Equivalence
A	4	93 to 100

A-	3.75	90 to < 93
B+	3.5	86 to < 90
B	3	83 to < 86
B-	2.75	80 to < 83
C+	2.5	76 to < 80
C	2	70 to < 76
F	0	<70

XI. Course Policies

COURSE ATTENDANCE REQUIREMENTS, REMEDIATION POLICY, ALL CDM POLICIES

Attendance Policy : Please refer to appropriate pages of the NSU-CDM 2020-2021 Student Handbook.

Link to the handbook:

<https://liverootnova.sharepoint.com/dentmed/Active%20Docs/Policies%20and%20Procedures/Pre%20a2020%20CDM%20PreDoctoral%20Student%20Handbook.pdf?wa=wsignin1.0>

Remediation Policy: Please refer to appropriate pages of the NSU-CDM 2020-2021 Student Handbook.

“Successful completion of each CDM course requires compliance with the CDM Code of Behavioral Conduct.”

CDM College Attendance Policy Please note that, the Office of Admissions, Student Affairs and Services manages excused absences including sick days, mission trips, dental meetings, externships, interviews, family events, and other personal leave time, etc. and all student absences will continue to be tracked in axiUm. (Please refer to NSU Wide Religious Holidays Policy in the Student Handbook.) • Planned excused absences: please fill out the appropriate paperwork, with backup documentation (e.g. physician’s note), and submit on the online portal for the Office of Student Services prior to the scheduled absence, so that we can approve the leave time, and help you map out a plan to make up the work. It is the student’s responsibility to inform the course director for any courses you will be missing, your team leader for any clinic sessions that will be missed and/or the Coordinator of Extramural Programs (Dr. Mairelina Godoy), etc. of your planned absence(s). • Unplanned excused absences: please email Dr. Galka at agalka@nova.edu with a cc to cdmservices@nova.edu to report that you will be out, the reason for your absence and to also let us know if you plan to return to school the following day. You should also email the course director for any courses you will be missing, Dr. Mairelina Godoy mg1189@nova.edu for any rotations you will be missing and/or your team leader for any clinic sessions scheduled for that day. You must continue to email us daily to keep us updated if you will be out additional days and you can submit your SREA form together with backup documentation when you know the date you will return to school. • The student will be responsible for making up all missed rotations, all material presented in lectures, all laboratory projects, all written and practical examinations (including OSCEs) and must fulfill all didactic and clinical responsibilities as outlined in the individual course syllabi. Also, please review the attendance policy in the individual course syllabi. • Please do not schedule externships or interviews when you are scheduled for an examination or rotation. • Remember, it is your responsibility to reach out to our office for any unexcused absences to see if these fall under excused absences and/or to see how the unexcused absence will be managed. Also, please contact Dr. Mairelina Godoy directly to arrange makeup of any and all missed rotations, which will take place during optional clinicweeks. • Every student will be able to take 1 Personal Day/per Semester (3 Personal Days/Academic Year) with NO BACKUP DOCUMENTATION REQUIRED, provided the day(s) are not taken when you are scheduled for a rotation, written examination, practical/competency examination, OSCE or taken directly before/after a school holiday, etc. These absences will be managed through our office and designated as excused absences, provided our office is notified by email in advance or on the day of the absence. (Please indicate

in the email if you will be using a personal day and designate D-1, D-2, D-3 or D-4 student.) For any additional absences to the 1 Personal Day/per semester, or in the event that you will be missing a written examination, a preclinical or clinical practical/competency examination, including an OSCE, or rotation, backup documentation WILL be required. Again, it is the student's responsibility to notify all course directors, team leaders, and/or the Coordinator of Extramural Programs, etc. affected by your absence(s). Please check your individual schedule before requesting a personal day, to be sure that you will not be missing a rotation or an exam. A personal day will be recorded as a full day. (Half days cannot be requested.) A personal day must be requested on or before the day in question and cannot be used retroactively. **COVID-19 Protocol (subject to change)**1. NO STUDENT IS TO COME TO SCHOOL SICK- if you do not feel right- please do NOT come to school. Email Dr. Galka- Assistant Dean for Admissions, Student Affairs and Services (agalka@nova.edu) 2. If a student has had direct/close contact with someone who has been infected with COVID-19 or is experiencing COVID-like symptoms- immediately self- isolate/quarantine. Email Dr. Galka and Dr. Schweizer- Director Infection Prevention Programs (schweize@nova.edu). a. Direct Exposure/ Asymptomatic: test on day 7- if negative test result- can come back after 10 days : if NO test- quarantine 14 days b. Symptomatic (with or without Direct Exposure): test immediately and then again on day 7- if negative test result on day 7- can come back after 10 days : NO test- quarantine 14 days and must be symptom-free for 72 hours3. If a student tests positive for COVID-19: remain self-isolated. To return to school: student needs to have 2 consecutive negative test results in a row (at least 24 hours apart). 4. Students who are in quarantine, need to contact both Dr. Galka and Dr. Hernandez (marher@nova.edu) to determine if they can participate in online courses during this time

XII. University Policies

Academic Integrity: Cheating or inappropriate behavior during any written examination, quiz, any assignment, any project; plagiarism of any work(s), or other unethical behavior will not be tolerated; the student risks receiving a grade of zero (0) for said examination, quiz, assignment, project and may be referred to the Associate Dean for Academic Affairs and the Student Progress Committee. Please refer to appropriate pages of the NSU-CDM 2020-2021 Student Handbook. and the NSU Student Handbook located at

<https://liverootnova.sharepoint.com/dentmed/Active%20Docs/Policies%20and%20Procedures/Pre%20and%202020%20CDM%20PreDoctoral%20Student%20Handbook.pdf?wa=wsignin1.0> .

Plagiarism Policy: All assignments, exams, works, patient care - written, laboratory, oral, clinical must be done as the independent work of each individual student. Plagiarism, copying or sharing the work of another or altering documentation to reflect something is your own work that is not; reflect false attendance, are considered serious offences that will not be tolerated. THESE ACTIONS WILL BE CONSIDERED IN VIOLATION OF THE UNIVERSITY AND THE CDM CODE OF BEHAVIORAL CONDUCT AND WILL BE REFERRED FOR APPROPRIATE ACTION. Students who need assistance in their learning goals should communicate with the appropriate NSU-CDM course director and/or faculty. Please refer to appropriate pages of the NSU and the CDM 2020-2021 Student Handbook. Following a link to the NSU Student Handbook

<https://liverootnova.sharepoint.com/dentmed/Active%20Docs/Policies%20and%20Procedures/Pre%20and%202020%20CDM%20PreDoctoral%20Student%20Handbook.pdf?wa=wsignin1.0>

University Policy

Class content throughout this course may be recorded in accordance with the NSU Class Recording Policy. If class content is recorded, these recordings will be made available to students registered for this course as a supplement to the classroom experience. Recordings will be made available to all students who were registered to attend the live offering of the class, regardless of a student's section or discipline, or whether the student is participating in the course online. If recordings are intended to be accessible to students or third parties who were not registered for the live offering of the class, students' personally identifiable information will be removed or redacted from the recording, unless (1) their written consent to such disclosure was previously provided, or (2) the disclosure is permissible in accordance with the Family

Educational Rights and Privacy Act (“FERPA”).

Students are prohibited from recording audio or video, or taking photographs in classrooms (including online classes) without prior permission from the instructor or pursuant to an approved disability accommodation, and from reproducing, sharing, or disseminating classroom recordings to individuals outside of this course.

Students found engaging in such conduct will be in breach of the Student Code of Conduct and subject to disciplinary action.

Title IX/Sexual Misconduct: Sexual violence and sexual harassment are contrary to our core values and have no place at Nova Southeastern University. In accordance with Title IX and other laws, NSU prohibits discrimination, including sex-based discrimination and discrimination towards pregnant/parenting students. If you or someone you know experience(s) sexual violence and/or sexual harassment, there are resources and options available. To learn more or to report an incident, please visit the NSU Title IX website at www.nova.edu/title-ix. Please be aware that as an instructor, I am not a confidential resource, and I will need to report any incidents of sexual misconduct to the NSU Title IX Coordinator. You can also contact Laura Bennett, NSU's Title IX Coordinator directly at laura.bennett@nova.edu or 954-262-7858.