



COURSE DATA

Data Subject

Code	34690
Name	Radiology and radiation protection
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1206 - Degree in Dentistry	Faculty of Medicine and Odontology	3	First term

Subject-matter

Degree	Subject-matter	Character
1206 - Degree in Dentistry	39 - Radiology and radiation protection	Obligatory

Coordination

Name	Department
ALMERICH SILLA, JOSE MANUEL	131 - Stomatology
CIBRIAN ORTIZ DE ANDA, ROSA MARIA	190 - Physiology

SUMMARY

The subject consists of two units: Radiology and Radiological Protection. Both units must be passed to pass the whole subject.

The radiographic unit includes training in oral radiology (intra and extra-oral) with special emphasis on the periapical series and orthopantomography. Students will also receive training in other techniques such as simple radiology, ultrasound, computed tomography, and magnetic resonance of the cervicofacial area.

The Radiation Protection Unit provides students with the basic technical and operational knowledge for the requirements listed in paragraph 10 set by the Nuclear Safety Council to obtain accreditation as a manager of an X-ray facility for medical and dental diagnosis – once the student has obtained a degree in dentistry.



PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

1206 - Degree in Dentistry :

1210 - Grado de Odontología 2012 :

R4-OBLIGATION TO HAVE SUCCESSFULLY COMPLETED THE COURSE

34696 - Human anatomy

34697 - Biology

34698 - Human physiology

34699 - Biochemistry

34702 - Psychology and communication

34703 - Biostatistics and public health

34696 - Human anatomy

34697 - Biology

34698 - Human physiology

34699 - Biochemistry

34702 - Psychology and communication

34703 - Biostatistics and public health

Other requirements

OUTCOMES

1206 - Degree in Dentistry

- Comprender y reconocer los principios de ergonomía y seguridad en el trabajo (incluyendo control de infecciones cruzadas, protección radiológica y enfermedades ocupacionales y biológicas).
- Conocer los procedimientos y pruebas diagnósticas clínicas y de laboratorio, conocer su fiabilidad y validez diagnóstica y ser competente en la interpretación de sus resultados.
- Tomar e interpretar radiografías y otros procedimientos basados en la imagen, relevantes en la práctica odontológica.
- Manejar, discriminar y seleccionar los materiales e instrumentos adecuados en odontología.
- Conocer y usar el equipamiento e instrumentación básicos para la práctica odontológica.
- Realizar las radiografías necesarias en la práctica odontológica, interpretar las imágenes obtenidas y conocer otras técnicas de diagnóstico por imagen que tengan relevancia.



- Conocer el peligro de las radiaciones ionizantes y sus efectos en los tejidos biológicos, junto con la legislación que regula su uso. Dirigir instalaciones de radiodiagnóstico bucal.

LEARNING OUTCOMES

- Understand the ergonomic and safety at work principles for preventing cross-infection and radiation protection.
- Understand diagnostic laboratory tests and ability to interpret adequately.
- Ability to take and interpret an intraoral radiography and other techniques for diagnostic imaging.
- Ability to handle, distinguish, and select different materials and basic tools for dental practice.
- Knowledge of the danger of ionizing radiation and its effects on biological tissues.
- Knowledge of current legislation on the use of radiation and the ability to manage X-radiology facilities.

DESCRIPTION OF CONTENTS

1. RADIOLOGY UNIT-THEORY-

1 (*). PHYSICAL CHARACTERISTICS OF X-RAY EQUIPMENTS. X-ray generator. Tube. Associated elements. The formation of the radiological image. Imaging systems. Radiographic film. Digital imaging. PACS.

(*) The contents of this topic are also part of the evaluation of the Radiation Protection Unit.

2. RADIOLOGY AND IMAGING. Concept. Imaging application in medical and dental radiology. Image formation. Procurement methods, support, storage and digitalization. Image processing. Background and clinical applications of conventional radiology. Computed axial tomography. Other techniques of diagnostic imaging.

3. RADIOLOGICAL TECHNIQUE of face and neck. Simple radiology. CT scans. Ultrasound. Computed Axial. Tomography. Sialography. Nuclear medicine.

4. INTRAORAL RADIOLOGICAL TECHNIQUE. Periapical, occlusal, Bitewing.

5. RADIOLOGICAL ANATOMY IN DENTAL AND OCCLUSAL RADIOGRAPHY. DENTAL ANATOMY.



During development. For anatomical regions. Occlusal. Identification of anatomical structures in the intraoral radiography. Imaging. Image analysis. Recommendations for proper dental radiology.

6. RADIOLOGICAL TECHNIQUE AND RADIOLOGICAL ANATOMY IN DENTAL PANORAMIC DENTAL. Orthopantomography. Radiological anatomy. Recommendations.

7. GUIDELINES FOR PRESCRIPTION OF DENTAL RADIOGRAPHS. RADIOLOGY IN DENTAL EXPLORATION. In caries. In periodontal disease. Anomalies. In trauma.
the radiological technique of choice

2. RADIATION PROTECTION UNIT- THEORY-

8. BASICS: ATOMS AND RADIATION. The atom. The atomic nucleus. Mass and energy; units. Electromagnetic radiation. The electromagnetic spectrum.

9. X RAYS: PROPERTIES AND INTERACTION WITH THE MATTER. Nature of X-rays X-ray Production: bremsstrahlung and characteristic X-ray. The X-ray spectrum of the x-ray interaction with matter. Photoelectric effect and Compton effect. Attenuation, absorption and scattering of photons. Attenuation exponential law. Inverse square law of distance.

10. BIOLOGICAL EFFECTS OF RADIATION I. General aspects of the interaction of radiation with biological environment. somatic and genetic effects. deterministic effects and stochastic effects.

11. BIOLOGICAL EFFECTS OF RADIATION II. radiation-induced carcinogenesis. cellular response to radiation. Radiosensitivity of organs and tissues. Factors influencing cell response. Types of response. Early and late effects.

12. QUANTITIES AND RADIATION UNITS IN RADIOLOGY. Magnitudes of the issuer and of the radiation beam. Magnitudes of interaction: LET. dosimetric quantities: exposure and absorbed dose. Magnitudes of radiation protection: equivalent dose and effective dose. Magnitudes in patient dosimetry.

13. DETECTION AND MEASUREMENT OF RADIATION. Radiation Detection: types of detectors. Basic principles of detection. Properties detectors.

14. DETECTORS in diagnostic radiology. Ionization chambers. proportional counters and Geiger-Müller. Semiconductor detectors. Thermoluminescence dosimeters. Detectors used in radiodiagnostic dosimetry.

15. RADIATION PROTECTION. GENERAL CRITERIA. Concept and objectives of the Radiological Protection (PR). Fundamental principles of PR: justification, optimization and dose limitation. basic measures of PR. Competent bodies in PR.



3. RADIATION PROTECTION UNIT -THEORY- (continuation)

16. OPERATIONAL RADIATION PROTECTION. Introduction. exposed workers (TE): training and classification. Classification and signaling areas. Exposure assessment: monitoring and recording. TE health surveillance. Inspection and sanctions. Shields.

17. RADIATION PROTECTION IN FACILITIES OF DENTAL RADIODIAGNOSIS. Considerations: Common recommendations to all facilities. Equipment and techniques in dental radiology: intraoral radiography, extraoral radiography (cephalometric), ortopantomografía and digital radiology. Standards for patient protection in dental radiology. Organization and control.

18. QUALITY ASSURANCE IN FACILITIES OF DENTAL RADIODIAGNOSIS. Introduction. Quality control in diagnostic radiology. Quality assurance program in diagnostic radiology: general aspects. Action levels. Implementation of a quality assurance program. Quality indicators. Technical parameters of quality control equipment. Audits.

19. SPANISH APPLICABLE LEGISLATION TO FACILITIES OF DENTAL RADIODIAGNOSIS. Introduction to the national regulatory framework. Spanish legislation: basic laws. Basic Spanish legislation: regulations. Other standards of interest. Community legislation.

4. RADIOLOGY UNIT -PRACTICES-

1. DIGITAL SYSTEMS.

2. RADIOLOGICAL SEMIOLOGY. SYSTEMATIC READING OF THE RADIOLOGICAL IMAGE.

3. DENTAL PANORAMIC.

4. CONE BEAM COMPUTED TOMOGRAPHY.

5. INTRAORAL RADIOGRAPHY.

5. RADIATION PROTECTION UNIT -PRACTICES-

1. DESCRIPTION AND MANAGEMENT OF RADIATION MONITORS AND DOSIMETERS.

2. VERIFICATION OF BASIC CONDITIONS OF RADIATION PROTECTION IN A DENTAL OPERATING ROOM.

3. QUALITY CONTROL OF X RAYS EQUIPMENT AND RADIATION BEAM.

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	33,00	100
Laboratory practices	22,00	100
Odontology practices	5,00	100
Attendance at events and external activities	5,00	0
Development of individual work	5,00	0
Study and independent work	35,00	0
Readings supplementary material	10,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	5,00	0
Resolution of case studies	5,00	0
TOTAL	150,00	

TEACHING METHODOLOGY

Theoretical classes are based on a presentation by the lecturers with some participation by students. Appropriate support elements will be provided through the virtual classroom.

The aim of the practical classes is the acquisition of skills in the use of equipment and measuring instruments, as well as the processing and/or interpretation of results relating to programme content.

The tutorials are based on personal interviews with the students involved, or in electronic consultation (via e-mail).

EVALUATION**RADIOLOGY UNIT**

Theory and practice: the exam consists of 40 multiple-choice questions (including images) whose assessment will provide the final rating of the unit. Each question answered incorrectly will result in 0.2 points subtracted from the total of correct questions.



RADIATION PROTECTION UNIT

Requirements to pass the unit:

- Mandatory attendance at 90% of the theoretical classes where attendance is monitored.
- Mandatory attendance of all practical classes.
- Obtain a pass grade in the theory test (after fulfilling these two requirements).

A degree in dentistry is required for accreditation as a manager of X-ray facilities for medical and dental diagnosis.

Evaluation method:

- **Theory:** The exam consists of 60 multiple choice questions. At least 75% of the questions must be answered correctly. The assessment of this section, having obtained 45 or more correct answers will constitute 80% of the final grade.
- **Practices:** the work carried out in the practices will be evaluated and specified in the practice notebook. This notebook must be handed in when taking the theoretical examination. The score in this section forms 15% of the final grade.
- **Attendance in theoretical classes:** the mark in this section constitutes 5% of the final

mark. Each non-attendance will mean a deduction of 0.1 points from the final grade – with a maximum of two absences (maximum admitted under compulsory attendance requirement).

FINAL SUBJECT SCORE



The subject cannot be passed until both units are passed. The final grade will be the average of the marks obtained.

If only one unit is passed, then the mark will be saved until the other unit is passed.

Accreditation as a manager of X-ray facilities for medical and diagnostics (referred to in paragraph 2) cannot be granted before obtaining a degree in odontology.

Students are reminded of the great importance of carrying out evaluation surveys of all the teaching teachers of this subject

REFERENCES

Basic

- UNIDAD DE RADIOLOGÍA
 - Koenig L. Diagnostic Imaging oral and maxillofacial. AMIRSYS, 2012.
 - Pasler FA. Radiología odontológica. Masson-Salvat, 1991
 - White SC, Pharoah, MJ. Radiología Oral. 4ª ed. Elsevier Science
 - Ramos L, Manrique J. Diagnóstico por Imagen de las enfermedades de Cabeza, Cuello, Torax y Abdomen. Masson, 1994
 - Valvasori GA. Imaging of the Head and Neck. THIEME, 1995
- UNIDAD DE PROTECCIÓN RADIOLÓGICA
 - Dalmases F, Romero C, Almerich JM. Fundamentos físicos de la Protección Radiológica en odontología. PUV Universitat de València, 2016.
 - CIEMAT. Curso de Protección Radiológica para dirigir instalaciones de rayos X con fines diagnósticos. Serie Ponencias/CIEMAT, 2006
 - Web guías y Cursos del CSN: <http://csn.ciemat.es/MDCSN/cargarAplicacionFichero.do?categoria=2>
 - Galle P, Paulin R. Biofísica: Radiobiología y Radiopatología. Masson, 2003
 - Shapiro J. Radiation Protection. Harvard University Press, 2002

Additional

- UNIDAD DE RADIOLOGÍA
 - Novelline, RA. Fundamentos de radiología. Masson, 2000
 - Gil Gayarre. Manual de radiología clínica, 2ª ed. Harcourt, 2001
 - Som PM, Curtin HD. Head and Neck Imaging, 4th ed. MOSBY, 2003
 - González-Rico J, Delabat RG, Muñoz C. Tecnología radiológica. Paraninfo, 1996



- Pedrosa CS.: Diagnóstico por Imagen. Interamericana-McGraw-Hill, 2000
- Web: www.bda-dentistry.org.uk/education/library.cfm?ContentID=1616
- Web: www.radiologyeducation.com/
- UNIDAD DE PROTECCIÓN RADIOLÓGICA
 - Aurengo A, Petitclerc T. Biofísica, McGraw-Hill/Interamericana, 2008
 - Parisi M. Temas de Biofísica, McGraw-Hill/Interamericana, 2001
 - Whaites E. Fundamentos de Radiología dental. Elsevier Masson, 2008
 - Catalá J. Física. García Muñoz-Saber, 1979
 - Kane JW, Sternheim MM. Física. Reverté, 1989
 - SEFM (Soc. Esp. de Física Médica). Protocolo Español de Control de Calidad en Radiodiagnóstico. SEFM-SEPR, Revisión 1, Edicomplet, 2002
 - Bushberg JT, Seibert, JA, Leidholdt EM, Boone, JM. The essential Physics of Medical Imaging. Lippincott Williams & Wilkins, 2002
 - Web: European Commission, Radiation Protection, European guidelines on radiation protection in dental radiology. EC Issue nº 136, 2004:
ec.europa.eu/energy/nuclear/radioprotection/publication/doc/136_en.pdf