RADIOPROTECTION SUBJECT GUIDE
2016-2017 COURSE EDITION

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1. Descriptive data.

<table>
<thead>
<tr>
<th>Subject title: RADIOPROTECTION</th>
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<tbody>
<tr>
<td>Code: 9999001508</td>
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<tr>
<td>Degree: DEGREE IN DENTISTRY</td>
</tr>
<tr>
<td>Course: FIFTH YEAR</td>
</tr>
<tr>
<td>Nº ECTS credits: 2</td>
</tr>
<tr>
<td>Nº room hours: 30</td>
</tr>
<tr>
<td>Study mode: HIBRID</td>
</tr>
<tr>
<td>Normative prerequisite: None</td>
</tr>
<tr>
<td>Recommended prerequisites: None</td>
</tr>
<tr>
<td>TEACHER NAMES: VICTOR DÍAZ-FLORES GARCÍA, JULIA SANCHEZ ITUAUTE</td>
</tr>
<tr>
<td>Tutorial timetable/follow-up: Wednesday from 10 to 13.</td>
</tr>
</tbody>
</table>

2. Context Contents and Subject Competences.

The use of ionizing radiation in the clinical practice meant an unthinkable advance in the diagnosis and treatment of different diseases decades ago.

Although dentistry has been one of the medical specialities that has obtained more benefits with the advances made in image diagnosis, its use means an increase in the radiation dose for the patient and for the professional. Dental professionals need to be aware of the limitations and protection measures against radiation.

The ICRP (International Commission on Radiological Protection) informs and perseveres on this fact (103, 105 and 113 publications) of the need that those who employ diagnostic ionization radiation procedures have a suitable formative level.

This course includes the fundaments of radiation production, radiation protection and radiobiology criteria, Spanish legislation related to ionizing radiation and the possible techniques applied to dentistry. This information is very important in order to train future professionals that will use radiation as one of the most important diagnostic methods. Also, as a complement to this course, the last advances in diagnosis will be included and experts of
different specialities will present how radiology and other recent technologies can help the professional getting a better treatment.

3. **General competences (UEM transversal).**

Basic competences:

CB2: Students are able to apply their knowledge to their professional work or vocation and prove to have this competences by proposing and defending arguments, and having the ability to solve problems on their study area.

CB3: Students are able to bring together and perform important facts (on their study area usually), and issue a sentence that includes social, scientific or ethical reflections.

CB4: Students are able to transmit information, ideas, problems and solutions to a specialised and non-specialised public.

CB5: Students have developed the learning skills needed to carry out works with a high level of personal autonomy.

Transversal competences:

CT1 - Autonomous learning: Process that enables a person to be in charge of its own development, choosing his path, strategies, tools and the best moments to learn and apply what he has been learnt. An autonomous student, at the end, chooses the best strategies to fulfill his learning goals.

CT2 – Self-confidence: Ability to value our own results, performances and the conviction to fulfill the challenges that have been layed out.

CT4 – Analysis and synthesis ability: Analysis is the reasoning methods that allow us to split up complicated situations into their components; also assesses other alternatives and perspectives to find out optimal solutions. Synthesis aims to reduce the complexity in order to have a better understanding and problem-solving capacity.

CT7 – Ethical value awareness: Ability to think and act according to the universal principles based on the personal values aimed at his full development related to the commitment of determined social values.

CT8 – Information management: Ability to search, choose, analyse and integrate information from different sources.

CT9 – Personal relationship values: Positive relationship with others verbally and non-verbally by assertive communication, understanding by this, the
ability to express or transmit what is wanted, thought or felt without causing discomfort, attacking or hurting someone’s feelings.

CT10 - Initiative and entrepreneurial spirit: Preference to assume and carry out different tasks. Ability to overcome correctly difficult tasks. Problem anticipation ability, to suggest improvements and carry on with the achievement of a task.

Subject’s specific competences. At the end of the subject, the student will be able to:

A. Professional values, attitudes and ethical behaviour.
   CE1. Recognise the basic elements of the dental profession, including the ethical principles and legal responsibilities.
   CE2. Understand the importance of those principles for the benefit of the patient, society and profession, taking special attention to the professional secret.
   CE3. Identify the patient’s concerns and expectations, as well as having the ability to have an efficient and clear oral and written communication with the patients, their family, the social media and other professionals.
   CE6. Understand the importance of the development of a professional practice respectful with the patient’s autonomy, beliefs and culture.
   CE7. Promote autonomous learning of new concepts, techniques and also motivation in order to obtain quality.

B. Dentistry scientific fundamentals. Acquisition and information critical assessment.
   CE11. Understand the basic biomedical science which are the basis of dentistry in order to guarantee a correct oral assistance.
   CE14. Recognise the general process of diseases, which include infections, inflammations, immune system alteration, degeneration, cancer, metabolic alterations and genetic disorders.
   CE16. Understand the action mechanisms, indications, drug efficiency and other therapeutic procedures, knowing the contraindications, interactions, systemic effects and interactions on other organs, based on the scientific evidence available.
   CE17. Understand and recognise the ergonomic and occupational safety principles (including cross-infection control, radiation protection, occupational and biological diseases).
   CE18. Be able to recognise, critically assess and use the different clinical and biomedical sources in order to obtain, organise, perform and communicate scientific and medical information.
C. Clinical skills: Diagnosis, prognosis and dental treatment plan.

CE20. Obtain and complete a medical record which includes all the relevant information.

CE21. Know how to fulfill a complete oral examination, including the radiological and complementary explorations, and to obtain the clinical references correctly.

4. Contents.

Including the ECTS contents and relation with the competences that the student must acquire.

LESSON 1: ATOMIC STRUCTURE.
Nature of electromagnetic radiation.
Physical atomic energy units.
Electromagnetic radiation spectrum; photon.
Atom structure.
Energy absorption and emission.
X-ray production: characteristic radiation and bremsstrahlung/braking radiation.

LESSON 2: RADIATION INTERACTION WITH MATTER.
Particle interaction.
Photon interaction.
Photon attenuation.
Interaction process.
Radiographic image production.
X-ray spectrum.
Effective atomic number.

LESSON 3: PHYSICAL CHARACTERISTICS OF RADIODIAGNOSIS EQUIPMENT.
Physical characteristics of X-ray equipment: generator, tubes...
Dispositives associated to X-ray tube.
Image system characteristics.

LESSON 4: RADIATION BEAM. X-RAY SPECTRUM.
Radiation beam.
X-ray spectrum.
Factors that modify the X-ray spectrum.
Estimation of beam quality.
Influence of the spectrum on the quality of the image.
Influence of the spectrum on the patients dose.
LESSON 5: MAGNITUDES AND UNITS.
Exposition and units.
Absorbed dose and units.
Equivalent dose and quality factor.
Equivalent effective dose.
Rates. Relation between magnitudes.
General aspects related to magnitudes.
Magnitudes associated to patient’s dosimetry.

LESSON 6: DETECTION AND DOSIMETRY RADIATION.
Physical detection fundamentals.
Gaseous ionization detectors.
Scintillation detectors.
Environmental and personal dosimetry.
Radiation monitors used in radiodiagnosis.
Measurement of dose for direct beam.

LESSON 7: ORAL X-RAY TECHNIQUES.
Intraoral.
Extraoral.
CBCT.

LESSON 8: BIOLOGICAL EFFECTS OF IONIZING RADIATION.
Cellular radiation interaction.
Deterministic and stochastic effects.
Late radiation somatic and genetic effects.

LESSON 9: SPANISH LEGISLATION APPLICABLE TO RADIODIAGNOSTIC FACILITIES.
Basic laws: Nuclear energy law and creation of the Nuclear Safety Council law.
Spanish basic regulation. Regulations:
Regulation of installations and use of X-ray equipments for medical diagnosis purposes.
RD about quality criteria in radiodiagnosis.
RD Regulation of Nuclear and Radioactive Installations.
RD Health protection regulation against ionizing radiation.
RD Justification of ionizing radiation use.
Other interesting regulations.

LESSON 10. RADIATION PROTECTION.
SPECIFIC RADIATION PROTECTION ON DENTAL RADIODIAGNOSTIC FACILITIES.
General considerations.
Facilities design.
Technical characteristics of the dental radiodiagnostic facilities.
Operational radiation protection. Organization and control.
Preventive and corrective maintenance.
Specific radiation protection requirements in radiodiagnostic facilities that use particular techniques:
Digital radiology.
Specific radiation protection patient considerations.

LESSON 11: NEW DIAGNOSIS TECHNOCOLOGIES.
Radiological relations – dental specialities.
Digital modification of the diagnostic image.
Applicable quality criteria.

5. Formative activities.
Educational activities proposed.

<table>
<thead>
<tr>
<th>Formative activities</th>
<th>Credits- Hours</th>
<th>% assistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master Classes</td>
<td>0,4 ECTS – 10h</td>
<td>90%</td>
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<tr>
<td>Problem solving</td>
<td>0,2 ECTS - 5h</td>
<td>90%</td>
</tr>
<tr>
<td>Porfolio</td>
<td>0,2 ECTS - 5h</td>
<td>0%</td>
</tr>
<tr>
<td>Tutorials</td>
<td>0,2 ECTS - 5h</td>
<td>50%</td>
</tr>
<tr>
<td>Practical exercises</td>
<td>0,2 ECTS – 5 h</td>
<td>0%</td>
</tr>
<tr>
<td>Evaluation</td>
<td>0,2 ECTS - 5h</td>
<td>100%</td>
</tr>
<tr>
<td>Autonomous study and work</td>
<td>0,6 ECTS – 25h</td>
<td>0%</td>
</tr>
</tbody>
</table>

Teaching methodologies.

- Master classes.
- Problem solving.
- Group works.
- Scientific article’s overview.
- Flipped Classroom.


<table>
<thead>
<tr>
<th>Evaluation method</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>Objective test</td>
<td>50%</td>
</tr>
<tr>
<td>Active methodologies</td>
<td>30%</td>
</tr>
</tbody>
</table>
Forum participation 5%
Activities 10%
Competences 5%

In order to obtain the final grade, all the parts (autonomous learning knowledge, active methodologies and activities) have to be passed with a grade of 5 OUT OF 10.

In relation to the active methodologies, the average weighting of all of them has to be 5 or more.

The students that fail any part will have to recover it on extraordinary call. In this case, the qualification on ordinary call will be 4 or the corresponding mark if it were less than 4.

If a student doesn’t complete an activity or doesn’t hand in a work or doesn’t take any of the objective tests on the established dates, with a justified cause, the student will obtain a “NO PRESENTADO: NP” and will have to take the test on a new date set by the teacher.

Class assistance is compulsory, failing the ordinary call if the assistance is less than the 50%.

The objective test will consist of a 30 multiple choice test with 4 possible answers, with only one correct answer for each question. Each wrong answer will take away 0.33 points. The passing grade is a 5.

Disciplinary actions will be taken in the following situations:

O Use of mobile phones or any other electronic device during the evaluation tests. Those students found in a suspicious situation during the tests and carrying any electronic device (switched on or off), will be penalized following the internal regulation of the University.

O Plagiarism of the teacher. Any recording media (voice, image, presentations...), can be consideres cause of penalty.

O Lack of respect (physical or verbal) to any University member (teaching staff, non teaching staff or student).
7. Materials and Other Considerations.
Course recommended bibliography:


Stafne. Diagnóstico radiológico en Odontología. Panamericana


Pasler F. Visser H. Pocket atlas of dental radiology. Thieme


Farman G. Panoramic radiology. Seminars on maxillofacial imaging and interpretation. Springer.


Joachim E. Zöller, Jörg Neugebauer, Cone-beam volumetric imaging in dental, oral and maxillofacial medicine: fundamentals, diagnostics and treatment planning Quintessence, 2008


Ds X-Ray decision support for interpretation and clinical management of radiographic (CD).
### 8. Teaching guide.

<table>
<thead>
<tr>
<th>WEEK 1-2</th>
</tr>
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| **Aim:** Identify the X-ray production with diagnostic purposes. Study the photon interaction with matter and the radiographic image production.  
**Outside classroom work:** Review of Lesson 1 and 2 and online tests. |

<table>
<thead>
<tr>
<th>WEEK 3-4</th>
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| **Aim:** Review the components and functions of the dental radiodiagnosis equipment.  
**Identify the factors that modify the X-ray spectrum.**  
**Outside classroom work:** Review of Lesson 3 and 4 and online test. |

<table>
<thead>
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<th>WEEK 5-6</th>
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| **Aim:** Know the magnitudes and units used in Radiation Protection and the way to measure the radiological activity on the working area.  
**Outside classroom work:** Review of Lesson 5 and 6 and online test. Practical activity: dosimetry report analysis. |

<table>
<thead>
<tr>
<th>WEEK 7-8</th>
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| **Aim:** Identify the radiological techniques used in dentistry and analyse the biological effects produced by radiation.  
**Outside classroom work:** Review of Lesson 7 and 8 and online test. Practical activity: Flipped classroom: positioner use, patient´s educational video. |

<table>
<thead>
<tr>
<th>WEEK 9-10</th>
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</table>
| **Aim:** Analyse the Spanish applicable legislation on radiodiagnostic facilities the staff involved.  
**Outside classroom work:** Review of lesson 9 and 10. Activity: complete a summary chart of legislation and dosimetry. |
WEEK 11-12

Aim: Study the dental radiological characteristics and analyse the use of radiology on all the dental specialities.

9. Resources.
Evaluation heading of the practical activities of Radiation Protection subject.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important information identification</td>
<td>The student identifies all the important aspects of an article without using it.</td>
<td>The student identifies all the important points of an article, but using it as a reference.</td>
<td>The student identifies all the important points of an article but uses it as a reference. Also, identifies information which is not important.</td>
<td>The student can`t identify the important information.</td>
</tr>
<tr>
<td>Synthesis</td>
<td>The student summarises clearly in 1-3 phrases what the article exhibits.</td>
<td>The student uses some phrases to explain what the article exhibits.</td>
<td>The student summarizes nearly all the article, but includes some misunderstandings.</td>
<td>The student has great difficulties to summarize the article.</td>
</tr>
<tr>
<td>Identification</td>
<td>The student identifies exactly a minimum of 5 key points of the article which provide a clear explanation, which are more than opinions.</td>
<td>The student identifies exactly at least 4 key points of the article that provide a clear explanation, which are more than opinions.</td>
<td>The student identifies exactly at least 4 key points of the article but with a weak explanation.</td>
<td>The student has difficulties to identify the key points of the article.</td>
</tr>
<tr>
<td>Resources</td>
<td>Gets information from the resources, graphs, facts and quotes. Everything documented with the desired format.</td>
<td>Gets information from the resources, graphs, facts and quotes. Nearly everything documented with the desired format.</td>
<td>Gets information from the resources, graphs, facts and quotes. Not documented with the desired format.</td>
<td>Nearly none or none information has been pulled out from the resources.</td>
</tr>
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<tr>
<td>Quality of the work</td>
<td>Delivers works with the highest quality.</td>
<td>Delivers works with high quality.</td>
<td>Delivers works that occasionally have to be corrected or repeated to improve their quality.</td>
<td>Delivers works that always have to be corrected or repeated to improve their quality.</td>
</tr>
<tr>
<td>Time management</td>
<td>Usually uses the time correctly when completing an activity to ensure that the activities will be on time. The group doesn`t need to adapt to the deadlines for his delay.</td>
<td>Usually uses the time correctly but only can deal with one task. The group doesn`t need to adapt to the deadlines for his delay.</td>
<td>Tends to postpone the tasks, but always completes them before the deadline. The group doesn`t need to adapt to the deadlines for his delay.</td>
<td>Rarely ends the tasks by the deadline and the group needs to adapt the date of the deadlines for his delay or for his lack of time management.</td>
</tr>
<tr>
<td>Contribution</td>
<td>Always contributes with useful ideas when working in group or in class. Leads the opinions and makes an effort.</td>
<td>Usually contributes with useful ideas when working in group or in class. Leads the opinions and makes an effort. Shows himself as a strong participant in the group.</td>
<td>Sometimes contributes with useful ideas when working in group or in class. Completes the tasks required in the group.</td>
<td>Rarely contributes with useful ideas when working in group or in class. Can refuse to participate.</td>
</tr>
</tbody>
</table>