**National Commission for Academic Accreditation & Assessment**

**Course Specification**

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| Institution **University of Dammam** |
| College/Department **College of Dentistry/**  **Biomedical Dental Sciences** |

**A Course Identification and General Information**

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| 1. Course title and code :**Title: Physics of Dental Diagnostic Radiology-I**  **Course Code: BDS-352** |
| 2. Credit hours **2Credit Hours** |
| 3. Program(s) in which the course is offered.(If general elective available in many programs indicate this rather than list programs) **Bachelor of Dental Surgery** |
| 4. Name of faculty member responsible for the course **Dr. Suhayla Mubarak** |
| 5. Level/year at which this course is offered **3rd Year dental students, 2nd Semester** |
| 6. Pre-requisites for this course (if any) **ANAT-222; RDS-232** |
| 7. Co-requisites for this course (if any) **None** |
| 8. Location if not on main campus **College of Dentistry** |

**B Objectives**

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| 1. Summary of the main learning outcomes for students enrolled in the course.  After completing this course the students will be able to understand the basic principles of dental radiology which include radiation physics, as well as the students will be able Practice intraoral radiographic exposure techniques and learn the basic concepts of infection control, biology and protection procedures related to radiology. This course will also enable the students to identify the normal anatomical structures and the radiographical film errors. |
| 2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)   * Improving the reference materials by incorporating high quality articles that are targeting the learning objectives. * Changes in content according to the new technology introduced in radiology. * Websites will be suggested by each course contributor related to his/her respective lectures. * Interactive usage of the blackboard will be emphasized through given assignments periodically * Increasing the number of students’ assignments, and formative assessment to drive their learning. |

**C.CourseDescription**(Note: General description in the form to be used for the Bulletin or Handbook should be attached)

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| 1 Topics to be Covered | | |
| List of Topics | No of  Weeks | Contacthours |
| **Radiation Physics**  Historical background of dental radiology  Discovery of X-rays  Nature of Radiation- Electromagnetic radiation:  Wave packets of energy, each packet is a photon  Nature of the atom  Atomic number and Orbital electrons  Ionization of the atom | One  week | 3 hours |
| **The production of ionizing radiation**  Types of x-rays:  - Characteristic radiation  - Bremsstrahlung radiation  -The production of images on the radiograph  Properties of x-rays:   * Coherent scattering * Photoelectric absorption * Compton absorption   Inverse Square law | One week | 3 hours |
| **X-ray Film, Intensifying Screens, and Grids**   * The different type of x-ray films their contents, and film holders used in intra and extraoral imaging. * The machines, solutions, and the procedures used in processing of different types of x-ray films   X-ray Films - Composition: Emulsion and Base.  Types: Intraoral films - Periapical  - Bitewing  - Occlusal  Extraoral films  Intensifying Screens – Composition and use  Grids – Composition and use  Processing of X-ray films  Composition of processing solutions – Developer and Fixer  Technique of film processing – Manual and automatic processing | One week | 3 hours |
| **Intraoral Radiographic Examinations**   * Periapical radiography- Technique and Criteria of quality   + Paralleling technique- Film holding instruments   + Bisecting angle technique- Angulation of the beam, film position and patient position * Bitewing radiography- Technique and Criteria of quality   Its types and indications   * Occlusal radiography- Technique and Criteria of quality   Its type and indications  Full mouth set radiographs | One week | 3 hours |
| **Digital Imaging**  Analog versus Digital  Concept of analog – to- digital conversion  Digital Detectors – Charge Coupled Device   * Complementary metal oxide semiconductors * Flat panel detectors * Photo stimulable phosphor plates   Digital image display and image storage | One week | 3 hours |
| **Radiographic infection control**  Applying Universal precautions  Wearing gloves during all the radiographic procedures  Disinfecting and covering x-ray machine, working surfaces, chair and apron  Sterilizing nondisposable instruments  Using barrier- protected film  Preventing contamination of processing equipment | One week | 3 hours |
| **Radiation Safety and Protection**  Sources of Radiation exposure – Natural and Artificial  Dosimetry  Effective dose – Intraoral Radiography   * Extraoral Radiography   Methods of exposure and dose reduction – ALARA principle  Factors affecting radiographic quality of a diagnostic film  Guide for establishing maintenance and quality control measures | One week | 3 hours |
| **Normal Anatomical Structures**  Normal Anatomical structures shown in the Oral & Maxillofacial Radiographs  The foreign materials and artifacts shown in the radiographs.  How can you recognize and differentiate between the normal structures and abnormal  images. | One week | 3 hours |
| **Panoramic Radiography**  The principles  Concepts of normal panoramic anatomy   * Concept 1: Structures are flattened and spread-out * Concept 2: Midline structures may project as real image * Concept 3: Ghost image are formed   Real images versus ghost images  Advantages of OPG  Indications of OPG | One  week | 3 hours |
| **Extraoral Radiographic Examinations**  Lateral Cephalometric projection- Technique and indications  Submentovertex projection - Technique and indications  Extraoral Radiographic Examinations -2  Water's projection - Technique and indications  PA Skull projection - Technique and indications  Reverse- Towne projection - Technique and indications  Mandibular oblique lateral projection - Technique and indications  Computed Tomography – Technique and indications | One week | 3 hours |
| **Techniques for specific circumstances**  Pediatric Radiography  Endodontic Radiography  Edentulous Radiography | One  week | 3 hours |
| **Radiation Biology and Chemistry**  Radiation acts on living systems through   * Direct effect * Indirect effect   Biology effects of ionizing radiation: 2 broad categories   * Deterministic effects * Stochastic effects   Threshold dose  Sensitivity of tissues to radiation  Risks from dental radiography  Cancer is the principle biologic risk in dental radiography  Which tissues have the highest risk for cancer from dental radiography | One week | 3 hours |
| **Factors affecting radiographic image**   * Contrast   + Radiographic contrast   + Subject contrast   + Film contrast   + The characteristic curve of the film * Image quality   + Fog and Scatter   + Image sharpness   Resolution | One week | 3 hours |
| **Analysis of errors and artifacts Technique errors Processing errors**   * Technique errors   + Pt. preparation errors   + Pt. movement   + Film placement errors   + Double image   + Beam angulations errors- Vertical and horizontal angulations   + Cone-cut errors   + Incorrect exposure time   Processing errors | One week | 3 hours |
| **Localization Techniques**   * The tube shift technique * The beam shift technique | One week | 3 hours |

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| 2 Course components (total contact hours per semester): | | | | |
| Lecture:**15** | Tutorial: | Laboratory: **30** | Practical/Field work/Internship: | Other: |

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| 3. Additional private study/learning hours expected for students per week. (This should be an average :for the semester not a specific requirement in each week) |

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| 4. Development of Learning Outcomes in Domains of Learning  For each of the domains of learning shown below indicate:   * A brief summary of the knowledge or skill the course is intended to develop; * A description of the teaching strategies to be used in the course to develop that knowledge or skill; * The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned. |
| **a. Knowledge** |
| * Description of the knowledge to be acquired   **In the program learning outcomes, the course addresses the following**  **knowledge item**  **1.7 Describe the radiographic exposure techniques and radiographic anatomy**  **of the head and neck region.**   * State the method of x-radiation production. * State the interaction of x-radiation with different matters. * Mention the biological effects of ionizing radiation. * List the intraoral and extra oral radiographic   exposure techniques, and state film processing, and film mounting.   * Name the different type of x-ray films and film holders used in intra and extraoral imaging. * List the machines, solutions, and the procedures used in processing of different types of x-ray films. * List the basic concepts of infection control procedure in oral and maxillofacial radiology. * Identify the technical and processing film errors and the ways of correction. * Mention the normal anatomical landmarks can be seen in maxillary and mandibular jaw bones |
| (ii) Teaching strategies to be used to develop that knowledge   * **Lectures** * **Small group discussion** |
| (iii) Methods of assessment of knowledge acquired   * **Short-answer questions** * **Multiple choice questions (MCQs)** |
| **b. Cognitive Skills** |
| (i) Description of cognitive skills to be developed   * Explain the types of radiation produced and the appearance of each material in the radiograph. * Analyse the need for patients and staff protection from ionizing radiation. * Describe the intraoral radiographic techniques and   their indications.   * Recognize the types of x-ray films and their contents. * Recognize the type of processing solutions and types of processing methods * Write a report after interpretation of the radiographs about the normal, abnormal structures and artifacts. * Evaluate the need for infection control implementation. * Recognize the good quality radiographs and the errors happened during the techniques and processing Procedures * Evaluate the need for referral to specialist radiological examinationand diagnosis. |
| (ii) Teaching strategies to be used to develop these cognitive skills   * **Lectures** * **Small group discussion** |
| (iii) Methods of assessment of students cognitive skills   * **Short-answer Questions** * **Multiple choice questions (MCQs).** * **Objective structured practical examination (OSPE)** |
| **c. Interpersonal Skills and Responsibility** |
| (i) Description of the interpersonal skills and capacity to carry responsibility to be developed  **In program learning outcomes, the course addresses the following**  **knowledge item:**  VI. 2 Implement ethical standards dealing with colleagues in the health care  field for the best interest of the patients.   * respect senior academic/clinical staff * observe professional obligations * cope with ambiguity * appreciate different views and team work * take responsibility for appropriate share of team work * take responsibility for arriving on time * be accountable for deadlines; complete requirements and responsibilities on time   VI.6 Maintain a safe environment for the patients, their families and the  dental team.   * Take responsibility for proper handling of equipments and chemicals in the laboratory. * Observe laboratory safety policies and procedures as in the clinical manual. |
| (ii) Teaching strategies to be used to develop these skills and abilities   * **Small group discussion** |
| (iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility   * **Structured direct observation with checklists for grading by faculty** |
| **d. Communication, Information Technology and Numerical Skills** |
| (i) Description of the skills to be developed in this domain. |
| (ii) Teaching strategies to be used to develop these skills |
| (iii) Methods of assessment of students numerical and communication skills |
| **e. Psychomotor Skills (if applicable)** |
| (i) Description of the psychomotor skills to be developed and the level of performance required  **In program learning outcomes, the course addresses the following**  **knowledge item:**  **III.2 Perform and order the special investigations needed for diagnosing**  **patients’ chief complaint including oral and maxillofacial**  **radiographic imaging.**   * Display competence in performing intraoral techniques: * Periapical technique * Bitewing technique * Occlusal technique * Object localization technique * Display competence in manual processing of conventional x-ray films. * Display competence in mounting the full mouth radiographs on mounts. * Display competence in processing and viewing the digital radiographs. * Apply appropriate patient and operator radiation protection. * Employ the basic concepts of infection control procedures in radiology |
| (ii) Teaching strategies to be used to develop these skills   * **Demonstration** * **Supervised practice** |
| (iii) Methods of assessment of students psychomotor skills   * **Objective structures practical examination(OSPE)** * **Structured direct observation with checklists for grading by faculty** |

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| 5. Schedule of Assessment Tasks for Students During the Semester | | | |
| Assessment | Assessment task (eg. essay, test, group project, examination etc.) | Week due | Proportion of Final Assessment |
| 1 | Practical evaluations (Structured direct observation with checklists for ratings by faculty) | 2nd week-13th week | 10% |
|  | First Quiz | 5thweek | 10% |
|  | First practical exam(OSPE | 6th week | 15% |
|  | Second Quiz | 10thweek | 10% |
|  | Midterm practical exam(OSPE) | 11thweek | 15% |
|  | Final Written exam | 15thweek | 30% |
|  | Final Lab Exam | 15th week | 10% |
|  | **Total** |  | 100% |

**D.Student Support**

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| 1. Arrangements for availability of teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)   * Each teaching staff of the course is available for student consultations and academic advice 4hrs / week. * The discussion board in the blackboard, and the university email system are formal ways that are available for students to communicate with the course director. |

##### E Learning Resources

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| 1. Required Text(s)   1. Oral Radiology- Principles and Interpretation. S White and M Pharoah,6thEdition, 2008, Mosby |
| 2. Essential References  1. Principles of Dental Imaging. O Langland, R Langlais and R Preece,2nd Edition, 2002, JA Majors |
| 3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List) |
| 4-.Electronic Materials, Web Sites etc |
| 5- Other learning material such as computer-based programs/CD, professional standards/regulations |

**F. Facilities Required**

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| Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.) |
| 1. Accommodation (Lecture rooms, laboratories, etc.)   * Lecture roomwith data show projector. * Oral Radiology simulation lab with bench-mounted simulation models ( phantom heads) * Wi-Fi access |
| 2. Computing resources   * Computers for viewing the digital images |
| 3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list)   * Basic radiographical examination instruments and equipments. |

**G Course Evaluation and Improvement Processes**

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| 1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching   * Exam Analysis * Questionnaires(Students’ survey that is conducted by the College Quality Unit).. |
| 2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department   * Faculty annual report * Peer evaluations using check list. |
| 3 Processes for Improvement of Teaching   * Attending workshops in the staff development program that is conducted either by   the College of Dentistry or the Medical Education Unit, University of Dammam. |
| 4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)   * Inviting an external teaching staff for evaluating students’ performance during the clinical sessions. |
| 5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.   * Course report reflects on both the course outcome in term of students’ performance, and the process in term of the difficulties that faced the course implementation. * Plans are put for improvement considering students’ survey and their opinions in the feedback sessions. |