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**SYLLABUS**

**General information**

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| **Name of the subject: DENTAL MATERIAL SCIENCE AND EQUIPMENT** | |
| Type of subject | Mandatory |
| Faculty of PMU | Faculty of Medicine and Dentistry |
| Field of study | dentistry |
| Speciality | - |
| Level of study | master's degree |
| Form of study | full-time |
| Year of study /semester | Year 2 / semester 3 |
| Number of ECTS credits | 5 |
| Forms of teaching  (number of hours) | Lectures 5/seminars 25/exercises 30 |
| Ways of verifying and assessing learning outcomes [[1]](#footnote-1) | credit:  descriptive  test  practical  oral  pass/fail  final exam:  descriptive  test  practical  oral |
| Head of the Department | Danuta Lietz - Kijak, MD, PhD, Professor of PUM  Tel. 91 466 17 29 |
| Subject supervisor | Lek. Dent. Lidia Kozłowska |
| Name and contact details of the Department | Department of Propedeutics, Physical Diagnosis and Dental Physiotherapy PUM, al. Powstańców Wlkp. 72;  70 - 111 Szczecin; tel. 91 466 16 73 |
| Department website | [https://www.pum.edu.pl/uniwersytet/dydaktyka](https://www.pum.edu.pl/uniwersytet/dydaktyka_i_) \_and\_treatment/clinics\_cathedrals\_and\_workshops  /wmis/academy\_of\_physical\_diagnostics \_and\_physiotherapy\_of\_dentistry/. |
| Language of subject | English |

**Detailed information**

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| Subject objectives | * Gain knowledge of basic dental instruments and appliances and the ability to recognise and use them in the specific field of dentistry. * Gain knowledge of dental materials for temporary and permanent fillings in the restorative treatment of deciduous and permanent teeth. * Gain knowledge of dental materials used in caries prevention, endodontic and cosmetic treatment and bonding systems. * Acquire knowledge and skills regarding the mixing (manual and automatic) of materials, application techniques, curing methods for dental materials and adhesion techniques. * Acquire knowledge and skills in the selection of restorative biomaterials and bonding, based on material properties and clinical conditions, and the use of ancillary equipment when placing fillings. * To gain an understanding of the surface properties of hard tissues and dental materials and the mechanisms of their degradation in the oral environment.   The learning objective will be met if the student is familiar with and appropriately uses dental instruments and materials in appropriate treatment procedures. | |
| Prerequirements for the subject | Knowledge | Knowledge of the anatomy of permanent teeth and deciduous teeth.  Knowledge of the histological structure of the hard and soft tissues of the oral cavity. Knowledge of the physiology of the masticatory organ. |
| Skills | Basic manual skills.  Spatial imagination.  Visual-motor coordination. |
| Social competence | The habit of self-education  Ability to work in a group  Communication skills  Ability to be precise and persistent |

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| **LEARNING OUTCOMES** | | | |
| **n/a learning outcome** | **A student who has completed the course**  **knows/can:** | **Symbol** | **Means of learning outcomes verification\*** |
| W01 | knows and understands the principles of operation of dental equipment | B.W13. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W02 | knows and understands the basics of disinfection, sterilisation and aseptic management | C.W5. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W03 | knows and understands dental equipment and instrumentation used in dental procedures | C.W23. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W04 | knows and understands the definition and classification of basic and auxiliary dental materials | C.W24. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W05 | knows and understands the composition, anatomy, bonding, properties, purpose and use of dental materials | C.W25. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W06 | knows and understands the surface properties of dental hard tissues and dental biomaterials | C.W26. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W07 | knows and understands the phenomenon of adhesion and the mechanisms of adhesion formation and the procedures for adhesive surface preparation of enamel, dentine and dental biomaterials | C.W27. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W08 | knows and understands the basic clinical procedures of dental hard tissue reconstruction and endodontic treatment and the methods and technical-laboratory procedures for restorations | C.W28. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W09 | knows and understands the mechanisms of degradation (corrosion) of dental biomaterials in the oral cavity and their effect on the biological properties of the materials | C.W29. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| W10 | knows and understands the morphology of dental cavities and the principles of endodontic treatment and the instrumentation used in this treatment | F.W7. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| U01 | can apply adhesive techniques | C.U10. | ET, EPR, K, S, O, PS, W, PM, TW, TDO, UP |
| U02 | is able to select restorative and adhesive biomaterials, based on material properties and clinical conditions | C.U11. | ET, EPR, K, S, O, PS, UP |
| U03 | can reconstruct missing hard tissue in a phantom/model tooth | C.U.9. | S, O, PS, |
| U04 | can formulate research problems in dentistry | F.U12. | S,O,PS |
| K01 | is ready to recognise and acknowledge his/her own limitations, make a self-assessment of his/her deficits and learning needs | K.5. | O, S, PS |
| K02 | is willing to use objective sources of information | K.7. | O |
| K03 | is prepared to form opinions on various aspects of professional activity | K.10. | O |

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| **n/a learning outcome** | **Learning outcomes** | **Form of classes** | | | |
| **Lecture** | **Seminar** | **Exercises** |
| W01 | knows and understands the principles of operation of dental equipment |  |  | x |
| W02 | knows and understands dental office equipment and instrumentation used in dental procedures |  | x | x |
| W03 | knows and understands the definition and classification of basic and auxiliary dental materials | x | x | x |
| W04 | knows and understands the composition, anatomy, bonding, properties, purpose and use of dental materials | x | x | x |
| W05 | knows and understands the surface properties of dental hard tissue and dental biomaterials | x | x | x |
| W06 | knows and understands the phenomenon of adhesion and the mechanisms of adhesion formation as well as the procedures for adhesive surface preparation of enamel, dentine and dental biomaterials | x | x | x |
| W07 | knows and understands the basic clinical procedures of dental hard tissue reconstruction, endodontic treatment and technical-laboratory procedures for restorations | x | x | x |
| W08 | knows and understands the mechanisms of degradation (corrosion) of dental biomaterials in the oral cavity and their effect on the biological properties of the materials | x | x | x |
| W09 | knows and understands the basics of disinfection, sterilisation and aseptic management |  | x |  |
| U01 | can apply adhesive techniques |  |  | x |
| U02 | is able to select restorative, prosthetic and bonding biomaterials, based on material properties and clinical conditions |  | x | x |
| U03 | can reconstruct missing hard tissue in a phantom/model tooth |  |  | x |
| K01 | is ready to recognise and acknowledge his/her own limitations, make a self-assessment of his/her deficits and learning needs |  | x | x |
| K02 | is willing to use objective sources of information |  | x | x |
| K03 | is prepared to form opinions on various aspects of professional activity |  | x | x |

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| **TABLE OF CONTENTS OF THE PROGRAMME** | | | |
| **n/a curriculum content** | **Programme content** | **L.hours** | **Reference to learning outcomes for classes** |
| **Winter semester** | | | |
| **Lectures** | | | |
| TK01 | Introduction to materials science.   Classification of dental materials. | 1 | B.W13 C.W23. C.W24. C.W25. C.W26. C.W27. C.W28. C.W29.; F.W7. |
| TK02 | The course of changes in the hard tissues of teeth (carious, non-carious and age-related) and the restorative techniques and materials that can be used. | 1 | B.U1. B.U2. B.U3. C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. |
| TK03 | Knowledge of caries risk and prosthetic factors as a basis for prevention and the biomimetic action of materials and the correct choice of material depending on the patient's risk group. | 1 | B.U1. B.U2. B.U3. F.W3. F.W5. F.W11. F.W14. C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. |
| TK 04 | Basics of preparation techniques and diagnostic methods to facilitate the selection of the correct working technique and material for hard tissue reconstruction. | 1 | B.U1. B.U2. B.U3. F.U23. C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. |
| TK05 | Degradation of materials in the patient's oral environment and its impact on patient health and material properties. Scientific development in the field of dental materials. Nanoparticles in dentistry. | 1 | B.U1. B.U2. B.U3. F.W3. F.W7. F.W5. F.W11. F.W14. C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. |
| **Seminars** | | | |
| TK01 | GIC: classification, composition and its modifications, binding reactions, properties, application. | 2 | B.U1. B.U2. B.U3. C.W23.C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10; F.U12. |
| TK02 | Adhesion to dentin and enamel - mechanism, bonding systems and their generations. Etching techniques (total and selective). Polymerisation phenomenon. | 2 | B.U1. B.U2. B.U3. C.W23.C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10.; F.U12. |
| TK03 | Composites: classification, composition and its modifications, structure, mode of bonding, properties, purpose and method of use  Optical properties: colour and its measurement, fluorescence, translucence, opacities, colour loss. | 2 | B.U1. B.U2. B.U3. C.W23.C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10.; F.U12. |
| TK04 | The carious process and methods for its diagnosis. Principles of cavity preparation (according to Black and modern) including differences due to the type of material used. Pulp vitality diagnostic devices. | 2 | B.U1. B.U2. B.U3. C.W23.C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10. |
| TK05 | Auxiliary equipment for placing fillings - types of moulds and their stabilisation. Retraction in the gingival area. | 2 | B.U1. B.U2. B.U3. C.W23.C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10.; F.U12. |
| TK06 | Mechanical properties of tissues and materials. Occlusal forces, cutting and abrasion in the oral cavity. | 2 | B.U1. B.U2. B.U3. C.W23.C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10. |
| TK07 | Thermal properties and thermal conductivity. Coefficient of thermal expansion. Tissue and material preparation methods - cutting pattern and heat generated. Surface phenomena. | 2 | C.W23.C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10.; F.U12. |
| TK08 | Materials and instruments used in orthodontic treatment. | 2 | C.W23.C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10. |
| TK09 | CAD-CAM, intra- and extraoral scanning. 3D printing in dentistry. | 2 | C.W23.C.W24. C.W25. C.W26. C.W28. C.W29.  C.U12. K.5. K.7. K.10. |
| TK10 | Equipment and methods for disinfection and sterilisation of instruments and surfaces in the dental practice. | 2 | C.W5. C.W28. C.W29. K.5. K.7. K.10. |
| TK11 | Materials and instruments used in endodontic treatment. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10.; F.W7. |
| TK12 | Selection of appropriate restorative and bonding techniques, instruments and biomaterials, based on material properties and clinical conditions. GROUP WORK. - Part I. | 2 | F.U15. C.U11. C.W23. C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10.; F.U12. |
| TK13 | Selection of appropriate restorative and bonding techniques, instruments and biomaterials, based on material properties and clinical conditions. GROUP WORK. - part II. | 1 | F.U15 C.U11. C.W23. C.W24. C.W25. C.W26. C.W27. C.W28. C.W29. K.5. K.7. K.10.; F.U12. |
| **Exercises** | | | |
| TK01 | Dental drills. Diagnostic kit. Tools used in dental specialities: conservative, periodontology, surgery, prosthetics, orthodontics. | 2 | C.W23.  K.5.; K7; K10 |
| TK02 | Health and Safety procedures. Filling of Class V Black cavities using encapsulated GIC and modelling technique and transparent cervical matrices. GIC mixed by hand as a primer. Working on models. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 03 | Rotary instruments for the treatment of dental hard tissue and dental materials. Small dental equipment. | 2 | C.W23.  K.5.; K7; K10 |
| TK 04 | Class I Black's cavity filling using glass/modified GIC hybrid and occlusal film. Compomers and composites as fissure sealers. Working on models. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 05 | Odontotropic materials and biological treatment techniques, Calcium hydroxide and calcium silicate preparations.   Bioactive materials. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 06 | Class I Black's cavity filling using bulk composites and adhesion systems as well as the Essential Line technique and occlusal punch. Working on models. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 07 | Techniques and preparations for infiltration, whitening, fluoride preparations, desensitisers, calcifiers - composition, properties application. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27.   C.U9. C.U11.  K.5. K.7. K.10. |
| TK 08 | Reconstruction of the contact point in Class II Black cavities using composite moulds. Tools and techniques for finishing and polishing fillings. Working on models. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 09 | Reconstruction of worn out incisal edges and occlusal surfaces with injectable composites - composition, properties, application procedure. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 10 | Class II Black's cavity filling with composite using layering technique and variable viscosity technique and sectional matrix systems. Working on models. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 11 | Temporary fillings: hand-mixed and light- and chemically-cured dressings, surgical, periodontal, endodontic. Oxide-zinc-eugenol cement. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27.   C.U9. C.U11.  K.5. K.7. K.10. |
| TK 12 | Filling of a Class III Black cavity with composite using the dentin and enamel layering technique and introduction to Smart Chromatic technology. Working on models. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 13 | Endodontic instruments. Methods of root canal preparation and measurement of root canal length, root canal rinses, medicaments and sealants used. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 14 | Filling of a Class IV Black cavity with composite using the silicone key and shaper technique. Composite veneer. Working on models. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |
| TK 15 | News summary.  Final credit in the form of a practical exam. | 2 | C.W23. C.W24. C.W25. C.W26. C.W27. C.W28 C. U9. C.U11.  K.5. K.7. K.10. |

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| **Recommended literature:** |
| Reference literature |
| 1. Dental materials. Powers J.M., Wataha J.C. Elsevier Urban & Partner. Wrocław 2013, wyd.1 |
| 1. Conservative Dentistry Vol. 1 and 2 by E.J. Swift Jr, H.O. Heymann, T.M. Robertson, Publisher: Czelej, 2009 |
| Complementary literature |
| 1. Essentials of Dentistry. Collection of tasks for students of dentistry. Part 1. Simińska, Aleksandra. Warsaw: PZWL, 2022, doi: https://doi.org/10.53270/2021.016 IBUK LIBRA. |
| 1. Endodontics of the developmental and mature age - 3rd edition. vol 1-2, Barańska-Gachowska M, Czelej, 2021. |
| 1. Handbook for dental assistants and hygienists. Mielczarek A., Kowalik R., Najman N.: PZWL. Warsaw 2018. |
| 1. A practical dictionary of dentistry. Lipski M., Czelej 2016. |
| 1. Conservative dentistry with endodontics - clinical outline: a textbook for dental students: Jańczuk Z, Kaczmarek U, Lipski M. PZWL, 2014. |
| 1. Dental materials. Craig R., ed. by John M. Powers, Ronald L. Sakaguchi. In: Elsevier Urban & Partner, 2008. |

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| **Student workload** | |
| Form of student workload  (class participation, activity, report preparation, etc.). | Student workload [h] | |
| In the teacher's assessment (opinion) | |
| Contact hours with the teacher | 60 | |
| Preparation for exercise/seminar | 20 | |
| Reading of designated literature | 15 | |
| Preparation of the final presentation sumerising knowledge from the seminars | 5 | |
| Preparation for a colloquium/quiz | 5 | |
| Preparation for the examination | 20 | |
| Total student workload | 125 | |
| ECTS credits | 5 |
| **Comments** | |
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\*Example ways to verify learning outcomes:

EP - written exam

EU - oral examination

ET - test examination

EPR - practical exam

K - colloquium

R – oral presentation

S - test of practical skills

O - assessment of student activity and attitude

SL - laboratory report

PS - assessment of ability to work independently

W - entrance exam, test before the start of class

PM - multimedia presentation

TWDO - yes/no choice tests, matching answers (quiz)

1. [↑](#footnote-ref-1)