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**SYLLABUS of the MODULE (SUBJECT)**

**General Information**

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| **Module title: Biochemistry** | |
| Module type | Obligatory |
| Faculty PMU | Faculty of Medicine and Dentistry |
| Major | Dentistry |
| Level of study | long-cycle (S2J) |
| Mode of study | full-time studies |
| Year of studies, semester | Year 2, semester III and IV |
| ECTS credits (incl. semester breakdown) | 8 |
| Type/s of training | lectures (18h) /seminars (30h)/ practical (60) |
| Form of assessment[[1]](#footnote-1) | ☒graded assessment:  ☒descriptive  ☒test  ☐practical  ☐oral  ☐non-graded assessment  ☒final examination  ☒descriptive  ☒test  ☐practical  ☒oral |
| Head of the Department/ Clinic, Unit | Prof. dr hab. n. med. Dariusz Chlubek |
| Tutor responsible for the module | dr n. med. Patrycja Kupnicka; patrycja.kupnicka@pum.edu.pl |
| Department’s/ Clinic’s/ Unit’s website | https://www.pum.edu.pl/wydzialy/wydzial-medycyny-i-stomatologii/zaklad-biochemii |
| Language | English |

**Detailed information**

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| **Module objectives** | | The attainment target of biochemistry is analyzing vital processes at the molecular level and explaining connections between the structure and the function of biomolecules in the living organism . This knowledge is a base of understanding action of individual tissues and organs, and in consequence functioning of the entire organism in health and illness. It lets also consciously react to the appearance of pathological processes by implementing the effective treatment. It enables the tooth decay to take preventive action with reference to diseases associated with the progress of civilization .  It also preparing students for studying of clinical objects is an attainment target of biochemistry. |
| Prerequisite /essential  requirements | Knowledge | Student knows patterns of basic substances. Explains concepts: of atom, molecule, substance, a chemical reaction, the functional group. Recognizes and defines organic compounds: hydrocarbons, alcohols, aldehydes, ketones, acids, esters, ethers, amides, amines. Knows and classifies chemical bonds. Defines notions: of solubility, diffusion, osmosis, osmotic pressure, molarity. Knows notions: of solution, molar concentration, percentage concentration, normal setting, electrolytic dissociation, ion, anion, cation. |
| Skills | Student is able to use the basic laboratory equipment ( use the speedy pipette, measure appropriate volumes of solutions out, prepare solutions according to the recommended concentration, titrate). Performs chemical calculations based on knowledge of chemistry and mathematic. Knows principles of operation in a chemical laboratory. He is able to react actually in emergencies in a chemical laboratory (functioning of gobbling, flammable, poisoning associations, action of the highest temperature and e.c.). |
| Competences | Student is able to work in a team and actually to perform tasks requiring the precision, acting according to the closely established procedure. He is able to behave responsibly in emergencies. A habit has self-educations. |

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| **Description of the learning out**c**omes for the subject /module** | | | |
| **No. of learning outcome** | **Student, who has passed the (subject)**  **knows /is able to /can:** | **SYMBOL**  **(referring the standards)** | **Method of verification of learning outcomes\*** | |
| W01 | knows and understands importance of main and trace elements in processes within human body with regard to intake, absorption and transport | B.W01 | S, RZC, W, ET, EP, EU | |
| W02 | knows and understands importance of electrolytes, buffer systems and chemical reactions in biological systems | B.W02 | S, RZC, W, ET, EP, EU | |
| W03 | knows and understands biochemical bases of human body integrity | B.W03 | S, RZC, W, ET, EP, EU | |
| W04 | knows and understands structure and functions of significant chemical compounds found in human body. In particular properties , functions, metabolism and energy aspects of proteins, nucleic acids, carbohydrates, lipids, enzymes and hormones reactions. | B.W04 | S, RZC, W, ET, EP, EU | |
| W05 | knows and understands principles of calcium-phosphate metabolism | B.W05 | S, RZC, W, ET, EP, EU | |
| W06 | knows and understands role and importance of body fluids including saliva | B.W06 | S, RZC, W, ET, EP, EU | |
| U01 | is able to associate chemical phenomena with processes occurring in oral cavity | B.U01 | S, RZC, W, ET, EP, EU | |
| K05 | is ready to notice and recognize own limitations, make self-assessment of educational deficits and needs | K05 | S, RZC, W | |
| K07 | is ready to use reliable sources of information | K07 | S, RZC, W | |
| K08 | is ready to draw conclusions from own measurements or observations | K08 | S, RZC, W | |

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| **Table presenting LEARNING OUTCOMES in relation to the form of classes** | | | | | | | | |
| **No. of learning outcome** | **Learning outcomes** | **Type of training** | | | | | | |
| **Lecture** | **Seminar** | **Practical classes** | **Clinical classes** | **Simulations** | **E-learning** | **Other…** |
| W01 | B.W01 | X | X | X |  |  |  |  |
| W02 | B.W02 | X | X | X |  |  |  |  |
| W03 | B.W03 | X | X | X |  |  |  |  |
| W04 | B.W04 | X | X | X |  |  |  |  |
| W05 | B.W05 | X | X | X |  |  |  |  |
| W06 | B.W06 | X | X | X |  |  |  |  |
| U01 | B.U01 | X | X | X |  |  |  |  |
| K05 | K05 | X | X | X |  |  |  |  |
| K07 | K07 | X | X | X |  |  |  |  |
| K08 | K08 | X | X | X |  |  |  |  |

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| **Table presenting TEACHING PROGRAMME** | | | |
| **No. of a teaching programme** | **Teaching programme** | **No. of hours** | **References to learning outcomes** |
| **Winter semester** | | | |
| **Lectures** | | | |
| TK01 | Proteins - structure and functions | 2 | W02,03,04,  K05,07,08 |
| TK02 | Enzymes | 2 | W02,03,04,  K05,07,08 |
| TK03 | Protein digestion | 2 | W02,03,04,  K05,07,08 |
| TK04 | Amino acid nitrogen catabolism | 2 | W02,03,04,  K05,07,08 |
| TK05 | Krebs cycle | 1 | W02,03,04,  K05,07,08 |
| TK06 | Carbohydrate metabolism | 2 | W02,03,04,  K05,07,08 |
| TK07 | Lipoprotein metabolism | 2 | W02,03,04,  K05,07,08 |
| TK08 | Iron and bilirubin metabolism | 2 | W01,W02,03,04,  K05,07,08 |
| TK09 | Magnesium metabolism | 2 | W01,02,03,04,  K05,07,08 |
| TK10 | Fluoride metabolism | 1 | W01,02,03,04,  K05,07,08 |
| **Seminars** | | | |
| TK01 | Amino acids and peptides - classification, properties, functions. Proteins: molecular structure, properties, functions. | 2 | W02,03,04,  K05,07,08 |
| TK02 | Nucleotides. Nucleic acids. Protein biosynthesis. | 2 | W02,03,04,  K05,07,08 |
| TK03 | Enzymes - general properties, kinetic of enzymatic reactions, mechanisms of action, regulation of the activity. | 2 | W02,03,04,  K05,07,08 |
| TK04 | Enzymes – regulation mechanisms of enzyme activity. Regulation on the gene level. | 1 | W02,03,04,  K05,07,08 |
| TK05 | Nutritional proteins. Biological value of the proteins. Nitrogen balance. Protein digestion. Amino acids absorption. | 2 | W02,W03,04,  K05,07,08 |
| TK06 | Catabolism of amino groups of amino acids. Urea cycle. | 2 | W02,W03,04,  K05,07,08 |
| TK07 | Getting the energy in the cell. Citric acid cycle. Mitochondrial respiratory chain. | 2 | W02,03,04,  K05,07,08 |
| TK08 | Nutritional sugars. Sugars digestion and absorption. Metabolism of glycogen. | 2 | W02,03,04,  K05,07,08 |
| **Practical** **classes** | | | |
| TK01 | Amino acids, peptides, proteins. Investigation of properties, determination of the isoelectric point. | 4 | W02,03,04,  K05,07,08 |
| TK02 | Nucleotides. Nucleic acids. Protein biosynthesis. Determination of protein concentration | 3,5 | W02,03,04,  K05,07,08 |
| TK03 | Enzymes - general properties, kinetics of enzymatic reactions, mechanisms of action. Determination of amylase activity in serum and urine | 3,5 | W02,03,04,  K05,07,08 |
| TK04 | Enzymes - mechanisms of activity regulation. Regulation at the gene level. Determination of serum transaminases activity. | 3,5 | W02,03,04,  K05,07,08 |
| TK05 | Nutritional proteins. Biological value of the proteins. Nitrogen balance. Protein digestion. Amino acids absorption. Kay's test | 3,5 | W02,03,04  K05,07,08 |
| TK06 | Catabolism of amino groups of amino acids. Urea cycle. Determination of urea in serum and urine | 3,5 | W02,03,04,  K05,07,08 |
| TK07 | Getting the energy in the cell. Citric acid cycle. Mitochondrial respiratory chain. Determination of cytochrome oxidase activity | 3,5 | W02,03,04,  K05,07,08 |
| TK08 | Nutritional sugars. Sugars digestion and absorption. Metabolism of glycogen. Testing the content of sugars in food products | 3,5 | W02,03,04,  K05,07,08 |
| **Simulation** | | | |
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| **E-learning** | | | |
| TK06 | Carbohydrate metabolism | 2 | W02,03,04,  K05,07,08 |
| TK08 | Iron and bilirubin metabolism | 2 | W01,W02,03,04,  K05,07,08 |
| TK10 | Fluoride metabolism | 1 | W01,02,03,04,  K05,07,08 |
| **Summer semester** | | | |
| **Lectures** | | | |
| TK01 | - |  |  |
| TK02 | - |  |  |
| **Seminars** | | | |
| TK09 | Glucose metabolism. Glycolysis. Gluconeogenesis. | 2 | W02,03,04,  K05,07,08 |
| TK10 | Pentose cycle. The metabolism of the fructose and galactose. Uronic acid pathway. | 1 | W02,03,04,  K05,07,08 |
| TK11 | Nutritional lipids. Lipids digestion and absorption. | 1 | W02,03,04,  K05,07,08 |
| TK12 | Lipids transport and storage. Lipoproteins. | 1 | W02,03,04,  K05,07,08 |
| TK13 | Metabolism of fatty acids: lipogenesis,  β-oxidation, ketogenesis. Triacylglycerol metabolism: synthesis and lipolysis. | 2 | W02,03,04,  K05,07,08 |
| TK14 | Cholesterol and bile acids metabolism. | 2 | W02,03,04,  K05,07,08 |
| TK15 | Iron and porphyrins metabolism. The synthesis and the catabolism of the hem. Metabolism of bilirubin. | 2 | W01,02,03,04,  K05,07,08 |
| TK16 | Macro- and microelements. Calcium-phosphate metabolism. | 2 | W01,03,05,  K05,07,08 |
| TK17 | Biochemistry of the oral cavity. Saliva. Chemical composition of tissues of the tooth. Processes of the demineralization and the remineralization. Biochemical aspects of tooth decay and periodontal diseases. | 2 | W01,03,06, U01,  K05,07,08 |
| **Practical** **classes** | | | |
| TK09 | Glucose metabolism. Glycolysis. Gluconeogenesis. Carrying out the synthesis of starch | 3,5 | W02,03,04,  K05,07,08 |
| TK10 | Pentose cycle. The metabolism of the fructose and galactose. Uronic acid pathway. Perform a sucrose loading test | 3,5 | W02,03,04,  K05,07,08 |
| TK11 | Nutritional lipids. Lipids digestion and absorption. Study of the properties of fats | 3,5 | W02,03,04,  K05,07,08 |
| TK12 | Lipids transport and storage. Lipoproteins. Determination of the concentration of β-lipoproteins in the serum | 3,5 | W02,03,04,  K05,07,08 |
| TK13 | Metabolism of fatty acids: lipogenesis,  β-oxidation, ketogenesis. Triacylglycerol metabolism: synthesis and lipolysis. Lipase activity test | 3,5 | W02,03,04,  K05,07,08 |
| TK14 | Cholesterol and bile acids metabolism. Reactions to detect steroid compounds. | 3,5 | W02,03,04,  K05,07,08 |
| TK15 | Iron and porphyrins metabolism. The synthesis and the catabolism of the hem. Metabolism of bilirubin. Determination of iron and TIBC concentration in the serum | 3,5 | W01,02,03,04,  K05,07,08 |
| TK16 | Macro- and microelements. Calcium-phosphate metabolism. Examination of mineral and organic components of the tooth, determination of serum phosphate concentration. | 3,5 | W01,03,05,  K05,07,08 |
| TK17 | Biochemistry of the oral cavity. Saliva. Chemical composition of tissues of the tooth. Processes of the demineralization and the remineralization. Biochemical aspects of tooth decay and periodontal diseases. Determination of amylase activity in saliva. | 3,5 | W01,03,06, U01,  K05,07,08 |
| **Simulation** | | | |
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| **E-learning** | | | |
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| **Booklist** |
| Obligatory literature: |
| 1. Biochemistry. Denise R. Ferrier. Seventh eddition |
| 2. |
| Supplementary literature: |
| 1. |
| 2. |

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| **Student’s workload** | |
| Form of student’s activity  (in-class participation; activeness, produce a report, etc.) | Student’s workload [h] |
| Tutor |
| Contact hours with the tutor | 108 |
| Time spent on preparation to seminars/ practical classess | 70 |
| Time spent on reading recommended literature |  |
| Time spent on writing report/making project |  |
| Time spent on preparing to colloqium/ entry test | 17 |
| Time spent on preparing to exam | 80 |
| Other ….. |  |
| Student’s workload in total | 269 |
| **ECTS credits for the subject (in total)** | 9 |
| **Remarks** | |
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\* Selected examples of methods of assessment:

EP – written examination

EU – oral examination

ET – test examination

EPR – practical examination

K – colloqium

R – report

S – practical skills assessment

RZĆ – practical classes report, incl. discussion on results

O – student’s active participation and attitude assessment

SL – lab report

SP – case study

PS - assessment of student’s ability to work independently

W – entry test

PM – multimedial presentation

other…

1. replace **☐** into **☒** where applicable [↑](#footnote-ref-1)