

**Course description (syllabus) form for higher education, doctoral,
postgraduate and skills development programmes**

A. General course description

[Filled out by teacher/course coordinator except for the following fields marked in blue:]

- 1) *course title,*
- 2) *unit organising the course,*
- 3) *unit for which the course is organised,*
- 4) *course ID,*
- 5) *ISCED code,*
- 6) *ECTS credit allocation,*
- 7) *form of course completion assessment,*
- 8) *language of instruction,*
- 9) *indication whether attempts at obtaining course credit can be repeated,*
- 10) *affiliation of the course to a course group].*

Field name	Comments
Course title	<i>Molekularne podstawy metabolizmu Molecular basis of metabolism</i>
Unit organising the course	<i>Faculty of Medicine Department of Medical Biology and Biochemistry Ludwik Rydygier Collegium Medicum Nicolaus Copernicus University</i>
Unit for which the course is organised	<i>Faculty of Medicine Field of study: Medicine, full-time studies, long cycle</i>
Course ID	<i>1655-LekM11NPMMPM-J</i>
ISCED code	<i>0912</i>
ECTS credit allocation	<i>4.00</i>
Form of course completion assessment	<i>ungraded credit</i>
Language of instruction	<i>English</i>
Indication whether attempts at obtaining course credit can be repeated	<i>no</i>
Affiliation of the course to a course group	
Total student workload	<p><i>1. The workload associated with activities requiring direct participation of academic teachers is:</i></p> <ul style="list-style-type: none"> - participation in lectures: 30 hours - participation in tutorials: 24 hours - participation in seminars: 6 hours - consultation: 5 hours - passing the test: 2 hours <p><i>The workload associated with classes requiring direct participation of academic teachers is 63 hours, which corresponds to 2.52 ECTS points</i></p> <p><i>2. Balance of student workload:</i></p> <ul style="list-style-type: none"> - participation in lectures: 30 hours - participation in tutorials: 24 hours - participation in seminars: 6 hours - preparation for tutorials and seminars: 10 hours - writing tutorial reports: 5 hours - reading the indicated literature: 10 hours

	<p>- consultation: 5 hours - preparation for passing and passing: 10 hours The total student workload is 100 hours, which corresponds to 4 ECTS points</p> <p>3. Workload related to scientific research: - reading of the indicated scientific literature: 10 hours - research and scientific consultations: 5 hours - participation in lectures (including methodology of scientific research, results of research, studies): 30 hours - participation in tutorials and seminars covered by scientific activity (including methodology of scientific research, research results, studies): 30 hours - preparation for tutorials and seminars covered by scientific activity: 10 hours - preparation to pass in the area of research and science aspects for a given subject: 10 hours - writing reports on tutorials covered by scientific activity: 5 hours The total amount of student work associated with the conducted research is 100 hours, which corresponds to 4 ECTS points</p> <p>4. Time required to prepare and participate in the assessment process: - preparation for passing + credit: 10 hours - reading the indicated literature: 10 hours The total amount of student work involved in preparing for the participation in the assessment process is 20 hours, which corresponds to 0.2 ECTS points</p> <p>5. Balance of student workload of a practical nature: - participation in tutorials: 24 hours The total student workload of a practical nature is 24 hours, which corresponds to 0.96 ECTS points</p> <p>6. Time required for compulsory placement: not applicable</p>
<p>Learning outcomes – knowledge</p>	<p>W1: knows the structure of amino acids and their physical and chemical properties - B K_W10 W2: knows the structure of carbohydrates and their physical and chemical properties - B K_W10 W3: knows the structure of lipids and their function at the cellular and extracellular levels - B K_W11 W4: knows the structure of polysaccharides and their function at the cellular and extracellular levels - B K_W11 W5: characterizes I-, II-, III- and IV structures of proteins- B K_W12 W6: knows the post-translational and functional modifications of the protein and their importance - B K_W12 W7: characterizes proteins participating in chromatin structure - B K_W13 W8: describes the role of enzymes and vitamins in metabolic processes - B K_W15 W9: knows the regulatory mechanisms of metabolic processes - B K_W15 W10: describes the effect of proper diet, digestion processes and absorption on the course of metabolic pathways - B K_W15 W11: describes antioxidant function of vitamins - B K_W17 W12: describes the role of blood in maintaining the body's water-electrolyte balance – B K_W01 W13: characterizes the participation of blood buffers in maintaining body homeostasis – B K_W02</p>

Learning outcomes – skills	<p><i>U1: calculates molar and percentage concentrations of diluted solutions - B K_U03</i></p> <p><i>U2: determines the pH of the solution and the effect of pH changes on the properties of proteins and carbohydrates - B K_U05</i></p> <p><i>U3: uses qualitative analysis, titration, colorimetry, pH-parameters, analyzes and interprets the results obtained - B K_U09</i></p> <p><i>U4: uses analytical balance, spectrophotometer, pH-meter and evaluates the accuracy of measurements – B K_U10</i></p>
Learning outcomes - social competence	<i>K1: is aware of the limitations of its knowledge and the need for its constant supplementing - K_K01</i>
Teaching methods	<p><i>Lecture:</i> <i>expository teaching methods - informative (traditional) lecture with multimedia presentation, problem-based teaching methods - discussion method</i></p> <p><i>seminar:</i> <i>expository teaching methods - a talk, problem-based teaching methods - classic problem method, discussion method, case method, discovery teaching methods - project method</i></p> <p><i>tutorial:</i> <i>expository teaching methods - explanation, problem-based teaching methods – classic problem method, didactic discussion, discovery teaching methods - laboratory practicals, practical exercises, demonstration</i></p>
Prerequisites	<i>Student beginning the course „Molecular basis of metabolism” should possess the knowledge in the field of chemistry and biology at the advanced level of secondary school exam.</i>
Brief course description	<i>„Molecular basis of metabolism” course is carried out in the first semester. It consists of 30 hours of lectures, 24 hours of tutorials, and 6 hours of seminars. The aim of the course is to prepare students for learning clinical subjects, as well as to work in a future profession. The topics provided allow to get to know the structure of the most important biomolecules (proteins, carbohydrates, vitamins, lipids), their physiological functions, as well as the influence of their pathological modifications on the course of human metabolism. Knowledge about the structure of enzymes, their activities and methods of regulation is necessary to understand metabolic changes in the states of physiology and pathology.</i>
Full course description	<p><i>Lectures:</i></p> <p><i>1. Protein amino acids, their characteristics. Structure and properties of peptide bond. Structure and function of biologically important peptides. Biosynthesis and structure of insulin.</i></p> <p><i>2 Proteins - classification, characteristics of I-, II-, III- and IV-structures. Post-translational modification of proteins. Structure of ribonuclease. Structure and synthesis of collagen.</i></p> <p><i>3. Relationships between protein structure and its function - myoglobin, hemoglobin, prions, immunoglobulins. The physiological role of hemoglobin and myoglobin. The mechanism of oxygen binding with myoglobin and hemoglobin. Changes in the structure of hemoglobin at various stages of human development. Glycosylated hemoglobin. Hemoglobinopathies.</i></p> <p><i>4. Blood functions. Organic and inorganic components of plasma. Characteristics and functions of plasma proteins. Buffering properties of blood - carbonate buffer and the role of hemoglobin in buffering (Bohr and Halden effect).</i></p> <p><i>5. Enzyme - structure, features, enzyme-substrate complexes. The concept of isoenzyme. Physical and chemical properties of isoenzymes. The significance of isoenzymes in diagnostics. Classification of enzymes.</i></p>

	<p>6. Michaelis-Menten kinetics of enzymatic reaction and allosteric enzyme kinetics. Regulation of enzyme activity. Types of inhibition with examples of inhibitors used in medicine.</p> <p>7. Water- and fat-soluble vitamins - structure and importance in metabolic processes. The structure of coenzymes and functions of coenzymes in enzymatic reactions.</p> <p>8. The role of enzymes in the digestion of carbohydrates, lipids, proteins and nucleic acids. Composition and role of digestive juices. The role of bile acids in the process of digestion. Enterohepatic circulation of bile acids. Molecular mechanisms of absorption of digestive products.</p> <p>9. Classification of carbohydrates, examples of biologically important mono-, di-, and polysaccharides. Glucosaminoglycans and glycoproteins - structure, examples, functions in the body.</p> <p>10. Saturated and unsaturated fatty acids, their nomenclature and structure. Simple and complex lipids - examples, structure, function. Cholesterol structure. Cholesterol derivatives and their role in the body.</p> <p>Seminars:</p> <ol style="list-style-type: none"> 1. Disturbed protein synthesis and structure in the pathogenesis of selected diseases. 2. The importance of enzymes in the diagnosis of selected diseases. Enzymes as a target of pharmacotherapy. <p>Tutorials:</p> <ol style="list-style-type: none"> 1. Qualitative analysis of amino acids and proteins. 2. Quantitative analysis of proteins. 3. Qualitative and quantitative analysis of blood components. 4. Enzyme kinetics. 5. Qualitative and quantitative analysis of selected vitamins. 6. Selected properties of digestive juices. 7. Selected properties of monosaccharides. 8. Revision. 														
Literature	<p>1) Leading textbook: Rodwell VW, Bender D, Botham KM, Kennelly PJ, Weil PA. <i>Harpers Illustrated Biochemistry, 30th Edition, McGraw-Hill Medical 2015 (or 31th Edition, 2018)</i></p> <p>2) Supplementary handbooks: Lieberman M, Peet A. <i>Marks' Basic Medical Biochemistry. A Clinical Approach, 5th Edition, Wolters Kluwer 2018</i> Ferrier DR. <i>Lippincott Illustrated Reviews: Biochemistry, 7th Edition, Wolters Kluwer 2017</i> Ronner P. <i>Netter's Essential Biochemistry, Elsevier 2018</i></p>														
Assessment methods and criteria	<p>1. Intrasemester test (MCQ): W1, W4-W13, U1-U2, K1 In the case of the intrasemester test, the points obtained are converted into grades according to the following scale:</p> <table border="1" data-bbox="598 1691 1021 1937"> <thead> <tr> <th>% points</th> <th>Grade</th> </tr> </thead> <tbody> <tr> <td>92-100</td> <td>Very good</td> </tr> <tr> <td>84-91</td> <td>Good plus</td> </tr> <tr> <td>76-83</td> <td>Good</td> </tr> <tr> <td>68-75</td> <td>Satisfactory plus</td> </tr> <tr> <td>56-67</td> <td>Satisfactory</td> </tr> <tr> <td>0-55</td> <td>Fail</td> </tr> </tbody> </table> <p>2. Oral or written answer (evaluation of active participation and preparation for the classes): W1-W13, U1-U4, K1. In order to pass the student must get a minimum of 60% of the points from the answer.</p>	% points	Grade	92-100	Very good	84-91	Good plus	76-83	Good	68-75	Satisfactory plus	56-67	Satisfactory	0-55	Fail
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	<p><i>In the case of an oral or written answer to the assessment of the learning outcomes achieved by the student, the following criteria are applied:</i></p> <ul style="list-style-type: none"> - <i>credit in the case when: the student knows the basic issues and has mastered the program minimum, understands the questions asked, presents his knowledge in a logical and systematic way, can practically apply the acquired knowledge;</i> - <i>failure to pass if: the student has not mastered the program minimum, does not understand the questions, provides answers not on the subject, does not properly use the basic vocabulary, can not practically apply the acquired knowledge.</i> <p><i>3. Focused observation of the student's activity while performing practical tasks: U1-U4.</i> <i>In order to pass the student must get a minimum of 60% of points for a properly completed activity.</i></p> <p><i>4. Report: W1-W13, U1-U4, K1.</i> <i>In order to pass the student must get a minimum of 60% of points for the presented report on the tutorials.</i></p> <p><i>5. Oral presentation: W1-W13, K1.</i> <i>In order to pass the student must get a minimum of 60% of points for the presentation.</i></p> <p><i>6. Activity – extended observation: K1.</i> <i>In order to pass the student must get a minimum of 50%.</i></p>
Work placement	<i>not applicable</i>

B. Description of the course within the period of instruction

[Filled out by teacher/course coordinator except for the following fields marked in blue:

- 1) period of instruction,*
- 2) form of assessment of course completion in the period of instruction,*
- 3) form(s) of classes, number of hours and completion assessment methods,*
- 4) name of course coordinator in the period of instruction,*
- 5) names of persons managing student groups for the course,*
- 6) course attributes,*
- 7) course groups including description and limit to the number of students within the groups,*

Field name	Komentarz
Period of instruction	<i>Year I, semester I - winter semester</i>
Form of assessment of course completion in the period of instruction	<i>ungraded credit</i>
Form(s) of classes, number of hours and completion assessment methods	<i>Lectures:30 hours, ungraded credit</i> <i>Seminars: 6 hours, ungraded credit</i> <i>Tutorials: 24 hours, ungraded credit</i>
Name of course coordinator in the period of instruction	<i>Karolina Szewczyk-Golec, PhD, Associate Professor</i>
Names of persons managing student groups for the course	<i>Karolina Szewczyk-Golec, PhD, Daria Kupczyk, PhD, Rafał Bilski, MSc</i>

Course attributes	Obligatory subject
Course groups including description and limit to the number of students within the groups	<i>Lectures for the whole year Seminar groups up to a maximum of 24 students Tutorial groups up to a maximum of 12 students</i>
Time and place of classes	<i>dates and places of classes are specified by the Department of Didactics of Collegium Medicum tutorials and seminars: lab classes at the Department of Biology and Medical Biochemistry of CM UMK</i>
Learning outcomes defined for a given form of classes within the course	<p><i>Lecture:</i></p> <p><i>W1: knows the structure of amino acids and their physical and chemical properties - B K_W10</i></p> <p><i>W2: knows the structure of carbohydrates and their physical and chemical properties - B K_W10</i></p> <p><i>W3: knows the structure of lipids and their function at the cellular and extracellular levels - B K_W11</i></p> <p><i>W4: knows the structure of polysaccharides and their function at the cellular and extracellular levels - B K_W11</i></p> <p><i>W5: characterizes I-, II-, III- and IV structures of proteins- B K_W12</i></p> <p><i>W6: knows the post-translational and functional modifications of the protein and their importance - B K_W12</i></p> <p><i>W7: characterizes proteins participating in chromatin structure - B K_W13</i></p> <p><i>W8: describes the role of enzymes and vitamins in metabolic processes - B K_W15</i></p> <p><i>W9: knows the regulatory mechanisms of metabolic processes - B K_W15</i></p> <p><i>W10: describes the effect of proper diet, digestion processes and absorption on the course of metabolic pathways - B K_W15</i></p> <p><i>W11: describes antioxidant function of vitamins - B K_W17</i></p> <p><i>W12: describes the role of blood in maintaining the body's water-electrolyte balance – B K_W01</i></p> <p><i>W13: characterizes the participation of blood buffers in maintaining body homeostasis – B K_W02</i></p> <p><i>U2: determines the pH of the solution and the effect of pH changes on the properties of proteins and carbohydrates - B K_U05</i></p> <p><i>K1: is aware of the limitations of its knowledge and the need for its constant supplementing - K_K01</i></p> <p><i>Seminar:</i></p> <p><i>W1: knows the structure of amino acids and their physical and chemical properties - B K_W10</i></p> <p><i>W2: knows the structure of carbohydrates and their physical and chemical properties - B K_W10</i></p> <p><i>W3: knows the structure of lipids and their function at the cellular and extracellular levels - B K_W11</i></p> <p><i>W4: knows the structure of polysaccharides and their function at the cellular and extracellular levels - B K_W11</i></p> <p><i>W5: characterizes I-, II-, III- and IV structures of proteins- B K_W12</i></p> <p><i>W6: knows the post-translational and functional modifications of the protein and their importance - B K_W12</i></p> <p><i>W7: characterizes proteins participating in chromatin structure - B K_W13</i></p> <p><i>W8: describes the role of enzymes and vitamins in metabolic processes - B K_W15</i></p>

	<p>W9: knows the regulatory mechanisms of metabolic processes - B K_W15</p> <p>W10: describes the effect of proper diet, digestion processes and absorption on the course of metabolic pathways - B K_W15</p> <p>W11: describes antioxidant function of vitamins - B K_W17</p> <p>W12: describes the role of blood in maintaining the body's water-electrolyte balance – B K_W01</p> <p>W13: characterizes the participation of blood buffers in maintaining body homeostasis – B K_W02</p> <p>K1: is aware of the limitations of its knowledge and the need for its constant supplementing - K_K01</p> <p>Tutorial:</p> <p>W1: knows the structure of amino acids and their physical and chemical properties - B K_W10</p> <p>W2: knows the structure of carbohydrates and their physical and chemical properties - B K_W10</p> <p>W3: knows the structure of lipids and their function at the cellular and extracellular levels - B K_W11</p> <p>W4: knows the structure of polysaccharides and their function at the cellular and extracellular levels - B K_W11</p> <p>W5: characterizes I-, II-, III- and IV structures of proteins- B K_W12</p> <p>W6: knows the post-translational and functional modifications of the protein and their importance - B K_W12</p> <p>W7: characterizes proteins participating in chromatin structure - B K_W13</p> <p>W8: describes the role of enzymes and vitamins in metabolic processes - B K_W15</p> <p>W9: knows the regulatory mechanisms of metabolic processes - B K_W15</p> <p>W10: describes the effect of proper diet, digestion processes and absorption on the course of metabolic pathways - B K_W15</p> <p>W11: describes antioxidant function of vitamins - B K_W17</p> <p>W12: describes the role of blood in maintaining the body's water-electrolyte balance – B K_W01</p> <p>W13: characterizes the participation of blood buffers in maintaining body homeostasis – B K_W02</p> <p>U1: calculates molar and percentage concentrations of diluted solutions - B K_U03</p> <p>U2: determines the pH of the solution and the effect of pH changes on the properties of proteins and carbohydrates - B K_U05</p> <p>U3: uses qualitative analysis, titration, colorimetry, pH-parameters, analyzes and interprets the results obtained - B K_U09</p> <p>U4: uses analytical balance, spectrophotometer, pH-meter and evaluates the accuracy of measurements – B K_U10</p> <p>K1: is aware of the limitations of its knowledge and the need for its constant supplementing - K_K01</p>
<p>Assessment methods and criteria for a given form of classes within the course</p>	<p>Lecture:</p> <ol style="list-style-type: none"> 1. Intrasemestral test (MCQ) (>60%): W1, W4-W13, U2, K1. 2. Extended observation (>50%): K1. <p>Seminar:</p> <ol style="list-style-type: none"> 1. Oral or written answer (>60%): W1-W13, K1. 2. Oral presentation (>60%) :W1-W13, K1. 3. Extended observation (>50%): K1. <p>Tutorial:</p> <ol style="list-style-type: none"> 1. Intrasemestral test (MCQ) (>60%): W1, W4-W13, U1-U2, K1. 2. Oral or written answer (>60%): W1-W13, K1.

	<p>3. Focused observation of the student's activity while performing practical tasks (>60%): U1-U4. 4. Report (>60%): W1-W13, U1-U4, K1. 5. Extended observation (>50%): K1.</p> <p>In the case of the intrasemestral test, the points obtained are converted into grades according to the following scale:</p> <table border="1" data-bbox="630 414 1050 660"> <thead> <tr> <th>% points</th> <th>Grade</th> </tr> </thead> <tbody> <tr> <td>92-100</td> <td>Very good</td> </tr> <tr> <td>84-91</td> <td>Good plus</td> </tr> <tr> <td>76-83</td> <td>Good</td> </tr> <tr> <td>68-75</td> <td>Satisfactory plus</td> </tr> <tr> <td>56-67</td> <td>Satisfactory</td> </tr> <tr> <td>0-55</td> <td>Fail</td> </tr> </tbody> </table> <p>In the case of an oral or written answer to the assessment of the learning outcomes achieved by the student, the following criteria are applied: - credit in the case when: the student knows the basic issues and has mastered the program minimum, understands the questions asked, presents his knowledge in a logical and systematic way, can practically apply the acquired knowledge; - failure to pass if: the student has not mastered the program minimum, does not understand the questions, provides answers not on the subject, does not properly use the basic vocabulary, can not practically apply the acquired knowledge.</p> <p>In order to receive the credit for the course the student must obtain positive results from two intrasemestral tests and a positive assessment in the field of social competences (the appropriate number of points from all assessed criteria).</p>	% points	Grade	92-100	Very good	84-91	Good plus	76-83	Good	68-75	Satisfactory plus	56-67	Satisfactory	0-55	Fail
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92-100	Very good														
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76-83	Good														
68-75	Satisfactory plus														
56-67	Satisfactory														
0-55	Fail														
Course content	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Amino acids and peptides. 2. Structure and synthesis of proteins. 3. Relationships between protein structure and its function. 4. Blood functions. 5. Enzyme - structure and properties. 6. Kinetics of enzymatic reaction. 7. Water- and fat-soluble vitamins. 8. The role of enzymes in digestion process. 9. Classification of carbohydrates. 10. Lipid classification. <p>Seminars:</p> <ol style="list-style-type: none"> 1. Disturbed structure of proteins in the pathogenesis of selected diseases. 2. Enzymes in diagnosis and treatment. <p>Tutorials:</p> <ol style="list-style-type: none"> 1. Qualitative analysis of amino acids and proteins. 2. Quantitative analysis of proteins. 3. Qualitative and quantitative analysis of blood components. 4. Enzyme kinetics. 5. Qualitative and quantitative analysis of selected vitamins. 6. Selected properties of digestive juices. 7. Selected properties of monosaccharides. 8. Revision. 														
Teaching methods	<p>Lecture: expository teaching methods - informative (traditional) lecture with multimedia presentation, problem-based teaching methods - discussion method</p>														

	<p><i>seminar:</i> <i>expository teaching methods - a talk, problem-based teaching methods - classic problem method, discussion method, case method, discovery teaching methods - project method</i></p> <p><i>tutorial:</i> <i>expository teaching methods - explanation, problem-based teaching methods – classic problem method, didactic discussion, discovery teaching methods - laboratory practicals, practical exercises, demonstration</i></p>
Literature	<i>The same as in part A</i>