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| Module name | **Laboratory Techniques** |
| Module code | B-BT.033 |
| ISCED code | 0511: Biology |
| Study cycle | Io |
| Semester | winter semester |
| Responsible for this module  | Part I: Dr. hab. Iwona Komaniecka (ikoma@hektor.umcs.lublin.pl tel.: 81 537 5981)Part II: Dr. Leszek Wawiórka (mniak11@hektor.umcs.lublin.pl)  |
| Language of instruction | English |
| Website | - |
| Prerequisites | Completed course of biochemistry, genetics, analytical and organic chemistry |
| ECTS | 6.5 |
| ECTS points hour equivalents | Contact hours (work with an academic teacher): 60Total number of hours with an academic teacher: 100Number of ECTS points with an academic teacher: 3.3Non-contact hours (students' own work): 60Total number of non-contact hours: 95Number of ECTS points for non-contact hours: 3.2**Total number of ECTS points for the module 6.5** |
| Educational outcomes verification methods | Written test questionsContinuous assessment of labs |
| Description | The module covers the knowledge in the area of: **Part I** 1. Spectrophotometry and statistical analysis of results
2. Refractometry and polarimetry
3. Chromatography – I. Quality analysis
4. Chromatography – II. Quantity analysis
5. Mass spectrometry
6. Nuclear magnetic resonance (NMR)
7. Mass spectrometry and NMR spectroscopy training.

**Part II**1. Methods of cell disruption
2. Cell fractionation, differential centrifugation
3. Protein precipitation and dialysis
4. Measurement of DNA and protein concentration
5. DNA and protein gel electrophoresis
6. Methods of protein staining after electrophoresis
7. Immunodetection of proteins
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| Reading list | **Part I**1. Handbooks of Analytical chemistry and Biochemistry.
2. R. M. Silverstrein, F. X. Webster, D. J. Kiemle: Spectrometric identification of organic compounds. Seventh edition. John Wiley & Sons, 2005.
3. H. G. Garg, M. K. Cowman, Ch. A. Hales: Carbohydrate chemistry, biology and medical applications. Elsevier, 2008

**Part II**1. Articles from prestigious journals recommended  by teacher |
| Educational outcomes | **KNOWLEDGE**1. Student has an awareness of the knowledge development, particularly in the field of experimental biology combined with an improvement of research techniques.
2. Student knows the basic laws of physics and physical chemistry, and can apply them to interpret the processes occurring in living organisms and their environment.
3. Student knows the basic instruments and analytical techniques used in life science.

**SKILLS**1. Student can apply the basic experimental instruments and techniques in the field of biological sciences.
2. Student can perform simple analyses of biological material, can make evaluations and diagnoses of experiments, and is able to plan simple analytical and/or preparative procedures.
3. Student applies mathematical and statistical methods to describe the biological phenomena, to analyze experiments and to elaborate obtained data.
4. Student is able to draw correct conclusions from experiments and observations that have been carried out.

**ATTITUDES**1. Student shows the active attitude to gain, complete and actualize the biological knowledge.
2. Student is conscious of responsibility for its own safety and the safety of the workplace during experiments, as well as he works safety with instruments, chemicals and biological materials.
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| Practice | not concerns |

**Information about classes in the cycle**

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| Website |  |
| Educational outcomes verification methods | Written test questions Continuous assessment of labs |
| Comments | The classes are carried out by 5 persons, in room 19A, in laboratories of Department of Genetics and Microbiology (GC-MS) and in the room 217A.  |
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| A list of topics | **Part. I:**1. Spectrophotometry: Beer’s law; transition of electrons during absorption of the light; absorption of colored substances; transmittance. Basic statistics: arithmetic mean, standard deviation; statistical data processing.2. Refractometry and polarimetry: Snellius laws; refraction index; optical rotation of polarized light; examples of optically active substances.3a and 3b. Chromatography: definition of chromatography; mobile and stationary phases in chromatography; retention time – definition; dead volume, dead time; methods of qualitative and quantitative analyzes in gas chromatography; dosing of the samples in GC; equipment in gas chromatography.4. Mass spectrometry: MS applications; parts of the mass spectrometer; types of MS analyzers and mechanisms of substance ionization; types of MS detectors and their characterization.5. Nuclear magnetic resonance spectroscopy: applications; nuclei used in NMR; chemical shift definition and units; reference substances; sample solvents; 1D and 2D experiments; MRI techniques of imaging. 6. Training with MS and NMR spectra of simple and complex organic compounds.**Part II**: 1. Methods of cell disruption: sonication, enzymatic digestion, detergent lysis, Dounce homogenization.
2. Cell fractionation, differential centrifugation: theory, sample preparation, applications.
3. Protein precipitation and dialysis: theory, Hofmeister series, ammonium sulfate precipitation, applications.
4. Measurement of DNA and protein concentration: Spectrophotometry of nucleic acids, Beaven and Holiday method, Granum method, Bradford method.
5. DNA and protein gel electrophoresis: theory, agarose gel electrophoresis, SDS-PAGE, Native- PAGE, applications.
6. Staining of proteins: Coomassie Brilliant Blue, silver staining, fluorescent staining.
7. 7. Immunodetection of proteins: theory, applications.
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| Teaching methods | Laboratory experiments; discussion; conversational lecture |
| Assessment methods | Written test questions (50% + 1 correct answer) |