# COURSE/MODULE SYLLABUS

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| **Course/Module Title** | Physical Methods in Biology |
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| **Lecturer/Lecturers** | Tamaz Mdzinarashvili, PhD (Doctor of Science) in Physics<br>Full Professor Faculty of Exact and Natural Sciences, TSU<br>phone: 2250149; 577213062.e-mail: tamaz.mdzinarashvili@tsu.ge |
| **Course/Module Type** | For PhD students |
| **Course/Module Aims** | Students will get information some feature about biological objects and they inquire working principles presented physical methods, which offen apply in biology. The presented methods give us possibility to determine not only the structure of biomolecules, as well as measured energetics of structural organisation of biomolecules. Lectures give information about working principles each methods and how measured result reflection on the biological object. |
| **ECTS** | 5 ECTC<br>45/80 ( contact hours/independent work hours)<br>*Contact hours:*<br>Lectures – 1 x 2hrs = 30 hrs;<br>Seminars: 1 x 1 hrs = 15 hrs<br>In total: 45 hrs<br>*Independent hours:*<br>Preparation for lectures and seminars: 40 hrs<br>Preparation for midterm exams: 15 hrs<br>Preparation for final exam: 25 hrs<br>In total: 80 hrs<br>45 hrs + 80 hrs = 125 hrs ( 1 ECTS = 25 hrs)<br>125 : 25 = 5 ECTS |
| **Pre-Requisites** | None |
| **Learning outcomes** | Students get knowledge about the physical methods which usable in biophysical Lab for characterize biologycal objects. They will be know those physical approaches, which lie in fundamentals each methods. |
| Evaluation Criteria | Attendance and interactive activity on lectures 10%<br>Seminar 30%<br>Coloqium 20%<br>Final Exam 40%<br>Final Evaluation 100% |
| **Course/Module Outline** | For course/module content details see appendix |
| **Teaching and Learning Methods** | *Lectures (30)/seminars (15)*<br>**Teaching and learning methods according to classification version A**<br>verbal and oral method<br>working on the book<br>written method |

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| | demonstrational method ( video presentations)<br>**Teaching and learning methods according to classification version B**<br>collaborative work<br>discussion/debates<br>practice-oriented study |
| **Compulsory learning sources** | See lecture notes (be attached)<br>1. Privalov P.L. and Dragan A.I. Microcalorimetry of Biologycal Macromoplecules. Biophysical Chemistry 126, 16-24 (2007). (Rev. DSC)<br>2. Cooper, A. Biophysical Chemistry Royal Society of Chemistry, 2011. Book. (Pp.DSC 117-138);(Picnometer - Partial volume and Density pp. 93-97); (viscosity pp.106- 110.)<br>3. Stafford, W. F. and Schuster T.M. Introduction to Biophysical Methods for Protein and Nucleic Acid Research. Edited by Jay A. Glasel, Murray P. Deutscher. Chapter 3. 1995. Book Viscosity (142-143), Ultracentrifugation (119-129), Capillary Electrophoresis (100-102):<br>4. Fraeifelder D. Physical Biochemistry. Applications to Biochemistry and Molecular Biology. Book. (1982) (specdtroscopy)<br>5. Miller F.M., Vandome A.F., McBrewster John. Henderson-Hasselbalch Equation. Book. 2010. |

**Appendix**

**Course/Module Content**

| N | Lecture/seminar Topic | Literature |
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| 1 | Water in biomacromolecules. Henderson-Hasselbalch equation. pK of Aminoacids.<br>**Seminar** on lecture topic. | Lecture notes.<br>[5] |
| 2 | Concentrations Based on the Volume of Solvent. Ionization of Water.<br>**Seminar** on lecture topic. | Lecture notes<br>[1] [5] |
| 3 | pH and pOH. Weak Acids and Bases. Buffers.<br>**Seminar** on lecture topic. | Lecture notes.<br>[5] |
| 4 | Fundaments of Absorption Spectrophotometry. Theory. Instrumentation.<br>**Seminar** on lecture topic. | Lecture notes.<br>[4] |
| 5 | Applications of spectrophotometry for the main biomacromolecules (proteins, DNA ).<br>**Seminar** on lecture topic. | Lecture notes.<br>[4] |
| 6 | Factors Affecting Absorption. Variations in Spectrophotometry.<br>**Seminar** on lecture topic. | Lecture notes.<br>[5] |
| Interim Assessment - Colloquium ( on Lecture 1-6 material) | | |
| 7 | Thermodynamics Laws. Main parameters of thermodynamics<br>Seminar on lecture topic. | Lecture notes.<br>[4] |
| 8 | Lecture: Chemical potential. The Van 't Hoff equation. | Lecture notes. |
| 9 | Lecture: Two-state folding of protein. Multi-step processes.<br>on lecture topic. Folding nucleus. Molten Globule State of Proteins. | Lecture notes.<br>[1 [2] |

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| | Seminar on lecture topic. | |
| 10 | Lecture: Determinattion Heat Capacity of Liquids in Temperature Broad Range (Principe of calorimeter works).<br>Seminar on lecture topic. | Lecture notes.<br>[1] [2] |
| 11 | Lecture: Calculation Heat Capacity from Calorimeter carve.<br>Seminar on lecture topic. | Lecture notes.<br>[1] [2] |
| 12 | Lecture: Pycnometric Method Pycnometric Method. Calculation of Parcial Molar Volume of Molecules<br>Seminar on lecture topic. | Lecture notes.<br>[3] [4] |
| 13 | Lecture: Viscosimetry Method for Determine Hydrodynamic Properties of Biomacromolecules.<br>Seminar on lecture topic. | Lecture notes.<br>[2] [3] |
| 14 | Lecture: Instrumentation. Applications viscosimetry methods for the main biomacromolecules (proteins, DNA<br>Seminar on lecture topic | Lecture notes.<br>[2] [3] |
| 15 | Final Exam | |