

DESCRIPTION/Syllabi of Curricula/Module

| Short Name of the University/Country code Date (Month / Year) | PSTU Ukraine Sep 2019 |
|--|--------------------------|
| TITLE OF THE MODULE | Code |
| Regenerative medicine and biotechnology in orthopedics | |

| Teacher(s) | Department |
|--|--------------------------------------|
| Coordinating: Prof. Azarkhov A.Yu Others: | Department of Biomedical Engineering |

| Study cycle (BA/MA) | Level of the module (Semester number) | Type of the module (compulsary/elective) |
|------------------------|--|---|
| BA | 8th semester | Compulsary |

| Form of delivery (theory/lab/exercises) | Duration (weeks/months) | Language(s) |
|--|----------------------------|-------------|
| Lectures, Practical classes | 18 weeks | Ukrainian |

| Prerequisites | |
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| Prerequisites: Knowledge: Basic knowledge of physics, chemistry, biology. Skills: Ability to search information in the Internet. Competences: None | Co-requisites (if necessary): Students should have skills to work in basic computer software. |

| ECTS (Credits of the module) | Total student workload hours | Contact hours | Individual work hours |
|---|--|--|-----------------------|
| 4 | 120 | 44 | 76 |
| Aim of the module (course unit): competences foreseen by the study programme | | | |
| The main aim of studying the course is to provide students with basic knowledge about the use of molecular and cellular mechanisms to restore the structures and functions of the body, which is the fundamental basis of medicine of the future, designed to rid mankind of many diseases. | | | |
| Learning outcomes of module (course unit) | Teaching/learning methods (theory, lab, exercises) | Assessment methods (written exam, oral exam, reports) | |
| <p>Knowledge:</p> <p>Knowledge of the basics of regenerative medicine,</p> <p>Knowledge of the basics of the field and possible clinical applications and clinical utility of regenerative medicine;</p> <p>Knowledge of the principles of tissue engineering,</p> <p>Knowledge of the basics of stem cells;</p> <p>Knowledge of the basics of tissue fabrication and microfabrication clinical need for tissue repair.</p> | Work with the lecture notes as well as on the available fundamental subject literature | Knowledge test | |
| <p>Skills:</p> <p>Selection of regulatory molecules and identification of molecular targets to stimulate the body's endogenous regenerative potential;</p> <p>Search, analysis and use of innovative ideas in the field of application of regenerative medicine;</p> <p>Ability to work with educational and scientific literature, using the capabilities of computer networks;</p> <p>Ability to aggregate information on a specific topic and disseminate the information received.</p> | Lectures, labs, project, consultation | Active attendance on lectures, individual/group project and presentation | |
| <p>Competences:</p> <p>Basics of therapeutic application of stem cells;</p> <p>Principles of cellular and tissue therapy;</p> <p>Principles of gene therapy and its application;</p> | Lectures, project, consultation | Individual/group project and presentation | |

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| Principles of medical engineering; Basics of tissue engineering; Basics of molecular mechanisms of regulation of cell differentiation, migration and proliferation; Basics of proteomic research; Fundamentals of biomaterials and 3D bioprinting technologies. | | |
|---|--|--|

| Themes | Contact work hours | | | | | | Time and tasks for individual work | | Tasks |
|---|--------------------|---------------|----------|----------------|-----------------|------------|------------------------------------|-----------------|---|
| | Lectures | Consultations | Seminars | Practical work | Laboratory work | Placements | Total contact work | Individual work | |
| Topic 1. Introduction to regenerative medicine. | 2 | | | | | | 2 | 4 | Study of theoretical material/case study/ presentations |
| Topic 2. Medical embryology. The concept of stem cell. Hierarchy, classification of stem cells. Embryonic and fetal stem cells. | 2 | | | 4 | | | 6 | 10 | Study of theoretical material/case study/ presentations |
| Topic 3. Medical embryology, histo- and organogenesis. Mechanisms of histogenesis. Stem cell differentiation. Cell type. | 2 | | | 2 | | | 4 | 6 | Study of theoretical material/case study/ presentations |
| Topic 4. Cell and nuclear reprogramming. Methods of genetic modification of cells. | 4 | | | | | | 4 | 6 | Study of theoretical material/case study/ presentations |
| Topic 5. Cell transplantology. | 4 | | | | | | 4 | 8 | Study of theoretical material/case study/ presentations |

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| Principles of cell transplantation. Target organs, methods of delivery and monitoring of regeneration. | | | | | | | | | |
| Topic 6. Molecular basis of humoral and cellular immunity. Molecules of the major histocompatibility complex. Genotyping by HLA markers. Rejection. | 4 | | | | | | 4 | 10 | Study of theoretical material/case study/ presentations |
| Topic 7. Therapeutic cloning. SCNT. Biomatrices. Artificial organs. | 2 | | | 2 | | | 4 | 8 | |
| Topic 8. Cell therapy in autoimmune diseases. | 2 | | | 2 | | | 4 | 6 | |
| Topic 9. Cell therapy in diseases of the cardiovascular system. | 2 | | | 2 | | | 4 | 6 | |
| Topic 10. Cell therapy in the treatment of diseases of the internal organs, musculoskeletal system and nervous system. | 2 | | | 2 | | | 4 | 6 | |
| Topic 11. Cell and tissue engineering. | 2 | | | 2 | | | 4 | 6 | |
| Total | 28 | | | 16 | | | 44 | 76 | |

| Assessment strategy | Weight in % | Deadlines | Assessment criteria |
|--|-------------|---|---------------------|
| Individual or group final project referred during seminars | 50 | 3 th - 17 th week | Project |
| Final exam | 50 | 18 th week | Test |

| Author | Year of issue | Title | No of periodical or volume | Place of printing. Printing house or internet link |
|--|---------------|---|----------------------------|--|
| Compulsory literature | | | | |
| Asok Mukhopadhyay | 2017 | Regenerative Medicine: Laboratory to Clinic | | Springer |
| Phuc Van Pham | 2017 | Bone and Cartilage Regeneration | | Springer |
| Masoud Mozafari, Jayakumar Rajadas, David Kaplan | 2018 | Nanoengineered Biomaterials for Regenerative Medicine | | Elsevier |
| Additional literature | | | | |
| Kursad Turksen | 2015 | Bioprinting in Regenerative Medicine | | Springer |
| Sean V. Murphy, Anthony Atala, | 2016 | Regenerative Medicine Technology: On-a-Chip Applications for Disease Modeling, Drug Discovery and Personalized Medicine | | CRC Press |
| Dr. Inamuddin, Abdullah M. Asiri, Ali Mohammad | 2018 | Applications of Nanocomposite Materials in Orthopedics | | Woodhead Publishing |