National University of Science and Technology
Politehnica Bucharest

Faculty of Engineering in Foreign Languages

Master program: Biomaterials for Tissue Engineering (chemical engineering), 2024-2028

Program coordinator: Prof.Dr.Ing. Alexandru Mihai GRUMEZESCU email: agrumezescu@upb.ro

CONTENT OF THE LECTURES

Ist YEAR

I Year, 1st Semester

No.	Code of the discipline	Name of the discipline	Number of ECTS	Hours per week					Form of evaluation
				C	**S**	**L**	**P**	**C/P**	
1	UPB.12.S.M1.I.901	Biomateriale avansate/Advanced biomaterials	4	2	0	0	0	0	E
2	UPB.12.S.M1.I.902	Biologie celulară și tisulară/Cell and tissue biology	4	2	0	2	0	0	E
3	UPB.12.A.M1.I.903	Celule stem și medicină regenerativă/Stem cells and regenerative medicine	4	1	0	2	0	0	E
4	UPB.12.A.M1.I.904	Nanomedicine: from concept to current and emerging applications/Nanomedicina: de la concept la aplicații curente și emergente	4	2	0	1	0	0	E
5	UPB.12.A.M1.I.905	Nanobiomateriale pentru ingineria tisulară/Nanobiomaterials for tissue engineering	4	2	0	0	0	0	E
6	UPB.12.A.M1.I.906	Practică de cercetare/Research practice	10					10	V

Advanced Biomaterials

Professor: Alexandru Mihai Grumezescu

Course Content: The "Advanced Biomaterials" course delves into the intricate properties, design, and applications of biomaterials in the realm of tissue engineering. Students will explore various classes of biomaterials, including polymers, ceramics, metals, and composites, understanding their unique properties and suitability for different biomedical applications. Key topics include biocompatibility, biodegradability, bioactivity, and the mechanical properties of biomaterials. The course also covers the latest advancements in biomaterials research, such as smart materials, nanomaterials, and bioactive materials that can interact with biological systems to promote healing and regeneration. Additionally, students will learn about the synthesis, surface modification, and functionalization of biomaterials, as well as the techniques used to characterize their structural and functional properties. Case studies and real-world examples will illustrate the application of biomaterials in medical devices, drug delivery systems, and tissue engineering scaffolds.

Applications: This course does not include specific laboratory applications.

Cell and Tissue Biology

Professor: Anca Hermenean

Course Content: This course provides an in-depth understanding of the cellular and molecular mechanisms that underpin tissue structure and function. Students will explore the organization and function of cells and tissues, cell signaling pathways, and the regulation of the cell cycle. Topics include the extracellular matrix and its role in tissue integrity, the mechanisms of cell adhesion, and the processes of cell differentiation and tissue morphogenesis. The course also covers advanced microscopy techniques, such as light microscopy, fluorescence microscopy, confocal microscopy, scanning electron microscopy (SEM), and transmission electron microscopy (TEM), to study cell and tissue morphology. Additionally, students will learn about histological methods and the application of immunohistochemistry to identify specific proteins and cellular

components.

Applications: The laboratory sessions start with an introduction to the laboratory environment, emphasizing safety aspects and an overview of the progress and assessment of practical works. Students will be introduced to various microscopy techniques, including light microscopy, fluorescence microscopy, confocal microscopy, scanning electron microscopy (SEM), and transmission electron microscopy (TEM). Histology techniques will be presented, with practical applications involving H&E staining, trichrome staining, and Alcian Blue staining. Immunohistochemistry techniques will also be covered, with practical applications focusing on the expression of mucins and cytoskeleton proteins.

Stem Cells and Regenerative Medicine

Professor: Florin Iordache

Course Content: The "Stem Cells and Regenerative Medicine" course focuses on the biology, therapeutic potential, and clinical applications of stem cells. Students will learn about different types of stem cells, including embryonic stem cells, adult stem cells, and induced pluripotent stem cells (iPSCs). The course covers the principles of stem cell isolation, cultivation, and differentiation, as well as the molecular mechanisms that regulate these processes. Topics include the use of stem cells in tissue regeneration, disease modeling, and drug screening, as well as the ethical and regulatory considerations in stem cell research. The course also discusses the latest advancements in regenerative medicine, including tissue engineering, gene therapy, and the development of bioartificial organs.

Applications: The laboratory component includes a thorough presentation of safety procedures specific to the laboratory environment. Students will gain hands-on experience in the isolation and cultivation of stem cells from bone marrow and peripheral blood, as well as amniotic fluid. The laboratory exercises will cover various types of cell cultures, the process of cell trypsinization, and the techniques for cell passage. Students will learn the methods for freezing and thawing stem cells, including the media and methods for freezing animal cells. The characterization of stem cells will be explored through microscopy to observe different cell morphologies, specific histological stains, and cell proliferation assays. Additionally, the immunophenotypic characterization of stem cells using flow cytometry and cell cycle analysis will be conducted.

Nanomedicine: From Concept to Current and Emerging Applications

Professor: Adrian Volceanov

Course Content: This course explores the principles and applications of nanotechnology in the medical field. Students will learn about the design, synthesis, and characterization of nanostructured materials used in medical imaging, tissue regeneration, and drug delivery systems. Topics include the unique properties of nanomaterials, such as size, surface area, and reactivity, that make them suitable for biomedical applications. The course also covers the methods of functionalizing nanomaterials to target specific cells or tissues, the mechanisms of nanoparticle uptake and distribution in the body, and the potential toxicological effects of nanomaterials. Case studies will highlight the use of nanomedicine in cancer therapy, imaging, and regenerative medicine.

Applications: Laboratory sessions for this course involve the compositional design and manufacturing of nanostructured materials for medical imaging, tissue regeneration, and drug delivery systems. Students will perform advanced characterization of these systems using techniques such as X-ray diffraction, FTIR spectroscopy, SEM and TEM electron microscopy, and laser granulometry. The properties of the materials, including density, porosity, and absorption characteristics, will be analyzed. The stability of the materials will be evaluated through chemical stability studies over time, and their bioactivity will be tested in vitro. The release profiles of drugs from the nanomaterials will also be determined.

Nanobiomaterials for Tissue Engineering

Professor: Anton Ficai

Course Content: This course delves into the use of nanobiomaterials for tissue engineering applications. Topics include the synthesis and functionalization of nanobiomaterials, their interactions with biological systems, and their role in promoting tissue regeneration. Students will learn about various types of nanomaterials, such as nanoparticles, nanofibers, and nanocomposites, and their unique properties that make them suitable for biomedical applications. The course also covers the techniques used to characterize nanobiomaterials, including their mechanical, chemical, and biological properties. Additionally, students will explore the challenges and opportunities in the field of nanobiomaterials, such as

biocompatibility, bioactivity, and the integration of nanomaterials into tissue engineering scaffolds.

Applications: This course does not include specific laboratory applications.

Research Practice

Professor: All teachers involved in this master program

Activity content: Research Practice is designed to provide students with hands-on experience in conducting scientific research. This activity emphasizes the practical aspects of research, guiding students through the entire research process from the initial formulation of research questions to the final presentation of findings. Students will gain essential skills in designing and executing research projects, managing data, and using statistical tools for analysis. Participants will begin by identifying a research problem and conducting a thorough literature review to frame their study within the existing body of knowledge. They will then develop a detailed research proposal, outlining their hypotheses, research design, and methodologies. This includes selecting appropriate qualitative, quantitative, or mixed-method approaches, and understanding the ethical considerations associated with their research. Students will engage in data collection activities, learning various techniques such as surveys, experiments, and observational studies. They will also receive training in data management and the use of software tools for data analysis. The activity focuses on developing competencies in interpreting results and drawing meaningful conclusions from the data. The practical component involves executing the research projects designed during the initial phases. Students will conduct experiments, gather data, and apply statistical methods to analyze their results. This hands-on practice is crucial for developing a deep understanding of the research process and the challenges that researchers face. Throughout the activity, students will present their research progress in regular seminars, receiving constructive feedback from peers and Professors. This iterative process allows for continuous improvement and refinement of their research methods and findings. In the final stages, students will compile their research into a comprehensive report, highlighting their methodologies, findings, and the implications of their work. They will also prepare and deliver presentations of their research to an academic audience, demonstrating their ability to effectively communicate complex information. The culmination of this activity is the development of a robust research skill set, enabling students to conduct independent research and contribute to their field of study with confidence and integrity.

I Year, 2nd Semester

No.	Code of the discipline	Name of the discipline	Number of ECTS	Hours per week					Form of evaluation
				C	S	L	P	C/P	
1	UPB.12.A.M2.I.901	Inginerie moleculară și celulară/Molecular and cellular engineering	4	2	0	2	0	0	E
2	UPB.12.A.M2.I.902	Caracterizarea biomaterialelor prin tehnici avansate/Biomaterials characterization by advanced techniques	4	2	0	1	0	0	E
3	UPB.12.A.M2.I.903	Ingineria țesutului și medicină regenerativă/Tissue engineering and regenerative medicine	4	2	0	1	0	0	E
4	UPB.12.A.M2.I.904	Afecțiuni invalidante ale țesuturilor vii/Debilitating diseases of tissues	4	2	0	0	0	0	E
5	UPB.12.A.M2.I.905	Dispozitive bio-medicale și de protezare/Biomedical devices and prostheses	4	2	0	0	0	0	E
6	UPB.12.A.M2.I.906	Practică de cercetare/Research practice	10					10	V

Molecular and Cellular Engineering

Professor: Florin Iordache

Course Content: The "Molecular and Cellular Engineering" course focuses on the manipulation and engineering of molecular and cellular systems for biomedical applications. Students will learn about the principles of gene editing, synthetic biology, and the development of engineered cell lines for therapeutic purposes. Key topics include CRISPR-Cas9 technology, gene therapy, and the design of synthetic genetic circuits. The course also covers the techniques used in molecular cloning, such as DNA sequencing, PCR, and recombinant DNA technology. Additionally, students will explore the applications of molecular and cellular engineering in drug discovery, regenerative medicine, and biotechnology.

Applications: Laboratory sessions will cover a comprehensive overview of laboratory safety issues and the progress of practical works. Students

will engage in DNA analysis and handling, including DNA purification and recombinant DNA technology. They will learn to identify and select DNA regions of interest using specific software and international databases, and design DNA primers for selected regions, checking in silico specificity of oligonucleotide sequences. Practical skills include DNA cloning, PCR technology, controlled digestion of DNA, in vitro ligation, bacterial transformation, and DNA recombinant cell cloning. Students will also focus on recognizing and analyzing recombinants.

Biomaterials Characterization by Advanced Techniques

Professor: Vasile Adrian Surdu

Course Content: This course provides an in-depth exploration of the advanced techniques used to characterize biomaterials. Students will learn about various analytical methods, including X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Transmission Electron Microscopy (TEM). The course emphasizes the importance of these techniques in understanding the structural and functional properties of biomaterials. Topics include the principles and applications of XRD for studying crystalline structures, SEM for surface morphology and composition analysis, and TEM for high-resolution imaging and electron diffraction studies. The course also covers additional analytical techniques such as EDAX (Energy Dispersive X-ray Analysis) and EELS (Electron Energy Loss Spectroscopy) for chemical analysis.

Applications: In the laboratory, students will receive an introduction to the laboratory environment and safety procedures, followed by hands-on experience with advanced characterization techniques. They will use X-ray Diffraction (XRD) to study the crystal structure of biomaterials, apply Scanning Electron Microscopy (SEM) for surface morphology analysis, and utilize Transmission Electron Microscopy (TEM) for high-resolution imaging. The laboratory work includes the application of analytical techniques such as EDAX for compositional analysis and EELS for chemical analysis. Students will also work with TEM for Selected Area Electron Diffraction (SAED) to perform detailed structural analysis.

Tissue Engineering and Regenerative Medicine

Professor: Alexandru Mihai Grumezescu

Course Content: This course covers the principles and techniques used in tissue engineering and regenerative medicine. Students will learn about

scaffold design, cell culture, and the use of growth factors to promote tissue regeneration. Topics include the selection and fabrication of biomaterials for scaffolds, bioreactor design, and the integration of cells and bioactive molecules into engineered tissues. The course also discusses the clinical applications of tissue-engineered products, such as skin grafts, cartilage repair, and organ regeneration, as well as the regulatory and ethical considerations involved in bringing these products to market. Case studies and real-world examples will illustrate the challenges and successes in the field of tissue engineering.

Applications: The laboratory component involves the preparation of organic, inorganic, and composite scaffolds using conventional methods. Students will be introduced to 3D modeling software and hardware for scaffold design and fabrication. Practical applications include bioimprinting, using magnetic and mechanical stirring techniques, utilizing analytical balance, and applying electrospinning techniques for scaffold production. The laboratory sessions also cover the preparation of scaffolds and the evaluation of their properties for tissue engineering applications.

Debilitating Diseases of Tissues

Professor: Anca Hermenean

Course Content: This course examines the pathophysiology of debilitating tissue diseases, providing insights into the molecular and cellular mechanisms underlying conditions such as cancer, fibrosis, and neurodegeneration. Students will learn about the etiology, progression, and clinical manifestations of these diseases, as well as the current therapeutic strategies and research developments aimed at treating them. Topics include the role of inflammation, genetic mutations, and environmental factors in disease development, as well as the latest advances in targeted therapies,

immunotherapy, and regenerative approaches. The course also covers the impact of these diseases on tissue structure and function, emphasizing the importance of early diagnosis and intervention.

Applications: This course does not include specific laboratory applications.

Biomedical Devices and Prostheses

Professor: Alexandru Mihai Grumezescu

Course Content: The "Biomedical Devices and Prostheses" course covers the design, development, and application of biomedical devices and prostheses. Students will learn about the selection of materials, biocompatibility, mechanical properties, and the integration of devices with biological tissues. The course includes discussions on the engineering principles behind the design of medical devices such as implants, prosthetics, and diagnostic tools. Topics also cover the regulatory and ethical considerations in the development and use of biomedical devices, ensuring they meet safety and efficacy standards. Case studies and examples from the medical field will highlight the challenges and innovations in biomedical device engineering.

Applications: This course does not include specific laboratory applications.

Research Practice

Professor: All teachers involved in this master program

Activity content: Research Practice is designed to provide students with hands-on experience in conducting scientific research. This activity emphasizes the practical aspects of research, guiding students through the entire research process from the initial formulation of research questions to the final presentation of findings. Students will gain essential skills in designing and executing research projects, managing data, and using statistical tools for analysis. Participants will begin by identifying a research problem and conducting a thorough literature review to frame their study within the existing body of knowledge. They will then develop a detailed research proposal, outlining their hypotheses, research design, and methodologies. This includes selecting appropriate qualitative, quantitative, or mixed-method approaches, and understanding the ethical

considerations associated with their research. Students will engage in data collection activities, learning various techniques such as surveys, experiments, and observational studies. They will also receive training in data management and the use of software tools for data analysis. The activity focuses on developing competencies in interpreting results and drawing meaningful conclusions from the data. The practical component involves executing the research projects designed during the initial phases. Students will conduct experiments, gather data, and apply statistical methods to analyze their results. This hands-on practice is crucial for developing a deep understanding of the research process and the challenges that researchers face. Throughout the activity, students will present their research progress in regular seminars, receiving constructive feedback from peers and Professors. This iterative process allows for continuous improvement and refinement of their research methods and findings. In the final stages, students will compile their research into a comprehensive report, highlighting their methodologies, findings, and the implications of their work. They will also prepare and deliver presentations of their research to an academic audience, demonstrating their ability to effectively communicate complex information. The culmination of this activity is the development of a robust research skill set, enabling students to conduct independent research and contribute to their field of study with confidence and integrity.

IInd YEAR

IInd Year, 1st Semester

No.	Code of the discipline	Name of the discipline	Number of ECTS	Hours per week					Form of evaluation
				C	**S**	**L**	**P**	**C/P**	
1	UPB.12.S.M3.I.901	Nanobiotoxicologie/Nanobiotoxicology	4	2	0	0	0	0	E
2	UPB.12.A.M3.I.902	Tehnici avansate de caracterizare a substanelor biologic active/Advanced techniques for the characterization of biological active substances	4	1	0	2	0	0	E

No.	Code of the discipline	Name of the discipline	Number of ECTS	Hours per week					Form of evaluation
				C	S	L	P	C/P	
3	UPB.12.A.M3.I.903	Imagistica medicală pentru reconstrucție și regenerare tisulară/Medical imaging for tissue reconstruction and regeneration	4	1	0	2	0	0	E
4	UPB.12.A.M3.I.904	Mechanisms of tissue regeneration and remodeling/ Mecanismele reconstrucției și regenerării tisulare	4	2	0	0	0	0	E
5	UPB.12.A.M3.I.905	Modele in vitro și in vivo în reconstrucția și regenerare tisulară/In vitro and in vivo models for tissue reconstruction and regeneration	4	2	0	2	0	0	E
6	UPB.12.A.M3.I.906	Practică de cercetare/Research practice	10					10	V
7	UPB.12.A.M3.I.907	Etică și integritate academică/Ethics and academic integrity	2	1	0	0	0	0	E

Nanobiotoxicology

Professor: Marius Radulescu

Course Content: This course explores the toxicological effects of nanomaterials on biological systems. Students will learn about the mechanisms of nanomaterial toxicity, including oxidative stress, inflammation, and genotoxicity. The course covers the methodologies used to assess the safety of nanomaterials, such as in vitro and in vivo toxicity testing, risk assessment, and the regulatory framework for the safe use of nanomaterials in biomedical applications. Topics also include the potential environmental and health impacts of nanomaterials, as well as the strategies for minimizing their adverse effects. The course emphasizes the importance of understanding the interaction between nanomaterials and biological systems to develop safer and more effective nanomedicines.

Applications: This course does not include specific laboratory applications.

Advanced Techniques for the Characterization of Biological Active Substances

Professor: Dan Eduard Mihaiescu

Course Content: This course provides an overview of the advanced techniques used to characterize biologically active substances. Students will learn about various analytical methods, including chromatography, mass spectrometry, spectroscopy, and microscopy techniques. The course emphasizes the importance of these techniques in identifying and quantifying bioactive compounds, understanding their structure and function, and assessing their biological activity. Topics include gas chromatography (GC), liquid chromatography (LC), high-performance liquid chromatography (HPLC), mass spectrometry (MS), Fourier-transform infrared (FTIR) spectroscopy, Raman spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, and inductively coupled plasma mass spectrometry (ICP-MS). The course also covers the interpretation of spectral data and the use of advanced software for data analysis.

Applications: Laboratory sessions begin with an introduction to laboratory safety procedures and the overall structure of practical works. Students will use gas chromatography (GC) and liquid chromatography (LC) for the separation and analysis of bioactive compounds, applying mass spectrometry (MS) for structural elucidation and quantification. Spectral analysis using FTIR and Raman spectroscopy, including microscopy and imaging techniques, will be conducted. The laboratory component also includes nuclear magnetic resonance (NMR) spectroscopy for detailed structural analysis and the use of inductively coupled plasma mass spectrometry (ICP-MS) for elemental analysis and detection of trace metals. Students will gain practical experience in interpreting spectral data and solving instrumental analysis problems related to the structure determination of bioactive substances.

Medical Imaging for Tissue Reconstruction and Regeneration

Professor: Gabriela Niculescu

Course Content: This course covers the principles and applications of medical imaging techniques in tissue reconstruction and regeneration. Students will learn about various imaging modalities, including magnetic resonance imaging (MRI), computed tomography (CT), ultrasound, and

optical imaging methods, and their use in visualizing tissue structure and function. The course also explores the application of imaging techniques to monitor the effectiveness of tissue engineering therapies and guide the development of regenerative treatments. Topics include image acquisition, processing, and analysis, as well as the integration of imaging data with other biomedical information. The course emphasizes the importance of imaging in diagnosing diseases, assessing tissue repair, and evaluating the outcomes of regenerative therapies.

Applications: Laboratory sessions involve the use of Python and MATLAB for digital processing of 2D biological signals, including basic operations such as noise filtering, deconvolutions, and contrast enhancement. Students will learn segmentation methods and visualization techniques using MATLAB, as well as utilize ImageJ/ITK software for digital processing, reconstruction, and viewing of 2D and 3D images. Practical applications of imaging techniques in tissue reconstruction and regeneration will be explored in these sessions.

In Vitro and In Vivo Models for Tissue Reconstruction and Regeneration

Professor: Anca Hermenean

Course Content: This course focuses on the development and use of in vitro and in vivo models to study tissue reconstruction and regeneration. Students will learn about the advantages and limitations of different model systems, including 2D cell cultures, 3D organoids, and animal models. The course covers the design and implementation of these models to mimic human tissue structure and function, as well as their applications in preclinical research. Topics include the ethical considerations in the use of animal models, the development of disease models, and the evaluation of regenerative therapies. The course emphasizes the importance of using appropriate models to advance the understanding of tissue repair and regeneration processes.

Applications: The laboratory work begins with an introduction to the laboratory environment, safety aspects, and an overview of the progress and assessment of practical works. Students will engage in practical applications of in vitro models in tissue engineering, such as osteodifferentiation assays, and in vivo models, including osteogenesis assays. These practical sessions will provide hands-on experience in setting up and analyzing in vitro and in vivo models to study tissue regeneration.

Mechanisms of Tissue Regeneration and Remodeling

Professor: Florin Iordache

Course Content: This course examines the biological processes involved in tissue regeneration and remodeling. Students will learn about the cell signaling pathways, extracellular matrix dynamics, and the role of stem cells in tissue repair. Key topics include the molecular mechanisms that regulate tissue regeneration, the interactions between cells and their microenvironment, and the factors that influence tissue remodeling. The course also covers the latest research on tissue engineering and regenerative medicine, highlighting the advances in understanding and manipulating these processes to develop effective therapies. Case studies and research articles will provide insights into the practical applications of tissue regeneration and remodeling in clinical settings.

Applications: This course does not include specific laboratory applications.

Research Practice

Professor: All teachers involved in this master program

Activity content: Research Practice is designed to provide students with hands-on experience in conducting scientific research. This activity emphasizes the practical aspects of research, guiding students through the entire research process from the initial formulation of research questions to the final presentation of findings. Students will gain essential skills in designing and executing research projects, managing data, and using statistical tools for analysis. Participants will begin by identifying a research problem and conducting a thorough literature review to frame their study within the existing body of knowledge. They will then develop a detailed research proposal, outlining their hypotheses, research design, and methodologies. This includes selecting appropriate qualitative, quantitative, or mixed-method approaches, and understanding the ethical considerations associated with their research. Students will engage in data collection activities, learning various techniques such as surveys, experiments, and observational studies. They will also receive training in data management and the use of software tools for data analysis. The activity focuses on developing competencies in interpreting results and drawing meaningful conclusions from the data. The practical component involves executing the research projects designed during the initial phases. Students will conduct experiments, gather data, and apply statistical

methods to analyze their results. This hands-on practice is crucial for developing a deep understanding of the research process and the challenges that researchers face. Throughout the activity, students will present their research progress in regular seminars, receiving constructive feedback from peers and Professors. This iterative process allows for continuous improvement and refinement of their research methods and findings. In the final stages, students will compile their research into a comprehensive report, highlighting their methodologies, findings, and the implications of their work. They will also prepare and deliver presentations of their research to an academic audience, demonstrating their ability to effectively communicate complex information. The culmination of this activity is the development of a robust research skill set, enabling students to conduct independent research and contribute to their field of study with confidence and integrity.

Ethics and Academic Integrity

Professor: -

Course Content: Ethics and Academic Integrity is focused on instilling the principles of ethical conduct and integrity in academic research and professional practice. This activity explores various ethical issues and dilemmas that researchers may encounter, providing students with the tools to navigate these challenges responsibly. Key topics include the importance of honesty, fairness, and transparency in research, as well as the responsibilities of researchers to their subjects, peers, and the wider community. Students will examine case studies that highlight common ethical issues such as plagiarism, data fabrication, and conflicts of interest. The activity emphasizes the development of critical thinking skills to identify and resolve ethical problems. Participants will learn about the ethical guidelines and codes of conduct established by professional organizations and institutions, and the legal implications of unethical behavior. The activity also covers the principles of academic integrity, including proper citation practices, the significance of peer review, and the role of mentorship in fostering an ethical academic environment. Students will engage in discussions and exercises that promote a deeper understanding of these principles and their application in various academic and research contexts.

II[nd] Year, II[nd] Semester

Nr. Crt.	Codul disciplinei	Denumirea disciplinei	Nr. ECTS	Ore/săptămână					Forma de evaluare
				C	S	L	P	C/P	
1	UPB.12.A.M4.I.901	Cercetare științifică, practică de cercetare și elaborare de disertație/Scientific research, research practice and dissertation development	28	0	0	0	0	28	E

Scientific Research, Research Practice, and Dissertation Development

Professor: All teachers involved in this master program

Activity content: Scientific Research, Research Practice, and Dissertation Development is designed to equip students with the essential skills and knowledge needed to conduct scientific research, engage in research practices, and develop their dissertation. The activity covers a broad range of topics including research methodology, literature review, data collection and analysis, and scientific writing. Students will be guided through the process of identifying a research problem, formulating research questions, and developing a research proposal. Emphasis is placed on understanding the ethical considerations in research and the importance of maintaining scientific integrity. Students will learn how to conduct a comprehensive literature review, critically analyze scientific papers, and synthesize information from various sources. The activity also introduces different research methodologies, including qualitative, quantitative, and mixed-method approaches, and provides training in data collection techniques such as surveys, experiments, and interviews. Data analysis will be taught using appropriate statistical tools and software.

In the latter part of the activity, students will focus on the development of their dissertation. They will receive guidance on structuring their dissertation, writing each chapter, and presenting their findings in a clear and concise manner. The activity also includes sessions on preparing for the dissertation defense, with tips on how to effectively communicate research findings and respond to questions from the evaluation committee. The practical component involves hands-on research practice where students will apply the methodologies and techniques learned to

their own research projects. This includes conducting experiments, collecting and analyzing data, and interpreting results. Students will work closely with their advisors to develop their research proposals and carry out their research plans. Throughout the activity, students will have the opportunity to present their research progress in seminars and receive feedback from peers and Professors. This iterative process helps refine their research questions and methodologies, ensuring that their dissertation meets the highest academic standards. The activity culminates in the submission of a well-researched and well-written dissertation, demonstrating the student's ability to conduct independent scientific research.