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Description of the Second Cycle degree program in STEM Teacher Training

**Title of the program:** STEM Teacher Training

**Level of program:** Master's degree program, 2 years, 120 ECTS

**Qualification awarded:** Master of Education (M.Ed.)

### **Profile of the degree program**

The master's degree program offers innovative campus-based and online graduate courses for future educators of STEM disciplines in schools, research centers, educational clubs, museums, industry, cultural institutions and community agencies. The program enrolls a maximum of 21 students per year and admits candidates with BS in Mathematics, Geography, Biology, Chemistry, Physics, Technology, Computer Science, Engineering, Education, Psychology, Child Development, Cognitive Science, and other related areas. In this program, you will gain theoretical insights and practical skills. International communications, academic mobility, cross-disciplinary research project in science and education will develop students into skillful practitioners as well as innovators. Program modules offer an overview of historical and current issues and trends impacting integrated STEM education. Modules of the STEM Teacher Training curriculum were designed to utilize the technological and didactic skill sets required for empowering 21st century learning in a global, digital sustainable society. Interdisciplinary efforts and both science content and pedagogy are incorporated into module parts. The learning experience is organized through cycles of lectures, seminars, workshops and laboratories. The degree program has four tracks: Natural Science education, Math and Physics education, Technology and Engineering education and Primary Education

The professional learning activities are designed to be immediately relevant to your STEM education practice. You will be prompted to test your developing ideas and reflect on the outcomes as you study.

### **Key learning outcomes**

1. To promote a holistic and comprehensive integrated approach to STEM education;
2. To integrate and apply science and engineering practices into instruction, curriculum materials, and assessment.

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3. To develop interdisciplinary approach to project-based and inquiry-based learning;
4. To carry out independent STEM research projects;
5. To cultivate a culture of innovation in schools;
6. To motivate and inspire students to choose STEM careers;
7. To use digital technologies to teach students (in the classroom);
8. To find and use different teaching and learning resources.
9. To communicate effectively with colleagues and students to create a favorable environment for cooperative learning experience.
10. To understand the importance of a research-based teaching and to develop own teaching continuously
11. To be able to use diverse assessment methods

### **Occupational profile/s of graduates**

After graduation of STEM Teacher Training you will acquire a greater knowledge and understanding of science and science education pedagogy, new opportunities for leadership in the classroom, school, community and beyond, better teaching practices and student outcomes, and you will increase your understanding of formative assessment in the science classroom and better implementation of classroom-based research

This two-year program can be your gateway to such careers as STEM teacher (at school/university, education/engineering center), investigator of STEM education research, science journalist, spokesperson (at museum, cultural institution, community agency, etc.), STEM consultant.

**Access to further studies:** The graduates of Master's degree program are eligible for further studies at PhD level

### **Description of M.Ed. Modules:**

The curriculum content of the Master's degree is divided into six modules, which is done so according to the main focus of the program. The next types of activities are used in education: Lecture (L), Lecture with practice (LP), Practice (P), Seminar (S), Research seminar (RS), Seminar with practice (PS), Laboratory work (LW).

#### **Module 1: Introductory module**

It is aimed at providing a holistic overview of historical and current issues and trends

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impacting STEM education in today's global society. The courses of this module are:

- Modern problems of science and education (4 ECTS, L, S);
- Innovative processes in education (2 ECTS, L, S);
- Foreign language (professional) (4 ECTS, P, SP);
- Modern problems of school STEM education (2 ECTS, LP, S, P).

After this module student will be able:

- To demonstrate an advanced, critical and integrated understanding of the contribution of STEM knowledge and skills to economic and social development
- To develop a sound understanding of concepts and contemporary issues in STEM education, contexts and systems, locally and globally
- To articulate what knowledge, skills and abilities are needed for a STEM educator
- To explore the major theoretical and professional debates in STEM education as located within contemporary research
- Manage the scope, cost, timing, and quality of the project with focus on project success
- To communicate science with words, visuals, and in multimedia across multiple types of audiences from peer to public
- To be guided by a sense of social and ethical responsibility in professional activities
- To use mathematical tools for tackling integrative STEM problems.

## **Module 2: Research module**

Research module aimed at enabling students to become informed consumers of research and to develop skills to prepare them to carry out action research in their schools and organizations. The courses of this module are

- Methods of scientific research (5 ECTS, LP, S, LW);
- Organization of research work of students in natural science (5 ECTS, L, S);
- Mathematical and computer modeling (2 ECTS, RS);
- Project activities in STEM (5 ECTS, RS, P, LW).

After this module student will be able:

- To critically evaluate research in relation to knowledge underpinning expert teacher pedagogies and practices in STEM and STEM education

- To make connections between STEM disciplines in teaching practice
- To critically reflect on one's own experiences as STEM learners and to identify implications for one's own professional identity
- To discuss the major theoretical and professional debates in STEM education as located within contemporary research
- To engage with current research about teaching and learning in science, technology and sustainability
- To understand how young children learn scientific and technological concepts in everyday contexts with a focus on sustainability

### **Module 3: Methodology module (semester 2)**

Methodology module aimed at examining various didactic strategies of pedagogy to foster the innovative engagement of diverse learners;

The courses of this module are

- Modern methods and technologies for organizing educational activities in teaching STEM disciplines (6 ECTS, LP, S);
- Methods of teaching STEM subjects (5 ECTS; LP, S)
- Problems of modern didactics (2 ECTS, L, P);
- Psychological and pedagogical foundations of school education (2 ECTS, L, P).

After this module student will be able:

- To formulate STEM learning objectives: curiosity, problem solving and communication;
- To work collaboratively within teams.
- To bring innovation in schools through active learning methodology tools
- To provide hands-on and minds-on lessons; making STEM both fun and interesting
- To apply evidence-based methods for teaching STEM content and concepts
- To apply instructional strategies that stimulate problem-solving, rigorous and relevant questions, systems thinking, problem identification, formulation and solution
- To utilize formative and summative assessments, evaluation practices
- Demonstrate an understanding of the contemporary practices of STEM and how such practices help to respond to changing technological and social change

- Develop a sound understanding of concepts and contemporary issues in STEM education, contexts and systems, locally and globally
- Demonstrate an understanding of contemporary approaches related to the development of creativity through arts pedagogies and inquiry-based learning
- Identify current ideas about how students learn and some implications for your digital technology classes
- Use and creatively integrate information and communication technologies (ICT) to enhance student engagement and conceptual understanding.
- Develop strategies to establish, monitor and develop student understanding of science and the importance of evidence, reasoning and critical thinking skills in this knowledge development

#### **Module 4: Subject (semester ?)**

The Subject content module is aimed at equipping future STEM teachers with methodological, organizational, and research skills to be employed for teaching different STEM subjects. The courses of this module are

- Special problems in Science education (OR primary, Computer science/technology, maths+phys) (7 ECTS, LP, S, LW);
- Ecological monitoring and Greening of educational programs (2 ECTS, L, LW);
- Basics of programming and robotics (4 ECTS, LP, LW, RS);
- CAD systems (4 ECTS, LP, LW);
- Statistical data processing (4 ECTS, L, P);
- Information technologies in professional activity (4 ECTS, LP, LW);

After this module student will be able:

- To translate conceptual ideas and processes about science into classroom learning activities for students
- To apply contexts for the teaching of STEM content that accounts for the experiences and social and cultural backgrounds of students
- To evaluate a range of teaching strategies and support resources (human and material) for teaching STEM disciplines
- To link the everyday world of the learner with STEM in ways that are meaningful and relevant

- To actively participate in professional conversations about the key theoretical and pedagogical perspectives and issues in teaching STEM
- To articulate and apply your understanding of a constructivist perspective of learning in STEM
- To demonstrate an advanced understanding of contemporary approaches and trends in STEM education
- To develop and implement a differentiated and inclusive STEM curriculum including the creative integration of digital technologies
- To engage learners and communities in STEM education to promote a more equitable and sustainable community

### **Module 5: Leadership module (semester 3)**

Leadership module aimed at fostering leadership skills to prepare future teachers for ongoing improvement of learning environment. The courses of this module are

- Educational marketing in STEM + educational laws (5 ECTS, LP, S);
- STEM ambassadors (8 ECTS, L, P);
- Exploration of STEM careers (5 ECTS, LP, S);
- STEM leadership (7 ECTS, LP, P)

After this module student will be able:

- To demonstrate understanding of how policies and legislative requirements intersect and inform curriculum development learning and assessment
- To develop strong connections between STEM policy, practice and identity as a leader in this educational field
- To design strategies for the effective distribution of knowledge in STEM teams
- To utilize enhanced research and leadership skills to develop sustainable action plans for the engagement of learners in STEM education.
- To evaluate your professional knowledge and understanding to identify and plan for areas of future professional learning
- To demonstrate an understanding for the ways in which STEM responds to changing technological and social change
- To mentor other educators and make systematic educational changes in their organization.

### **Module 6: Integrated module (semester 3)**

Integrated module aimed at preparing integrated into the STEM learning environment. The courses of this module are

Design of forms and methods of STEM disciplines assessment and quality control (5 ECTS, LP, P, S)

After this module student will be able:

- To demonstrate knowledge and understanding of curriculum (e.g. as enacted, actual, hidden, take-home, contested)
- To examine the ways in which data informs learning and planning, feeding back and forward into learning
- To apply knowledge and understanding in the planning, implementation or evaluation of a lesson or learning program.
- To work independently and collaboratively integrating digital technology to enhance learning in classes which reflect digital technology as both a separate discipline and as part of an integrated curriculum
- To critically understand the principles of curriculum design as these relate to the content of current general STEM curricula
- To develop an understanding of a constructivist perspective on learning and its implications and a variety of assessment techniques available for use in STEM education classrooms

**Master's Thesis (semester 4):** Master's Thesis comprises of the preparatory work that the students must undertake for the examinations "Presentation: Master's Project". The ability to develop independent research-led concepts, as well as their verbal presentation and performance must be demonstrated.