This specialization aims to equip education students with an in-depth understanding of theoretical and practical issues surrounding STEM education. The specialization will explore philosophy, theories, learning design, technologies and policy at local and international level with respect to STEM. Specific theoretical constructs will be examined in the specialization, with a focus on developing further research agenda at graduate level, e.g., STEM literacies, learning design, levels of integration, computational thinking, and design thinking.

Who would benefit from this specialization?
This course aims at Education students across all levels of schooling and higher education. STEM has been implemented by the Education Bureau (EDB) in Hong Kong in Primary and Secondary schools, and universities around the world are actively promoting transdisciplinary education and research. Although, the specialisms might best relate to science, mathematics, and technology teachers, the current trend is to make better integration of STEM with arts and social studies. Therefore, teachers other than science mathematics and technology would also benefit from such a specialization. Professionals working in industries supporting STEM Education will also benefit from this specialization.

Mode of study:
The specialization is available in 1-year full-time and 2-year part-time modes of study.

Outline of the four specialist courses:

Course 1: Emerging Technologies in STEM Education (6 credits)
This course explores a broad range of current and emerging tools, practices and themes in STEM education. Also, the course will review current and future research trends in emerging tools, practices and themes in STEM Education. The course begins by exploring the historical development of cross-disciplinary integration in STEM education, in order to equip students with an overall picture on the types and trends of digital technology used for delivering STEM education in the past, present and future classrooms. Furthermore, the course explores uses of robotics as a mean of integration (e.g., Micro:bit, MakeBlock, Arduino, Lego Mindstorms). Also, attention will be given to product design and 3D printing as a special form of engineering design in integrated STEM. Finally, emerging tools such as mobile, wearable, VR, Augmented VR technology, etc., will be explored in context of STEM integration.

Course 2: Learning, Teaching and Assessment in STEM Education (6 credits)
This course focuses on STEM implementation at the classroom level. It takes as its starting point a focus on developing students’ self-directed learning and collaborative problem-solving capacity as a central goal for STEM education. It examines the curriculum and assessment designs and the role of teachers and learners in different models of classroom implementation. This course will also examine different models of teacher learning and leadership support for STEM implementation at the classroom and school levels.
Course 3: STEM Education in an Evolving Social Context (6 credits)

This course examines the nature of STEM as a curriculum and pedagogical innovation from a socio-historical perspective. Topics addressed include: the historical development of cross-disciplinary integration in STEM education; the role of STEM in modern society; central ideas cutting across the disciplines of science, technology, engineering and mathematics; the relationship between STEM education and science literacy, technology literacy and mathematics literacy, social responsibility and moral reasoning, as well as 21st Century skills; STEM as a curriculum and pedagogical approach to foster inquiry and problem solving of authentic problems through the application of conceptual knowledge and skills from diverse disciplines.

Course 4: STEM Education Theory, Practice and Application (6 credits)

This course discusses different theories, models and trends in STEM education underpinning international and local STEM policies and initiatives. Particular focus will be given to different models of STEM integration (e.g., discipline-focused, theme-based, interdisciplinary, etc.) This course will also examine policies and strategies at system, network and school levels employed in the implementation of STEM, and the challenges encountered. Students will be able to adopt appropriate theories, models and approaches for planning, organizing and evaluating STEM education related practices to strengthen the coherence and collaboration among teachers of different KLAs. The students will also appreciate the other developments and enhancements of STEM education, such as STEAM and STREAM with the incorporation of Arts elements too.

Specialist elective: Computational and Design Thinking for STEM Literacy in the 21st Century (6 credits)

This course explores the computational thinking, design thinking, and 21st century literacies developed in the context of STEM education. Computational and design thinking, which originated and populated in MIT (Grimson, 2017) and Stanford University (Plattner, 2010), represents a new and emerging digital literacy, and becomes a core literacy in solving computational and engineering design problems in real-world contexts. In this course, the role of “E” (Engineering) in STEM education integrated with computational and design thinking will be discussed, and how to link these to other disciplines within STEM will be investigated. The course helps novice educational researchers and practitioner with background in science and mathematics to develop a comprehensive understanding of where the origin, motives for cognitive development and educational impacts are in the theory and application of STEM learning. Through collaborative learning environment and interactive seminars, students will identify instructional and pedagogical approaches to implement the thinking methods in school-based STEM curriculum. Research agenda and educational policy of this emerging field of transdisciplinary education can be developed with computational thinking and design thinking in this course.

In addition to the four specialist core courses and a specialist elective, students will also have to complete:
- The compulsory core course Educational Issues and Research (6 credits);
- Two elective courses (6 credits each); and
- An option of a professional portfolio (12 credits) or a research project (12 credits).