

## DOCTOR OF PHILOSOPHY PROGRAM IN SCIENCE AND TECHNOLOGY EDUCATION (INTERNATIONAL PROGRAM)

### Courses Description - Prerequisite Courses

#### **ILSE603 : BASIC KNOWLEDGE IN EDUCATION (2 Credits)**

National Education Act; National Education Plan; educational curriculum; educational system; learning standards; content; learning in the 21st century; transformative education; contemplative education; extra-curricular activity; educational technology; learning community

#### **ILSE607 : BASIC KNOWLEDGE FOR EDUCATIONAL RESEARCH (2 Credits)**

Components of educational research; database for educational research; information retrieval for research; literature review; basic statistics for educational research; citation and reference

#### **SCID500 : CELL AND MOLECULAR BIOLOGY (3 Credits)**

Cell structure and function; life and information flow in cell, energy flow in biosystem; cell signaling; cell division; cellular differentiation; cell death and development

### Courses Description - Required Courses

#### **ILSE600 : INSTRUCTIONAL SCIENCE (3 Credits)**

How students learn; learning theory; pedagogical content knowledge; effective teaching and learning approaches; instructional design theory and model; learner analysis; learning level and assessment; classroom management; principle, concept, and guidelines for constructing lesson plan; ethics in teaching and professional ethics; micro-teaching

#### **ILSE609 : NATURE, HISTORY AND PHILOSOPHY OF SCIENCE (3 Credits)**

Nature, role, relationship, and methodology of science, mathematics, and technology; origin and philosophy of knowledge in science, mathematics, and technology; scientific reasoning, law, and theory; relationship between nature of science and learning science; self-enhancement of in-depth understanding in science, mathematics, and technology; morals and ethics in the construction of knowledge in science, mathematics, and technology

**ILSE616 : RESEARCH IN SCIENCE AND TECHNOLOGY EDUCATION (3 Credits)**

Research paradigms and methodology; quantitative research; qualitative research; mixed methods research; research question; research design; research instruments; data analysis; ethics in science and technology education research; analysis of science and technology education research; classroom action research

**ILSE655 : MEASUREMENT AND EVALUATION IN EDUCATION (2 Credits)**

Principle of measurement and evaluation for improving learner; formative assessment; summative assessment; authentic assessment; principle and practice in measurement and evaluation of cognitive, affective, and psychomotor domains; quality of measurement and evaluation tool; ethics in measurement and evaluation

**ILSE657 : RESEARCH SEMINAR IN SCIENCE AND TECHNOLOGY EDUCATION (1 Credit)**

Current issue concerning research in science and technology education; selected interdisciplinary topics; ethics in using and publishing academic work

**ILSE658 : RESEARCH SEMINAR IN INNOVATIVE LEARNING (1 Credit)**

Current issue concerning research in learning innovation; presentation of selected learning innovation; ethics in using and publishing learning innovation; organizing academic seminar

**ILSE659 : INNOVATIONS IN SCIENCE AND TECHNOLOGY TO IMPROVE LEARNING (3 Credits)**

Principle, concept, design, application, and development of innovation for improving science, mathematics, and technology learning; morals and ethics in the development of innovation in science and technology education; morals and ethics in using innovation to improve learning; quality of innovation in science and technology education

## **Courses Description - Elective Courses**

### **ILSE606 : MINI PROJECT RESEARCH IN SCIENCE, MATHEMATICS, AND TECHNOLOGY EDUCATION (3 Credits)**

Analysis of research in science and technology education; designing of mini research project in science and technology education; components in research development; data collection and analysis; ethics in educational research; writing and presenting research work; teaching an interdisciplinary project

### **ILSE615 : DEVELOPING LEARNING MEDIA USING MODERN INFORMATION TECHNOLOGY (3 Credits)**

Information and communication technology and learning in the 21st century; concept of using modern information technology (IT) in learning and teaching; analysis of case study on using modern IT in learning activity; learning media design; application for authoring learning media; learning media development and evaluation

### **ILSE617 EMERGING TECHNOLOGY FOR LEARNING (2 Credits)**

Relationship between technology and educational reform; relationship between technology, specific content, and pedagogy; role of technology in the development of learning process; using emerging technology in learning and teaching; technology for context-aware learning; ethics in using educational technology for learning; technology for measurement and evaluation in education

### **ILSE625 : CHEMISTRY EDUCATION (3 Credits)**

Nature of learning chemistry; misconceptions in learning chemistry; pedagogical content knowledge for teaching chemical bonding, chemical reactions and stoichiometry, chemical thermodynamics, chemical kinetics, chemical equilibrium, electrochemistry, nanochemistry, green chemistry, biocatalyst, solar cell, spectroscopy techniques

**ILSE631 : BIOLOGY EDUCATION (3 Credits)**

Nature of learning biology; misconception in biology; pedagogical content knowledge for teaching cell biology, biodiversity, evolution, biochemistry, modern genetics, bionanotechnology, biomass and bioenergy, plant biology, and biomedicine; emerging fields of biological sciences; professional ethics and ethics in biology teaching

**ILSE642 : PHYSICS EDUCATION (3 Credits)**

Nature of learning physics; misconceptions in physics; pedagogical content knowledge for teaching mathematics for physics, mechanics, thermodynamics, electricity and magnetism, light and optics, nuclear physics, relativity

**ILSE652 : MATHEMATICAL EDUCATION (3 Credits)**

Nature of learning mathematics; misconceptions in mathematics; pedagogical content knowledge for teaching probability and statistics, logic and mathematical proof, real and complex numbers, geometry, algebra, calculus

**ILSE653 : COMPUTER SCIENCE EDUCATION (3 Credits)**

Nature of learning computer education; transformation of computer education and development of today's computer education curriculum; misconceptions in computer education; pedagogical content knowledge for teaching algorithm, programming, data structure, simulation, artificial intelligence, microcontroller

**ILSE660 : PSYCHOLOGY AND PHILOSOPHY FOR EDUCATION (2 Credits)**

Fundamental psychology; developmental psychology; educational psychology; cognitive psychology; individual differences; inclusive education; multiple intelligences; educational guidance; counselling; philosophy, concept and theory in education, religion, economy, society and culture; educational concept and strategy for sustainable development

## **Courses Description – Dissertation**

### **ILSE699 : DISSERTATION (36 Credits)**

Research projects on science and technology education with emphasis on content, yielding instructional multimedia, apparatus, or processes; an international publication whose work is useful for learning and teaching in the nation; research that aligns with national priorities concerning science and technology education; research in chemistry, biology, physics, mathematics, or computer science

### **ILSE799 : DISSERTATION (48 Credits)**

Research projects on science and technology education with emphasis on content, yielding instructional multimedia, apparatus, or processes; an international publication whose work is useful for learning and teaching in the nation; research that aligns with national priorities concerning science and technology education; research in chemistry, biology, physics, mathematics, or computer science

### **ILSE898 : DISSERTATION (48 Credits)**

Research projects on science and technology education with emphasis on content, yielding instructional multimedia, apparatus, or processes; an international publication whose work is useful for learning and teaching in the nation; research that aligns with national priorities concerning science and technology education; research in chemistry, biology, physics, mathematics, or computer science