

# The Master Program for the Graduate Institute of Mathematics & Science Education

(Jurisdiction Clause for 99 Academic-year Entering Freshmen)

98.12.31 Passed at the Institute Curriculum Committee Meeting  
99.01.19 Passed at the College Curriculum Committee Meeting  
99.03.09 Passed at the University Curriculum Committee Meeting  
99.04.20 Passed at the Academic Affairs Meeting

## I 、 Development Policies and Characteristics

The graduate institute of mathematics and science education is a response to the calls for teacher education and for the educational research. Two main aims are emphasized. One is to enhance mathematics and science teachers' professional knowledge and abilities. The order is to cultivate mathematics and science education researchers. In addition, the graduate students are encouraged to engage in informal education, including textbook writing, developing teaching medium and devoting to museum education or cram school.

## II 、 Course Objectives

Based on history and philosophy of mathematics and science, psychology, sociology and methodology, both of theories and practice in mathematics and science education are highlighted to plan the courses. Four objectives are shown as follows:

1. Enable students to possess belief, knowledge and practice about mathematics and science education.
2. Enable students to conduct the researches in mathematics and science education.
3. Enable students to develop, design and evaluate mathematics and science curriculum.
4. Enable students to implement mathematics and science teaching and assess its effect.

## III 、 Basic Ability Index

- 1-1.Enhance professional knowledge in mathematics, science as well as mathematics and science education.
- 1-2.Plan and participate in academic activities which improve mathematical and scientific literacy.
- 1-3.Guide elementary school and high school students to conduct science fair.
- 2-1.Plan, implement and communicate academic researches.
- 3-1.Design teaching activities according to teaching strategies and learning theories in mathematics and science education.
- 3-2.Design and create mathematics and science teaching materials and media.
- 4-1.Consider students' multiple intelligence and develop appropriate instruments to assess students' mathematics and science learning effect.
- 4-2Based on students' mathematics and science learning effect to implement mathematics and science teaching.

### **Credits Required for Graduate:**

Students must complete at least 40 credits, including:

1. Professional Compulsory Courses : 12 credits
2. Professional Elective Courses : The total credits are 22, including 10 compulsory credits for each program and 12 elective credits.
3. Thesis : 6 credits

### **Remarks:**

Science Education program

1. A minimum of 6 credits, including Special Topics in Physics, Special Topics in Chemistry, Special Topics in Biology, Special Topics in Earth Science, Special Topics in Environmental Science, Special Topics in Information Science and Special Topics in Science Experiment, are required.
2. Several elective courses, such as Synoptic Meteorology, Astronomical Observation, Introduction to Science & Technology, belong to the program of high school teacher training. They are excluded from the required credits for graduate.

## Mathematics Education Group

1 <sup>st</sup> year			
<b>Professional Requirement Courses</b>			
Subject Name	Semester	Times	Credits
Research on Educational Research Methods	1	3	3
Introduction of Mathematics & Science Education Research	1	3	3
Advanced Educational Statistics	2	3	3
Qualitative Research	2	3	3
<b>Sub-total</b>			<b>12</b>
<b>Professional Selective Courses ( must select 10 credits at least )</b>			
Subject Name	Semester	Times	Score
Abstract Algebra	1	2	2
The Study of Mathematics Concepts Development	1	2	2
The Study of Mathematics Curriculum Development	2	2	2
Advanced Probability	2	2	2
The Study of Mathematics History	2	2	2
Mathematics Education Seminar (I)	2	2	2
<b>Sub-total</b>			<b>12</b>
<b>Professional Selective Courses</b>			
Educational Measurement and Evaluation	1	3	3
Diagnostic Test Construction and Data Analysis in Mathematics	1	3	3
The Study of Mathematics Learning Psychology	1	3	3
Computer Multimedia and Mathematics Education	2	3	3
Achievement Test Construction and Data Analysis in Mathematics	2	3	3
Instruction Technology and Mathematics Education	2	3	3
<b>Sub-total</b>			<b>18</b>

**2<sup>nd</sup> year****Professional Selective Courses ( must select 10 credits at least )**

<b>Subject Name</b>	<b>Semester</b>	<b>Times</b>	<b>Credits</b>
The Study of Mathematics Teaching Design	1	2	2
Mathematics Education Seminar ( II )	1	2	2
Real Analysis	2	2	2
Geometry	2	2	2
<b>Sub-total</b>			<b>8</b>

**Professional Selective Courses**

Qualitative Data Analysis	1	3	3
Multivariate Analysis	1	3	3
The Study of Special Topics in Mathematics Education	1	3	3
The Study of Mathematical Problem Posing	1	3	3
Literature Review in Mathematics Education	1	3	3
Constructivism and Mathematics Learning	1	3	3
Multiculture and Mathematics Education	1	3	3
The Philosophy of Mathematics Education	2	3	3
The Study of Mathematical Assessment	2	3	3
The Study of Mathematical Learning	2	3	3
The Study of Mathematical Teaching Strategies	2	3	3
The Study of Mathematics Teaching Practice	2	3	3
The Study of Mathematical Problem Solving	2	3	3
<b>Sub-total</b>			<b>39</b>

<b>Subject Name</b>	<b>Semester</b>	<b>Times</b>	<b>Credits</b>
Thesis	2	6	6
<b>Sub-total</b>			<b>6</b>

## Science Education Group

1 <sup>st</sup> year			
<b>Professional Requirement Courses</b>			
Subject Name	Semester	Times	Credits
Research on Educational Research Methods	1	3	3
Introduction of Mathematics& Science Education Research	1	3	3
Advanced Educational Statistics	2	3	3
Qualitative Research	2	3	3
<b>Sub-total</b>			<b>12</b>
<b>Professional Selective Courses ( must select 10 credits at least )</b>			
Subject Name	Semester	Times	Credits
Special Topics in Physics	1	2	2
Special Topics in Earth Science	1	2	2
Special Topics in Information Science	2	2	2
Science Education Seminar ( I )	2	2	2
<b>Sub-total</b>			<b>8</b>
<b>Professional Selective Courses</b>			
Curriculum Development in Science	1	3	3
Instructional Design in Science	1	3	3
Conceptual Change in Science	1	3	3
Learning and Assessment in Science	2	3	3
Psychology and Science Education	2	3	3
Analysis in Science Instructional Activities	2	3	3
<b>Sub-total</b>			<b>18</b>

<b>2<sup>nd</sup> year</b>			
<b>Professional Selective Courses ( must select 10 credits at least )</b>			
<b>Subject Name</b>	<b>Semester</b>	<b>Times</b>	<b>Credits</b>
Science Education Seminar ( II )	1	2	2
Special Topics in Biology	1	2	2
Special Topics in Science Experiment	1	2	2
Special Topics in Chemistry	2	2	2
Special Topics in Environmental Science	2	2	2
<b>Sub-total</b>			<b>10</b>
<b>Professional Selective Courses</b>			
Data Analysis	1	3	3
Nature of Science and Science Education	1	3	3
History of Science and Science Education	1	3	3
Social Psychology and Science Learning	1	3	3
Professional Development of Science Teachers	2	3	3
Cognition and Science Learning	2	3	3
Scientific Games and Science Education	2	3	3
Issues in Science Education	2	3	3
<b>Sub-total</b>			<b>24</b>
Thesis	2	<b>6</b>	<b>6</b>
<b>Sub-total</b>			<b>6</b>

\* 選修課程名稱，得隨科技潮流異動。

## Others

<b>Subject Name (Mathematics Education Group)</b>	<b>1<sup>st</sup> First</b>	<b>1<sup>st</sup> Second</b>	<b>2<sup>nd</sup> First</b>	<b>2<sup>nd</sup> Second</b>
Cognitive Psychology	3			
Teaching Strategies for Cooperative Learning		3		
Experimental Design			3	
Special Topics in Mathematics Education			3	
Multimedia Design and Development				3
The Study of Mathematical Curriculum Comparison				3
Application of Distant Learning in Mathematics Education				3
Special Topics in School Reform				3
Strategies of Web-Based Instruction				3
<b>Subject Name (Science Education Group)</b>	<b>1<sup>st</sup> First</b>	<b>1<sup>st</sup> Second</b>	<b>2<sup>nd</sup> First</b>	<b>2<sup>nd</sup> Second</b>
Science Concept Development	3			
Constructivism and Science Education	3			
STS in Science Education	3			
Science Teaching Models	3			
Science Process Skills		3		
Multiculture and Science Education		3		
Discourse Analysis		3		
Sociology of Science		3		
Management in Science Classroom		3		
Introduction to Science & Technology		3		
Methods in Elementary School Science Teaching		2		
Teaching Methods & Materials in Chemistry			2	
Teaching Methods & Materials in Physics			2	
Philosophy of Science			3	
Problem Solving and Science Education			3	
Historical Perspectives in Science			3	
Special Topics in Science Learning			3	
Internet Instruction of Computer Multimedia			3	

<b>Subject Name</b>	<b>1<sup>st</sup> First</b>	<b>1<sup>st</sup> Second</b>	<b>2<sup>nd</sup> First</b>	<b>2<sup>nd</sup> Second</b>
Supervision in Science Education			3	
Analysis of Scientific Text			3	
Computer Application in Science Education			3	
Analysis in Scientific Concept			3	
Synoptic Meteorology			2	
Teaching Methods & Materials in Biology				2
Issues in Administration of Science Education				3
Special Topics in Science Learning				3
Evaluation in Science Curriculum				3
Practice and Research in science Teaching				3
Methodology in Science				3
Astronomical Observation				2