

ADE/B.Ed. (Hons) Elementary
Syllabus
Mathematics
Semester 4

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Technical Support: Education Development Centre (EDC); Teachers College, Columbia University

Syllabus: Teaching Mathematics

Year/Semester: Year 2/Semester 2

Credit value: 3 credit hours

Prerequisite: Successful completion of the General Mathematics course in Semester 2

Course Description

This course will equip prospective teachers with the knowledge and skills to teach math in grades 1 through 8. They will become familiar with Pakistan's National Mathematics Curriculum and expected student learning outcomes. Prospective teachers will learn to use a variety of instructional methods that promote active learning of math, including making and using teaching and learning materials. They will plan mathematics lessons and activities, and engage in practice teaching of math.

Learning Objectives:

Students will:

- Deepen their understanding of key mathematical concepts in Pakistan's 1-8 National Mathematics Curriculum.
- Identify and assess areas of youngster's understanding and misconception to inform their teaching practices.
- Acquire the pedagogical skills and competencies required to teach Pakistan's 1-8 National Mathematics Curriculum.
- Describe the nature, history, and development of grade 1-8 mathematics education both in Pakistan and internationally.

Course Structure

Each three-session week will focus on three aspects of Math education: Mathematical Content, Learning the Math Content, and Teaching the Math Content. These will be combined to form an integrated instructional model that addresses the above learning outcomes.

4. **Mathematics Content:** The first session of the week will begin working on at least one math problem. Prospective teachers will engage in solving and discussing the problem and sharing approaches and solutions. The content will be developed so that prospective teachers will engage in mathematics *in depth* to help them connect concepts within and across the four units of the National Curriculum: Number & Operations, Algebra & Algebraic Thinking, Geometry & Geometric Measurement, and Information Handling.
5. **Learning & Pedagogy:** The week will continue with an emphasis on children's learning and teachers' instructional practices. Class participants will continue to do mathematics in order to experience approaches to teaching and learning that they can use when they teach. They will recognize that there are often multiple ways of approaching a problem (and in some instances more than one correct answer). The instructor will present questions that stimulate curiosity and encourage prospective teachers to investigate further: by themselves, with their classmates, or in local schools.

The course will examine how children learn and develop mathematical understanding and skills and how the way children think should influence the teaching of mathematics in the primary, elementary, and middle grades.

6. **Assignments:** Students are expected to continue learning about math and the teaching of math after class. There will be assignments to stretch prospective teachers' content knowledge so that they learn more about teaching math. Assignments will take many forms including independently solving math problems and school-based tasks.

In summary, the Teaching Mathematics is a comprehensive effort so that pre-service teachers will:

1. Build and deepen their math content knowledge
2. Study ways in which young students learn mathematics
3. Learn about and use high-quality instructional practice

Semester Outline

Week #	Mathematics Content	Learning the Math Content	Teacher Decision Making: Teaching the Math Content
Unit 1			
1	• Prime & Composite Numbers • Factors & Multiples	• Anticipated Student Misconceptions	• Setting Goals for: ◦ The Program ◦ Teaching ◦ Learning
2	• Division of Whole Numbers	• Emergent Mathematical Thinking	• Lesson Design Model ◦ Launch ◦ Explore ◦ Summarize
3	• Greatest Common Factor • Least Common Multiple • Prime Factorization	• The Value of Student Errors	• Using Questioning Techniques, Wait Time, Probes, and Prompts to Foster Student Thinking

Unit 2			
4	• Operations with Fractions (1)	• Learning Mathematics with Manipulatives & Visual Aids	• Using Application Problems to Develop Algorithms
5	• Operations with Fractions (2)	• Mathematical Problem Solving Strategies	• Physical Set-up of a Student-Centered Classroom
6	• Fractions-Decimals-Percents	• Mathematical Discourse: Learning by Talking	• Designing & Managing Cooperative Group Work
7	• Pie Charts	• Seeing Connections between Units of the National Curriculum	• Timing of Lessons, Pacing of Units

Unit 3			
8	• Geometric Ratios	• Cognitive Demand of Mathematical Tasks	• Selecting Worthwhile Mathematical Tasks
9	• Rates & Linear Functions	• The Balance Between Concepts & Skills, The Role of Drill & Practice	• Bloom's Taxonomy of Learning applied to Mathematics
10	• Systems of Linear Equations	• Multiple Representations for a Single Mathematical Idea	• Comparing Models of Teaching ◦ Deductive-Analytic ◦ Inductive-Synthetic
11	• Symmetry	• Mathematical Learning Styles and Modalities, Mathematics &	• Comparing Models of Teaching ◦ Heuristic

		Multiple Intelligence Theory	○ Interactive ○ Hands-on
12	● Volume & Surface Area	● Learning Mathematics by Writing	● Comparing Models of Teaching ○ Problem-based Learning ○ Project-based Learning
13	● Measurement & Precision	● Precision in Mathematical Vocabulary and Syntax	● Differentiating Assignments

Unit 4			
14	● Data: Estimation & Large Numbers	● Learning Mathematics with Available Technology	● Differentiating Assessments
15	● Introduction and/or Review of Seminal Thinkers in Mathematics & Mathematics Education		
16	● Introduction and/or Review of Seminal Islamic Thinkers in Mathematics & Mathematics Education		

Suggested Resources:

These resources provide additional information about math education and the mathematical topics addressed during the course.

NCTM *Illuminations*: <http://illuminations.nctm.org/>

New Zealand's Maths Curriculum: <http://nzmaths.co.nz/>

UK's N-Rich Maths site: <http://nrich.maths.org/public/>

How Students Learn: History, Mathematics, and Science in the Classroom
www.nap.edu/catalog.php?record_id=10126#toc Published by National Academies Press.

What does Good Mathematics Instruction Look Like?:
<http://www.naesp.org/resources/2/Principal/2007/S-Op51.pdf>

Mathematics for Elementary School Teachers, by Tom Basserear, published by Brooks Cole.

Elementary and Middle School Mathematics: Teaching Developmentally, by John A. Van de Walle, Karen Karp, and Jennifer Bay-Williams, published by Pearson Education.

Mathematics Explained for Primary Teachers, by Derek Haylock, published by SAGE Publications.