

## **(107)Pedagogy of Mathematics**

**Maximum Marks: 100**

**External: 70**

**Internal: 30**

### **Design of the Course**

- Each unit of study focuses on the specific aspect of mathematics education relevant at that stage
- Several Hands-on activities are part of each unit of study

### **Rationale and Aim**

When children come to school, they are already familiar with mathematics and are using it in their own ways. In school they come across

a systematic treatment of mathematics which at times is in conflict with their internalized processes. It is important for teachers to understand these conflicts and differences for effective learning.

In the Position Paper produced by the National Focus Group on Teaching of Mathematics (NCERT, 2006) it was said, “Mathematics education relies very heavily on the preparation that the teacher has, in her own understanding of mathematics, and in her bag of pedagogic techniques”. Every teacher needs to develop her understanding of mathematics afresh from the point of view that takes in account the processes in which learning takes place in children’s mind. Teachers need to be aware of the ways in which students think so that they can design and adapt their teaching approaches to deal with the alternative conceptions of mathematical knowledge of young learners.

The aim of the course is to sensitize prospective teachers that, not only do they need to reflect on their own knowledge of mathematical content taught at the primary level but they also need to connect to children and their experiences. Engagement with this course should enable prospective teachers to learn and reflect on what research has to say about children and their mathematics education and use it to promote learning.

### **Specific Objectives**

- To enable student-teachers to develop deeper insights into the content areas of mathematics at the primary level
- To make student-teachers aware of factors that impact on the process of acquisition of mathematical knowledge
- To sensitize student-teachers about the ways in which children respond to mathematical knowledge
- To help student-teachers develop skills, have deeper insights, acquire appropriate attitudes, learn effective strategies that promote effective children’s learning

### **Thread Running through the Course**

The units have been conceptualised to help prospective teachers understand that student’s learning is dependent on the learning of the content by the teacher as well as the ways children perceive and respond to mathematical knowledge

## **Units of Study**

### **Unit 1: Pedagogical Content Knowledge**

- Numbers: Number Concept, Counting, Place value, Arithmetic operations, Fractions, Decimals. Odd, even, prime, composite, co-primes, twin-primes, basic knowledge of L.C.M. and H.C.F. of numbers, divisibility test upto 11, representation of numbers on number-line. Roman system.
- Measurement: The idea of unit in length, area, volume, weight, time, money, temperature and their conversion into smaller and bigger units.(basic idea and not their applications)

### **Unit 2: Algebra Thinking**

- Algebraic expression: Addition, subtraction, multiplication and division
- Algebraic identities and their applications
- Factorisation using algebraic identities
- Forming and solving simple linear equations

### **Unit 3: Practical Arithmetic and Handling Data**

- Collection, classification and interpretation of data
- Presentation of collected data
- Elementary statistical techniques
- Percentage
- Ratio and proportion
- Interest (simple and compound)

### **Unit 4: Geometric ways of looking at space and shapes**

- Space and Shape: Geometric shapes, construction of geometric shapes through paper folding, Symmetry
- Congruency and similarity: meaning and criterion of congruency and similarity of triangles
- Construction of angles, triangles, quadrilateral, tangent to a circle, in circle and circum circle of a triangle using geometric equipment.

### **Unit 5: Communicating Mathematics**

- Curriculum and Classroom Practices
- The role of text books in the teaching-learning process of mathematics
- Mathematics Laboratory/Resource Room
- Feed back to students about errors committed in their work
- Mathematics phobia and coping with failure

### **Unit 6: Mathematical Reasoning**

- Meaning, need and importance of mathematical reasoning, pattern recognition and inductive reasoning
- Validation process of mathematical statements: Proof; Counter-Example; Conjecture.
- Problem solving in mathematics – a process
- Creative thinking in Mathematics

### **Unit 7: Assessment**

- Purpose of assessment
- learning assessment
- Assessment tools
- Assessment of performance

### Mode of Transaction

- Prospective teachers to be engaged in discussions on observed children's work in order to acquire an understanding how children respond to mathematical knowledge
- Prospective Teachers in groups develop concept maps to understand linkages and relationships between various mathematical concepts and to imbibe the importance of team work
- Reading of texts (suggested as discussion) with dialogue to understand theory from the point of view of issues raised
- Collecting historical samples of mathematical knowledge (such as ways to multiply in different cultures) and reflecting on them
- Preparing mathematical models, particularly geometric
- Critically examining teaching-learning materials through presentations

### Essential Readings

1. Haylock, D. (2006). *Mathematics Explained for Primary teachers*. New Delhi: Sage Publication, Chapter 22: Measurement, 247-263.
2. Lieback, P. (1984). *How children learn mathematics: a guide for parents and teachers*. London: Penguin.
3. Skemp, Richard R. *Mathematics in the Primary School*. London: Routledge. Chapter a The formation of Mathematical Concepts, Chapter 4: The Construction of Mathematical Knowledge, Chapter 5: Understanding Mathematical Symbolism, 49-71, 72-89, 90-108.
4. Post, Thomas, R. (1992). *Teaching Mathematics in Grades K-8, Research-Based Methods*. allifornia: Allyn and Bacon, Chapters 1, Chapter 4, Chapter 5, Chapter 6, and Chapter 7.
5. Zevenbergen, R., Dolley, S. And Wright Robert J., (2005), *Teaching Mathematics in Primary Schools*. Australia: Allen & Unwin; (First South Asian Edition). Chapter 2, Chapter 3, Chapter 7 and Chapter 9.

### Advanced Readings for Faculty

1. Moses, B. (Ed.) (1999). *Algebraic Thinking, Grades K-12. USA*: National Council of Teachers of Mathematics.
2. **Readings for Discussion**
  1. Carraher, T. N., Schliemann A. D. and Carraher, D. W. (1988). Mathematical concepts in everyday life. In G. B. Saxe & M. Gearhart (Eds.). *Children's mathematics. New Directions for Child Development*. San Francisco: Jossey-Bass, 71-87.
2. IGNOU, AMT – 01 *Teaching of Primary School Mathematics*. New Delhi: IGNOU.
3. IGNOU, LMT – 01, *Learning Mathematics*. New Delhi: IGNOU.
4. Wood, D. (1998). The Mathematical Mind. In *How Children Think and Learn*. UK: Blackwell Publishing, Chapter 8, 225-255.