**A5 PEDAGOGY OF MATHEMATICS**

**Course Code: A 5 (Part IV) Credits: 04**

**Contact Hours: 60 Maximum Marks:100(Int:30,Ext:70)**

**Introduction**

The course will help the student-teachers to generate their student's interest for learning maths and develop dispositions towards the subject. It is designed to equip the learners to teach maths using innovative methods, techniques and teaching learning material for children with & without disabilities.

Learning outcomes:

After completing the course the student-teachers will be able to

* *Explain the nature of Mathematics and its historical development with contribution of Mathematicians.*
* *Describe the aims and objectives of teaching Mathematics at school level.*
* *Demonstrate and apply skills to select and use different methods of teaching Mathematics.*
* *Demonstrate competencies of planning for teaching Mathematics, organizing
laboratory facilities and equipment designing pupil centered teaching learning experiences.*
* *Demonstrate skills to design and use various evaluation tools to measure learner achievement in Mathematics.*

**UNIT – 1 Mathematical Content and its Pedagogic issues (15 hours)**

Approaches of teaching mathematics in relation to the conceptual development of:

***1.1 Number systems and Number Theory***

Explore the idea of number sense and different number systems, role of estimation in developing number sense. Exploring properties associated with numbers including their geometric representations.

Different interpretations of rational numbers –fractions, rational numbers, proportional relationship; using number line, and real life context for teaching rational numbers

Children’s reasoning in relation to integers and rational numbers, role of ‘number talks’ in promoting number sense

 ***1.2 Geometry, spatial thinking and measurement***

Exploring different dimensions of geometry and spatial reasoning such as – visualisation, understanding symmetry, congruency and similarity; attributes of different geometrical shapes - surface area and volume, mapping skills

Development of proof skills: making generalisations and justification.

 ***1.3 Statistics & Probability***

Understanding different statistical concepts of data collection and representation, use and meaning of central tendencies, analyzing variations;

Investigating basic concepts of probability such as nature of distributions,

randomness, sample space, independent events, relationship between statistics and probability

 ***1.4 Patterns, Functions and Algebra***

Relationship between arithmetic and algebra

Big ideas in algebraic reasoning such as finding, describing and using patterns, understanding linearity and non-linear functions

Development of algebraic reasoning leading to more sophisticated ideas related to growth and decay, optimization, making different types of graphs (linear and non-linear) and drawing interpretations from the nature of graphs

**Unit 2: Designing and Planning a Unit and Lessons (15 hours)**

 2.1 Engagement with the National curriculum, syllabus and textbooks. Critical study of all three in light of the conceptual and pedagogical understanding developed in Unit 1

 2.2 Studying the curriculum: Aspects related to what is worth knowing and experiencing in mathematics, understanding the nuances between intended curriculum and implemented curriculum.

 2.3 Developing unit plans and concept maps, designing constructive lesson plans, understanding the role of communication, mathematical community and group dynamics in classrooms

2.4 Critical engagement with 1CT, Simulations and mathematical modelling in promoting mathematical thinking.

**Unit 3: Teaching-Learning Resources in Mathematics for Students with Disabilities (15 hours)**

3.1 Mathematics Laboratory- Concept, Need, and Equipment for Setting up Mathematics Laboratory

3.2 Utilization of Learning Resources in Mathematics: Charts and Pictures, Weighing and Measuring Instruments, Drawing Instruments, Models, Concrete Materials, Surveying Instruments such as Abacus, Cussionaire Rods, Fractional Discs, Napier Strips, geoboard, tangrams, tessellation kits, paper models, paper folding actions with reference to children with disabilities.

3.3 Mathematical modeling is promoting mathematical thinking

3.4 Role of calculators and computers, simulations and special teaching aids to Promote learning in children with special needs.

**Unit 4: Assessment (15 hours)**

 4.1 Assessment and Evaluation – Concept, Importance and Purpose

 4.2 Error analysis, Diagnostics Tests, Identification of Hard Spots and Remedial Measures

 4.3 Critical role of assessment in enhancing learning- Explore diverse methods and tools of assessing an array of learning/performance outcomes of diverse learners, relationship of assessment with self-esteem, motivation, and identity as learners, assessment for learning and role of feedback

 4.4 Traditional assessment vs. assessment within a constructivist paradigm

 4.5 Adaptations in Evaluation Procedure for students with disabilities

**Suggested Readings**

* Banerjee, R., &Subramaniam, K. (2012).Evolution of a teaching approach for beginning algebra. *Educational Studies in Mathematics,80{3),* 351-367.
* Bryant, P., &Nunes, T. (2012). *Children's understanding of probability.* Nuffield Foundation. Retrieved from
* Clements, D.H., & Battista, M.T. (1992). Geometry and spatial reasoning. In D.A.
* Grouws - (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 420- 464). New York, Macmillan.
* Gal, I. (2005). Towards" probability literacy" for all citizens: Building blocks and instructional dilemmas. In G. A. Jones (Ed.), *Exploring probability in school* (pp. 39-63).Springer.
* Kieran, C. (1992). The learning and teaching of school algebra. In Grouws, D.A. (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 390-419). New York: MacMillan Publishing Company,
* Lamon, S. (2005). *Teaching fractions and ratios for understanding: Essential content knowledge and instructional strategies for teachers.* Mahwah, NJ: Erlbaum.
* LMT-01 Block 5 Unit-16: Exploring Number System.
* NCERT.(2006). *Syllabus for classes at the elementary level* (Vol. 1). New Delhi: NCERT.
* NCERT. (2006). *Syllabus for secondary and'higher secondary classes.* New Delhi: NCERT.
* LMT-01 Block 2, Unit-05: Building a Constructive Classroom (classroom organization, material and assessment). IGNOU.
* Cooper, B., & Dunne, M. (1998). Any one for tennis?Social class differences in children's responses in national curriculum mathematics testing. *The Sociological Review,* . 46(1), 115-148.
* Grant, D. A. (2000). What's on the test? An analytical framework and findings from an examination of teachers' math tests.*Educational Assessment,* 6(4), 221-256. .
* Hamilton, T. M. (2010). Mathematics learners and mathematics textbooks: A question of identity? Whose curriculum? Whose mathematics? *Curriculum Journal, 21(1),* 3-23.
* Morgan, C, & Watson, A. (2002). The interpretative nature of teacher's assessment of students' mathematics: Issue for equity. *Journal for Research in Mathematics Education,* 35(2), 78-110.
* NCERT.(2006). *Position paper-National focus group on assessment (NCF 2005).* New Delhi: NCERT.
* Swaffield, S. (2011).Getting to the heart of authentic assessment for learning, *Assessment in Education: Principles, Policy & Practice, 18(A),* 433-449.

***Assignments/Projects/Practicum***

 • Textbook analysis

 • Analysing student's oral and written responses

 • Undertaking performance based assessment in a classroom

 • Small action research on children's conceptions of mathematical concepts

 • Designing field based projects for middle or secondary school children

 • Organizing a Mathmela in a school or a locality

 • Using historical anecdotes as means for promoting mathematical communities in classrooms

 • ICT-based projects for linking higher mathematics

 • Analyzing'math-talk'

 • Creating videos of students' mathematical work

**Teaching Learning Process**

The course will be taught through interactive pedagogic methods such as classroom discussion, debates, film discussions, critical media analysis, collaborative learning tasks which enhance reading comprehension of core writings in the area and innovative projects. Reflective expression and learning will be encouraged.

 **Key words: Maths Lab, Concept Map, Constrictivist Paradigm,Error Analysis**