**Bachelor of Education (B.Ed.) Special Edu-ID**

**Understanding the Discipline of Mathematics**

**(Semester: II )**

**Course Code: A-4 (Part-III)**

 **Credits: 4**

**MM: 100 (External: 70 Internal: 30)**

**Introduction of the Course**

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 math using innovative methods, techniques and teaching learning material for children with & without disabilities.

**Learning Outcomes**

After completion of the course student 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 I: Introduction to mathematical thinking**  **(15hours)**

1. Mathematics as a study of creating,discerning and generalising patterns: Identifying and analysing abstract patterns,patterns of shapes,patterns of motion,numerical patterns.
2. Understanding Mathematics as a humanly created subject: creating mathematical structures :idea of axioms,postulates and proofs, Different methods of proof: direct proof,indirect proof,counter examples,proof by induction.
3. Sociocultural,economic and political factors in the development of mathematics.
4. Everyday mathematics,multicultural mathematics;its use in the decision making. Societal benefits related to ‘knowing and doing’mathematics. Critically challenging the sociological beliefs related to mathematics abilities.

 **Unit 2: Learning Mathematics**  **(15 hours)**

1. Developmental progression in the learning of mathematical concepts: Piaget,Skemp,Bruner and Vygotsky; Fishbein on intuitive thinking
2. Focus on mathematical processes -Problem solving,Problem posing,reasoning,abstraction and generalisation,argumentation and justification.
3. Sociocultural perspectives in mathematics learning-situated learning;social construction of knowledge;socail interaction and community of practice.
4. Historical evolution of concepts-understanding how concepts evolved,power play in legitimising concepts.

 **Unit 3: How should we teach mathematics? (15 hours)**

(i) Culture of learning- Creating dynamic classroom environments; sharing and exploring ideas, encouraging diverse and innovative procedures, using multiple ways to solve problems, making conjectures, seeking generalisations; respecting diverse capabilities; use of context; metacognition

(ii) Role of Communication in classroom- Math talk; building a community of mathematicians in classrooms; constructing mathematical ideas by providing scope for exploration, explanation and evaluation of children’s work

(iii)  Use of resources, activities, story-telling and technology in initiating mathematical thinking.

(iv) Notions related to mathematical ‘ability’; promoting growth mindset, depth versus speed; math anxiety

(v) Teacher’s beliefs and knowledge about the nature of mathematics and mathematical learning, teachers’ agency in school math reform.

**UNIT 4: Mathematics for equity and social justice (15 hours)**

(i)  Why teach ‘mathematics to all’? – Concerns and challenges

(ii)  Issues of gender, class and culture in mathematics learning and achievement - Expectations, attitudes and stereotypes; access to higher mathematics; interrogating the notion of ‘achievement gap’;

(iii) construction of learners’ identity in a mathematics classroom

(iv)Addressing the concerns of societal as well as mathematical equity

**Engagement with the Field**

An understanding of the relationship between the discipline and a selection of school curriculum will be enhanced through observations and projects to address the following issues: What knowledge is valued? How is mathematics experienced in school settings and how are learner identities constructed? How do communities shape knowledge production and, there, what counts as useful mathematical knowledge? How might scholars and teachers work with community-based knowledge makers to develop collaborative knowledge resources?

Assignments/Projects

1.     Analysis of books, folk games, and other resource materials

2.     Observation of children doing everyday math; numeracy Practice

3.     Use and setting up of a mathematics lab

5.     Development of manipulatives, games, low-cost activity materials

Essential/ Recommended Readings

Boaler, J. (2010). The elephant in the classroom. Helping children love and learn maths. Souvenir Press Ltd

Boaler, J. & Staples, M. (2005). Transforming students’ lives through an equitable mathematics approach: The case of Railside school. Available for download on: [www.stanford.edu/~joboaler/](http://www.stanford.edu/~joboaler/)

Boaler, J. (2013, March). Ability and Mathematics: The mindset revolution that is reshaping education. In Forum (Vol. 55, No. 1, pp. 143-52). Symposium Journals.

Burns, M. (2007). About teaching mathematics: A K–8 resource, Third Ed. Math Solutions Publications.

Bishop, A. J. (1988). The interactions of mathematics education with culture. Cultural Dynamics, 1(2), 145–157.

Devlin K. (2011). Introduction to Mathematical thinking.

Ernest, P. (2009). New philosophy of mathematics: Implications for mathematics education. In B. Greer, S. Mukhopadhyay, A. B. Powell, & S. Nelson-Barber (Eds.), Culturally responsive mathematics education (pp. 43–64). Routledge.

Gutstein, E. (2007). “And that’s just how it starts”: Teaching mathematics and developing student agency. Teachers College Record, 109(2), 420–448.

Kazemi, E., &Stipek, D. (2001). Promoting conceptual thinking in four mathematics classrooms. The Elementary School Journal, 102(1), 59–80.

Chapin, O’Connor, & Anderson (2009). Classroom discussions: Using math talk in elementary classrooms. Math Solutions.

Cirillo, M. (2009).Ten things to consider when teaching proof. Mathematics Teacher, 103(4), 250-257.

Fuller, E., M Rabin, J., &Harel, G. (2011). Intellectual need and problem-free activity in the mathematics classroom. Jornal Internacional de Estudosem EducaçãoMatemática, 4(1).

Hiebert, J., Carpenter, T., Fennema, E., Fuson, K., Wearne, D., Murray, H. (1997). Making Sense: Teaching and learning mathematics with understanding. Portsmouth, NH: Heinemann.

Lampert, M. (2001). Teaching problem and problems for teaching. Yale University.

Lockhart, P., & Devlin, K. J. (2009). A mathematician’s lament. New York: Bellevue Literary Press.

Martino, A.M. & Maher, C. (1999). Teacher questioning to promote justification and generalization in mathematics: What research practice has taught us?. Journal of Mathematical Behavior, 18(1), 53-78.

Parish, S. (2014).Number talks: Helping children build mental math and computation strategies, Grades K-5, Updated with Common Core Connections. Math Solutions.

Reinhart, S. (2000). Never say anything a kid can say! Mathematics Teaching in the Middle School, 5(8), 478-483.

Schifter, D. (2001). Learning to see the invisible. What skills and knowledge are needed in order to engage with students’ mathematical ideas? In T. Wood & B. Scott Nelson & J. Warfield (Eds.), Beyond classical pedagogy: Teaching elementary mathematics. Mahwah, (pp. 109-134). NJ: Lawrence Erlbaum Associates

Smith & Stein (2011). Five practices for orchestrating productive mathematics discussions.

Dweck, C.S. (2006). Is math a gift? Beliefs that put females at risk. In W.W.S.J.Ceci (Ed.), Why Aren't More Women in Science? Top Researchers Debate the Evidence. American Psychological Association.

Greer, B., Mukhopadhyay, S., & Powell, A. B. (Eds.). (2009). Culturally responsive mathematics education. Routledge.

Teaching Learning Resources (Digital and others): Across Units

TIMSS Videos of mathematics classrooms available at: <http://www.timssvideo.com/videos/Mathematics>

**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.

**Keywords: Math Talk,Community of Practice, Societal Beliefs,Mathematical Thinking**