M Ed Two Year Programme

S.Ma 2 (a) : Mathematics Curriculum : Development and Analysis

Maximum Marks: 100

Course Vision

The course delineates main assumptions behind a range of theoretical frameworks for conceptualising and analysing learning and teaching of mathematics at the developmental stages of a child and how they contribute towards an intended curriculum. This course is designed for analytic considerations related to the content, organization, presentation and evaluation of school mathematics curricula. Develop a critical perspective towards knowledge that is embedded in and anticipated to be attained in the mathematics curriculum in schools.

Unit I: Philosophical Considerations of Learning Mathematics

Focus will be also be given to the philosophical considerations of learning mathematics through the perspectives of*:*

Cognitive- constructivist theories
Interactionist theory
Socio-cultural perspective of understanding mathematics, development of thinking and knowledge in and out of school settings
Mathematics for social justice and citizenry

Unit 2: Mathematics Curriculum at School Level: Issues and Emerging Trends

Issues in curriculum making, power and politics of knowledge, critical view of curriculum at school level, reviewing the position of mathematics in national education policies and documents of India, compare and contrast mathematics curriculum across the world, critically analyse the perspectives and rationale adopted in other countries on goals of teaching mathematics, textbook and content analysis of different countries.

Unit 3: Contemporary Research in Construction and Development of Core Topics

In this section evaluation and critical analysis of research done in the development of core topics in elementary/ secondary school mathematics curriculum will be done. Students will choose area/s of their choice and will focus on the contemporary researches being done in understanding pedagogical concerns, approaches that promote students' conceptual understanding and address anticipated learning difficulties; and teaching methods that provoke critical thought and foster inquiry-based learning in that area. Emphasis will on analyzing ways in which students make multiple representations, develop generalizations and give justification while developing understanding of these areas:

Geometry Number sense and number theory
Algebra Statistics Probability theory
Elementary calculus
Kinematics
Language issues in mathematics

Unit 4: Assessment in Mathematics:
Perspectives related to assessment and learning mathematics will be studied as part of this section. Changing role of assessment, can assessment be seen as continuum to learning? Research related to contemporary issues related to assessing mathematical thinking. Assessment methods for linguistically, culturally and mathematically diverse students.

Critical analysis and comparison of large-scale mathematics tests such as TIMSS, PISA, Olympiads

Unit 5: Meeting Diverse Needs in a Mathematics Classroom
This section will discuss the theories and researches that ensure success of each child in an elementary mathematics classroom: Gender, socioeconomics, language, learning differences. Role of differentiated assessment, differentiated instruction and adapting curriculum to meet diverse learners will be considered.

List of Recommended Readings

AMT-01. Teaching Mathematics. IGNOU Series

Apple, M. (1992). Do the Standards Go Far Enough? Power, Policy, and Practice in Mathematics Education? Journal for Research in Mathematics Education.

Bharath. S., English, L. (2010).Theories in Mathematics education. Seeking new frontiers. Springer. Boaler, J. (1998). Open and Closed mathematics: Students' experiences and understandings. Journal for Research in Mathematics Education. Vol. 29, No. 1, 41–62.

Butler, J. (1999). Gender trouble. New York: Routledge.

Chapman, A. (1995). Inter-textuality in school mathematics: The case of functions. Linguistics and Education, 7, 243-262.

Charalambous, C., Delaney, S., Hsu, A., & Mesa, V. (2010). The addition and subtraction of fractions in the textbooks of three countries: A comparative analysis. Mathematical Thinking and Learning, 12(2), 117-151.

Christensen, O. R., Skovsmose, O., and Yasukawa, K. (2008). The mathematical state of the world-Explorations into the characteristics of mathematical descriptions. ALEXANDRIA Revista de Educação em Ciência e Tecnologia, 1(1), 77−90.

Cogan, L., Houang, R., & Wang, H. C. The conceptualization and measurement of curriculum. College Press.

Cuoco, A., Paul Goldenberg, E., & Mark, J. (1996). Habits of mind: An organizing principle for mathematics curricula. Journal of Mathematics education. 15, 375-40

Devlin K. (2011). Introduction to Mathematical thinking. Ernest P. (1991). The Philosophy of Mathematics Education.

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.

Frankenstein, M. (1989). Relearning mathematics: A different third R—Radical math. London, UK:Free Association Books.

Frankenstein, M. (1995). Equity in mathematics education: Class in the world outside the class. In W.G. G. Secada, E. Fennema, & L. B. Adajian (Eds.), New directions for equity in mathematics.

Gutstein, E. (2006). Reading and writing the world with mathematics: Toward a pedagogy for social justice. New York: Routledge.

Harwell, M. R., Herrick, M. L., Curtis, D., Mundfrom, D., & Gold, K. (1996). Evaluating statistics texts used in education. Journal of Educational and Behavioral Statistics, 21(1), 3-34.

Herbel-Eisenmann B., Choppin J., Wagner D., Pimm D. (2012). Equity in Discourse for Mathematics Education: Theories, Practices, and Policies. Springer, New York.

Herbel-Eisenmann, B. (2007). From intended curriculum to written curriculum: Examining the ―voice‖ of a mathematics textbook. Journal for Research in Mathematics Education, 38, 344-369.

Herbst, P. (1997). The Number-Line metaphor in the discourse of a textbook series. For the Learning of Mathematics, 17(3), 36-45. Howson, G. (1998). Some thoughts on constructing a curriculum. Mathematics Teacher, 16(5), 18-21.

Herbst, P. (2002). Establishing a custom of proving in American school geometry: evolution of the two-column proof in the early twentheith century. Educational Studies in Mathematics. Springer. 49, 283-312.

Howson, G., Keitel, C., & Kilpatrick, J. (1981). Curriculum development in mathematics. Cambridge: Cambridge University Press.

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

Kilpatrick, J. (1993). The chain and the arrow: From the history of mathematics assessment. In M. Niss (Ed.), Investigations into assessment in mathematics education: An ICMI study (pp. 31-46). Dordrecht: Kluwer.

Kilpatrick, J. (1995). Curriculum change locally and globally. In R. P. Hunting, G. E. Fitzsimons, P. C. Clarkson & A. J. Bishop (Eds.), Regional collaboration in mathematics education 1995.Melbourne, Australia: Monash University, Faculty of Education.

Kline, M. (1973). Why Johnny can't add: Random House

Lakatos, I. (1976). Proof and Refutations: The Logic of Mathematical Discovery, ed. J. Worrall and E. Zahar. Cambridge: Cambridge

Lampert, M. (1990). When the Problem is Not the Question and the Solution is not the Answer: Mathematical Knowing and Teaching. American Education Research Journal.27(1), 29-63.

Lithner, J. (2004). Mathematical reasoning in calculus textbooks exercises. Journal of Mathematical Behavior, 23, 405-427.

Lloyd, G. and M. Wilson (1998). Supporting innovation: The impact of a teacher's conceptions of functions on his implementation of a reform curriculum. Journal for Research in Mathematics Education 29(3): 248-274.

LMT-01. IGNOU Series

McBride, M. (1994). The theme of individualism in mathematics education: An examination of mathematics textbooks. For the Learning of Mathematics, 14(3), 36-24.

McCaffrey, D., F., Hamilton, L. S., Stecher, B. M., Klein, S. P., Bugliari, D., & Robyn, A. (2001). Interactions among instructional practices, curriculum and student achievement: The case of standards-based high school mathematics. Journal for Research in Mathematics Education.

Mesa, V (2004). Characterizing practices associated with functions in middle school textbooks: An empirical approach. Educational Studies in Mathematics, 56, 255-286

Mesa, V. (2010). Strategies for controlling the work in mathematics textbooks for introductory calculus. Research in Collegiate Mathematics Education, 16, 235-265.

MESE -001(2003). Teaching and Learning Mathematics. IGNOU series

Mewborn, D. S. (2000). Learning to teach elementary mathematics: Ecological elements of a field experience. Journal of Mathematics Teacher Education, 3, 27-46.

Mukhopadhyay, S., & Greer, B. (2001). Modeling with purpose: Mathematics as a critical tool. In B. Atweh, H. Forgasz, & B. Nebres (Eds.), Sociocultural Research on mathematics education: An internation
Murrell, Peter C. Jr. (1994). In Search of Responsive Teaching for African American Males: An Investigation of Students' Experiences of Middle School Mathematics Curriculum. The Journal of Negro Education, 63, (4), 556-569

Newman, J. (2003). The World of Mathematics: A Four-Volume Series. Washington Tempus
Newton, D. P., & Newton, L. D. (2006). Could elementary mathematics textbooks help give attention to reasons in the classroom? Educational Studies in Mathematics, 64, 69-84.

Noddings, N. (1994). Does everybody count? Journal of Mathematical Behavior 13(1): 89-106.

Polya, G. (1954). Induction in solid geometry. In Mathematics and plausible reasoning (Vol. 1, pp. 35-41). Princeton: Princeton

Schmidt, W. H., Houang, R. T., & Cogan, L. (2002). A coherent curriculum: The case of mathematics. American Educator, 26(2), 10-26,47.

Schoenfeld, A. (1988). When good teaching leads to bad results: The disasters of "well taught" mathematics courses. Educational Studies in Mathematics, 56, 255-286

Schoenfeld, A. H. (2004). The Math Wars. Educational Policy, 18(1), 253.

Skemp, R. (1978). Relational understanding and instrumental understanding. *Arithmetic Teacher 26* (3), 1-16.
Steen, L. A. (1998). Core curriculum in context: History, goals, models, challenges. In J. Dossey (Ed.), Confronting the core curriculum (Vol. 45, MAA Notes, pp. 3-13). Washington, DC: Mathematical Association of America.

Stein, M. K., & Lane, S., (1996). Instructional tasks and the development of student capacity to think and reason: An analysis of the relationship between teaching and learning in a reform mathematics project. Educational Research and Evaluation, 2, 50-80.

Stigler, J. W., Fuson, K. C., Ham, M., & Kim, M. S. (1986). An analysis of addition and subtraction word problems in American and Soviet elementary mathematics textbooks. Cognition and Instruction, 3, 153-171.

Stodolsky, S. S. (1989). Is teaching really by the book? In P. W. Jackson & S. Haroutunian-Gordon (Eds.), From Socrates to software: The teacher as text and the text as teacher.

Tarr, J. E., Reys, R. E., Reys, B. J., Chavez, O., Shih, J., & Osterlind, S. J. (2008). The Impact of Middle-Grades Mathematics Curricula and the Classroom Learning Environment on Student Achievement. Journal For Research In Mathematics Education, 39(3), 247.

Timothy Gowers (2002). Mathematics: A Very Short Introduction. Oxford University Press

Wheeler D (1983). Mathematisation matters. *For the Learning of Mathematics*, *3*(1).
Wu, H. (1997). The mathematics education reform: Why you should be concerned and what you can do. The American Mathematical Monthly, 946-954.