

Syllabus : Semester - IV

MES551(d) SP: 11 - Theme A /Theme B

Theme Based Specialization Course – I

Theme A : Pedagogy, Technology and Assessment in Education

Pedagogy and Methodology of Teaching Mathematics

(Elementary/Secondary and Senior Secondary Education)

Objectives

On completion of this course students will be able to:

- appreciate the abstract nature of mathematics
- distinguish between the roles of Pure and Applied Mathematics
- develop the skill of solving real-life problems through mathematical modeling as an art
- develop the skill of using various methods of teaching Mathematics
- develop the an awareness towards the structure of Mathematics
- develop the skill of constructing test items
- adopt different strategies of evaluation
- highlight the significance of Mathematics Laboratory & Mathematics Club
- develop the skills required for Action Research in Mathematics
- develops positive attitude towards profession
- explores avenues of professional growth

Mode of Transaction

Lecture cum discussion, demonstration, group presentations, seminars, debates, assignments, brain storming sessions, peer group discussion, interaction with community, case study, survey and dialogue, Problem Solving.

Unit 1: Nature, Objectives and Strategies of Teaching Mathematics

- 1.1 Abstractness of Mathematics ; Distinction between Mathematics and Science; Distinction roles of Pure and Applied Mathematics ; Mathematization; Aesthetic aspect of Mathematics; Historical development of Mathematical concepts with some contributions of Indians and Greek Mathematicians such as Aryabhata, Brahmagupta, Bhaskaracharya, Srinivasa Ramanujan, Euclid, Pythagoras, Euler, Gauss : Teaching of Mathematical Modeling.
- 1.2 Aims and Objectives of teaching Mathematics at various levels of school mathematics; Instructional objectives in teaching mathematics;
- 1.3 Psychological approach in Mathematics Education- Motivation and Transfer of learning in Mathematics classrooms- Contributions of Piaget, Bruner, Gagne, Vygotsky, Ausubel, Richard Suchman and Gardner for Mathematics Education and learning

- 1.4 Methods of teaching Mathematics- Lecture-cum-Demonstration Method, Inductive and Deductive methods, Analytic and Synthetic methods, Heuristic Method ; Problem Solving Skills- stages in problem solving techniques to improve problem solving skills (Polya method); Competence based approach to teaching mathematics; constructivist approach in teaching of Mathematics; Computer based instructions;
- 1.5 Models - Information Processing Models
- Concept Attainment Model
 - Advance Organizer Model
 - Inquiry Training Model
 - Inductive Thinking Model
 - Cognitive Growth Model

Unit 2 : Structure of Mathematics

- 2.1 Undefined Terms and Axioms; Proofs and Verification in Mathematics and distinction between them; Types of Theorems such as Existence and Uniqueness theorems etc.; Types of Proofs- Direct proofs, Indirect proofs, Proof by Contradiction, Proof by Exhaustion, Proof by Mathematical Induction and distinction between Induction and Mathematical Induction; Role of Examples, Counter Examples and Non-examples in Mathematics; Conjectures; Scope and limitations of Intuition in Mathematics; Sets and Venn Diagrams as a representative of Mathematical properties and their relations.

Unit 3 : Mathematics Curriculum

- 3.1 Curriculum Development – Approaches and Patterns – Criteria for selection and organization of contents.
- 3.2 New trends in the development and transaction of mathematics curriculum
- 3.3 Differential curricula – Horizontal and Vertical Acceleration— Enrichment Programmes individualized instruction

Unit 4 : Evaluation and Research in Mathematics

- 4.1 Concept of Evaluation in Teaching- Learning process (Formative, Summative, Criterion, Diagnostic); Role of Evaluation in Teaching- Learning process; Types of mistakes in Mathematics, their identification and analysis with a purpose of preventing and remedial measures; Types of Test items in Mathematics - Long answer type, Short answer type, Very Short answer type and objective type; Construction of unit test (Blue print, construction of items, administration, scoring & interpretation)
- 4.2 Research in Mathematics education (focusing on Problem-Solving Ability & diagnostic studies);
- 4.3 Action Research in Mathematics; Use and preparation of teaching aids; Development of Mathematics Laboratory and Organizing Mathematics Club; Ethics of teaching

profession; Need for recurrent education; Types of in-service programs; Role of mathematics teacher association;

4.4 Professional growth- participation in seminars/orientation/conference/workshops;

4.5 Professional forums and associations (online & Offline); Journals

Practicum (Any Two):

- Assignment on construction of Test items for a Unit
- Analysis of famous quotations on Mathematics
- Class Test
- Group puzzles activity
- Preparation & use of teaching aids
- Conducting mathematics Olympiads (school level)

References

- Alice F. Art and Eleanan Armaer Thomas. *Becoming a Reflective Mathematics Teacher*.
- Cooney T.J and Others (1975), *Dynamics of Teaching Secondary School Mathematics*, Boston; Houghton Mifflin.
- Gronlund, N.E., (1990) *Measurement and Evaluation in Teaching*. New York; Macmillan.
- Heimer, R.T. and Trueblood, C.R. (1970) *Strategies for Teaching Children Mathematics; Reading*. Massachusetts: Addison Wesley Publishing C
- Kumar Sudhjir, Teaching of Mathematics, Anmol Publications, Publisher Pvt. Ltd., New Delhi, 2000.
- James Anice, Teaching of Mathematics, Neelkamal Publications Pvt. Ltd., Educational Publishers New Delhi – 2006.
- James Anice, Methods of Teaching Mathematics, Neelkamal Publications Pvt. Ltd., Educational Publishers New Delhi – 2010.
- James Anice and Jayanthi Alwan, Skills and Strategies of Teaching Mathematics, Neelkamal Publications Pvt. Ltd., Educational Publishers New Delhi , 2012.
- Mangal S.K., A Text Book on Teaching of Mathematics, Prakash Brothers, Ludhiana, 1994.
- NCERT, A Textbook of Content-cum-Methodology of Teaching Mathematics, New Delhi-16
- Polya, G (1957). *How to Solve it*. 2nd edition, Garden City, N.Y.: Doubleday and Company.
- Polya, G *Mathematical Discovery on Understanding, Learning and Teaching Problem Solving*. John Wiley & Sons.
- Sawyer, W.W. *Mathematics in Theory and Practice*. Udham Press Ltd, London.
- Siddiqui Mujebul Hasan, Teaching of Mathematics, A.P.H. Publishing Corporation, 5 Ansari Road, Dariya Ganj, New Delhi, 2005.
- Sidhu, K.S., Teaching of Mathematics, Sterling Publishers Pvt. Ltd, New Delhi, 1995.