

**21 DAYS INSERVICE TRAINING PROGRAMME FOR
THE PGTs IN MATHEMATICS OF
THE KENDRIYA VIDYALAYA SANGATHAN (NEW DELHI)**

(24-05-2000 to 13-06-2000)

DR. N.M. RAO
ACADEMIC COORDINATOR



REGIONAL INSTITUTE OF EDUCATION
(NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING, NEW DELHI)
MYSORE-570 006

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REGIONAL INSTITUTE OF EDUCATION, MYSORE-570 006
(NCERT, NEW DELHI)

Report of the 21 days Inservice Training Programme
for the PGTs in Mathematics of the
Kendriya Vidyalaya Sangathan (New Delhi)
(24-05-2000 to 13-06-2000)

The above programme was conducted by the faculty members of the Mathematics section of the Regional Institute of Education, Mysore-570 006 between 24-05-2000 and 3-06-2000 at RIE, Mysore, as per the request of the Kendriya Vidyalaya Sangathan, New Delhi. This programme was fully financed by the Kendriya Vidyalaya Sangathan.

Dr. N.M. Rao, Reader and I/C Mathematics Section of the RIE, Mysore was the Academic Coordinator of the Programme.

Planning

The planning was done in two stages.

Step 1: Planning for the selection of topics to be
discussed

Eventhough the KVS has not given us the advance information about the topics to be discussed during the training programme, we selected the newly introduced topics (Curriculum 2000) because of our past experience with the other organisations like Navodaya schools, A.P. Social Welfare Boards Residential Schools, Railway Schools, etc.

Step 2: Planning for the conduct of the 21 days
training programme

A detailed time table for 21 days was prepared well in advance. Some well experienced professors (retired) and all the faculty members of the Institute were associated with the programme.

Step 3: Planning for the development of materials

Projects on Mathematics and Mathematics Lab activities were planned. The strategies of teaching the new topics like statics, dynamics, probability, statistics, commercial mathematics, etc. were discussed thoroughly in the Mathematics sections and the materials were developed accordingly.

Content Enrichment

The programme was made to suite the requirement of the teachers - by converting it to be a Content Enrichment Programme instead of a General Orientation Programme.

Faculty Members

The names of the faculty members involved and the list of topics covered by them during the programme is as follows:

Dr. G. Ravindra, Principal, RIE Mysore (GR)

Linear programming, optimisation problems and a general lecture 'Why Mathematics ?' and the graphical method of solving equations/inequations.

Dr. D. Basavayya, Reader in Mathematics, RIE, Mysore

1. Concepts of Skewness and Kurtosis
2. Measurement of Skewness and Kurtosis
3. Meaning of Correlation
4. Measurement of Covariance
5. Karl Pearson Correlation Coefficient
6. Rank Correlation Coefficient
7. Concept of Regression - Linear, Curve Linear
8. Least Square Method
9. Regression Equations
10. Problems Solving in Regression
11. Concept of Probability
12. Historical Development of Probability
13. Definitions of Probability - Mathematical, Statistical and Axiomatic
14. Results in Probability
15. Conditional Probability
16. Addition and Multiplication Theorems of Probability
17. Bayes Theorem in Probability
18. Matching Problem
19. Geometric Probability
20. Problem Solving in Probability
21. Concept of Random Variable
22. Binomial Distribution
23. Graphical Representation of Statistical Data
24. Concept of Index Numbers

Dr. B.S.P. Raju, Reader in Mathematics, RIE, Mysore

1. Content categories, i.e. concepts, generalisations in Mathematics
2. Shares - Preferential and ordinary shares
3. Debentures - Convertible and non-convertible
4. Sinking fund - Definition, uses and the calculation
5. Partnership and admission of a partner, sacrificing ratio good will - death or retirement of a partner - adjustment of capital.
6. Bills of exchange - Discounting the bill, true discount, bankers discount, bankers gain - Retiring a bill under rebate.
7. Depreciation - factors that cause depreciation, need for providing depreciation, methods of calculating depreciation.
8. Forecasting, time series analysis - components
9. Foreign exchange - Vostro, Nostro and Low accounts
10. Inverse trigonometric functions
11. Differential equations - variable separable, homogeneous, non-homogeneous (two types) that can be converted to homogeneous and variable separable. Exact equations and linear equations. Simple second order differential equations.
12. Annuity - ordinary, annuity due, deferred, annuity, present value of annuity.

Dr. B.S. Upadhyaya, Reader in Mathematics, RIE, Mysore

1. Number System
2. Complex Numbers
3. Congruences

Under the number system, the need for axiomatic definition of natural numbers, starting from the Peano's axioms for natural numbers, the construction of integers, construction of rational numbers were discussed. How the laws of addition and multiplication of natural numbers, integers, rational numbers could be 'proved' and not just 'verified' were shown. Real numbers were defined axiomatically and the insufficiency of real numbers for solution of polynomial equations were shown. Ordering in real numbers was also discussed.

Under complex numbers, complex numbers were defined as ordered pair of reals satisfying certain properties. For this definition why complex numbers can be represented by symbols of the term $a + bi$ where a and b are real numbers was shown. Representation of complex numbers by argand diagrams was discussed. Solutions of complex number equations were also discussed. The important difference between the real numbers and complex numbers, viz. that the complex numbers are not ordered was proved. Fundamental theorem of algebra was also discussed.

Under congruences, after defining congruences, its properties and Fermats theorem were proved. Existence of solutions of Congruence Equations were discussed.

Sri B.C. Basti, Sr.Lecturer in Mathematics,RIE,Mysore

Integral Calculus, Limit Continuity and Differentiation, Fundamental Theorem of Integration, and their applications in the real life situations.

**Dr. N.B. Badrinarayana, Reader in Mathematics (Rtd)
RIE, Mysore**

A complete revision of the whole part of dynamics (as prescribed in the new syllabus) was done.

**Dr. N.M. Rao, Reader and I/C Mathematics Section
RIE, Mysore**

Complete revision of the whole part of statics (as prescribed in the Curriculum 2000) including resultant equilibrium of concurrent forces, parallel forces, moments and couples. A manual of Mathematics Laboratory containing about 60 projects in Mathematics was supplied to each participant. Each participant has also developed a project during the programme. A detailed experience of Mathematics Laboratory was given to everybody.

Units test including - design, blue print, test paper, scheme of valuation, item analysis was also discussed.

Seminars

Seminars were conducted on all the days in the last sessions. A list containing 65 seminar topics, is enclosed. The participants prepared well and discussed the seminar lectures under the guidance of our faculty members.

A.V. Section

The participants had one session in which they could visit the A.V. studio of this institute and see the usage of A.V. materials.

Film Shows

Following films, which were relevant to their courses, were screened for the benefit of the participants.

1. Conic Sections
2. Complex Numbers
3. Binomial Theorem

Computers

Dr. D. Basavayya demonstrated the usage of the computers in the teaching of Mathematics while Sri D.N. Nagaraj showed the usage of computers in other fields.

Time Table

The general time table is enclosed for ready reference.

REGIONAL INSTITUTE OF EDUCATION, MYSORE (NCERT)
And
KENDRIYA VIDYALAYA SANGATHAN, NEW DELHI

INSERVICE TRAINING PROGRAMME FOR PGTs IN MATHEMATICS (KVS)

SCHEDULE

Date	Day	I 9.30-11.00	II 11.30-1.00	III 2.00-3.30	IV 3.30-5.00
24.5.2000	Wednesday	Registration and Inauguration	Exploratory Session (NMR)	BCB	Seminar NMR
25.5.2000	Thursday	GR	DB	NBB	Seminar DB
26.5.2000	Friday	DB	NMR	NBB	Seminar BSPR
27.5.2000	Saturday	BCB	BSPR	DB	Seminar BSU
28.5.2000	Sunday	Assignments NMR			
29.5.2000	Monday	BSU	NMR	BCB	Seminar BCB
30.5.2000	Tuesday	DB	NBB	BSU	Seminar NMR
31.5.2000	Wednesday	BSPR	NBB	BCB	Seminar NMR
1.6.2000	Thursday	NMR	BSPR	NBB	Seminar DB
2.6.2000	Friday	NMR	BSU	GL	Seminar BSPR
3.6.2000	Saturday	BSU	BSPR	NMR	Seminar BSU
4.6.2000	Sunday	Assignments NMR			
5.6.2000	Monday	BSPR	NBB	BSU	Seminar BCB
6.6.2000	Tuesday	BSU	NBB	NMR	Seminar DB
7.6.2000	Wednesday	GR	BSPR	DB	Seminar BSPR
8.6.2000	Thursday	GR	BSPR	BCB	Seminar BSU
9.6.2000	Friday	DB	BCB	NBB	Seminar BCB
10.6.2000	Saturday	DB	BSPR	Maths Films/ GR	Seminar NMR
11.6.2000	Sunday	Assignments NMR			
12.6.2000	Monday	NMR	NBB	BSU	Seminar NMR
13.6.2000	Tuesday	NMR	GL	Valedictory	


Dr. N.M. RAO
(Academic Co-ordinator)

REGIONAL INSTITUTE OF EDUCATION, MYSORE

List of Teaching Aids/Mathematics Experiments
available in the Mathematics Laboratory

1. Models to show the Triangular and Square Numbers.
2. Working model of $\sin\theta$ and $\cos\theta$ reckoner.
3. Tangrams to form the geometrical shapes of square, rectangle, hexagon and trapezium from the given pieces.
4. Model to show that the area of the circle is πr^2 .
5. Probability curve experiment: wooden model to show that the marbles flowing through Pascal's triangle will settle in the form of a Normal Probability Curve.
6. Relation between volume of the given sphere and the volume of the cube constructed from the sphere with empty space in the middle.
7. Model to show the proof of Pythagoras Theorem by Perigals Dissection Method.
8. Model to show the proof of Pythagoras Theorem given by Bhaskaracharya's Dissection Method.
9. Model to show the proof of Pythagoras Theorem (by using the expansion of $(a+b)^2$).
10. Model to show that

$$1 + 3 + 5 + \dots + (2n-1) = n^2$$
11. A model to show the Physical Meaning of FIBONACCI sequence.
12. A chart to show how to construct a circle whose area is equal to the area of the given square using a scale and compass.
13. A chart to show how to construct a square whose area is equal to the area of the given circle using a scale and compass.
14. A chart to show the convergence of ellipse to a circle.
15. A chart to show how the Fibonacci series is related to the growth of a plant.

16. A model to show that

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

17. A chart of circular tables to do the addition and multiplication in modulo system.
18. A model to construct the irrational numbers on the (i) number line, (ii) in the spiral form.
19. A model to show that the mid point of the hypotenuse of a right angled triangle is equidistant from the vertices.
20. A model to show that the series $\sum (1/2^n)$ converges to 1.
21. A model to show the convergence of the series $\sum (1/3 \cdot 2^n)$.
22. A model to verify that the base angles of an isosceles triangle are equal.
23. A model to show that the sum of the interior angles of the convex polygon of n sides is $(n-2) 180^\circ$.
24. A teaching aid to show that
volume of the cuboid = length x breadth x height.
25. A chart (i) to show the different shapes of parabolas $y = ax^2$ and $x = ay^2$, (ii) to solve the quadratic equation graphically.
26. A chart and models to find the area of trapezium in seven different ways.
27. A model to show the factorisation of a quadratic equation.
28. Button and Beads puzzles to improve the mental ability of students.
29. A model to solve the quadratic equations.
30. A model to show that the altitude of an equilateral triangle is equal to the sum of perpendicular distances from any arbitrary point inside the triangle to the sides.
31. A model to show that the opposite angles of a cyclic quadrilateral are supplementary.
32. A chart to show the relation between a histogram and a frequency curve.

33. A model to show the conjunction and disjunction - a circuit model.
34. A model to show the concurrency of orthocentre, centroid, incentre and centre of gravity in some triangles.
35. A model to show the orthogonal circles.
36. An electric connection to show the set theory operations.
37. A model to show some geometry results (theorems on circles) in high school Mathematics.
38. A model to find the curved surface area of the cylinder.
39. A working model to show the 3-D shapes (cone, sphere, etc.) by the rotation of 2-D shapes (triangles, rectangles, etc.).
40. A model to show that the surface area of the cone is equal to πrl .
41. A model of card board pieces to find the area of combined figures.
42. Logic boxes 'AND BOX' and 'OR BOX'.
43. Card board and stick model to introduce the sequences and series as the sum of the sides of a triangle.
44. A model to manipulate the percentages through an elastic band and a percentage graph.
45. A teaching aid to exhibit the expansion:

$$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca.$$
46. A model of Pascal's pyramid: An extension of Pascal's triangle to find the coefficients in the trinomial expansions.
47. Geometry Board to verify various results of high school geometry.
48. A wooden model to deduce the result

$$1^2 + 2^2 + 3^2 + \dots + n^2 = (1 + 2 + 3 + \dots + n)^2$$
49. A model to show the properties of common tangents to circles.

50. A model to show the Euler's formula

$$V + F = E + 2$$

to Tetrahedron, Octahedron, Dodecahedron, Icosahedron and other Polyhedron.

51. A conceptual model for solving percentage problems by overlapping graph sheets (plastic sheets).
52. Curve stitching models to show parabola, hyperbola, cardoid, four leaf flower (Rox), etc. (envelopes and evolutes).
53. Tower of Hanoi puzzles for children of high schools to develop inductive reasoning.
54. Puzzle box to join the thermocole pieces to make them the given cube.
55. The number balance to introduce the concepts of mathematical operations.
56. A counter example of Four Colour Theorem in 3-D models.
57. A model to show the operations on S_3 .
58. A model to find the recurring decimals for $1/29$.
59. The Napier Strips for the Multiplication of Large Numbers.
60. Ruled surfaces - Paraboloid and hyperboloid models.
61. A model of Mobius Bands and its properties.
62. A model of spherical coordinates and cylindrical coordinates.
63. A chart showing value of π upto several decimals.
64. A right circular cone and the conic sections.
65. A model of clinometer to find the angle of elevation and depression.
66. A chart of Konigsberg Bridge Problem and its solution.
67. A model to show the transformations (translation, rotation, reflection, etc.).
68. A chart to show the relation between $\tan\theta$ and $\cot\theta$; $\sin\theta$ and $\cos\theta$, etc.

69. Puzzles and Flower games related to Primary Mathematics.
70. A puzzle of concurrent figures.
71. A chart showing the Trigonometric relations (cofunction relations, reciprocal relations, productive relations and Pythagorean relations).
72. A model to deduce that the volume of the cylinder is equal to $\pi r^2 h$ (Primary).
73. A model to show that the number of images formed by two mirrors is equal to $((360/\theta) - 1)$ if the mirrors are inclined at an angle θ .
74. A chart and a model to show that area of the triangle is equal to $1/2$ (Base) x height (Primary).
75. A chart and a model to deduce that the area of circle is πr^2 , by forming a triangle.
76. Magic cube (a puzzle cube and a solution cube, where the Sum of Numbers is constant in all layers).
77. A model to verify the conditions of similarity of triangles.
78. A wooden model to verify that
- $$(a-b)^3 = a^3 + 3a^2b + 3ab^2 - b^3$$
79. Can a knight visit each square of a chess board? (Knights Tour Problem): Chart.
80. Some patterns in the hundreds chart.
81. A solution to the problem of interchanging of Railway Wagons (chart).
82. A model to find the location of the sinking ship (circum centre of the triangle).

83. Construction of a triangle equal in area to a given quadrilateral.
84. To show that for any quadrilateral whose four sides are tangential to any given circle, the sum of the opposite sides are equal.
85. To show that the length of the tangents to a circle from an exterior point of the circle are equal.
86. To find the area of the circle by using the area of small sectors.
87. To show that in the case of concentric circles, any chord of the larger circle, which is tangential to the smaller circle is bisected at the point of contact.
88. To locate any point in the three dimensional space.
89. Concept of square members.
90. Path of pursuits.
91. Building trigonometric tables.
92. Solids of revolution.
93. Magic square.
94. Curved surface area of the cone.
95. To find the ratio of the area of the triangle and the triangle inside its incircle.
96. To show that the line joining the mid points of a quadrilateral is a parallelogram.
97. Pentagonal numbers.
98. To show that the line joining the centres of three equal circles which touch each other externally, is an equilateral triangle.
99. A transformation group.
100. The development of the fifth tetrahedral numbers through triangular numbers.
101. To illustrate that the path of the moving chord of constant length inside a circle is circle and to find its radius.

102. Number patterns (triangular and pythagorean numbers).
103. Square root by guess average method.
104. Conic sections (circle, parabola, ellipse, hyperbola).
105. Logic box (conjunction and disjunction box).
106. The relationship between the radius of the incircle of a right triangle and its sides.
107. How to construct a magic square.
108. Find the path of the mid points of the segments of the chords passing through a fixed point inside the circle.
109. Locus of the centres of the circles passing through two given points is the perpendicular bisector of the line segment joining the points.
110. Model of $a^3 - b^3 = (a-b)a^2 + (a-b)ab + (a-b)b^2$.
111. A property of two tangential circles (internal contact and external contact).

REGIONAL INSTITUTE OF EDUCATION, MYSORE

LIST OF TOPICS FOR SEMINARS

21 DAYS INSERVICE TRAINING PROGRAMME FOR
PGTs IN MATHEMATICS (KVS)

24-05-2000 to 13-05-2000

1. Alternative proofs in Mathematics.
2. Problem solving approach to introduce a topic of Mathematics.
3. Well ordering principle of Natural Numbers and its application.
4. Principle of Mathematical Induction and its applications.
5. A set theoretic approach to Complex Numbers and its significance.
6. Definition and Meaning of a tangent to a curve.
7. Koenigsberg seven bridge problem and its solution by graph theoretic method.
8. Utility problem and its solution by graph theory methods.
9. Problems and Puzzles in Mathematics.
10. Geometrical and physical significance of Rolle's Theorem.
11. Mean Value Theorems of Differential Calculus and Integral Calculus.
12. Existence of inverse functions.
13. Equivalent relations, partitions and their inter-relationship.
14. Congruence Modulo relation among integers and its properties.
15. Countable and uncountable sets.
16. Role of Mathematical modelling in teaching of mathematics.
17. Using Logarithmic series in the summation of series.
18. Using Binomial series in the summation of series.

19. Using exponential series in the summation of series.
20. Arithmetics and Geometric series.
21. Analytic and synthetic methods of proof.
22. Approaches in Euclidean geometry.
23. Non-Euclidean Geometry.
24. Applications of Calculus in Maxima and Minima.
25. Applications of Calculus in finding areas, volumes.
26. Applications of calculus in finding CG and Moment of Inertia.
27. Use of examples and nonexamples in the attainment of a mathematical concept.
28. Use of counter examples in proofs.
29. The conic sections in geometry.
30. Different coordinate systems in mathematics.
31. The uses of differential equations in the other branches.
32. The applications of mathematics in biological sciences.
33. The applications of mathematics in commerce industry and management.
34. Sequence and series.
35. Indian mathematicians.
36. Techniques and simple methods of solving integration problems.
37. History of Mathematics.
38. Coaxial system of circles.
39. Projects in Mathematics.
40. Graph Theory and Mathematical Modelling.
41. Applications of vectors.
42. General Equations of Second Degree - Geometrical Interpretations.
43. Applications of Group Theory.

44. Computers for Teaching Mathematics.
45. Mathematics club activities.
46. Curve Tracing.
47. Translation, Rotation and Transformations.
48. Motivational strategies in Mathematics Learning.
49. Development and uses of Logarithmic and Exponential Functions.
50. Fun, Magic and entertainments with the help of Topology.
51. My experiences of Teaching Mathematics in a better way.
52. Unsolved problems in Mathematics.
53. Search for Prime Numbers and the Goldbach conjecture.
54. Pythagorean Numbers and Fermat's Last theorem.
55. Rational, irrational and real numbers.
56. Origin of Complex Numbers and their geometrical interpretations.
57. Construction of regular polygons.
58. Conics and Quadric surfaces.
59. Topological properties of figures.
60. Triangular Numbers and Square Numbers.
61. Fibonacci Series and its significance.
62. Importance of Mathematics and Statistics in Educational Researches.
63. Paradoxes in Mathematics.
64. Logic and Philosophy as the foundation of Mathematics.
65. Well ordering theorem and Axiom of choice in Mathematics.

LIST OF PARTICIPANTS

Name	School Address	Residence
1. A.R. Jayalakshmi (Ms)	PGT (Maths) K.V. Coimbatore Sowripalayam Coimbatore-28 Pin: 641 028 Tamil Nadu	1710, Trichy Road Ramanathapuram Coimbatore-641 045 Tamil Nadu
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3. C.V. Sridhar	PGT (Maths) KV No. 1 Airforce Station New Project Area Lohogaon Pune-32 Pin: 411 032 Maharashtra	C-3/11 Staff Quarters KV No. 1 Air Force Station Lohogaon Pune-411 032 Maharashtra
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5. Ashok Kumar	PGT (Maths) KV No. 1, Golconda Langar House Hyderabad-500 008 Andhra Pradesh	Ashok Kumar Teacher H.No. 16.11.199 Moosaram Bagh Hyderabad-500 036 Andhra Pradesh
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16. Hari Kumar P.S.	PGT (Maths) K.V. Railway Colony Bangalore-560 023	Anugraha No. 74/2 B.B. Nagar Jalayahalli Bangalore
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22. Ms. Velamparampil- Alice-Jacob	PGT (Maths) KV NAD Aluva Kalamasseny PO Ernakulam-683 104 Kerala	Type C-2 KV Quarters NAD Aluva Kelemesseny PO Ernakulam-683 104 Kerala

Name	School Address	Residence
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Impressions, and Suggestions and Reactions of
the Participants and the Faculty

1. The development of the materials was taken quite seriously by the resource group and a lot of hard work has gone into it. The faculty members will be happy if the teachers really use them during their teachings.
2. The teachers (23 attended out of the deputed 30) who participated were also serious in their studies. They have worked hard, noted down the projects from the Mathematics Laboratory, noted down the books and journals from the library, etc. Majority of them have done the homework given to them and done the seminar work.
3. The coordinator likes to thank all the persons who helped directly or indirectly in conducting this programme.