

TEACHER'S  
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**B.Ed.**

**Second Year - Third Semester**

**Pedagogy of  
MATHEMATICS**



**Course - X**

**SECOND YEAR**

**III<sup>rd</sup> Semester**

**PEDAGOGY OF  
MATHEMATICS**

*Authors :*

**Well Experienced Teacher Educators**

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**PEDAGOGY OF MATHEMATICS**

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## UNIT - 1

### MATHEMATICS CURRICULUM

#### 1. Write the Meaning and objectives of Curriculum ?

**Ans:** The word "Curriculum" is derived from the Latin word "Curresre" which means to run. So curriculum is a course or path which one runs to reach a goal. Thus curriculum includes the subject-matter and all learning experiences arranged by the school for a particular subject.

**Objectives of curriculum :** Young discusses the principal values of the study of mathematics under three general subheads 1) Practical values 2) Mathematics as a mode of thought and 3) Other functions under the third and rather indefinite heading he mentions values which are in the nature of attitudes, habits and ideals.

Breslich classifies the principal aims as 1) Understandings 2) Skills 3) Problems and methods 4) appreciations 5) attitudes 6) habits

Black hurst lists them as 1) attitudes 2) concepts 3) informations

Schorling presents them as 1) attitudes 2) concepts 3) abilities and 4) information

Mimick discusses them under four sub-heads as 1) Practical values 2) Preparatory values 4) Cultural values 4) disciplinary values.

#### 2. Enlist important principles which should be kept in mind while framing curriculum in mathematics.

**Ans :** Curriculum has to be properly planned and to be based on certain principles.

**1) Principle of utility (or use) :** The curriculum material of the subject should have the following ingredients in it.

♣ It should have some vocational utility ♣ It should be useful in ever day life. ♣ It should be useful in the study of other subjects.

**2) Principle of modernisation :** We should shape the curriculum according to the latest development of the subject. We should keep pace with the modern world.

**3) Principle of cultural value :** Mathematics has played an important role in the advancement of culture and civilisation.

**4) Principle of child centredness :** While making a selection of useful topics for inclusion in curriculum child's interests, abilities, age levels etc should be kept in mind.

**5) Principle of Flexibility :** The aims of education and the aims of teaching mathematics go on changing. These aims depend up on the ever-changing society.

**6) Principle of community - centredness :** We should include the topics of mathematics which cater to the needs, aspirations and ideals of the community.

#### 3. What are the important principles of the organisation of school syllabus in mathematics ? Discuss fully.

**Ans :** When the content has been selected, the next job is the organisation of the content. Some such questions have to be answered. What should be done at a particular stage and what afterwards ? When should a particular topic be introduced ? How should it be developed ? How much of it should be taught at a particular stage ? and so on. All these questions relate to the organisation of the curriculum. For this, the following principles should be kept in mind.

**1) Psychological and Logical arrangement.** Logical arrangement means the rig-orous treatment of the subject matter based on logical reasoning whereas psychological arrangement is from the point of view of the students. It appears that both the approaches are different but there can be easily merged. The organisation can both be psychological and logical. All thinking is psychological. Psychology throws light on the power of understanding of students at a particular stage. We can be logical in a number of ways. Psychology should decide which logical approach will suit for a particular topic. Logic will help in maintaining proper sequence of topics, so we should organise the topics in such a way that we may follow Psychology and Logic at the same time. The happy combination of the two is always desirable.

**2. Topical and Spiral Arrangement.** Topical arrangement means that a topic should be finished entirely at one stage. It takes the topic as a unit. Spiral arrangement implies that a topic should be split up into different portions and these portions should be spread over different grades. Easier portions should be dealt with in the lower grades and the difficult portions

should be gradually introduced in the next grades the latter is certainly a good arrangement. Topical arrangement requires that easy and difficult portions of a topic should be dealt with at one stage only which is unpsychological.

**3. From Easy Difficult.** While organising topics, we should see to that easier topics come first and difficult topics later on according to the nature of difficulty.

**4. Scoope for Practical Work.** The child likes activity and passive listening is contrary to his nature. Organisation of curriculum should not fail to suggest some practical work wherever it is possible.

**5. Correlation.** While organising the content in Mathematics we should arrange the topics in such a way that correlation of the subject possible. Correlation can be of the following types.

- (i) Correlation with life (ii) Correlation with other subjects
- (iii) Correlation among the branches of the same subject
- (iv) Correlation among the topics of the same branch (v) Correlation with craft or work experience

**In order to correlate teaching of the subject, we must know:**

- (i) Day to day life activities of the students (ii) The nature of topics included in other subjects at the same stage. (iii) The topic included in different branches of the subject

Example : Arithmetic, Algebra, Geometry etc.

**4. What are the recommendations of NCF 2005, APSCF 2011 with reference to mathematics education?**

**Ans : Recommendations of NCF 2005 on mathematics curriculum are as follows.**

♣ Mathematics taught in the schools should be important in the sense that teachers and students should feel that the time spent for addressing the problems is so worth full and useful. ♣ The primary goal of mathematics educations should be "Mathematisation of the child's taught processes" and the development of "Inner resources of the growing child. ♣ The content and the approach to dealing with the topics has also remained the same over the years. ♣ Mathematics empowers an individual

to think logically handle abstractions, generalize patterns and solve problems using a variety of methods. ♣ Mathematics curriculum should be interesting and importance should be given for the achievement of higher level objectives but not limited objectives ♣ Mathematical expression should be clear, brief, unambiguous, Terminology should have a definite purpose aim, clear and a definite style.

**Recommendations of APSCF 2011 with reference to Mathematics education:**

♣ importance should be given to logical proof ♣ geometry and trigonometry should be provided in algebra ♣ emphasis to creating and solving a problem ♣ mathematical skills should be taught ♣ understand and develop skills related to number and space ♣ higher level data analysis and substitution should be emphasized ♣ Research projects should be taken up.

**5. What is the meaning of syllabus ? Write the difference between syllabus and curriculum.**

**Ans : Syllabus:** A syllabus is an out line and summary of topics to be covered in an education or training course. It is descriptive. A syllabus may be get out by an exam board or prepared by the professor who supervises or controls course quality. It may be provided in paper form or online.

Curriculum	Syllabus
It is a comprehensive and related to all subjects and other than subjects too	It is related to one subject
It relates the total experiences to the child with in the school and out side the school	It gives only the subject knowledge and experience on it
It scope is large and related to all the activities performance by the child during the year.	Its scope is limited and child performance is limited to the particular activities prescribed in the syllabus
It gives the aims and objectives of the child.	It is a part of the curriculum and having limited aims and objectives.

6. Discussion of important concepts principles and processes from the topics of the branches as specified below.

(a) Arithmetic (b) Algebra (c) Geometry (d) Trigonometry (e) probability (f) statistics

**Ans : (a) Arithmetic :** The part of the mathematics that deals with Numbers and counting or calculation is known as arithmetic

**Major objectives of the teaching of Arithmetic:**

♣ To develop a proper idea of weights and measures. ♣ To lay the foundation for the understanding of higher mathematics ♣ To enable the students to make dependable estimates and approximations

**Aims of teaching of Arithmetic:**

♣ To arouse interest in the quantitative side of world ♣ To develop mathematical thinking in the students ♣ To prepare students for study of higher mathematics

**Approaches in teaching of Arithmetic:**

**1. Drill Approach:** In this approach the teacher continues to repeat a thing before the students till it gets fixed in the mind of the students.

**2. Incidental approach:** In this approach teaching is done in rational and incidental manner.

**3. Meaning full approach :** In this approach, the whole programme of the teaching work is systematically worked out.

**(b) Teaching of Algebra:** Algebra is referred to as "Generalised Arithmetic". Algebra is a method of calculation by using letters and signs with integers the word Algebra has been derived from the Arabic word 'Aljebr - At- Muqabulah"

**Aims of teaching Algebra:** ♣ To check the results ♣ To simplify the calculations ♣ To help in solving difficult problems in Arithmetic ♣ To inculcate the power of analysis

**Methods of teaching of Algebra:**

**1. Formal method:** In it we simply teach four arithmetical operations. In place of numbering here we use letters.

**2. Teaching of Algebra and Literal numbers of Quantities:** In algebra we use letter or literal numbers in stead

of numbers.

**(c) Teaching of geometry:** Geometry is a combination of two words, geo + metry which means measurement of earth the geometry teaching provides a mass of geometrical facts.

**Stages of teaching of geometry:** Teaching of geometry should be divided into the following 3 stages.

1. Experimented stage
2. Deductive stage
3. systematic stage

**Teaching of geometry to the Beginners:**

**1. Handling of models etc:** The pupils be allowed to handle the geometrical models like cone, square etc

**2. Observing familiar objects:** The pupils may be allowed to examines the corners of rooms, books etc.

3. Concept of an area can be made more clear by counting unit squares in geometrical figures.

**(d) Teaching of Trigonometry:** Trigonometry is a branch of mathematics. It is a combination of Algebra, Arithmetic and Geometry.

**Objectives:** ♣ To find out heights and distances ♣ To solve the problems in the space ♣ To solve the problems related to geometry and algebra

**Values of studying trigonometry:**

♣ Trigonometry is mirror of modern civilization ♣ The utilitarian value of trigonometry includes the extension of the gene educational and potential values of arithmetic algebra and geometry ♣ The study of trigonometry develops keen sense of observation and disciplines in mind.

**(e) Probability:** Probability is the measure of the likelihood that an event will occur. Probability is quantified a number between 0 and 1.

**Values of probability:** The probability values is computed assuming the null hypothesis is true. The lower the probability value, the stronger the evidence that the null hypothesis is false.

**(f) Statistics:** Statistics is the study of the collection analysis, Interpretation, presentation and organization of data. Statistics deals with all aspects of data including the planning of data collection in terms of the designs of surveys and experiments.

**Measures of central tendencies:** The most common measures of central tendency are the arithmetic mean, the median and the mode.

## UNIT - 2

### LANGUAGE AND AESTHETIC SENSE OFF MATHEMATICS

1. Write about Aesthetic sense in Mathematics, three aesthetic experience variables identified by brickhoof and their relation?

**Ans.** Mathematical beauty describes the Notion that some mathematicians may derive aesthetic pleasure from their work, and from mathematics in general. They express this pleasure by describing mathematics as beautiful.

Bertrand russel expressed his sense of mathematical beauty in these words.

"Mathematics, rightly viewed, possesses not only truth, but supreme beauty - a beauty cold and austere, like that of sculpture with out appeal to any part of our weaker nature with out gorgeous trappings of paintings or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show. The true spirit of delight the exit action the sense of being more than man, which is the touch stone of the highest excellence, is to be found in mathematics as surely as poetry.

Paul Erdo's expressed his views on the ineffability of mathematics when he said "Why are numbers beautiful? It's like asking why is Beethoven's Ninth symphony beautiful.

**Beauty in Method :** Mathematicians describe an especially pleasing method of proof as elegant depending on context, this may mean.

♣ A proof that uses a minimum of additional assumptions or previous results.

♣ A proof that is unusually succinct

**Birkhoffs Aesthetic experience variable and their relation:**

According to George David Birkhoof the typical aesthetic experience of an object is a function of three variables namely

1. Complexity of the object (c) 2. The feeling of value or

Aesthetic measure (M) 3. Property of Harmony, symmetry of order (o).

**BirtherFF's Formula:** 
$$M = \frac{O}{C}$$

**BirtherFF's Hypothesis:** The aesthetic measure is determined by the density of order relations in the aesthetic object.

2. Explain the Co-existence of precision and beauty in mathematics - order pattern, structure and symmetry.

**Ans :** Mathematics is one place where both precision and beauty are always united G.H Hardy "A mathematicians. Apology demonstrates that mathematics through precise, is intimately about beauty.

The First who introduced mathematical beauty as well as simplicity as criteria for a physical theory was copernicus, since them, these criteria have continued to play an extremely important role in developing scientific theories.

**Order in Mathematics:** According to plato the essence of mathematical beauty was its absoluteness, its resistance to change and fashion.

According A.H. Hardy the mathematicians patterns like or the poet's must be beautiful the ideas like the colours or the words must fit together in harmonious way beauty is the first test there is no permanent place in this world for ugly mathematics.

#### Example for order in Mathematics

I.  $139 \times 109 = 15151$

$$27994681 \times 441 = 12345654321$$

$$152207 \times 73 = 11111111$$

$$1234569 \times 9 = 111111111$$

$$33333366667 \times 33 = 1100000110000011$$

II. (a)  $a < b$  or  $a = b$  or  $a > b$  then  $\forall a, b, \in R$

(b)  $a < b, b < c$  then  $a < c \forall a, b, c \in R$

**Pattern in Mathematics:** Mathematics in some times called the science of pattern in the sense of rules that can be applied wherever needed

A pattern a part from the term's use to mean template is a discernible regularity in the world or in a man made design. As such, the elements of a pattern repeat in a predictable manner. A geometric pattern is a kind of pattern formed of geometric shapes and typically repeating like a wall paper.

Examples: 1. Some products

$$142857 \times 7 = 999999$$

$$12345679 \times 9 = 111\ 111\ 111$$

$$987654321 \times 81 = 80000000001$$

**Sequence in mathematics:** In mathematics, a sequence is an enumerated collection of objects in which repetitions are allowed. Like a set, It contains members (Also called elements or terms) . The number of elements (possibly infinite) is called of the sequences.

**Examples:**

$$\frac{1}{19} = 0.052631578947368421$$

$$\frac{1}{29} = 0.034482758620689655172417931$$

$$\frac{1}{49} = 0.020408163265306122448979591836$$

$$73493877551$$

Example :  $1 \times 8 + 1 = 9$

$$12 \times 8 + 2 = 98$$

$$123 \times 8 + 3 = 987$$

**Structure in mathematics:** In mathematics, a structure on a set is an additional mathematical object that, in some manner, attaches to that set to endow it with some additional meaning or significance.

A partial list of possible structures are measures, algebraic structures, orders, and categories

**Example:** If a set has both a topology and is a group and these two structures are related in a certain way, the set becomes a topological group.

**Structure in mathematics:** Maths is no different a mathematical structure is nothing but a complicated organization of smaller, more fundamental mathematical substructures. Numbers are one kind of structure, and they can be used to build bigger structures like vectors and matrices.

Sets and functions are both incredibly fundamental in mathematics and they can be used to build crazy things like topological spaces.

**Symmetry:** In mathematics symmetry has a more precise definition, that an object is invariant to any of various transformations, including, reflection, rotation (or) scaling.

Mathematical symmetry be observed with respect to the passage of time, as a spatial relationship through geometric transformations

**Examples:** ♣ Rotational symmetry ♣ Point symmetry  
♣ Reflection symmetry

### 3. Write about recreational mathematics

**Ans : Recreation mathematics:** Recreational mathematics is a term for mathematics carried out for recreation rather than as strictly research and applications based professional activity. Recreational activities bring variety and also develop taste for mathematics .

**Importance of Recreational activities:** The importance of these activities can be stated as below.

♣ Students develop a taste for mathematics ♣ They lend much interest and zest to the course. ♣ These activities sharpen cuit and stimulate thinking ♣ Recreational activities change monotonous at mosphere of the class room.

#### Organising recreational activities:

♣ A period of should be fixed in mathematics time table and students be in formed about it. ♣ An active and intelligent

student be in charge of these activities ♣ The participants are to enlist their names for the purpose.

**1. Riddles:** Riddles in mathematics provide fun and are quite witty. Some of mathematical riddles are illustrated below.

**2. Riddle:** 1 Imagine a small railway line with 30 railway stations. Can you guess how many different kinds of tickets the railway has printed. Ans 870

**Riddle 2:** An oil merchant has a tank full of oil and he has two measures, one of 3 liters and another of 4 liters. He is to take 5 liters from the tank. How will he do this by using these two measures? Ans.  $4 + (4 - 3) = 5$  liters.

## 2. PUZZLES:

### Puzzles 1 :

Can you curite 30, using three identical digits except 5s?

**Solution**  $6 \times 6 - 6 = 30$   
 $33 + 3 = 30$   
 $33 - 3 = 30$

**Puzzle 3.** Can you write, 1 by using all the ten digits?

**Solution**  $(148/296) + (35/70) = 1$

**Puzzle 2:** using only five nines can you write 10?

**Solution**  $9 + 99/99 = 10$   
 $99/9 - 9/9 = 10$   
 $(9 + 9/9)^{9/9} = 10$

### (iii) Fund with numbers

1. Any number if reserved in order, the difference between the two is always divisible by 9.

**Example:** (i)  $93 - 39 = 54$ ,  $9 \times 6 = 54$ . Hence the difference is divisible

(ii)  $241 - 142 = 99$ ,  $9 \times 11 = 99$ . Hence the difference is divisible by 9.

2. The sum of digits of multiplies of 9 is always 9 ordivisible by 9.

**Example** (i)  $9 \times 3 = 27$ ,  $2 + 7 = 9$   
(ii)  $9 \times 5 = 45$ ,  $4 + 5 = 9$   
(iii)  $9 \times 21 = 189$ ,  $1 + 8 + 9 = 2 \times 9$

3. The sum of digits of all digits of any number is divisible by 9, the number is also divisible by 9.

## 4. Magic Squares

A magic square is an array of integers arranged in a square in such a way that the sums of rows, columns and diagonals all equal the same number.

### Example:

Here is a magic square in which all the rows, columns and diagonals add upto 2001. Two of the numbers are provided to get you started. Your job is to work out the other seven.

	1	
		2

### Solution

1332	1	668
3	667	1331
666	1333	2

### Beauty and Symmetry of Numbers.

i)  $1 \times 8 + 1 = 9$       ii)  $1 \times 9 + 2 = 11$   
 $12 \times 8 + 2 = 98$        $12 \times 9 + 3 = 111$   
 $123 \times 8 + 3 = 987$        $123 \times 9 + 4 = 1111$   
 $1234 \times 8 + 4 = 9876$        $1234 \times 9 + 5 = 11111$

Recreation is necessary in all fields of human endeavour. From time immemorial puzzles and paradoxes have been popular. Men, in amusing themselves with these play things, have sharpened their wits and whetted their ingenuity.

### Value of Mathematical puzzles, Games and Riddles:

(i) Many abstract relationships and characteristics of the number system may be developed effectively through recreational activities. (ii) The variety and inherent interest in mathematical thinking and manipulation, are utilised to improve pupil attitudes and thus learning is more effective. (iii) The puzzles are useful devices in overcoming emotional blocks to learning (iv) They are permanent sources of enjoyment (v) They furnish a challenge to

imagination and a powerful stimulus to mathematical activity (vi) They are most useful when brought in at the appropriate time and in a context suitable to their purposes. A teacher may begin a topic with a fallacy or puzzle related to the content. (vii) Games are very effective means of making mathematics interesting to pupils, especially in the primary and middle school stages. Some type of games are useful in drilling.

#### 4. Explain the language of mathematics.

**Ans :** In teaching mathematics, the teacher uses ordinary language to communicate mathematical concepts and to clarify thoughts. Mathematics has a peculiar language in which symbols occupy a most important position.

According to Lind say, "Mathematics is the language of physical sciences and certainly no more marvelous language was ever created by the mind of man".

The symbols are used to make the mathematical results exact and readily useful. The skill in using mathematical symbols helps teachers and students in solving many a complicated problems some of the important and familiar symbols used in mathematics are as:

|| For parallel lines

= For is equal to

> for greater than

< for less than

$\Sigma$  For summation etc

The main characteristics of mathematical language are simplicity, accuracy and precision in contrast to, ordinary language which can be ambiguous, vague, and emotive. Special care is needed in formulating definitions. A good definition should satisfy the following conditions.

1. A definition should be consistent 2) A definition should be stated clearly and precisely without redundancy.

## UNIT - 3

### ASSESSMENT AND EVALUATION

#### 1. How do you test the mathematical abilities of children?

**Ans.** A mathematical ability is a cognitive ability, the skill to perform calculations etc in the formal language of mathematics. It can also be regarded as a nonverbal ability

Such skills include:

♣ Counting ♣ Addition ♣ Subtraction ♣ Multiplication

♣ Division ♣ Ordinal numerical competence

#### Types of mathematical abilities:

1. Conceptual understanding
2. procedural knowledge
3. problem solving

**Testing mathematical abilities :** Five types of questions used to test mathematical abilities

1. Problems in mathematic symbols and concepts
2. problems in computation
3. problems in mathematics in every day life
4. word problems
5. problems in attitude toward maths

Some examples to test mathematics abilities.

1. Next number in this sequence 10, 17, 26, 37, ? ( c )  
A. 46    b. 52    c. 50    d. 56

2.

17	8	5	5
13	7	5	4
6	12	6	3
10	6	4	?

A. 4    B. 5    C. 6    D. 7    ( a )

#### 2. Explain the meaning of assessment measurement and evaluation in mathematics?

**Ans : Assessment:** Assessment is the preliminary phase

in the process of evaluation. It is the gathering of all important and accurate information on students progress. Assessment is a process of professional judgement.

According to Robert L. Sinn & M. David Miller, assessment of student learning requires the use of a number of techniques for measuring student achievement.

Assessment is a general term that includes the full range of procedures used to gain information about student learning and the function of value judgments concerning learning progress.

**Nature :** ❖ Assessment is key components of teaching and education. ❖ Assessment is central to every school and class room. ❖ Various techniques are organised and employed for assessment i.e. to collect information.

**Functions of assessment :** ❖ Assessment can improve cognitive ability and enhance self esteem.

❖ Assessment enhance students learning and motivation.

❖ Assessment serve to enhance students education and to improve teacher instruction.

**Concept of Test, Examination/Measurement and Evaluation :**

**1. Test :** A test is a set of standardized or controlled occasions for responses presented to an individual with design to elicit a representative sample of his behaviour when meeting a given kind of environmental demand.

A psychological test is a standardized instrument designed to measure objectively one or more aspects of a total personality by means of samples of verbal or nonverbal responses or by means of other behaviour.

**Examination :** Generally the instruction is followed by various kinds of evaluation throughout the academic schedule. Teachers who provide the instruction or involve directly in the process of instruction also devise different types of tests from time to time and evaluate the students performance. Basically they can be broadly divided into two categories of examinations i.e., internal and external.

**Measurement** Measurement is an important feature of our daily life "From birth to death " says Ross

According to R.N. Patil, Measurement is an act or a process that involves the assignment of a numerical index to whatever is being assessed.

According to Anthony J. Measurement is a procedure for assigning numbers to specified attributes or characteristics of a person in a manner that maintains the real world relationship among persons with regard to what is being measured.

Prof. Richard & Lindemard defines measurement is the assignment of one of a set of number to each of a set of persons or objects according to certain established rules.

### **Evaluation**

Evaluation is a new term in the field of education which is introduced to replace the terms like testing or examinations etc. It has a wider meaning as it includes assessing all educational outcomes and outputs of the teaching learning process

In the words of the kothari commission

" Evaluation is a continuous process, it forms an integral part of the total system of education and is related intimately to educational objectives

**Objectives learning experiences and evaluation :** The interrelationship among objectives, content, learning activities and evaluation procedures is shown below

- |            |                          |
|------------|--------------------------|
| Objectives | 1. Content               |
|            | 2. Learning activities   |
|            | 3. Evaluation procedures |

The above figure clearly indicates the evaluation involves continual appraisal of objectives and of the testing procedures used by the teacher.

**Purpose of Evaluation :** These are 1. To monitor pupil progress 2. To improve the quality of learning environment 3. To improve courses and curricula, texts and teaching - learning materials 4. To diagnose students weakness and determine the need for remedial work.

**Types of evaluation : 1) Diagnostic Evaluation :** It

determines the causes of learning problems and formulates a plan for remedial action.

**2) Formative Evaluation :** Formative Evaluation is the assessment made by the teacher during teaching learning process in order to know about learner's progress in learning and make essential changes to improve teaching learning process. Formative evaluation is a continuous process that simultaneously happens with teaching. Asking questions during classroom teaching, classroom assignments, home assignments informal interviews with students etc. are examples of formative evaluation.

**Need and Importance :** Formative evaluation is must to provide immediate feedback to teacher so that he/she modify and improve instruction.

- ❖ It is also necessary to provide feedback to students enable them to identify their learning errors and rectify them immediately.

- ❖ Since it is child centered, it gives more importance to student's achievement or their learning.

- ❖ It is a flexible way of evaluation.

- ❖ It helps in designing remedial teaching by providing data of student's performance regularly.

**3. Summative Evaluation :** Summative evaluation is the assessment made at the end of the term, semester, course or instructional program to assign a grade for learners. The term summative means the summing up of all the available information regarding a program at its terminal point. Unit test, quarterly examination, half yearly examination, semester examination and annual examination are examples of summative evaluation. Summative test is given to a learner after he/she has passed all the formative tests.

**Need and Importance** The summative evaluation is conducted to give overall picture of student's performance.

**Process of Evaluation :**

**Steps involved in the evaluation process :**

1. First and foremost is to formulating and selecting worth while objectives of teaching in a subject.

2. The objectives and the behavioural changes are brought through proper content and subject matter.
  3. Learning experiences can be brought through reading good number of text books listening and acquiring the subject matter.
  4. In accordance learning experience, use devise proper evaluation procedures
  5. The expected output can be obtained and suggest in turns by results or behavioural changes.
- 3. Explain the planning preparation and conduct of achievement Test in CCE Model ?**

**Ans. Concept of Achievement Test** Achievement may be defined as a change in the behaviour of students in a desired direction. It is an important and essential constituent in the process of evaluation. 'Achievement' means one's learning attainments, proficiencies, accomplishments etc.

According to N.M. Downie, any test that measures the attainment or accomplishments of an individual after a period of training or learning is called an achievement test. Waters says that Achievement tests are useful aids for diagnosing a students specific learning needs, for identifying his relative strengths and weaknesses, for studying his progress and for predicting his success in a particular curriculum.

Good defines an achievement tests as a test that is designed to measure a person's knowledge, skills, understanding etc., in a give field taught in a school.

Assessment involves collecting information about students knowledge, skill and abilities. An achievement test is a formal assessment. The test helps the teacher to understand the level of comprehension of the students in a particular subject and helps him to estimate the capabilities of the students.

In the school evaluation programmes, various forms of achievement tests are used to measure the extent of learning of

the pupils. So, it is necessary for the teacher to know how to construct an achievement test efficiently.

#### Important features of achievement test

- ❖ Achievement tests measure the modification of behaviour brought about by learning.
- ❖ It is a standardised test to suit needs of the students.
- ❖ It is based on the difficulty level of students.
- ❖ It contains a number of items in all three domains.
- ❖ It is accompanied by a test manual for administering and scoring the test.

#### Functions of Achievement Tests

The major functions are :

- ❖ To provide basis for promotion to the next classes.
- ❖ To motivate students before a new assignment is taken up.
- ❖ To know the placement of a student in a particular section.
- ❖ "A teacher can use achievement to see for himself how effectively he is doing, what is getting across to his pupils and what is not."
- ❖ It helps in ascertaining quantity and quality of learning, attained in the subject of study or group of subjects after a period of instruction by measuring the present ability of the individual.
- ❖ To know the performance of the students.
- ❖ To know the efficiency of learning experiences provided.
- ❖ To know the extent of teaching - learning process.

#### Construction of a Scholastic Achievement Test (SAT) In CCE modal

A teacher prepares the test, and gives due weightage to academic standards distribution and difficulty level. These tests help in :

- a) Understanding the success of a teaching method.
- b) Identifying the strengths and weakness of the students.

c) Developing the remedial measures.

d) Application of knowledge gained.

#### Steps in the Construction of an Achievement Test:

The following figures represents the steps based on which an achievement test is constructed :

- 1) Planning the test
  - Weightage to Academic Standards
  - Weightage to Questions
- 2) Preparing the Blue print
- 3) Designing questions and Editing question Papers
- 4) Administering the test

#### IX CLASS MODEL QUESTION PAPER

##### SUMMATIVE - 3

Academic Standard	%of weightage	Marks Allotted
AS-1	40%	16
AS-2	10%	04
AS-3	15%	06
AS-4	15%	06
AS-5	10%	04
AS-6	100%	04

##### Question wise weightage table

Types of Question	Allotted Marks	No.of Questions
Essay type questions	16	04
Short answer questions	04	05
Very Short answer questions	06	04
Multiple Choice Questions	06	20
	40	33

## 2. Preparation of Blue Print

## Blue Print

Academic	Essay Type	SAQ	VSAQ	MCQ	No. of Questions
AS-1(40%)	1P/P	1(P)(1C)	2c, 1P	10	16
AS-2 (10%)	-	1(P)(1C)	-	-	2
AS-3 (15%)	1C/C	-	-	4	5
AS-4(15%)	1P/C	-	1-p	2	4
AS-5(10%)	1P/C	-	-	-	1
AS-6(10%)	-	1p	-	4	5
<b>Total</b>	<b>4</b>	<b>5</b>	<b>4</b>	<b>20</b>	<b>33</b>

## 4. Write about speed test in Mathematics.

**Ans : Definition of Speed test :** A psychological test for the maximum speed of performing a task that lies well with in the subjects power compare power test.

## Speed test in Arithmetic

- $\left(1 - \frac{1}{n}\right) + \left(1 - \frac{2}{n}\right) + \left(1 - \frac{3}{n}\right) + \dots$  n terms [ ]  
 A)  $\frac{1}{2}n$  B)  $\frac{1}{2}(n-1)$  C)  $\frac{1}{2}n(n-1)$  D) None of the above
- $2^2 + 4^2 + 6^2 + \dots + 20^2$ ? [ ]  
 A) 770 B) 1155 C) 1540 D) 385 x 385
- The HCF of 2923 and 3239 is [ ]  
 A) 37 B) 47 C) 73 D) 79
- If  $\frac{144}{0.144} = \frac{14.4}{n}$  then the value of n is [ ]  
 A) 0.0144 B) 1.44 C) 14.4 D) 144
- If  $\sqrt{3} = 1.732$  find the value of  $\sqrt{192} - \frac{1}{2}\sqrt{48} - \sqrt{75}$   
 A) 1.732 B) 1.327 C) 1.237 D) A, B, C [ ]
- A : B = 5 : 9; B : C = 4 : 7 find A : B : C [ ]

- A) 36 : 20 : 63 B) 20 : 36 : 23  
 C) 63 : 20 : 36 D) None of the above

- $1^2 + 2^2 + \dots$  20 sum of the terms [ ]  
 A) 200 B) 210 C) 220 D) None
- The L.C.M. of 10, 50 is [ ]  
 A) 10 B) 50 C) 25 D) 20

## Speed Tests in Algebra

- $8^{x+2} = 2^{4x-3}$  find x [ ]  
 A) 6 B) 8 C) 9 D) 4
- $\left(x + \frac{1}{x}\right)^2 - \left(x - \frac{1}{x}\right)^2 =$  [ ]  
 A) 2 B) 3 C) 4 D) -4
- $27^{x+1} = 9^{x+3}$  find x + y [ ]  
 A) 1 B) 2 C) 3 D) 4
- $a = x + \sqrt{x^2 + 1}$  find x = .... [ ]

A)  $\frac{1}{2} \left(\frac{a^2 - 1}{a}\right)$  B)  $\frac{1}{2} \left(\frac{a^2 + 1}{a}\right)$

C)  $\frac{1}{2} \left(\frac{a-1}{a}\right)$  D)  $\frac{1}{2} a^2$

- $4^{1+x} + 4^{1-x} = 4$  find x = ..... [ ]  
 A) 1 B)  $\frac{1}{2}$  C)  $\frac{1}{3}$  D)  $\frac{1}{4}$
- $a^{m-n} \times a^{m-1} \times a^{l-m} = \dots$  [ ]  
 A) 0 B) 1 C) 2 D) 3

## Speed Test in Geometry

- Circle :  $2\pi r$  : : ..... 2 (l + b)
- Circle  $\pi r^2$  : : .....  $a^2$

3. Distance between A (2, 3) B (4, 5) is  
A) (3, 4) B) (4, 5) C) (2, 3) D) (1, 2)
4. Mid point of A (2, 3), B (4, 5)  
A) (3, 4) B) (4, 5) C) (2, 3) D) (1, 2)

5. Loss percentage :  $\frac{\text{Loss}}{\text{C.P.}} \times 100 ::$  Profit percentage : .....

**5. How do you prepare test items in different branches of Mathematics.**

**1. Reliability:** Reliability refers to the consistency of a measuring instrument. A test is considered reliable if it yields consistent results in its successive administration

The followings are the methods of determining test reliability.

a. The test retest method b. The split half method

**2. Validity:** Validity is considered as another important characteristic of a good test.

**3. Objectivity :** It is most important factor that effects both the reliability and validity of a test.

**4. Discriminating power:** A test should be classified the students. Then it is said to be a test has discriminating power.

**5. Comprehensiveness :** It should be competent enough to assess the knowledge, skill, interests as possible types of tests.

**Types of Tests : 1. Essay type test:** Essay types tests demanding long answers have ever remained the most popular form of written test of pupils achievement

**Example:** Factorize the following polynomial  $x^3 + 13x^2 + 32x + 20$  by using remainder theorem

**2. Short answer type tests:** These question can be answered in a few sentences. A large number of questions covered in a short time.

Example : Solve  $\frac{x}{3} + 1 = \frac{x}{2} + 5$

**3. Objective type tests:** These test items answered by a single word or by ticking or under lining of the given choices

Example if  $(x+2)$  is a factor of  $x^2 + 3x + 1$  then  $f(-2) = \dots$

**Model test items based on educational standards:**

- 1) Problems solving 2) Reasoning proof 3) Communication  
4) Connection 5) Representation visualisation.

## UNIT - 4

### MATHEMATICS FOR ALL

**1. Explain the role of speed and accuracy in mathematics**

**Ans : Speed and accuracy:** The combination of speed and accuracy qualities can make the students good mathematicians and success full citizens in different walks of life

**Correlation between accuracy and speed:** Psychologically speaking, speed and accuracy are not contradictory qualities. They are in fact, complementary qualities. Through habit formation theses two things can go to gather

**Means of securing speed and accuracy:** Given below are the ways and means of developing accuracy.

**1. Oral exercises:** In order to develop accuracy along with speed, it is advisable that the exercises that are given, should be mostly oral.

**2. Legibility and proper posting of figures:** Students should be trained to write figures correctly, legibly and in good hand writing.

Rough work should not be done along with the fair work.

**3. Analysis of problem:** The students should be encouraged to understand and analyse the problems.

**4. Verification of Results:** verification of results lead to accuracy.

**5. Diagnostic testing and Remedial teaching:** This is very useful in teaching of mathematic and in developing accuracy and speed.

Given below are certain ways and means for the development of speed.

♣ Attempt should be made to develop the habit of correct figure work in the students ♣ Inaccuracy is the greatest obstacle in the development of speed. ♣ Shortcuts would help students to acquire speed as well as accuracy.

2. **How do you understand different learners in your Mathematics class.**

a) **Backwardness** b) **gifted** c) **dyscalculia**

**Ans : BACKWARD STUDENTS IN MATHEMATICS**

When a student is found to lag behind other students in his class we call that particular child as backward. Backwardness in mathematics may be of two kinds.

(i) General backwardness, and

(ii) Specific backwardness

**(a) General backwardness:** It is the case when a child is backward in all the subjects. This type of backwardness is because of low I.Q. Such students can be pulled up to some extent, by the combined efforts of teachers and parents. In case a child has very low I.Q. he may be guided to take up some manual job.

**(b) Specific backwardness:** In this case, a child is backward in Mathematics, but he is quite good in other subjects. To pull up such a student the Mathematics teacher must make efforts in a planned way. Individual cases may have to be tackled in separate classes whereas border cases may be treated in the class-room itself. The teacher must study individual cases, before applying remedial measures.

**Identification of Backward students.**

The teacher can identify backward students in the following ways:

(i) To identify students with low I.Q. teacher may carry out intelligence tests. (ii) To find, if a student is slow in picking up facts, teacher can put up few oral questions and observe the responses given by the students. (iii) Teacher can also know about the level of understanding of a student by observing their faces. Whenever a student fails to understand some important details his face bears a blank look. (iv) The score of a student in an achievement test also points to the position of the student. The score of a backward child is generally low. (v) A backward child is not able to do written work in a finished style. He generally do things in a haphazard manner.

**Suggestions for Helping Backward Children**

A teacher will be able to help a backward child if he can find the cause of backwardness of the child. Here we are listing some important causes for backwardness of a child. The suggestion for helping a backward child are also given along with the cause of backwardness.

**(i) Physical Handicaps:** In case of some students the cause of backwardness may be a physical cause, such as poor eye sight, defect in hearing, stomach trouble or head-ache. Mathematics needs special concentration and because of the physical defects the child fails to concentrate on Mathematical work.

A medical examination of such students may be advised. The cooperation of parents should also be sought, physically handicapped children be given sympathetic but normal treatment. They should never be ridiculed by the teacher or the class-mates.

**(ii) Poor Mental Health.** The backwardness may be due to mental cause, inborn or environmental.

In such a case the teacher should study each case individually. An attitude of love and sympathy and preparedness to help children will be helpful. The teacher should develop in them proper reading and learning habits, power of concentration and memorisation. Serious cases of poor mental health be referred to psychologists or psychiatrists.

**(iii) Lack of interest.** In some cases the cause of backwardness may be the distaste for the subject which may be natural or acquired. The distaste for the subject may be due to faulty methods of teaching or learning, harsh and disinterested teachers heavy syllabus etc.

In such cases a genuine taste will be developed through the teacher's patience and persistence. He should not pronounce a case as hopeless and backward. He should develop a positive attitude of the students for the subject.

**(iv) Defective Teaching.** If the method of teaching is defective, it is likely to create a distaste for the subject. The faulty method of teaching creates certain doubts in the student's mind,

about some fundamentals of the subject. Such doubts hinder the progress of the child.

In such a case the teacher should choose some correct method of teaching keeping in view the nature of the topic and the type of students to be taught. The teacher should not hesitate to explain to students again and again if required.

**(v) Teacher's Attitude:** Some teachers are lenient while some are strict. The harsh and unsympathetic attitude of the teacher never pays. Teacher should be sympathetic to his students and his attitude should be encouraging.

### GIFTED STUDENTS IN MATHEMATICS

A student is considered as Mathematically gifted student if he shows consistent remarkable interest and achievement in Mathematics. The number of Mathematically gifted students in a school is generally limited to one or two. However the education of gifted children is of utmost importance. Thus such gifted students in mathematics have to be identified by the teacher.

#### Identification of Gifted students in Mathematics.

It has been observed that the gifted students begin to show their talent right in early stages and such students can be identified as under.

- (i) Gifted student picks up things rapidly and easily.
- (ii) A gifted student is quick in grasping relationships, making generalisations and drawing conclusions
- (iii) He puts intelligent questions in class
- (iv) He is able to solve those problems which are of a higher standard.
- (v) He shows originality in solving problems
- (vi) He possesses a good power of imagination thinking and reasoning.
- (vii) He has a liking to work at abstract levels and does not like simple practical work.
- (viii) His achievements are remarkable in various achievement tests.
- (ix) His assignment work is of good standard.
- (x) He is always alert and actively participates in teaching learning process.

**Enrichment programme for Gifted Students:** Since it is not possible to have separate schools for such gifted students so such gifted students be given certain enrichment programmes

in the same class. The enrichment programme for such students may include.

- (i) An enriched syllabus to provide for extensive and intensive study.
- (ii) They should be encouraged to enrich their knowledge by the study of supplementary readers, reference books and generally literature from the library.
- (iii) They should be allowed to do their independent study in the library.
- (iv) For teaching such gifted children the teacher should use heuristic, analytic, problem, project or discussion method.
- (v) They should be told the history of the development of various topics and about the contributions of renowned mathematicians.
- (vi) Gifted students be encouraged to actively participate in various activities of Mathematics club.
- (vii) Gifted students be encouraged to apply mathematical facts for solving their day to day problems and should be told about the practical, cultural and disciplinary values of the subject.
- (viii) Gifted students be asked to organise seminars, exhibitions etc concerning Mathematics.
- (ix) They should be asked to work on some useful projects either independently or collectively.

**Dyscalculia:** Dyscalculia is a learning issue that causes serious maths difficulties. Dyscalculia is a brain-based condition that makes it hard to make sense of numbers and maths concepts.

#### Symptoms of dyscalculia:

- ♣ Trouble learning
- ♣ Difficulty using finger counting
- ♣ Particular difficulty with subtraction
- ♣ Poor coordination of movement.

#### Diagnosis of dyscalculia.

- ♣ Using calculators for calculations
- ♣ Use abacus and puzzles in mathematics teaching
- ♣ Using colour pencils for step problems
- ♣ Using computers in mathematics.

#### 3. Explain the following.

- (a) Mathematics club
- (b) Mathematics fair
- (c) Mathematics Olympiad
- (d) Recreational activities

**(a) Mathematics club:** Through the mathematics club the learning of mathematics becomes joyfull. The students learn

the things with out the conscious effort on their part and pursue mathematics as a pleasant hobby and not a burden on them

**Factors governing the success of a science club:**

The success of a mathematics club depends up on the following factors.

**(a) Mathematics teacher:** The mathematics teacher in the most important force.

**(b) Accommodation :** This is one of the governing factors in the effective deliberation of the mathematics club

**(c) Equipments:** Inadequate equipments may also stand in the way of smooth and successful programmes of the mathematical club.

**(d) Proper guidance:** It is again important that the mathematics teachers as well as pupils should get proper type of guidance

**Importance of mathematics club:**

- ♣ Mathematics club is related with childs activity and life
- ♣ In encourages active participation of the students
- ♣ It develops internet in mathematical hobbies like preparing riddles,. Magic square etc.
- ♣ It helps in making proper utilization of leisure time
- ♣ It teaches students "how to organise an leisure time"

**Activities :** Some of the mathematics club activities are suggested as below.

- ♣ Holding discussions ,meetings, declamations, debates, paper reading contests etc.
- ♣ Arranging excursions and visits to places of mathematical interest like bank, market places etc
- ♣ Preparing items for wall magazines
- ♣ Rendering possible services to the community
- ♣ Arranging a lecture by some renowned mathematics teacher.

**(b) Mathematics fairs:** Every school should organise mathematics fair, at least once a year. This shold include the exhibits of the students as well as demonstrations. Talks by experts, debates and declamations discussions etc. Can also be organized

**Objectives:** The main objectives of mathematics fairs are:

- ♣ To popularise activities among greater number of students
- ♣ To given impetus and encouragement to students to try out

their ideas and apply their class room learning into more creative and recreational channels.

**Value of mathematics fair :** The mathematics fairs have social intellectual, psychological and educational values. The students takepart in group activites and learn many things which cannot be learnt through class room teaching. The students should be encouraged to take part in mathematics fairs at district, state or National level.

**Organisation of Mathematics fair:** The following procedure is suggested for the organisation and administration of the mathematics fair.

**1. Planning :** During planning the following aspects should be considered.

- ♣ Objectives and aims of the fair
- ♣ Scope of the fair whether to limit to the school or open to other schools type of programmes etc
- ♣ Producer
- ♣ Financing
- ♣ Place, time and duration
- ♣ Other factory and facilities

**2. Distribution of work :** After planning the work should be assigned to different individuals or groups

**3. Execution:** The different committees now execute the planning of the fair

**4. Judging:** The fair should be judged by different committees of judges for different items of the fair

**c) Mathematics Olympiad:** Mathematical Olympiads are competitive evens where participants sit a mathematics test. These tests may require multiple choice or numeric answers or a detailed written solution or proof.

**National Mathematics Olympiads:**

- ♣ Indian National Mathematical Olympiad (InMo)

**Online Mathematics competitions**

- ♣ AOCMM
- ♣ NIMO
- ♣ JOMO
- ♣ Mathlathon

**(d) Recreational activities:**

Recreational mathematics is a term for mathematics carried out for recreation rather than as a strictly research and application based professional activity. Although it is not necessarily limited

to being an endeavor for amateurs, it often involves Mathematical puzzles and games.

**Types of Recreational activities :** There are two types of recreational activities:

**a. Active :** Active recreation includes activities that an individual must direct by participate in such as dancing etc.

**b. Passive:** Passive recreation only requires one to observe such as listening to Music etc.

**4. Justify the need of mathematic laboratory for effective teaching of mathematics?**

**Ans : IMPORTANCE OF MATHEMATIS LABORATORY**

In Mathematics laboratory all essential items (e.g. Set - square, Compass, Models etc) concerning the learning activities in mathematics are kept. It also provides facilities for laboratory work. The main aim of teaching of mathematics is the development of power of abstract thinking and reasoning to for this we must start from concrete subjects. When the students handle concrete objects, his learning is quicker and understanding is better. Use of geometrical models helps the student in grasping various geometrical facts. If mathematical facts are verified physically then they could be understood more easily and can be easily applied in new situations. Further more any practical work in mathematics makes the subject interesting to the students.

**Importance of Laboratory work in Mathematics can be summarized as follows.**

(i) It helps in making clear and in understanding abstract concepts. (ii) It saves teachers time by cutting short certain lengthy explanations. (iii) It helps in developing the habit of verification in the students. They accept mathematical truths only after confirming their validity practically. (iv) It enables the students to apply mathematical facts and principles in a actual life. (v) The pupils develop love for the subject and arousing their interest in mathematics (vi) It enables the students to learn by doing. The things so learnt are retained in the mind for a longer time (vii) It is multi-sensory approach to learning.

In the lower classes, laboratory work helps the students in learning elementary mathematics. Even the mentally deficient children can profit from practical work. Moreover, Mathematics laboratory is a rich repository of audio visual aid that can be used in day to day teaching.

**EQUIPMENT FOR MATHEMTATICS LABORATORY**

Mathematics laboratory serves not only as laboratory but also as Mathematics room and Mathematics museum. Keeping in view the various purposes it should have the following equipment :

**(i) Concrete Materials.** It should be provided with concrete materials connected with simple arithmetical topics such as beads, sticks, pebbles, balls frames, number cards, seeds, balances, coins, weights, measuring tapes, didactic apparatus which is used in Montessori Method, scissors, pins, card board, chart paper, graphs, nails, hammers, ropes etc. It may also provided with the following materials :

(a) *A number Kit* consisting of a set of wooden blocks of different colours, labeling the digits from one to ten. Each block has the numeral and word representing the numeral.

(b) *Place value pockets* is a box having three or four portions labeled as units, Tens, Hundreds, Thousands. This is used to teach place value of numbers, idea of carrying processes of addition and subtraction etc.

(c) *Fractional Parts* is a series of discs that is divided into halves, thirds, fourths, fifths etc. These are quite useful to illustrate the concept of fractions, addition , multiplication etc.

(d) *Charts* : A number of mathematical charts should be kept in the Mathematics laboratory. Charts can be used to explain certain points which otherwise would be difficult to explain. These charts are drawn on paper with the help of colour as well as pencil. These charts may be got prepared by the students on different topics such as % age, average, fractions, circles, cubes etc. Some set of charts are also available from the market.

The charts, as far as possible, should be accurate, interesting and good looking. If the charts do not fulfill these requirements,

they shall not be useful for the class be room teachings. There may charts and models of certain geometrical figures such as triangles, quadrangles, rectangles.

**(ii) Pictures and Photographs :** The pictures and photographs of various Mathematicians be prominently displayed in the Mathematics room. It would be much useful if the contributions of these Mathematicians are also indicated on such charts.

**(iii) Models :** Various Mathematical models such as those of triangles, squares, solids etc., be stored in a Mathematics laboratory. These help in understanding abstract mathematical concepts, Now various models illustrating mathematical proofs or principles or statements are available in the market.

**(iv) Black Board and Geometrical Instruments.** As already pointed out the size of black board provided in mathematics room should be larger than ordinary size. Provisions for coloured chalks may also be made in the laboratory. Coloured chalks are required for use in drawing various figures and diagrams. A set of geometrical instruments like protractors, compass, rulers etc., be kept in a mathematics laboratory. Stencils for drawing geometrical figures is also an important equipment for mathematics laboratory.

**(v) Bulletin Boards or Display Boards:** Such boards are used to display various illustrations concerning mathematics. The material for display on such boards e.g. mathematical figures, rules, graphs etc., can be collected from various sources.

**(vi) Equipments and Materials Concerning Other Subjects :** Mathematical principles and procedures are used in other subjects and the materials, equipment illustrating the application of mathematics (e.g. barometer, hydrometer, pendulum etc. ) be also kept in Mathematics laboratory.

**(vii) Proportional Dividers, Slide Rules, Calculating Machines etc.** These are quite useful in the study of similiary of geometrical figures and be kept in a mathematics laboratory.

Making use of these instruments we can magnify or reduce figures, graphs, maps etc. Slide rules are quite useful in mathematical calculations. A training in mathematical calculations can be provided by using simple calculating machines.

**(viii) Surveying instruments:** Various instruments used in surveying be kept in a mathematics laboratory because surveying is concerned with Mathematics. Some of these instruments are

(a) *Angle Mirror* which is used for laying out right angles in the field (b) *Plane table and Alidate* which are used for elementary mapping and surveying (c) *Hypsometer and Clinometer* are simple devices to measure angles of elevation and depression. These can be used to measure heights and distance of objects indirectly. (d) *Level* which is an in finding differences in elevation (e) *Transit* which is an angle measur and a leveling instrument.

**5. Explain the role of (a) Co-operative learning (b) Peer learning (c) Reciprocal learning (d) Breur using technology to meet diverse needs of learners.**

**Ans : (a) Co-operative Learning :** Co-operative learning is an integral part of the process of mathematical teaching and learning. Cooperative learning involves structuring the classes around small groups that work together in such a way that each group member's success is dependent on the group success. In this learning students work in groups to complete tasks and achieve the goals of education.

**Elements of Co-operative Learning :** According to Brown and Ciuffetelli Parker and Sitala essential elements as

✦ Group processing ✦ Positive interdependence ✦ Face to face promotive interaction ✦ Individual and group accountability

**Types of co-operative learning:**

**1. Informal co-operative Leaning:** This learning contains small groups of two students which are often temporary and can change from lesson to lesson.

**2. Formal co-operative learning;** A well structured, facilitated group learning to achieve group goals and systematically monitored by the teacher is called formal co-operative learning.

### 3. Long term study group or base group learning:

This approach make the students accountable to educating their peer group in the event that a member was absent for a lesson.

#### Techniques of co-operative learning

#### 1. Student - teams - Achievement divisions (STAD):

Students are placed in small groups the lesson is presented to the entire class and after wards each student is tested individually.

**2. Jigsaw:** In this technique students are members of two groups home group and expert group.

**3. Think pair share:** In this technique the student silently thinks about a posed problem the student may write down thoughts or simply just brainstorm in his head.

#### Advantages

♣ In collaboration skills can be learned. ♣ Students participate actively in teaching learning process

#### Disadvantages:

♣ Difficult to complete the syllabus in time ♣ It may be difficult for every student to acquire knowledge by their own.

**(b) Peer - learning:** Peer learning is an educational process in which students interact with other students and learn in order to achieve the aims and objectives of education . Peer learning was evolved out of cognitive psychology. Peer learning is also called as peer-to-pee learning which is a mode of learning for every one, by every one and about anything.

#### Peer learning procedures:

**1. Affinity groups:** Groups of four - five students are each assigned particular tasks to work on out side of formal contact time.

**2. Buzz groups:** A large group of students is sub divided into smaller groups of 4-5 students to consider the issues surrounding a problem.

**3. Critic groups :** one sub group is assigned a discussion topic for a tutorial and the other groups constitute critics who observe, offer comments and evaluate the sub groups presentation.

**Advantages:** ♣ Peer group will be developed cominedly

♣ Team building spirit and more supportive relation ships.

#### Limitations:

♣ Peer learning would not be successful when there are difference in the capabilities of peers.

**(c) Reciprocal learning:** Reciprocal learning is best represented as a dialogue between teachers and students in which participants take turns assuming the role of teacher.

Reciprocal learning is a process involving four distinct activities (clarifying, predicting, questioning, summarizing) employed in a student - led, team approach, to develop reading comprehension skills among primary students.

**Stategies in reciprocal learning:** 1. Summarizing  
2. Questioning 3. Clarifying 4. Predicting

**Summarizing:** A great ways to help students get to know what they read is through summarizing.

**Questioning :** Thinking questions allow student to identify areas that are confusing, share their needs for clarification and ask if there are connecting with material already read.

**Clarifying:** Clarifying is answering the posed questions the clarifier also points out areas the class may see an confusing and clarifies them.

**Predicting:** When students predict, they are coming up with ideas of what can happen next in the test they fast read.

#### Features of Reciprocal teaching:

♣ Takes place in small stable groups ♣ Involves massed practice initially ♣ Uses challenging ♣ interesting text ♣ The focus in on reading comprehensions not reading strategies.

### Basic roles of reciprocal learning

Leader	Predictor	Clarifier	Questioner	Summarizer
Organize the reading assign the roles	Have a quick look at the text and predict what is will be about	Pick out any confusing ideas and discuss them in the group	Ask questions to make sure every one understands the text	Summaries the key ideas in the text

**Beur using technology to meet diverse needs of learners:** Technology is useful to increase maintain or improve the functional capabilities of a child with varied needs.

#### Technology for children with little diverse needs:

✦ Reading skills ✦ Writing skills ✦ Maths skills

**Technology for children with sensory problems / needs**

1. **For the blind:** ✦ Canes ✦ OCR ✦ Screen readers

2. **For the partially blind:** ✦ CCTV ✦ LCD.

## UNIT - 5

### PROFESSIONAL DEVELOPMENT IN MATHEMATICS TEACHER

1. **Mention different in - service programmes for mathematics teacher.**

**Ans : In service training:** A training that is given to employees during the course of employment. The teacher in service program provides a form for volunteers to mathematics concepts by sharing their real - world experiences with local educators.

#### Goals of teacher in service program:

✦ Promote applied inquiry - based learning ✦ Enhance the level of technical literacy of teachers

#### In service programme can deal with the following:

✦ Projects in mathematics ✦ Motivation for learning the topics in mathematics ✦ Use of mathematics laboratory ✦ Various evaluative techniques in mathematics

#### Purpose of in service training to teachers :

✦ To release creative activities ✦ To keep the professional abreast of new knowledge ✦ To promote the continuous improvement of the total professional staff of the school system.

In service training programme for mathematics teacher can be categorised into three types

**a. Skill enhancement programme:** Skill enhancement programs are focused around training that combines the best practices from education, carries counselling and technology training

**b. Up dation and enrichment programme:** Updation and enrichment in existing practices and content is an important factor for better teaching -learning of mathematics on the part of mathematics teacher.

**c. Introductory programme for new policy and the curriculum:** New text books were developed by NCERT based on NCF - 2005.

## 2. Explain the role and uses of mathematics teachers Associations

Mathematics associations are some times formal and some times non formal. Mathematics teacher are active not only for their own and subjective growth, but also endeavouring for professional development of mathematics teachers community they have established associations of mathematics teachers. These associations have their own established norms, guidelines, plan for activities and their own set up.

A mathematics teacher's association can bestow opportunities for professional growth as revealed from various sources to teachers

- ♣ It can bring out a mathematics journal
- ♣ it can establish a website for communication among mathematics teachers in the region
- ♣ it can organize orientation programmes for their members- teachers with the help of some other organisations.

### Mathematics Associations :

- ♣ National Education Association (NEA)
- ♣ Indian mathematics association (IMA)
- ♣ National council of teachers of mathematics (NCTM).

## 3. Write about professional growth of mathematics teacher

**Ans :** There are conferences, seminars, work shops and competitions at these higher levels which encourage the professional development of mathematics teachers and in turn facilitate the learning of mathematics on the part of their students.

Department of teacher educational and extension of NCERT holds an "All India competition on innovative practices and Experiments in education for schools and teacher educational institutions, at National level.

**Participation in conferences:** Mathematics teachers can participate in conferences, which will add to their professional

growth. There are conferences at regional, National and international level in which mathematics teacher can participate. Conferences will help the mathematics teachers in two ways (a) they can clear their individual doubts arise during their teaching learning of mathematics

(b) they can share their experiences with other.

### Participation in seminars

Teachers can participate in seminars for their professional growth and hence adding to their professional portfolio.

In seminars, one gets an opportunity to meet a large number of teachers and exchange teaching learning experiences and innovative ideas with them.

**Participation in work shops:** Work shops provide one sort of real outcomes then and there, where the work shops are being organized.

### Objectives of work shop:

- ♣ Developing sustainable strategies
- ♣ Increased awareness
- ♣ Shifting attitudes

Mathematics teacher agreeing with the norms for the work shop can send request to the concerned authority to participate in the work shop.

**Participation in E-learning:** E-learning has become one of the primary ways of delivering education around the globe.

There are four sequential conditions for pre-service teacher's E-learning competency

- (a) ease to use
- (b) competency
- (c) psychologically safe environment
- (d) E-learning self Efficiency.

### Approaches of E-learning services:

- ♣ Computer - based learning (CBL)
- ♣ Computer based teaching (CBT)
- ♣ Computer supported collaborative learning (CSCL)
- ♣ Technology - enhanced learning (TEL).

**4. Write about resource material in mathematics education.**

**Ans : Mathematics journals:**

Important and useful journals should occupy an important part of mathematics library and the mathematics teacher should impress up on the student of the use of such journals. Some of the mathematics journals published in India are.

1. School mathematics (NCERT Delhi) (Quarterly, English)
2. The mathematics teacher journal, SITU colony Chennai - 28.
3. The mathematics education journal, PO SLWAN, Distt saran (Bihar)
4. NECR and SCERT mathematics periodicals and magazines
5. Mathematics today
6. Competition refresher
7. Mathematics for you

**Other Resources material in mathematics**

**Mathes websites**

[http:// www. Mathforum.org](http://www.Mathforum.org)

[http:// www.cimt.plymouth.ac.uk](http://www.cimt.plymouth.ac.uk)

[http:// www.counton.org](http://www.counton.org)

[http:// www. Michaelbach.de/ot](http://www.Michaelbach.de/ot)

**E- Books:**

[http:// www. Mathsisfun.com](http://www.Mathsisfun.com)

[http:// www. Mediatefire.com](http://www.Mediatefire.com)

[http:// www. Gyanpedia.in](http://www.Gyanpedia.in)

**Reference Books:**

Mathematics for all (UNESCO)

Hindu Geometry (B. Datta & A.N. Singh)

How to solve It ? (G. Polya)

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