CHAPTER – I

Problem and its significance

“There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things”. Niccolo Machiavelli

1.1 Introduction :

Education is an integral part of human life. It is the basis for the development of the ‘whole man’ and a vital instrument for accelerating the well-being and prosperity of all in every direction. Without education man would still be living just like a splendid slave or like a reasoning savage.

Adams viewed (B.N.Dash, 2003) “Education is a conscious and deliberate process in which one’s personality acts upon another in order to modify the development of the other by the communication and manipulation of knowledge”. (P.5)

1.2 Mathematics education in life :

Mathematics is the mainstay in today’s systematic life. Without numerical and mathematical evidence one cannot decide many issues in day to day life.

Servais, (Sonia Bhasin, 2005) says : “Mathematics is an abstract science, it is the science of abstraction, learning mathematics is learning to abstract, to handle abstractions and to use it” (P.3)
Mathematics is the study of abstractions and their relationships in which the only technique of reasoning that may be used to confirm any relationship between one abstraction and another is deductive reasoning.

According to Berthelot, (K.S.Sidhu, 1995) “Mathematics is the indispensable instrument of all physical researches” (P.26)

1.3 Nature of mathematics:

Mathematics plays a vital role in the economic and social development of a country because it is the basis for all science and technology. Mathematics is the queen of all sciences and the backbone of civilization. Doing any profession can not survive without the knowledge of mathematics.

W.W.SAWYER (1952) says “Mathematical thinking is a tool. There is no point in acquiring it unless you mean to use it”. [P.9].

Mathematics is the indispensable tool of precision in measures involving quality and time. The ultimate concept of space travel, the harnessing of hidden sources of energy from other space, newer and greater use of atomic energy, atomization and electronic devices and such other developments serve only a few illustrations of the greater demand for scientific and mathematical advent.

❖ Mathematics is an abstract science.

❖ Mathematics is a science that deals with number and space.

❖ Mathematics deals with quantitative facts and relationships.
Mathematics deals with problems involving space and form.

Mathematics helps man to give exact interpretation to his ideas and conclusions.

Mathematics explains that science is a byproduct of our empirical knowledge.

Mathematics involves man's high cognitive powers.

Mathematics has its own tools like intuition, logical reasoning analysis, construction, generalities and individuality.

Mathematics has certain unique features which one could hardly find in other disciplines. The following are the important characteristics of mathematics.

- Precision and accuracy
- Logical sequence
- Applicability
- Generalization and classification
- Mathematical language and symbolism
- Abstractness
- Structures in mathematics
- Mathematical systems
- Rigor and logic
1.4 Objectives of teaching mathematics:

Robert F. Mager (Sonia Bhasin, (2005) says “An objective is an intent communicated by a statement describing a proposed change in a learner- a statement of what the learner is to be like when he has successfully completed a learning experience”. [P.27]

At the end of the high school stage, a pupil should be able to

- Acquire knowledge and understanding of the terms, concepts, principles, processes, symbols and mastery of computational and other fundamental processes that are required in daily life and for higher learning in mathematics.

- Develop skills of drawing, measuring, estimating and demonstrating.

- Apply Mathematical knowledge and skills to solve problems that occur in daily life as well as problems related to higher learning in mathematics or applied areas.

- Develop the ability to think, reason, analyse and articulate logically.

- Appreciate the power and beauty of mathematics

- Show an interest in mathematics by participation in mathematical competitions, and engaging in its learning.

- Develop a reverence and respect towards great mathematicians for their contributions to the field of mathematical knowledge.
• Develop necessary skills to work with modern technological devices such as calculations, computers etc.,

The NPE (1986) identifies the strengths and weaknesses of the present system of education and clearly enunciates the direction for reshaping the system, particularly at school level. There is a specific mention in the NPE (1986) about mathematics education in the following words “Apart from being a specific subject it should be treated as a concomitant to any subject involving analysis and reasoning with the introduction of computers in schools, educational computing and emergence of learning through the understanding of cause effect relationship and the interplay of variables, the teaching of mathematics will be suitably redesigned to bring it in line with modern technological devices”.

As general guidelines, the NPE has two very significant directives and every teacher of mathematics should know their implication in the teaching of mathematics. The NPE states: “To promote equality, it will be necessary to provide for equal opportunity to all not only in access, but also in the conditions for success”.

According to experimental mathematics educators, the implication of this policy statement for mathematics education is as follows.

“At the secondary stage, a beginning will be made to teach mathematics as a discipline in a suitable manner. Even then the concepts of essential learning outcomes, minimum level of learning and mastery learning are
relevant and valid. Many pupils perform poorly in mathematics and find its understanding very difficult. The probable reasons for these are some socio economic factors which have a bearing on the performance of such pupils and the existing school conditions inclusive of its teaching”.

The NPE (1986) re-emphasizes that mathematics should be visualized as the vehicle to train child to think, reason, analyze and articulate logically. This means that the teaching of mathematics should not be a simple narrative type of activity. mathematics is the discovery of human mind and, as such learning mathematics should be to a large extent, a guided rediscovery. At the upper primary stage, the pupil is not mature enough to appreciate mathematical proof.

Still mathematics can be taught to stimulate the pupils thinking and reasoning. Many geometrical properties that include at the upper primary level/secondary level can be discovered by the pupil by doing some simple experiments. These may require teaching aids which can be easily made. Many mathematical rules in arithmetic and algebra can be discovered through patterns.

1.5 Importance of mathematics in school education:

Mathematics has played a predominant role not only in the advancement of civilization in general but also in the development of physical science, and has now wider applications in other branches as well.
Hogben (S.K. Mangal, 1997) says: “Mathematics is the mirror of civilization”. (P.9)

The place of mathematics in modern education must be determined by an analysis of the culture of civilization of the modern society. The Kothari Commission report (1964-66) rightly points out that the study of mathematics plays a prominent part in modern education. It says: “one of the outstanding characteristics of scientific culture is qualification”. [P.199] mathematics, therefore, assumes a prominent position in modern education.

Mathematics education in schools is more emphasized as it improves concept development, fosters higher cognitive abilities and skills. Mathematics is a very useful subject for most vocations and higher specialized courses of learning. At the higher secondary and university stages, most of the physical and social sciences require the applications of mathematics. No other subject can be a substitute for mathematics. Thus mathematics has now become compulsory in the school curriculum.

Mathematics has been an inseparable part of school curriculum ever since the beginning of formal education and it continues to be so. Mathematics curriculum has undergone various changes from time to time in accordance with the changing needs of the society. Realizing its social relevance the Kothari education commission recommended that mathematics should be taught as a compulsory subject of general education up to class X.
Mathematics is a self contained mental discipline, with its own language and structure. Mathematics is a sequenced discipline, in the sense that it is slightly different from other subjects.

Lindsay (Dr. Anice James, 1995) says: “Mathematics is the language of physical sciences and certainly no more marvelous language was ever created by the mind of man” (P.2)

In the case of other subjects the child can make up the previous portion if he was absent at the time of teaching of that portion. But this is not possible in the case of mathematics because it is a sequence subject. It is difficult to follow a topic, when the topics that have been dealt with earlier are not properly understood. One cannot follow multiplication and division unless one knows addition and subtraction also. Simple interest, discount and stock cannot be understood unless one knows percentage.

Mathematics as explained earlier, is a sequence subject and is also a complex system of concepts. The pupil should be helped to have carefully chosen set of Mathematical experiences through learning in order to help him/her to form a new concept. If the concepts at the foundation level are clear, interest and enjoyment become automatic in mathematics. The clarity of fundamental concepts and procedures also help the learner to master difficult concepts of higher order.
The present state of teaching mathematics in the majority of our schools is far from satisfactory, many pupils find mathematics a difficult subject whatever be the reason for this attitude.

**National Curriculum Frame Work 2005 :** It suggests the development of children’s abilities for mathematics education. The narrow aim of school mathematics is to develop ‘useful’ capabilities, particularly those relating to numeric-numbers, number operations, measurements, decimals and percentages. The higher aim is to develop the child’s resources to think and reason mathematically, to pursue assumptions to their logical conclusion and to handle abstraction. It includes a way of doing things, and the ability and the attitude to formulate and solve problems.

This calls for a curriculum that is ambitious, coherent and teaches important principles of mathematics. It should be ambitious in the sense that it seeks to achieve the higher aim mentioned above, rather than only the narrower aim. It should be coherent in the sense that the variety of methods and skills available piecemeal (arithmetic, algebra, geometry) need coherence into an ability to address problems that come from other domains such as science and social studies in high school. It should be important in the sense that students feel the need to solve such problems, that teachers and students find it worth their time and energy to address these problems. The twin concerns of the mathematics curriculum are: what can mathematics education do to engage the mind of every student, and how can it strengthen the student’s resources?
As mathematics is a compulsory subject at the secondary stage, access to quality mathematics education is the right of every child. In the context of universalisation of education, the first question to ask is, what mathematics can be offered in eight years of schooling that will stand every child in good stead rather than be a preparation for higher secondary education alone? Most of the skills taught in primary school mathematics are useful. However, a reorientation of the curriculum towards addressing the ‘higher aims’ mentioned above will make better use of the time that children spend in school in terms of the problem-solving and analytical skills that it builds, and in preparing children to better meet a wide variety of problems in life. Also, the tall shape of mathematics (where mastery of one topic is prerequisite for the next) can be emphasized in favour of a broader based curriculum with more topics that starts from the basics. This will serve the needs of different learners better.

**Vision for school mathematics**

- Children learn to enjoy mathematics rather than fear it.

- Children learn the importance of mathematics: mathematics is more than formulas and mechanical procedures.

- Children see mathematics as something to talk about, to communicate through, to discuss among themselves and, to work together on.

- Children pose and solve meaningful problems.
• Children use abstractions to perceive relationships, to see structures, to reason out things, to argue the truth or falsity of statements.

• Children understand the basic structure of mathematics, arithmetic, algebra, geometry and trigonometry, the basic content areas of school

• Teachers engage every child in class with conviction that everyone can learn mathematics.

Many general tactics of problem solving can be taught progressively during the different stages of school. Abstraction, qualification, analogy, case analysis, reduction to simpler situations, even guess and verify exercises, are useful in many problem solving contexts. Moreover, when children learn a variety of approaches (over time), their toolkit becomes richer, and they also learn which approach is the best children also need exposure to the use of heuristics, or rules of thumb rather than only believing that mathematics is an ‘exact science’. The estimation of quantities and approximating solutions is also an essential skill. When a farmer estimates the yield of a particular crop, he uses considerable skills in estimation, approximation and optimization. School mathematics can play a significant role in developing such useful skills.

**Development of useful skills in mathematics:**

Visualization and representation are skills that mathematics can help to develop. Modeling situations using quantities, shapes and forms are the best use of mathematics, mathematical concepts can be represented in multiple
ways, and these representations can serve a variety of purposes in different contexts. All of this adds to the power mathematics. For example, a function may be represented in algebraic form or in the form of a graph. The representation p/q can be used to denote a fraction as a part of the whole, but can also denote the quotient of two numbers, p and q. Learning this about fractions is as important, if not more than learning the arithmetic of fractions.

There is also a need to make connections between mathematics and other subjects of study. When children learn to draw graphs, they should also be encouraged to think of functional relationships in the sciences, including geology. Our children need to appreciate the fact that mathematics is an effective instrument in the study of science.

The importance of systematic reasoning in mathematics cannot be overemphasized, and is intimately tied to notions of aesthetics and elegance so dear to mathematicians. Proof is important, but in addition to deductive proof, children should also learn when pictures and constructions provide proof. Proof is a process that convinces a skeptical adversary; school mathematics should encourage proof as a systematic way of argumentation. The aim should be to develop arguments, evaluate arguments, make and investigate conjectures, and understand that there are various methods of reasoning.

Mathematical communication is precise and employs unambiguous use of language and rigor in formulation, which are important characteristics of mathematical treatment. The use of jargon in mathematics is deliberate,
conscious and stylized. Mathematicians discuss what is appropriate notation since good notation is held in high esteem and believed to aid thought. As children grow older, they should be taught to appreciate the significance of such conventions and their use. For instance, this means that setting up of equations should get as much coverage as solving them.

In discussing many of these skills and processes we have referred to a multiplicity of approaches and procedures. These are all crucial for liberating school mathematics from the tyranny of applying them only to those algorithms that are taught.

Some corrective action should be taken immediately. NCERT at the central level, and SCERT at that state level have initiated several steps to improve the quality of mathematics education in our schools. The association of mathematics teachers at the national level and in various states is doing very useful work. It is organizing seminars, publishing useful materials, conducting mathematical Olympiads and so on to make the students learn mathematics more enjoyable, leading to the qualitative improvements of mathematics education in schools.

Mathematics is about pattern and structure, it is about logical analysis, deduction, calculation within these patterns and structures. When patterns are found often in widely different areas of science and technology, mathematics of these patterns can be used to explain and control natural happenings and
Mathematics has a pervasive influence on our everyday lives, and contributes to the wealth of the country.

**Mathematics in everyday use:**

The everyday use of arithmetic and the display of information by means of graphs are everywhere in every day life. The use of mathematics in everyday life is manifold and varied. The specific instances are:

- Advanced mathematics is widely used.
- The mathematics of error correcting codes is applied to CD players and to computers.
- The stunning pictures of far away planets sent by Voyages II could not have had their crispness and quality without such mathematics.
- Voyager’s journey to the planets could not have been calculated without the mathematics of differential equations.
- Whenever it is said that advances are made with supercomputers, there has to be a mathematical theory which instructs the computer what is to be done, so allowing it to apply its capacity for speed and accuracy.
- The development of computers was initiated in this country by mathematicians and logicians, who continue to make important contributions to the theory of computer science.
• The next generation of software requires the latest methods from what is called category theory, a theory of mathematical structures which has given new perspectives on the foundations of mathematics and on logic.

• The physical sciences (chemistry, physics, oceanography, astronomy) require mathematics for the development of their theories.

• In ecology, mathematics is used when studying the laws of population change.

• Statistics is also essential in medicine, for analyzing data on the causes of illness and on the utility of new drugs.

• Statistics provides the theory and methodology for the analysis of wide varieties of data.

• Travel by aero plane would not be possible without the mathematics of airflow and of control systems.

• Body scanners are the expression of subtle mathematics, discovered in the 19th century, which makes it possible to construct an image of the inside of an object from information on a number of single X-ray views of it. Thus mathematics is often involved in matters of life and death.

These applications have often developed from the study of general ideas for their own sake: numbers, symmetry, area and volume, rate of change,
shape, dimension, randomness and many others. Mathematics makes a special contribution to the study of these ideas, namely the methods of

- Precise definitions
- Careful and rigorous argument, representation of ideas by many methods, including symbols and formulae, pictures and graphics.
- Means of calculation
- And the obtaining of precise solutions to clearly stated problems, or clear statements of the limits of knowledge.

These features allow mathematics to provide a solid foundation to many aspects of daily life, and to give a comprehension of the complexities inherent in apparently quite simple situations.

For these reasons, mathematics and calculation have been associated from earliest times. In modern times, the need to perform rapid mathematical calculations in war time, particularly in ballistics, and in decoding, was a strong stimulus to the development of the electronic computer. The existence of high speed computers has now helped mathematicians to calculate and to make situations visual as never before. Also this calculation has developed from numerical calculation, to symbolic calculation, and currently to calculation with the mathematical structures themselves. This last is very recent, and is likely to lead to a major transformation. These capacities change, not the nature
of mathematics, but the power of the mathematician, which increases perhaps a million fold the possibility to comprehend, to argue, to explore.

1.6 Mathematics education for all:

The NPE stresses that education is a unique investment in the present and future and emphasizes not only access to education of comparable quality for all students irrespective of caste, creed, location or sex, but also the need to provide the conditions for success. It is clear that all students should achieve mathematics education of comparable quality. As it is, mathematics is felt to be a difficult subject by many children who are first generation learners, who are from the disadvantaged, deprived sections of the society. So some specific steps should be taken at the institutional level and individual teacher level.

To achieve it NPE suggests a multimedia approach for curriculum transaction. Educational technology should be extensively used. In this connection mathematics educators have suggested the development of instructional packages in place of a single text book. An instructional package should consist of both printed as well as non printed materials. The composition of an instructional package, as suggested by some mathematics educators could be the following.

- The text book.
- The supplementary problem book, consisting of additional drill material plus some challenging mathematical problems for high achievers and the talented.
- Enrichment materials (including recreational mathematics) for high achievers and the talented for use in mathematics clubs in schools.

- Teacher’s hand book based on the above materials.

- Models, charts, films etc.,

In every class pupils who have interest in mathematics and who are high achievers in the subject should be properly nurtured in the class and also outside a regular class. For this purpose it would be useful to start mathematics clubs in the schools. Variety of activities can be organized in the mathematics club. The pupils may be made to prepare mathematical models. They may be encouraged and helped to solve challenging types of problems, they may be prepared to participate in mathematical competition (mathematical Olympiads) which are being conducted by mathematics teachers associations; they may be taught additional mathematics to enrich their mathematical knowledge and so on. Every teacher should maintain a collection of challenging problems. A lot of them can be collected from question papers of mathematical competitions. In addition, the teacher should develop such problems.

1.7 Promotive factors of mathematical learning:

Meaningful learning: Teachers today, both in the elementary and secondary school are concerned not only in developing speed and accuracy in the computational processes but also in making pupils see the reason behind each process, its relation to other processes, and the basis for all arithmetical
processes in the nature of number system itself. The development of meanings should come through a variety of experiences. A meaning provides the key to each step of procedure.

1. The concepts and processes should arise from concrete and familiar situations in the pupils life.

2. There should be development from the concrete to the increasingly abstract and symbolic.

3. The pupil should understand the reason for the process and be able to reconstruct it if necessary.

4. When a rule is developed, it should be in so far as it possible, the pupils own generalization of the way he solves the problem.

5. The relationship between processes is emphasized in the explorations and generalizations.

6. Drill is used only when understanding is complete at the abstract level.

Learning Opportunities:

The opportunities for and mathematical learning include:

- Making mathematical models.

- Constructing items where mathematics is used in an ongoing unit of study.
- Dramatizing a mathematical situation.

- Drawing diverse geometrical figures to show design and spatial relations.

- Modeling a process or procedure to share with others.

**Basic facilities for mathematics learning:**

Provision of at least basic facilities in all the schools is a must for effective curriculum transaction. The NPE recognizes this fact and suitable action to be taken in this regard in the implementation of NPE at the upper primary/secondary level. A lot of mathematics should be learnt by doing skills such as drawing skills, measuring skills and skills of estimation. For this purpose mathematics laboratory/workroom is essential.

**1.8 How to develop human life to promote mathematics:**

“*Mathematics should be taught on compulsory basis to all pupils as a part of general education during the first ten years of schooling*”.

- Kothari Commission.

It is a scientific, competitive, corrupted, polluted, technical and internet world. Globalization is the slogan of today. All this is due to science.

But, all technical progress in science goes to mathematics. Mathematics is called as ‘Mother of sciences’. Mathematics is the soul of science.
The fourth verse of vedang Jyotish notes “As are crests on heads of peacock, as are jewels on the hoods of the snakes so is Ganit, (Mathematics) at the top of all sciences”. (in Sonia Bhasin, 2005) (P.3)

Without mathematics, science will be incapable of saving its own existence. For fulfilling the needs of the technological world, it is necessary to have full fledged knowledge of important contribution of mathematics.

Mathematics knowledge is necessary for every person, our needs remain incomplete without it. Man in all stages of life makes use of mathematics to a smaller or greater degree. Modern life situations have become so complex that we need to save our time, energy and money. Therefore, the help of different disciplines particularly mathematics is to be take meet out pressing needs in a variety of ways and means.

Whatever may be ones profession, mode of living or daily routine one has to use mathematical knowledge.

Leibnitz (S.K.Mangal, 1990) says that: “Music is a modern hidden exercise in arithmetic of a mind unconscious of dealing with numbers” (P.7).

Right from ordinary man to big land lord and business man, from ordinary house wife to manger from small child to mature adult, all utilize mathematics.

• Making housing complexes need quality of cement, number of bricks, different sizes and lengths of iron bars etc.,
• Using different varieties of clothing, for different seasons, (quality used) and sizes needed etc.,

• Quality of fertilizers, insecticides, quality of water, soil, its quantity etc.,

• Telephone billing, electricity billing, reservation of seats and berth in railway, airway, railway time table etc.,

• Banking transaction, medical scanning.

• Computer mathematics, mobiles, internet, graphics, animation.

• Home science, catering, quantity of different masalas, vegetable.

• Playing different instruments, number of ragas, rhythm etc.,

Thus it is seen that food, clothing and shelter all need mathematics. According to Prof. Sawyer, “Any theory, (even laws) of mathematics must account both for power of mathematics, its numerous applications to natural science and the beauty of mathematics, and practical value in different walks of human life”.

Mathematics is a thinking process. It is a sort of a language. It is useful in personality development. By learning mathematics, a person develops his various abilities, confidence, logical reasoning, concentration, imagination, thinking and achieves different disciplines like punctuality, honesty, sincerity, patience, hard working etc., thus those topics should be included in the application of which is possible in actual life problems which are not true to
life bring contempt and hatred towards study of subjects. Thinking and solving of unreal problems makes mind lose its critical power.

Moreover real problems give true idea of what is happening in life. Topics of preliminary nature should be included in syllabus. All this depends on teacher, organizers and experts in field, to organize and arrange the subject matter.

1.9 The societal need for mathematics:

Society itself has consistently played a role in the kind of mathematics taught in school. Initially colonial society required that the individual know only the rudiments of arithmetic. Today’s societies in which live, however, has become increasingly complex, more scientifically and technologically oriented. To function within this society the individual must be able to perform a multitude of complex tasks, many of which are mathematically oriented.

Mathematics is one subject which has extensive application in our day to day life situations. It has an important bearing on various aspects of life. Mathematics is an indispensable tool of precision in measure involving quantity and time. A fundamental knowledge of basic mathematical concepts is valuable even for a lay man. In his day to day life when he calculates his wages, and plans his expenses, he is making use of a lot of simple mathematics.

For an intellectual understanding of contemporary literature and to lead a successful life in society, knowledge of Mathematical language, and symbols
and their manipulations are essential. Even for a student who discontinues his education, the fundamental knowledge in mathematics helps him in taking up a good number of vocations such as tailoring, carpentry etc. A knowledge of elementary mathematical concepts such as interest rate, banking, percentage, discount, ratio and proportion, variation are very essential to lead a fruitful life in the society.

Not only are many occupations mathematically oriented, but they also require various kinds of mathematical knowledge, that is, a person employed in the insurance business will require a different kind of mathematical knowledge and understanding than a person employed as a laboratory technician. A person educated in the mathematics necessary for a job will often find that, due to job mobility or job attrition, he or she must look for a position in another area requiring different mathematical knowledge. Such circumstances require that society to educate people with broad, fundamental mathematical understanding who can, with minimal retraining, adopt to different kinds of livelihood.

1.10 Learning of mathematical concepts:

In the modern context, mathematics forms the basis of modern science and technological development and thus becomes the subject of national interest. Mathematics is a discipline used in every walk of life. But in our present day school curriculum, mathematics is presented as an isolated, indifferent and dry subject, which is no more than memorizing formulae, calculations and getting a right answer for a routine problem, mechanically
applying a rigid algorithm, there is no scope for self directive learning and context based understanding.

Mathematics should be visualized as the vehicle to prepare a child to think, reason, analyse and articulate logically, although over the past few decades, efforts have been made to improve the present status of mathematics, one common objective is to broaden the understanding of mathematics. But we have not achieved much. CBSE results of the past few years give us the real picture inspite of all our efforts, success in mathematics is declining day by day. We have maximum failures in mathematics, and this is increasing every year. Both teachers and parents feel that their children are going away from mathematics. How can we make our students good problem solvers in mathematics?. This is possible only when we make mathematics education more meaningful and interesting. We can look at this problem form various angles like contents, pedagogy, evaluation, learning process, child psychology, meta cognition etc., But only collectively we can find a solution for this problem.

**School mathematics can be referred to as:**

School mathematics can be a series of interrelated conceptual networks, with the characteristics of natural languages in which judgment as to the progress of society, economy, climate, the expectations of behaviour etc., are expressed. mathematics is an essential element of the culture of all times.
More precisely it is:

- A body of knowledge to be learned.
- A set of techniques for solving problems.
- The study of certain structures, arithmetic, algebra, geometric etc.,
- A language with a given system of signs.
- A formal science with a highly formalized language.
- A collection of procedures for carrying out practical calculations made to measure classification, predict, count etc.,

Hence, doing mathematics can’t be viewed as a mechanical performance, an activity that an individual is engaged in solving problems by following predetermined rules. Mathematics is more than a vast collection of fixed concepts and skills. It is an ever growing field, which is created by groups of persons in all cultures.

Learning mathematics extends beyond learning concepts, procedures and their applications. It also includes developing a disposition towards mathematics and seeing mathematics as a powerful way to looking at situations.

Learning mathematics is basically a constructive process, which means that pupils gather, discover, create mathematical knowledge and skills mainly
in the course of some social activity that has purpose consequently mathematics classroom instruction should move away from the information transmission model. Meaningful and authentic context should play a crucial role in mathematics learning and teaching, therefore, we need an integrated approach to mathematics teaching.

We need to integrate conceptual knowledge of mathematics with its procedure of application of knowledge. There is a big gap between understanding of mathematical concepts and the procedures through which they can be applied to various situations, unless the gap is bridged it would be difficult to develop mathematical knowledge among students. This can be done through matematization and mathematical modeling.

The process of developing mathematical concepts and ideas though real world is called conceptual matematization, which involves representing relationships with in complex situations such a way as to make it possible to put them into qualitative relationship with one another.

Doing and learning mathematics should not be conceived and practiced as a purely soul activity, while class teaching and individual work must be combined with cooperative learning, small group activities, classroom discussion and social interaction are considered essential because of the importance of changing ideas, comparing solution strategies and discussing arguments.
Learning mathematics should be viewed as construction of coherent and well organized knowledge base. Therefore, mathematics should not be split up into completely separate standards, but the different parts of its contents should be interrelated with each other as well as connected to reality as much as possible because we must keep in mind that learning is the process whereby knowledge is created. The transformation of tools for pedagogy are changing day by day because of technological developments. We need to integrate mathematics concepts with changing modes of pedagogy.

An integrated approach works only when content is well planned, assignments are ready and varied and teachers are enthusiastic and willing to make mathematics livelier, more practical and more useful. To enable children to view mathematics as a tool that allows them to quantify data and relationships to measure and deal meaning fully with measures and to put procedure rules, theorems and axioms, daily problem solving must be preceded by problem finding, which means to make students aware that within a learning doing context, a problem exists and that some process can be applied to solve it. We need to focus on open ended and unfamiliar, new tasks. We need to develop independent learning skills among students. We need to balance our approach to create a rich and novel learning experience for pupils.

1.11 Mathematics curriculum - its relevance:

The Curriculum: At the pre-primary stage, all learning occurs through play rather than through didactic communication. Rather than the rote learning of
the number sequence, children need to learn and understand, in the context of small sets, the connection between word games and counting, and between counting and quantity. Making simple comparisons and classifications along one dimension at a time, and identifying shapes and symmetries are appropriate skills to acquire at this stage. Encouraging children to use language to freely express one’s thoughts and emotions is extremely important at this and at later stages.

Having children developed a positive attitude towards, and a liking for mathematics at the primary stage is as important, if not more than the cognitive skills and concepts that they acquire. Mathematical games, puzzles and stories help in developing a positive attitude and in making connections between mathematics and every day thinking. It is important to note that mathematics is not just arithmetic. Besides numbers and number operations, due importance must be given to shapes, spatial understanding, patterns, measurement and data handling. The curriculum must explicitly incorporate the progression that learners make from the concrete to the abstract while acquiring concepts. Apart from computational skills, stress must be laid on identifying, expressing and explaining patterns, on estimation and approximation in solving problems, on making connections, and on the development of skills of language in communication and reasoning.

At the upper primary stage, students get the first taste of the power of mathematics through the application of powerful abstract concepts that comprise previous learning and experience. This enables them to revisit and
consolidate basic concepts and skills learnt at the primary stage, which is essential from the point of view of achieving universal mathematical literacy. Students are introduced to algebraic notation and its use in solving problems and in generalization, to the systematic study of space and shapes, and for consolidating their knowledge of measurement. Data handling, representation and interpretation form a significant part of the ability of dealing with information in general, which is an essential skill. The learning at this stage also offers a continuity to enrich student’s spatial reasoning and sensation skills.

At the secondary stage, students begin to perceive the structure of mathematics as a discipline. They become familiar with the characteristics of mathematical communication: carefully defined terms and concepts, the use of symbols to represent them, precisely stated propositions, and proofs justifying propositions. These aspects are developed particularly in the area of geometry. Students develop their facility with algebra, which is important not only in the application of mathematics, but also within mathematics in providing justifications and proofs. At this stage, students integrate the many concepts and skills that they have learnt into a problem-solving ability. Mathematical modeling, data analysis and interpretation taught at this stage can consolidate a high level of mathematical literacy. Individual and group exploration of connection and patterns, visualization and generalization, and making and proving conjectures are important at this stage. And can be encouraged through
the use of appropriate tools that include concrete models as in mathematics laboratories and computer.

The aim of the mathematics curriculum at the higher secondary stage is to provide students with an appreciation of the wide variety of the application of mathematics, and equip them with the basic tools that enable such application. A careful choice between the often conflicting demands of depth versus breadth needs to be made at this stage. The rapid explosion of mathematics as a discipline, and of its range of application, favours an increase in the breadth of coverage. Such increase must be dictated by mathematical considerations of the importance of topics to be included. Topics that are more naturally the province of other disciplines may be left out of the mathematics curriculum. The treatment of topics must have an objective, that is, the communication of mathematical insights and concepts, which naturally arouse the interest and curiosity of students.

As a subject it is of great value, aesthetic, utilitarian and social. It has made our living more organized and systematic. It plays an indispensable role in shaping our mind and behaviour. Mathematics is not just a tool to assist science; it is rather an approach to develop scientific tamper, which leads to the highest level of human enquiry. Mathematics sets the path of self actualization as mathematical discoveries are nothing but union of natural phenomena with human behaviour.
In spite of playing such a vital role in our cultural development as well as for individual’s progress, mathematics is not a subject of choice too. So many students, majority of students are afraid of mathematics and develop a phobia for mathematics. Our board results of past few years tell us the true story. Failures in mathematics are increasing day by day. Inspite of its great importance, students avoid mathematics because phobia for mathematics is increasing inadvertently. Students are getting irrationally impulsive and have started taking things at face value.

Is the nature of mathematics reflected in mathematics curriculum? Present mathematics curriculum does not give much scope to develop mathematical disposition. It seems mathematics is just a collection of symbols and notions, definitions, undefined laws, rules to carry out calculations, results to be used in science, mathematics is taught like a mechanical subject with no creativity and imagination. Students are trained to develop mathematical skills of calculation and construction. They are not encouraged to develop mathematical thinking, mathematical aptitude and problem solving approach. When a child is encountered with a mathematical situation, he/she is working in a mathematical system, which involves:

- Knowledge of mathematical laws.
- Ability to connect these laws in present situation.
- Modifying existing laws to apply in present situation as per requirements.
- Ability to generate new laws and verifying new laws for perfection and certainty.

**Order and beauty in mathematics:**

J.B.Shaw stated (Dr. Anice Jame, 1995) "Mathematics is engaged in fact, in the profound study of art and the expression of beauty". (P.2)

Knowledge of mathematical laws requires understanding of existing system of mathematics which is based on axioms, postulates, definitions, notations, reasoning and logical thinking. Axioms in mathematics are those statements which we assume to be truth and then we deduce the truth of theorems logically from the assumed truth of the axioms. Mathematics consists of all results which can be deduced from axiom system. We are concerned only with the absolute proof of the theorems relative to the truth of axioms. This has led to a feeling of freedom in mathematics. Although we are free to create axioms system and deduce theorems from them without the necessity of relating, yet the surprising fact is that the physical interpretation of axioms based theorems gives very often physically verifiable correct results. This is the most fascinating and thrilling beauty of mathematics. This helps the learners to develop a system of thought based on mathematical thinking. The understanding of the systems of mathematics requires a systematic approach to thinking and accepting the certainty of existing laws or curiosity to verify these laws. A thorough and deep understanding of mathematical connection helps a child to know about structure of mathematics.
1.12. **Problem solving in mathematics:**

Problem solving involves application of thinking and reasoning to various kinds of problems encountered in life. Problem solving is an integral part of developmental activities and provides opportunities for children to practice what they have learned by applying their learning situations. The amount of practice needed by any learner is reduced if he understands the concepts and skills to be practiced.

Problem solving is at the very heart of understanding mathematics. The whole purpose of teaching the various concepts which make up mathematics as a tool is to give the learner the tools and the building blocks with which he can actually solve problems that is, resolve difficulties which he wants to resolve.

Mathematics education today encourages the interpretation and utilization of problem solving in its broadest sense. The teacher is no longer limited totally to the abstract solution of written word problems as traditionally continued in text books. Instead, the teacher may incorporate a variety of techniques to help the child relate the mathematics being learned to situation she or he encounters in life.

**Techniques to improve problem solving skill:**

- Encourage the child to work within a general framework of problem solving strategy.
- Utilize the tools of mathematics.
• Encourage the child to seek alternate methods of solution to given problem situations.

• Present problem situations to the child in a variety of ways, not just in written form.

• Utilize as often as possible problem situations which arise normally in out of the classroom.

• Maintain the active learning approach to mathematics, encourage the child to be the initiator in recognizing and developing mathematical problem situation.

• When written problems are used, provide problems of varying degrees of difficulty.

• Present the child with word problems that are different, either in form or requested solution, from those word problems typically found in mathematics text books.

• Incorporate problem situations throughout the learning of a view concept or skill.

• Maintain motivation by allowing the use of puzzles and games which utilize specific mathematical concepts and skills.
Problem solving in mathematics requires an ability to understand mathematical ideas and to apply them in a variety of situations. It also requires a positive attitude towards mathematics including confidence, enjoyment and perseverance. This is possible when mathematics is presented as a progressive body of knowledge as a whole and not as a fragmented set of skills. Students should be made aware of the wider relevance of mathematics including its aesthetic and humanistic role in society. Teaching of mathematics should concentrate more on developing attitude, self-esteem, confidence and perseverance. School mathematics should not be considered a tool for vocational aspiration and helping subject for science or commerce students. It is to be viewed as an approach towards systematic, organized, creative and disciplined life. It should aim to develop analytical, focused and creative problem solvers who are innovative, full of energy and bursting with power, in search of diversified options available. The realm of mathematics teaching should be made more extensive and enriched in terms of content and pedagogical approach. Even evaluation in mathematics should focus more on attitude towards mathematics, understanding of mathematics structure and learner’s approach to solve a mathematical problem. It is important that mathematics be presented to the learners within the frame work of its nature. It should keep alive the flame of curiosity, intuition, encourage the habit of questioning, problem solving and equip the minds of young children with worthy elements in the intellectual domain of mankind.
1.13 Spatial ability in mathematics:

Spatial ability can be defined as ‘The ability to interpret and make drawings, form mental images, and visualize movement or change in those images’. Spatial ability tests measure the ability to manipulate shapes in two dimensions or to visualize three dimensional objects presented as two dimensional pictures.

Spatial ability tests often involve the visual assembly and the disassembly of objects that have been rotated or which are viewed from different angles or objects that have different markings on their surfaces.

The spatial ability tests all about manipulation of shapes. Once reasoning with shapes is tested in a number of ways:

- Most of the spatial ability tests contain two, three or multidimensional shapes, one is required to reason with the given dimensions to reach to the right conclusion. Such tests are also called spatial reasoning tests.

- Spatial ability tests offer different sizes of shapes. One may identify forms from the patterns or vice versa, depending upon the sizes. The shapes may change their patterns with the change of sizes.

- Some problem may contain different planes with different shapes. The diagrams are rotated in the planes to see how much sharp the once memory is. One may be offered 2-D or 3-D shapes to know their
direction of rotation in the planes. Such tests are also called spatial ability tests.

- One may be required to visualize disintegration of a shape in parts and reassemble them at another place. One has to find out topographical relation between different shapes.

- One may be required to see objects from a different angle. One needs to become part of the problems and reorient ones position with other objects. Such tests are called spatial orientation tests.

Spatial ability is category of reasoning skills that refers to the capacity to think about objects in three dimensions and to draw conclusions about those objects form limited information. For example, a person with good spatial reasoning skills might be particularly quick to finish a tangram puzzle, a game in which smaller shapes must combine to form a larger shape. Someone with good spatial abilities might also be good at thinking about how an object will look when rotated. These skills are valuable in many real world situations and can be improved with practice. Many tests of spatial ability have been developed, as well as mental exercises meant to improve these reasoning skills. Some tests take the form of tangrams, involving arranging shapes within a larger shape. Another test involves comparing a three dimensional object to a flat rendition of that object, which would form that three dimensional object when folded, and seeing how quickly a person can match the sides of both objects.
1.14 Need of the study:

The education commission report (1964-66) observes, “the advent of automation and cybernetics in the country marks the beginning of new scientific industrial revolution and make it all the more imperative to devote attention to the study of Mathematics”.

Our society is moving into a technological era. Mere acquisition of arithmetical skills is not sufficient. We need people with sound mathematical skills. The mathematical curriculum has therefore, undergone periodic changes. In the sixties, there was the wave of modern mathematics throughout the world including our country. Whether the programme of modern mathematics is successful or not, is not relevant. But qualitatively better mathematics education is undoubtedly the need of the study.

The notion of computing would not have made sense without mathematics, and it was the analysis of the methods of mathematics by mathematicians, philosophers, logicians and engineers which led to the concept of a programmable computer.

Indeed, two mathematicians, von Neumann in the USA and Turing in the UK, are known as the fathers of the modern computers. Analysis of computing, and attempts to make it as reliable as possible needs deep mathematics, and this need is likely to grow. A computer, unless it is programmed, is just a box made of metal, glass, silicon, etc., Programming expresses algorithms in a form suitable for the computer. Mathematics is
needed as a language for specification, for determining what is to be done, how and when, and for the verification that the programs and algorithms work correctly. Mathematics is essential for the correct use of computer in most of their applications and the mathematical needs of computing have sparked off many new and exciting questions. Thus computers, while they have, fortunately, done away with the need of humans to carry out routine calculations, have also required from mathematicians a deeper analysis of the process and logic of computation, and its representation in a machine.

The imagination of mathematicians is also stirred by its rigorous nature, which forces them to follow through the logic of their ideas. There are many examples of mathematicians producing apparently strange and inapplicable theories, noting simply that this is the way the mathematics seems to go, only to find these vindicated perhaps decades later by surprising applications. A recent example is the theory of knots, which was developed as a part of pure mathematics since 1870. A wonderful advance in 1985 showed how the theory could be applied in physics in relation to quantum theory, and in biology in relation to the way DNA unknots itself before dividing. Similarly, modern notions of chaos and fractals were pioneered by mathematicians in the early years of this century. Now fractals are a practical tool for compressing data on computer discs. Has been very liberally used and applied, in almost all aspects of human endeavor, with power and convenience. The Kothari Commission draws the attention of the educators to the teaching of mathematics and the need for strengthening the method of teaching mathematics Butler and Wren
(1960) maintain that through the teaching of mathematics students attain higher intellectual and mathematical abilities like logical thinking, rational reasoning, concentration of mind, orderly presentation, precision and accuracy, analytical and inductive skills, and above all general problem solving abilities.

Society is not static, it is ever changing day by day. Not only the individual is facing numerous problems in the society but also life of the individual has become complicated in the process of change. To overcome this situation it is important to develop scientific attitudes in students so that they may solve their problem and adjust in society. Problem solving is the highest level of learning in the hierarchy proposed by Gagne. It is one of the methods which involves the use of the process of reflective thinking or reasoning to solve the problem.

Mathematical problem solving is an individual or a group activity in which a question is posed, but route to the answer is not indicated. The challenge of answering the question is accepted and mathematical concepts and principles are used in seeking an answer.

The verbal problems are introduced into instruction when pupils have learned a mathematical procedure and the teacher wants to give them practice in applying it. The verbal problem describes a situation. Some information is given and the other information is to be found by applying one or more mathematical procedures.
The process of problem solving according to psychologists, involves the following steps:

1. Confrontation (or) the emergence of a problem.

2. Identifying and defining the problem in definite terms.

3. Search of solution (or) Exploring possible strategies.

4. Selection of the correct solution or acting on the strategies.

5. Verification of the concluded solution or hypothesis.

6. Making generalization and application.

In order to provide opportunities for problem solving activities in a crowded mathematics curriculum, the teacher needs a serious commitment to the importance of problem solving. According to Polya (1957) problem solving involves the following four phases and mental processes within each phase.

1. Under Standing the problem
   - Restage the problem
   - Select the problem
   - Make a sketch or table

2. Devising a plan
   - Look for a pattern
► Make a simplex problem

► Make a guess and check it.

► Use appropriate labels

3. Carrying out the plan

► Check special cases

► Verify the details of the plan

4. Looking back

► Generalize

1.15 Scope of the study:

According to Napoleon, (S.K. Mangal, 1997) “The progress and the improvement of mathematics are linked to the prosperity of the state”. (P.6)

The following are the defects in present mathematical curriculum.

Mathematics content as reflected in Math’s text is not properly differentiated into formulae, concepts and principles, Concepts are not taught properly in the classrooms.

To remedy this situation mathematics education must be strengthened. The first step in this direction involves giving due importance to concepts in mathematical learning because concepts are the fundamental units of thought and the building blocks of other forms of content namely formulas, principles,
theorems etc., Learning can produce both good and bad developments in the learner. Meaningful learning is, therefore, that learning which is oriented towards good experiences and outcomes.

W.W.SAWYER (1952) says: “Bad teaching is almost entirely responsible for the dislike which is shown in such words an ‘high brow’”. (P.9)

Meaningful learning in mathematics can consist of the mathematical experiences of the following type.

- Which are helpful in mental, emotional and social development.

- Which have utilitarian, practical and behavioural values.

- Which are helpful in the proper learning of other subjects and activities of the curriculum.

- Which stimulate and maintain interest in the subject.

Mathematics is becoming more and more important, mathematics with all its branches plays an important role in everyday life. It is created to investigate the whole range of knowledge. Mathematics is the only subject which exercises more reasoning power and claims less from memory. It is to enable the student to think accurately. Thinking accurately is a great power and can the cultivated by teaching mathematics in the right sprit. Mathematical reasoning done by the student is entirely original thinking and not the reproduction of the ideas previously heard or read. Originality gives the student
power to face the difficulty of solving practical problems of life in his future career.

Mathematics helps to promote logical thinking, develops truthfulness in thinking, exactness and clarity of thought and promotes power of concentration. It develops the attitude of discovery in pupil’s. Therefore secondary school children’s learning of mathematical concepts is found very significant for the present study.

The learning abilities of mathematical concepts may differ. Bruner; Good Now and Austin differentiate between three types of concepts namely conjunctive, disjunctive and relational basing on the mode of combining attributes. In a conjunctive concept the appropriate values of several attributes are jointly present. In a disjunctive category the appropriate values of one attribute or of another attribute or of both are present. In disjunctive concepts attributes and values are substituted for one another. Disjunctive concepts are arbitrary. A relational concept is one that has a specific relationship between attributes. In these three concepts conjunctive concepts are considered easy for learning and teaching.

➢ In short relational behaviour, which involves exploring, ordering, solving, creating and predicting, is made possible by conceptualization. Two of the best predictions of a child’s success in school work are the clarity and completeness of the child’s concept.
Among the mathematical concepts mainly three categories of subject areas arithmetic, algebra and geometry were taken for the present study.

**Arithmetic**:

It is said that when man first wanted to answer questions like (how many? how much? how long?), he invented arithmetic. Arithmetic is the language of commercial activity.

C.F Gauss has remarked (Dr. Anice James, 2005) “**Mathematics is the queen of science and Arithmetic is queen of mathematics**”. (P.110) Arithmetic is the oldest branch of subject mathematics. The word “Arithmetic” is derived from Greek word which is used to contrast the science of number with the part of computing this distribution in terminology prevailed until the 16th century when ‘Arithmetic’ came to mean both science of number and art of calculation. Historically, arithmetic was developed out of a need for a system of counting. Now it is an effective instrument for any computation work needed in commerce and industry. Thus it is also defined as ‘science of numbers’ and ‘art of computing’.

“The need of a good command of arithmetic in a skilled mechanic by the up to date farmer, by the progressive professional man, by the successful merchant and by the efficient housewife is so obvious that it needs no discussion” – Unknown.
Arithmetic has practical, cultural and disciplinary value, Importance of mathematics was realized, even in centuries before Christ in India and Egypt.

Algebra:

As Arithmetic was invented to answer questions like, how many? how long? Algebra was devised to simplify arithmetical problems. Algebra gives the idea of functional dependence and generalizations.

Sometimes Algebra is referred as “Generalized Arithmetic”. According to A.N. Whitehead (Sonia Bhasin, 2005) “Algebra is the intellectual instrument for rendering clear quantitative aspects of word”. (P.9) The word branch of mathematics is dealing with the relationships and properties of number systems by use of general symbols to represent mathematical quantities.

Geometry:

Geometry was invented mainly for measurement. It teaches logical thinking and natural designs. Geometry is combination of two words Geo and metry “Geo” means – Earth, thus Geometry means measurement of earth.

Geometry teaching provides a mass of geometrical facts. The geometric principle of equality, symmetry and similarity are implanted in nature of things. It develops ability to draw accurate plans. It is key to mathematical thinking.

According to G.W. Leibnitz, (Sonia Bhasin 2005). “those few things having been considered whole matter is reduced to pure geometry which is the one aim of physics and mechanics”. (P.10).
In Arithmetic, the selected topic for the present study is ‘Mensuration’.

Mensuration deals with the measurement of the length of sides, areas and volumes related to the Geometric figures i.e., square, rectangle, triangle, quadrilateral, parallelogram, rhombus, trapezium, circle, semicircle, circular path, sector, right angle and equilateral triangles.

In Algebra, the selected topic is ‘set’s. The set concept and set language play an important role in mathematics in unifying different branches of mathematics. The importance of set concept was recognized about 100 years back. The theory of sets influenced and enriched every branch of mathematics. In sets various sub concepts are included - set concept, symbols, set formation, types of sets (finite, infinite, null), equal and equivalent sets, subset, coordinal number of a set, union and intersection of sets, universal sets, compliment set, difference and symmetrical difference of sets, disjoint sets, power set, super set, vene diagrams and demorgan laws.

In Geometry, the selected topic is ‘symmetry’. In daily life one comes across with many things of which some of them are even or uniform or beautiful and so on. For example, if a person is seen with one hand short and the other hand long or one leg short and the other leg long or one eye nearer to the nose than the other eye, or one ear smaller than the other ear, one doesn’t feel happy. One enjoys to see a butterfly, or Charminar or Tajmahal or the various designs made in the front yard of the house with lime powder during festivals. One also enjoys the sight of so many things of nature, because there is some beauty in them which touches the mind. What is the beauty due to?
Evidently, it is due to the uniformity or evenness in their shape. This quality in the shape of things is called symmetry. In symmetry various concepts are included - line and point symmetry, linear and reflection symmetry and image of line segments.

Secondary school children learn these fields of mathematics as mentioned above. This aspect of learning of mathematical concepts is found very significant for the present study. One of the correlates of learning of mathematical concepts in the present study is their spatial ability or ability to visualize the patterns and evaluate.

“Mathematics is a science that deals with number and space”
(S.K.Mangal,1997,) (P.4)

“Mathematics deals with problem involving space and form”

According to new English dictionary (Sonia Bhasin 2005)
“Mathematics – in a strict sense is an abstract science, which investigates deductivity, the conclusion implicit in the elementary conceptions of spatial, numerical relations” (P.2)

Spatial ability is required in technical and design jobs where drawing and plans are used, for example, architecture, surveying, engineering and design. It is also important in some branches of science and technology where three dimensional components are interacting.
Albert Einstein says “the imagination is more important than knowledge”. Researchers have proven that one of the common denominators of peak performers is that they possess an above average ability to consciously practice task in their minds using visualization. They start with the end in mind.

The ability to think in pictures, visualize a future result by imaging things in the mind’s eye to have a sense of direction is identified as visual, spatial intelligence by Howard Gardner. Such pupils can assemble the parts quite easily, can follow diagrams and make up their own points when some sketches provided to them. They can visualize how things look from different perceptive and how a building might look from a plan. Therefore spatial ability in mathematics is significant for the present study.

And the other correlate would be problem solving skills of the pupils that focuses on approach or avoidance of the problem, problem solving confidence and personal control in problem situations.

Problem solving has a special importance in the study of mathematics. A primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematical problems. Mathematics is essential in the modern world. In the present era of computers memorization of facts and principles is not sufficient. Teaching and learning of mathematics play a different role in the present century of automation, and cybernetics which marked the beginning of new scientific and industrial revolution.
National policy on education (1986) has envisaged that “Mathematics should be visualized as the vehicle of communication to train a child to think, to reason, to articulate and to analyze logically. It should be treated as a concomitant to any subject involving analysis and synthesis.

The fundamental goal of all instruction is to develop skills, knowledge and abilities that transfer to tasks not explicitly covered in the curriculum. It has been established that the problem solving skills occupy a very important place in mathematics teaching. The national council of teachers of mathematics [(NCTM), 1980,1989] recommended that the problem solving should be the focus of school mathematics. In other words, the art of problem solving is the heart of mathematics teaching. Therefore, it becomes necessary for the mathematics teacher to constantly and consciously follow methods that would maximize the inculcation of problem solving skills among the students.

We need people who can solve not only the mathematical problems but also the problems of other fields by applying the approaches that are used in solving mathematical problems. Principles and standards for school mathematics. (NCTM 2000, p.52) state that instructional programmes from kinder garden through grade 12 should enable all students to:

• Build new mathematical knowledge through problem solving.

• Solve problems that arise in mathematics and in other context.

• Apply and adopt a variety of appropriate strategies to solve problems.
Monitor and reflect on the process of mathematical problem solving.

Mathematical problem solving has occupied a very important place in the teaching of mathematics. Rosenbloom (1966) and Polya (1966) assert that the ‘central’ activity of all teaching of mathematics is the development of problem solving skills in the students. Collier and Lerch (1969) observe that problem solving is a ‘major force’ in the growth of modern mathematics and Barnes (1959) stresses that it should be ‘major concern’ of the school curriculum.

Mathematics has been very liberally used as applied in almost all the aspects of human endeavor, with power and convenience. The Kothari Commission draws the attention of the educators to the teaching of mathematics and the need for strengthening the method of teaching mathematics. Butler and Wren (1960) maintain that through the teaching of mathematics students attain higher intellectual and mathematical abilities like logical thinking, rational reasoning, concentration of mind, orderly presentation, precision and accuracy, analytical and inductive skills, and above all general problem solving abilities. Therefore problem solving skill in mathematics is very significant for the present study.

IX Class is the good representative class for the secondary stage. This is the stage where the pupils have both physical and mental maturity. They can understand and solve the problems. They require this type of ability as they are going to step into the future world which expects more responsibility and
individuality on their part. Therefore IX class pupils were selected for this study.

Krishna district is the place known for many technical and medical courses, coaching institutions for admission into professional intuitions CA, GATE and many pupils come from agriculture field. Education should promote pupils as useful citizens with all the life needing skills to stand for the modern demands of the competitive world of today. Therefore this study was conducted in the schools of Krishna District.

1.15. Conclusion :

In this chapter the researcher presented the conceptual background of mathematics education in life, importance of mathematics in school education, development of useful skills in mathematics, the societal need for mathematics, learning of mathematical concepts, and need of the study and scope of the study. In the next chapter, the researcher will present the related literature.