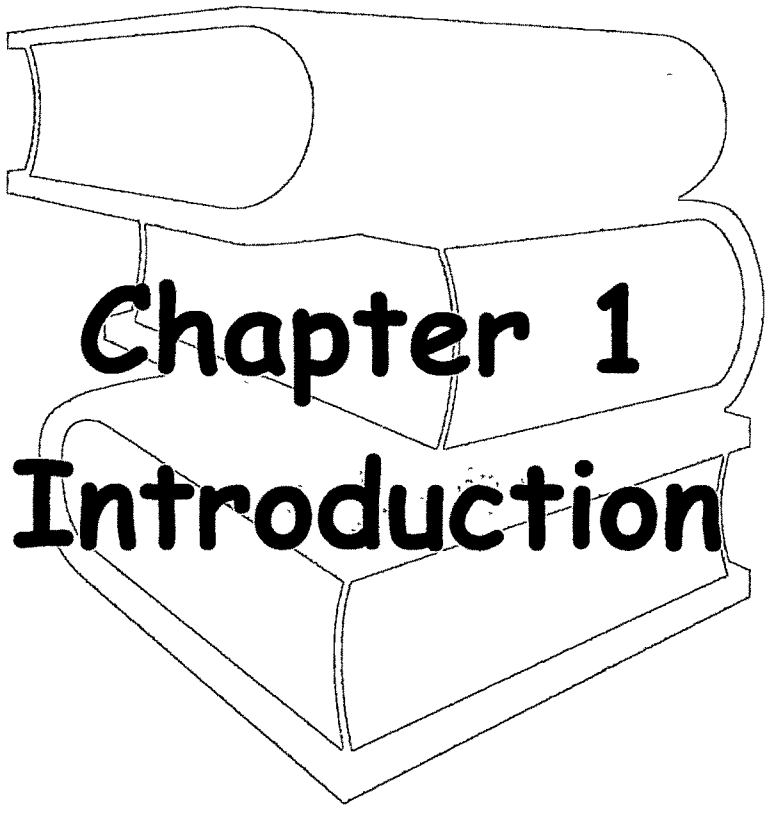

Chapter 1
Introduction

CHAPTER – I
INTRODUCTION

1.1 INTRODUCTION

Education is the process of bringing desirable changes in a learner through a systematized process. It is meant for enabling the individual to perfect himself and lead a better, a more complete life, so that child can grow to become a productive person in the society lead a successful life. Education makes man a right thinker and a decision maker. It can be achieved by knowledge from the external world. Education gives worth and self-esteem so that one can see oneself as a valuable person.

The secondary education, which serves as a bridge between primary and higher education, is expected, to prepare young persons between the age group of fourteen to eighteen for the world of work and entry to higher education. Secondary schools supply students for universities and centres of higher education. It is essential that secondary education should be of the higher quality. Mathematics is one of the greatest of all the sciences. It enters into all walks of the life. Mathematics is required for effective living and acquisition of important skills. Child starts learning of Mathematics from class first. Here major focus is on number system and basic operation on it. Algebra and geometry are informally introduced in class VI and VII, but in real sense same starts from class VIII and content included in class X is not free from concepts studied by them in previous classes. Therefore errors committed by students should be identified, remedial approach should be designed for enhancing achievement in Mathematics.

1.2 IMPORTANCE OF MATHEMATICS

Modern age is an age of science and technology, advancement in technology space, science, atomic research, commerce and trade are some of the factors which place a special emphasis on the teaching of Mathematics at all levels of instruction, i.e. it may be primary, secondary or higher secondary. ***According to Bruner (1962) "Neglect of Mathematics does injury to all knowledge, as it has connection with all the other subjects."*** Knowledge of Mathematics is essential in solving social economic and technical problems. Whenever quantitative facts and relationship have to be dealt with or whenever questions are faced that involve space and form,

Mathematics has a good contribution to make. The significance of this contribution is steadily increasing. Mathematics has been considered as one of the greatest realms of human intellectual achievement. In the modern technological and scientific era the scope of Mathematics is far beyond mere numbers, space, computations, astronomy, music or fine arts. Mathematics is important not only for individual but also for the progress of the nation and human civilization. Moreover, it has provided us with most powerful practical tools to tackle all kinds of problems. Besides being an independent subject of study, it has its application in almost all other subjects.

Several mathematical concepts are being used by scientists to bring about a co-ordination among the knowledge of physics, chemistry, biology and agriculture. Social sciences like economics, sociology and political science require the use of many mathematical and statistical techniques for explanation of certain key ideas. Psychologists make use of Mathematics and statistics to study different aspects on human behaviour such as ability, personality, crime and delinquency. The Mathematics is also used in commerce. The Mathematics of probability and linear programming being applied in business management to schedule production and distribution. Thus, Mathematics is the synthesis of all sciences and all arts. Mathematics is the estate on which other subjects are cultivated. In the present technological, electronic and computer dominated age no scientific and technological advancement can be made without Mathematics.

1.3 OBJECTIVES OF TEACHING MATHEMATICS AT THE SECONDARY LEVEL

The objectives of teaching Mathematics at the secondary stage as reported by ***National Curriculum Framework for School Education (2000)*** are as follow:

- To enhance the capacity of the student to employ Mathematics in solving problems that they face in their day-to-day life.
- To develop idea of proof to be developed with thrust on deductive reasoning.

- To emphasis on wider application of Mathematics by way of making data based problems pertaining to actual data on population, agriculture, environment, industry, physical and biological sciences, engineering, defense etc.
- To attain proficiency in presenting information available in their environment in the form of graphs and charts and be able to do calculations with speed and accuracy.
- To acquire the ability to solve problems using algebraic methods and apply the knowledge of simple trigonometry to solve the problems of height and distance.
- To study the history of Mathematics with special reference to India and the nature of mathematical thinking should find an importance.
- To encourage to enhance their computational skill by the use of Vedic Mathematics.

The aims of teaching Mathematics given by ***Kumar and Ratnalikar (2003)*** are as follow:

- To enable the child to solve Mathematical problem of everyday life.
- To develop in the child acquaintance with his culture.
- To provide a suitable type of discipline to the mind of the pupil.
- To prepare the child for technical professions like accountants, teachers, researchers, auditors, engineers, cashiers, scientists, statisticians, etc.
- To prepare the child for economic, purposeful, productive, creative and constructive living.
- To develop in pupil a sense of appreciation of cultural arts.
- To prepare the child for elementary as well as higher education in science, economics, engineering, psychology.
- To develop in the pupil such habits as concentration, self-confidence and discovery.
- To help the child to follow the maxim "Work is Worship".
- To develop in the child the power of thinking and reasoning.
- To develop the learner's power of expression.
- To enable child to understand and enjoy popular literature in Mathematics.
- To develop in child a scientific and realistic attitude towards life.

- To bring about all-round harmonious development of the personality of the child.

The three values of teaching Mathematics – utilitarian, cultural and disciplinary which can be enumerated for the above aims of teaching Mathematics as – to develop the children to think better, work hard, develop good study habits, self–esteem, prepare for higher education, prepare for technical professions, develop acquaintance with his culture, develop a sense of appreciation of cultural arts, and to enable to solve mathematical problems of everyday life.

1.4 STATUS OF MATHEMATICS IN SCHOOL CURRICULUM

Mathematics has always occupied an important place in school curriculum. ***The Education Commission (1964-66) recommended Mathematics as compulsory subject for students at school level.*** In fact, upto the present moment, we have not come across any curriculum framework at the national or international level which does not figure Mathematics as one of the core component. It is a part of every school curriculum and over the world and perhaps the only subject occupying unique position. This provides sufficient evidence that Mathematics has achieved central place in school curriculum.

Mathematics is not merely counting, measuring or manipulating formulae but a way of thinking using deductive and inductive reasoning. It is one of the most dynamic subjects because of the prospects of existing new discoveries. It is an instrument of education found to be in keeping with the need of human mind. It is a self contained mental discipline with its own language, symbolism and structure. According to the universal Dictionary (1988) "Mathematics when used with a singular verb, means the study of number, form arrangement and associated relationships, using rigorously defined literal, numerical and operational symbols. When used with plural verb, means the application of Mathematics to a calculation or a problem. In the same sense of academic subject Mathematics takes a singular verb."

Mathematics equips pupils with uniquely powerful set of tools to understand and change the world. These tasks include logical reasoning,

problem solving skill and the ability to think in abstract ways. It also develops and train individuals' fundamental dispositions and action; and also displays sharpness of mind. Thus, the usefulness of Mathematics in job opportunities has also strengthened its position in school. It leads to the general view that Mathematics has achieved central place in school curriculum will continue to have this privileged position in future all over the world.

Mathematics studied at secondary school level in class X in Gujarat contains nineteen chapters covering the branches of geometry, algebra, statistics, trigonometry, arithmetic and computer. The names of the chapters: Functions, Rational Expressions, Cyclic Expressions, Ratio and Proportion, Variation, Quadratic Equations, Trigonometry, Height and Distances, Statistics, Computing, Similar Triangles, Conditions of Similarity, Similarity and Pythagoras Theorem, Circle and Chord, Arc of a Circle, Circle and its Tangent, Construction, Area, Volume and its areas covered under the chapter as well as related contents in class VIII and class IX are showed in Appendix 1. For example to teach the chapter "Trigonometry" of class X required prerequisite knowledge of Identities, Factorization, Angles of class VIII and basic trigonometry knowledge of class IX. In the same way to teach "Variation" chapter of class X prerequisite knowledge of Real Numbers, Identities, Factorization, Equations of class VIII and Liner Equations of two variables of class IX is required.

1.5 TEACHING AND LEARNING OF MATHEMATICS

In the teaching of Mathematics emphasis should be given more on the understanding of basic principles than on the mechanical teaching or numerical computation. The objectives of teaching Mathematics may look to be well drawn out, but the reality may be different. The teaching of Mathematics has hardly anything remarkably different to achieve the objectives. It is observed that in the average school, today instructions still confirm to a mechanical routine and continue to be dominated by the old besetting evil of verbalism or even if teacher demonstrate then demonstrate the entire Mathematical procedure without student's contribution. Student's responses are generally ignored and the student's participation is

discouraged. So instructions remain as dull and uninspiring as ever before. ***Sharma (1978) found various factors responsible for low achievement in Mathematics. One of them was approach of classroom teaching.***

Undue stress is given on memory intensive procedure rather than discussion, which hampers the purpose of Mathematics education. Students are bound by the rigid dependence on rules and authority. Instructions given by teachers are based on rules and memorizations. More importance is given to right answer rather than errors committed. The teaching of Mathematics is more oriented to prepare the child for external examination and achievement in the external examination is considered as the index of child's level of learning in Mathematics as a result one is not able to use Mathematics learned at school level. A subject which has its influence in all fields and permeates human life, seems to be on the urge of being opt out. The reason could be, un–thoughtful teaching. One is not able to use Mathematics learnt at schools because school Mathematics and out of school Mathematics have no common ground.

Individual differences in intellectual ability are increasingly seen as a result of both genetic variation and effect of differences in experiences. ***According to Backhouse, et al., (1992) "No learner can be expected to think as his or her teacher". "No two learners in a class can be expected to think in the same way as each other."*** As Mathematics is taught in our schools as a culture free, context free body of absolute truth with its formal algorithms, rigour and structure, little or no attention is paid by teachers and educators to the ways by which individuals construct and interpret their own mathematical knowledge. ***Piaget (1973) acknowledged that social interaction could play a part in promoting cognitive development.***

According to Cobb, et al., (1995) "Individual student's mathematical interpretation might give rise to conflicts and resolving of these conflicts would precipitate mathematical learning." The focus is on the individual autonomous learner as one participates in social interaction. Teacher is to initiate, guide and organize the renegotiation process while students reorganize their individual beliefs about their own role, other's role and the general nature of mathematical activity. ***According to Saxe and***

Bermudez (1992) An understanding of the mathematical environments that emerge in children's everyday activities requires the co-ordination of time analytic perspective.

According to **Bauersfeld (1995).** ".....the understanding of learning and teaching Mathematics supports a model of enculturation rather than a model of transmitting knowledge. Participating in the processes of mathematical classroom is participating in a culture of using Mathematics,.....Knowledge will be for nothing once user cannot identify the adequateness of a solution for use. Knowledge also, will not be of much help, if the learner is unable to relate and transform the necessary elements of knowing into his/her actual situation." Individual's mathematical activity is profoundly influenced by his or her participation in encompassing cultural practices, such as completing worksheets in the school, shopping in a market, selling candy on the street and packing creates in a daily.

1.6 CAUSES OF HIGH AND LOW ACHIEVEMENT IN MATHEMATICS

Though Mathematics has occupied a central place in school curriculum, in reality, still not able to reach to the desirable level of performance in the Mathematics. Students are weak in Mathematics. There could be many reasons for that. Students differ in intellectual ability to abstract, generalize, reason and remember. Level of interest in Mathematics also differs from students to students. Also disposition to try to understand is different. Because of these varying abilities, interest and nature, some students learn readily and usually understand what they are taught at the first time, while others are not quick to catch on and need review and reflecting. Because of this, students may not understand many concepts of Mathematics, which lead to weaknesses in those concepts of Mathematics.

In some cases the causes of low achievement may be the distaste for the subject, which may be natural or acquired. The distaste may be due to harsh and uninterested teachers, heavy syllabus, and faulty method of teaching or learning. The faulty method of teaching creates certain doubts about some fundamentals of the subject in the student's mind. Such doubts

hinder the progress of child. Many times the students are not very regular with their work and as the teacher proceeds further, they fail to pick up certain facts because they forget certain previously learnt facts.

Kasat (1991) found that low intelligence, poor numerical abilities, poor comprehension and recall ability, no interest in Mathematics and poor study habits were the causes of large failure in Mathematics: (i) A gap in knowledge hinders their progress in Mathematics, as one knows Mathematics being a hierarchy of special knowledge, skills and understanding. (ii) Poor Mathematics background, lack of prerequisites related to basic principles; fundaments are some of the most prominent aspects make students unable to enjoy the learning of Mathematics. **Sashidharan (1992) Manika (1983), Chel (1990) Shah (1985)** found that the initial deficiencies, lack of basic concepts have a long term damaging effect because the content of Mathematics is organized in such a way that learning in each class is depend on prior learning which is known as vertical relationship. **Chel (1990)** found that underachievement was due to lack of understanding of Mathematics concepts of earlier stages. Weaknesses of students in Mathematics at lower stage also hinder their progress in learning Mathematics at higher stage of Mathematics. **Sharma (1978)** found the major factors responsible for low achievement in Mathematics were imparting of limited knowledge by teachers, blind use of rules, heavy syllabus, lack of natural urge, in sufficient drill at primary and absence of methodical approach of class-room teaching. **Rajyaguru (1991)** found high achievers had (a) better study habits, (b) more positive attitude towards Mathematics. **Greg (1998)** found that teaching methods have a significant impact and mathematical achievement. Studies conducted by **Rastogi (1983) Bhardwaj (1987), Kapur and Rasario (1992),** found diagnosis and remediation to be very effective and giving positive results. **Das and Barua (1968)** found that the remedial teaching has definitely improved the achievement in Mathematics (arithmetic). **Lalithama (1975)** found that achievement was positively related to intelligence, interest in Mathematics, study habits, socio-economic status, studying lessons daily, repetition in tearing, influenced the achievement in Mathematics positively. **Baskaran (1991)** studied that there was a positive relationship between the

attitude towards problem solving and achievement in Mathematics. **Naga Lakshmi (1996)** examined that the higher qualifications of the parents, the better was the performance of the students with reference to problem-solving ability in Mathematics, the school climate influenced the performance of the students. **SIE Guj. (1969)** found that when mistakes were diagnosed and remedied pupils progressed well in Mathematics. **Pal (1989)** found that there existed significant correlation between Mathematics self-concept, between Mathematics and attitude, between Mathematics and academic motivate.

1.7 RATIONALE OF THE STUDY

The need for conducting such a study "***Development of a Programme for Enhancing Achievement of the Students of Class X in Mathematics***" was due to the following reasons –

In the present study the investigator has taken class X students because class X is the entrance of higher secondary education from where the students can select the stream like science / arts / commerce. The examination of class X is conducted by Gujarat Secondary and Higher secondary Education Board, Gandhinagar, and its result has a great importance for higher studies. Moreover from eleventh standard, the abstract concepts of Mathematics are introduced, so such type of enhancing programme becomes helpful to the students of class X to achieve better result. Mathematics has always occupied an important place in school curriculum. The Education Commission (1964-66) recommended Mathematics as compulsory subject for students at school level. It is a part of every school curriculum and over the world and perhaps the only subject occupying unrivalled position. This provides sufficient evidence that Mathematics has achieved central place in school curriculum.

In the present knowledge based society, mathematical literacy has become essential. This has been emphasized by Kalamaros (1991), Duncan (2000). In order to lead an intelligent life, one needs minimum essential knowledge from the discipline of Mathematics. Everyone, irrespective of age, gender, profession; performs mathematical discriminations daily in the form of "how much", "how many", "how far ", "when", "where", "what". In class X,

there are five compulsory subjects Gujarati, English, Social Studies, Mathematics and Science. Mathematics is one of the compulsory and important subjects. It is a subject which covers geometry, algebra, statistics, arithmetic, trigonometry and some concepts of computer.

Among the causes for learning difficulties identified by Brueckner and Bond (1955) are physiological, emotional, social, intellectual, factors. In the event of lack of basic concepts, it becomes a potential cause of difficulty in learning higher concepts as observed by Sashidharan (1992), Manika (1983), Kasat (1991), Chel (1990) and Shah (1985). Several studies on factors leading to mathematical backwardness have been conducted; Tzeng Shwu-Rong (1987), Kalamaros (1991), Sumangala (1995), Rajyaguru (1991), Wangu and Thomas (1995), found attitude towards Mathematics as a deciding factor of mathematical achievement. Influence of study habits on mathematical achievement was found by Kasat (1991). Lack of basic concepts or deficiencies, leading to mathematical backwardness was found by Sashidharan (1992), Sarangapani (1990), Sharma (1978), Sarala (1990). Studies by Jain and Burad (1988), Chel (1990), Rose (1991). Sashidharan (1992), Greg (1998) found that teaching methods have a significant impact on mathematical achievement. Other factors found to influence mathematical achievement were teacher's beliefs regarding the nature of Mathematics (Sjostrom, 2000), parental assistance in doing homework (Warrick, 2000), deprivation (Gupta et. al., 1993), Intelligence (Verma, 1996), (Stella et. al., 1995; Jain, 1979), language ability (Manika, 1983; Rangappa, 1992), anxiety (Verma, 1996; Rajyaguru, 1991), location (Srivastava, 1992; Baskaran, 1991). Diagnosis and remedial approach was very effective and has yielded positive results (Rastogi, 1992). The present research scenario shows a dearth of diagnostic and remedial studies in Mathematics which compelled the investigator for development of such a programme which includes both diagnosis and remediation for enhancing achievement. Equally factors affecting low achievement have to be taken care of while conducting remedial programme.

There are growing number of students in school in class X with difficulties in passing the examination and enhancing achievement, for example in March 2003 candidates enrolled for S.S.C. Board Examination were 5,01,270 from which 4,91,951 candidates appeared and only 2,43,944 candidates passed in the examinations. This shows that only 49.59 percent students passed in the examination while only 53.25 percent students passed in Mathematics. In the same way in March 2004 candidates enrolled for S.S.C. Board Examination were 6,34,120 from which only 3,34,099 candidates passed in the examination. This shows that only 52.69 percent students passed in the examination while only 53.89 percent students passed in Mathematics. Following table 1 indicates the details.

Table – 1:

Year Wise Result of S. S. C. Board Examination in Gujarat (1999 – 2007)

Year	No. of Recorded Candidates	No. of Candidates Appeared in the Examination	No. of Candidates Passed the Examination	Result in Percentage
March–1999	5,60,615	5,47,067	3,05,266	55.87
March–2000	6,01,273	5,86,559	3,44,347	58.70
March–2001	6,41,770	6,30,416	4,42,230	68.91
March–2002	5,02,267	4,94,635	2,81,576	56.92
March–2003	5,01,270	4,91,951	2,43,944	49.59
March–2004	6,34,120	–	3,34,099	52.69
March–2005	6,71949	6,61,680	3,71,747	56.18
March–2006	7,51,176	7,42,521	4,28,543	57.71
March–2007	5,32,968	5,29,129	3,73,839	70.65

Source: Year wise Result Booklet published by Gujarat Secondary and Higher Secondary Education Board, Gandhinagar.

The results of S.S.C. Board Examination (Gujarat) show that it has reduced continuously for the last three years. In March 2001 the result was 68.91 percent, it reduced by twelve percent and in March 2003 the result was 49.59 percent, it reduced by seven percent and as compared to last but one year the result was reduced by nineteen percent.

Repeated failure and low achievement is concluded as inability, lack of interest, insufficient practice, etc. on the part of the students. The data

retrieved from the S.S.C. Board showed that in Mathematics the number of candidates failed were 46.75 percent (March, 2003); 46.11 percent (March, 2004) and 43.43 percent (March, 2005).

In March, 2006 the result was 57.71 percent and in March, 2007 in new syllabus it increased to 70.65 percent.

Table – 2:

S.S.C. Board Examination Result of Mathematics in Class X (2003–2007)

Subject Index	Subject	Percentage				
		March, 2003	March, 2004	March, 2005	March, 2006	March, 2007
28	Mathematics	53.25	53.89	56.57	66.18	77.77

Source: Year wise Result Booklet published by Gujarat Secondary and Higher Secondary Education Board, Gandhinagar.

If the academic lag continues to increase with time and no assistance is provided by teachers, parents or counsellers, there is the risk of the students not completing up to class X examination, Drop-out rates for the learning Higher Secondary and College Education will be fairly high. In the months of examination especially in the month of Board examination cases of frustration, hopelessness, depression, suicide and drop out increase due to lack of motivation, good study habits, reading habits and anxiety of examination. If proper guidance is provided then such type of cases will comedown.

Many researches have been conducted for secondary level to find out the factors affecting scholastic achievements in different subjects but next step would be development of a sound programme and to help the students. The urgent need of the education system is to teach self–learning, to give examination without anxiety so there should be a programme which teaches the students how to learn one–self. The shifting from "Teaching Process" to "Learning Process" is the need of educational process. If the students learn then teaching will not be the first requirement. Developed countries now-a-days focus on learning process rather than a teaching process, hence here the investigator intend to develop a programme for enhancing achievement for the students of Class X in Mathematics which can enable the students to learn satisfactorily.

Here the investigator has identified the factors related to low achievement from students, teachers and parents. The investigator attempted to develop and tryout a programme to enhance their achievement as to create interest in Mathematics through different remedial measures as well as through counselling and guidance. The Investigator covered some new techniques also for the students to enhance their achievement like concentration techniques, "Tratak" for concentration, deep breathing for relaxation, mini nap for effective reading, strengthening self–esteem and self–concept through powerful auto suggestions, etc. The investigator has also attempted to administer a prerequisite test as well as unit test for each chapter of class X, the pilot test and the final achievement test to enhance the achievement in mathematics. Thus, present programme is different from routine school programme and has added some newness in the system of studying Mathematics.

1.8 RESEARCH QUESTIONS

While researching into the subject of study, some vital questions that emerge are as follows:

1) Which are the factors responsible for high and low achievement of the students in Mathematics?
2) What are the educational needs and requirements for enhancing achievement in Mathematics?
3) Which inputs can enhance the Achievement?
4) Can achievement of the students be enhanced?
5) Can such a programme be effective?

To answer these questions the investigator has undertaken this study.

1.9 STATEMENT OF THE PROBLEM

"Development of a Programme for Enhancing Achievement of the Students of Class X in Mathematics".

1.10 OBJECTIVES OF THE STUDY

1) To identify the students having low achievement in class IX in Mathematics in Baroda city.
2) To identify the factors related to low achievement of identified students.
3) To study the problems faced by the students who have low achievement in Mathematics.
4) To study the problems in teaching and learning Mathematics from teachers, parents and students.
5) To develop and tryout a programme to enhance achievement of students of class X in Mathematics.
6) To study the effectiveness of the programme in terms of achievement of the students of class X in Mathematics.

1.11 EXPLANATION OF THE TERMS

1) Enhancing: Enhancing means to increase or to raise the present level of marks. Here marks of students in class IX were considered as the base.
2) Achievement: Achievement for the present study means the score (marks) achieved by the students in Mathematics in the final achievement test administered by the investigator on completion of programme.
3) Low Achievers: The students scoring fifty or less than fifty percent of marks in Mathematics in final examination of class IX were considered as low achievers.
4) Programme: Programme includes prerequisite test, remedial teaching, unit test, some counselling sessions, the pilot test and the final achievement test.

1.14 DELIMITATION OF THE STUDY

The study has the following delimitation:

1) The study was delimited to Gujarati Medium Schools of Baroda city following Gujarat State Board Syllabus.