FORM I

UNIT 1

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
1	**Numbers and counting** *Objectives:* (1) To revise the number work done at primary level. (2) To understand the relationship between numbers and numerals. (3) To see the advantages of Hindu-Arabic numerals and to accept them as part of our cultural heritage. (4) To recognize some basic properties of natural numbers. (5) To work on binary numbers.	1.1	Revision on arithmetic.	4	The 4 rules, simple fractions, H.C.F. and L.C.M. should be revised. The meaning of prime numbers should also be brought into review. Number work should be restricted to positive numbers.
		1.2	Primitive man's concept of numbers and the different systems of numerals used to represent counting numbers in the early civilizations.	1	Students may be interested in the rich variety of numeral systems that have existed. Some of these are still widely used today such as Chinese numerals while others are found only in history books. It is not essential for students to be able to convert a number in one system to another system. Teachers can set out a simple multiplication using Roman numerals just to illustrate how impractical this system is, when it comes to calculation. Stories of how primitive man understood the concept of numbers and how these numbers evolved from knots on a string to written symbols should be of interest to students, We know that counting was practised by man long before the invention of numbers.
		1.3	The advantages of the Hindu-Arabic numerals over other systems and the creation of zero as a place holder.	2	Students are expected to know the difference between digit and place value and they should be able to represent any denary number as a sum of units, multiples of 10 and multiples of 100, etc. (avoid using exponents unless students are already familiar with them). It can be pointed out that in some numeral systems, an empty space is used instead of the place holder "zero", Also at this stage it may be of interest to introduce some basic idea of binary numbers since these numbers are essential to modern computers. It can soon be seen that while a denary number employs 10 symbols, a binary number employs only two, 0 and 1. The point to emphasize is the idea that "rather than 2 in a column we carry 1 to the next column". To illustrate this point. teachers may use objects like marbles, toothpicks or matches and put them in groups

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UNIT 1

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
1					of 8, 4, 2 and 1 like which is represented by 1011. Why don't we group them like and represent the number by 211? Teachers may like to illustrate the significance of binary numbers using mechanical devices such as punch cards, switches and flash light bulbs.
		1.4	Conversion of denary numbers into binary numbers and vice versa; addition and subtraction of binary numbers.	5	Conversion between the denary and binary numbers should be limited to simple numbers only and fractions should be excluded. Addition and subtraction of the binary numbers usually fascinate students who first encounter this system. It is desirable that they are given some practice in these two simple operations. The use of simple teaching aids and activity method to introduce this topic is recommended.

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UNIT 2

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
2	**Formulae, open sentences and simple equations** *Objectives:* (1) To learn the use of letters to represent numbers. (2) To understand the difference between a mathematical sentence and an equation. (3) To construct and solve simple equations and apply them to practical problems.	2.1	The use of letters to represent numbers.	2	The use of letters to represent numbers arises quite naturally when formulae such as $A = b \times \ell$ and $P = 2(b + \ell)$, where A stands for area, b breadth, ℓ length and P perimeter of a rectangle, are considered. Teachers can point out that even in daily life, letters may be used to represent numbers, e.g. in a secret code. Your ticket is A 1234; does the letter A mean anything? Teachers should stress that throughout the algebra course, letters represent numbers.
		2.2	Formulae and substitution.	3	Familiar formulae can be mentioned and it should soon be evident to students that in these simple formulae when all but one of the letters are replaced by numbers, the remaining letter (called the unknown) can be calculated. This process of replacing letters with numbers is called substitution.
		2.3	Open sentences.	3	A statement about numbers (or anything to do with mathematics) is a mathematical sentence. An open sentence is one which can be either true or false depending on how the blanks in the sentence are filled. Teachers may first introduce some simple sentences like ▲ is 4 years old, ( ) is round. Then open mathematical sentences can be considered, ● + 3 = 11 ■ + 5 = 7 21
		2.4	Simple linear equations in one unknown, their construction and solution in practical problems.	4	It follows from the above that it is more convenient to replace the blanks by letters like x and y. Students can observe that different letters are used to replace different shapes of blanks and when there is an equal sign "=" appearing in an open sentence, it becomes an equation. They should soon discover that when an equation has two or more letters, then the values of these letters are usually

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UNIT 2

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
2					indeterminate. For simple equation with one unknown, the standard form is $ax + b = 0$, where a and b are constants. After students have sufficient practice in constructing and, subsequently, solving simple equations in connection with practical problems, teachers may then introduce the terms: "variable", "coefficient", "solution", "term", etc. in an equation. If only very simple numbers are used in exercises, then there is no need for the rules of transposing terms in an equation. This tends to be confusing, rather than illustrative, at this stage. Checking of answers should always be encouraged.
				12	

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UNIT 3

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
3	**Use of protractor and compasses and basic properties of angles and simple shapes** *Objectives:* (1) To approach geometry in an informal and practical way. (2) To appreciate the practical use of geometry. (3) To work on problems related to angles, congruence and similarity.	3.1	Use of the protractor and ruler to measure and construct angles in any position and use of the compasses to mark off length.	3	The use of the protractor may already have been taught in Primary School; nevertheless teachers are advised to teach it again and ensure that every student in the class can use the instrument without error. Angle is a fundamental idea and whether it has been approached as a rotation or fraction of a revolution its measurement helps the understanding of the concept. The measurement of an angle can best be taught using an overhead projector as the students' protractor can easily be shown on the screen. Failing this, a blackboard protractor is useful. Throughout this introductory unit in Geometry, it is advisable to leave terms like “line segment” and “angle” as undefined terms and to accept where appropriate whatever intuitive ideas the students may have about these terms.
		3.2	Acute and obtuse angles and the two scales of the protractor.	2	For some classes, teachers may find it helpful to instil the idea of acute and obtuse before using the protractor in order to help student choose which of the two scales to use on the instrument.
		3.3	Illustration of angle sum of a triangle.	1	By tearing off corners from a triangle and laying them on a straight line, students should be able to see that the angle sum of a triangle is 180°.
		3.4	Congruence and similarity investigated through the construction of triangles.	7	From one set of instructions, each student should construct one triangle (and this may be orientated in any position). The class should then cut out their triangles so that the teacher can stack them into a triangular prism. What must we do to them before it is possible to stack them? What does this property of stacking illustrate? Similarity should be introduced through examples in the environment, and its properties should be limited to triangles only.
				13	

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UNIT 4

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
4	**Percentages** *Objectives:* (1) To see percentage as a particular form of fraction and to change percentages into fractions and vice versa. (2) To apply percentages to practical problems.	4.1	Meaning of percentage.	1	Emphasis here should be on the meaning of percentage. Students should see the need for using percentage as a convenient means for comparing fractions. This can be done through consideration of some realistic problems such as discounts. Percentage is then understood as a particular fraction where the denominator is 100, hence the term "per cent" (i.e. per hundred). While there are many ways of comparing fractions, conversion to percentage is the most practical way and is especially acceptable to the layman in dealing with problems in commerce or technology.
		4.2	Practice in converting fractions to percentages and vice versa; decimalization of the fraction can be considered as an intermediary step.	2	Practice should involve simple numbers only, Graded exercises in manipulation can be given to test accuracy and mental drills can also be used as a diagnostic tool where mastery of the skill is in doubt.
		4.3	Percentages in everyday problems: interest rate, discount, profit and loss, etc.	7	As students are already quite familiar with these topics, they should try some harder and more practical problems to consolidate the work done at primary level. Problems should be simply worded so as not to obscure application of percentages.
				10	

FORM I

UNIT 5

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
5	**Simple areas and volumes** *Objectives:* (1) To find the areas of polygons. (2) To find the volumes of solids with uniform cross-sections.	5.1	Comparison of areas, measurement of area and unit area.	2	The idea of area is a fundamental concept that has been dealt with in Primary School. To develop this concept students should compare the areas of figures with similar or different shapes. It soon becomes apparent that a standard unit is required for comparison. This unit area usually takes the form of a square, triangle, hexagon or any other shape that tessellates.
		5.2	Areas of simple polygons, including regular and irregular shapes; use of pinboard for irregular polygons.	4	A very convenient and inexpensive piece of apparatus, useful for this topic, is the pinboard (geoboard, pegboard). As a substitute for the pinboard, students can use squared paper. Areas of a variety of simple polygons can be investigated by drawing the polygons on squared paper. When a pinboard is used, it is a good idea to try to discover the formula $\left(\frac{1}{2}m-1\right)+n$ where m denotes the number of pins on the boundary of the polygon and n the number of pins inside the polygon. Teachers may guide and help with formulation, step by step, using many examples. No formal proof need be given.
		5.3	Unit volume.	2	Here again, students should realize the need for choosing a standard unit of volume. They should also realize that the unit volume should tessellate.
		5.4	Volumes of cuboids and solids with uniform cross--sections.	4	The volumes of cuboids, solids of uniform cross-sections and the same height but varying bases (equilateral triangle, square, regular hexagon, regular octagon) should be investigated. Some students may be interested in building frames of solids using plasticine and toothpicks. For high ability groups, it may be worthwhile to investigate these networks and as an activity students can attempt their design on paper. As a puzzle or a game, teachers may also mention Euler's formula: $V+F-E=2$.
				12	

FORM I

UNIT 6

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
6	Approximation and measurement *Objectives:* (1) To understand the meaning of measurement. (2) To practise in measuring.	6.1	Approximation; measurement.	3	Students should see that all measurements are approximations. The more appropriate measuring device we use, the greater is the degree of precision. Take, for example, a leaf whose traced outline encloses approximately 150 squares on a sheet of graph paper. This is not an exact number, as in counting the number of people in a classroom, because we have to think of parts of squares adding up to whole squares to arrive at our total. This type of counting is an approximation, just as any measurement is an approximation. Teachers can point out that, for practical use, such as measuring the length of this paper, a precision to the nearest millimetre is sufficient. Practical activities should be assigned whenever appropriate. The symbol "≈" should be used where an approximation is intended.
		6.2	Choice of appropriate unit for measurement.	1	It is desirable to mention that there are many units for measurement. But it should be pointed out that the appropriate size of unit should be chosen for certain measurement. For example we use m^2 for measuring the area of the school playground but cm^2 for the area of a desk.
				4	

FORM I

UNIT 7

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
7	**Negative numbers and the extended number line** *Objectives:* (1) To understand and to accept intuitively the concept and uses of negative numbers. (2) To handle negative numbers in calculations.	7.1	Introduction of negative numbers as a means to solve some linear equations.	2	Students should see the necessity for introducing negative numbers. An intuitive interpretation of negative numbers representing deficit temperature below zero, time before countdown, and so on can then be discussed.
		7.2	The complete number line and calculation with the help of the number line.	4	With the introduction of negative numbers, the number line, which is a graphical representation of numbers, can be extended at both ends. The calculation of $-5 - 7$ can be performed on the number line to give an answer of -12. Numbers are now divided into 2 groups, the positives and the negatives (0 is unique).
		7.3	Simple idea of ordering.	3	This is a natural development from the number line. Students should soon discover that any number lying to the left of a certain number on the number line is smaller than any number lying to the right. The symbols “>” and “<” can be introduced and students can conclude that $-7 < -5$ and $7 > 5$ Can students find any practical explanation for $-7 < -5$?
				9	

FORM I

UNIT 8

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
8	**Introduction to coordinates** *Objectives:* (1) To learn another type of geometry – coordinate geometry. (2) To understand the concept of an ordered pair of numbers. (3) To learn the calculation of distance and area in coordinate geometry.	8.1	Locating a point in a plane by means of an ordered pair in a coordinate system.	3	This involves two concepts: (a) reference lines leading to a grid system; (b) some sort of ordered pair to represent a point on the grid. These ideas can be introduced by asking the class to describe the position of a particular student in the classroom. The obvious answer gives the student's position referring to columns and rows. This can be refined and subsequently an idealized grid system formed. Examples of other grid systems, such as latitude and longitude, atlas notation for maps, games such as “battle ships” and chess can be used. By this time the idea of an ordered pair and a coordinate system should be emerging. At this stage the distinction between an ordered pair describing a square of the lattice and a point of intersection of two grid lines should be emphasized and discussed. Which system describes a position more accurately? Then why is the other system also used?
		8.2	Use of rectangular and polar coordinates.	1	A great deal of oral work using a graph board, or grid on a projector, should be done at speed until there are no errors in the ordering of the number pair. Intuitively the coordinates of points on the grid can be asked for and then points plotted from given coordinates. The order of the pair should be emphasized and the reason for the order discussed. The same sort of exercises should now be given as written work to be done on graph paper. At this stage students should be challenged and asked for other means of describing position. Guidance may have to be given in order that they discover the idea of polar coordinates. A polar grid on an overhead projector would be very useful. If not, rather than spending time on the board, students may proceed themselves to polar graph paper. The rectangular and polar grids should be compared. Again an overhead projector is very useful for this type of work. With the aid of transparencies and overlays, work on the formation of grid lines, points on a line, naming lines on the grid, intersection

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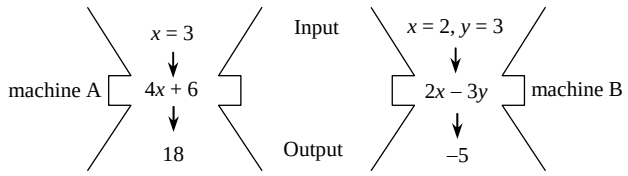
UNIT 8

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
8					of lines, regions and intersection of regions, plotting points to form lines and curves can be done efficiently and quickly. When learning polar coordinates, as long as students can plot a point using polars, this is sufficient for the less able. Further practice in plotting polar coordinates to form spirals may be given. The more able students may be able to appreciate that the grid as well as the numbered pairs determine the shape of the curve, and that there are reasons for using one grid in preference to another.
		8.3	Calculation of distance and area.	3	This sub-unit refers to calculations from first principles upon the rectangular grid and enables teachers to use the negative number unit that has just been studied. At this stage students have not done Pythagoras' Theorem and cannot calculate the distance between any two points. They should be given only questions involving vertical and horizontal distances. Area should be calculated from first principles and only those shapes that can be broken down into rectangles and triangles should be considered.
				10	

FORM I

UNIT 9

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
9	**Algebraic expressions** *Objectives:* (1) To translate a statement into an algebraic expression. (2) To understand the nature of an algebraic expression that later leads to the idea of a function. (3) To see the connection between algebra and geometry as illustrated by graph of linear equation.	9.1	Practice in translating word phrases into mathematical phrases.	3	The number of days in x weeks; the cost of y apples at \$0.5 each-these soon are translated into $7x$ days and \$ $\frac{y}{2}$. These are called algebraic expressions in one variable, Their significance may be discussed and it can easily be established that as soon as the values of the variables are assigned, the values of these algebraic expressions can be determined. To what do we compare these expressions?
		9.2	The making and the use of linear algebraic expressions.	2	Teachers can draw on the blackboard diagrams like  Students can conclude that an algebraic expression can produce numbers just as an ice-cream machine produces ice-cream, However, to get the output, some materials need to be put in first. In the case of ice-cream, it might be milk and sugar but in the case of algebraic expression, the input is number.
		9.3	Linear equation in two unknowns and its graph.	4	From here teachers can easily lead the class to graph the linear algebraic equation. At this stage, only one equation need to be considered. It is desirable, however, to emphasize the idea that there are infinitely many ordered pairs satisfying the given equation.
				9	

FORM I

UNIT 10

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
10	**Angle and line segment bisection** *Objectives:* (1) To acquire a preliminary idea of loci. (2) To use some standard constructions as further applications of congruent triangles. (3) To acquire a first approach to the idea of proof.	10.1	Angle bisection using compasses and ruler.	4	Students may be asked to draw different types of angles, acute and obtuse, which may then be bisected using compasses and ruler. That the two halves of the bisected angle are equal can be explained by noting there are two congruent triangles. The given (dimensions constructed equal) can be marked upon the triangles, which are then folded upon each other, or cut out, then superimposed to illustrate the validity of the explanation. Reflex angles should also be bisected. A miscellaneous exercise involving bisection of all types of angles may now be introduced and students should be encouraged to use their protractors to check that the bisection is accurate. The term "angle bisector" should be emphasized and every student should know it is a line that bisects an angle into two equal halves.
		10.2	Construction of 90°, 60°,45° and 30° using compasses and ruler.	3	The 60° angle construction follows from the construction of an equilateral triangle, and when this angle is bisected, we get an angle of 30°. The 90° angle can then be explained as a bisection of 180° and the 45° angle as a bisection of 90°.
		10.3	Construction of the Perpendicular bisector of a given line segment using compasses and ruler.	4	The emphasis here is on the idea of perpendicular bisector (abbreviated as ⊥bisector) being a line that bisects the given line segment at an angle of 90° (which can now be called a right angle and written as rt-∠). This construction can be verified by paper folding or cutting out the congruent triangles and superimposing them. The logical steps needed to verify the congruence can be written out to introduce students to a formal proof. Above-average students may be given exercises to find the in centre, escribed centres and circumcentre of a triangle.
				11	

FORM I

UNIT 11

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
11	**Angles and parallel lines** *Objectives:* To learn the properties of angles and parallel lines.	11.1	Adjacent angles on a straight line and angles at a point	3	It must be impressed upon students that definitions cannot be proved. The difference between axiom and definition need not be discussed at this stage.
		11.2	Vertically opposite angles.	1	This is a simple proof which follows from adjacent angles. Students can use their protractors to check that they are equal.
		11.3	Parallel lines and transversal.	8	With the use of set squares, parallel lines can be constructed more rapidly and simply. Students should be able to see that the corresponding angles formed by a transversal cutting two lines are equal if the lines are parallel. If two parallel lines are cut by a transversal. the alternate angles formed are equal and the sum of interior angles formed is 180°. These may be derived from corresponding and vertically opposite angles.
		11.4	The use of angles associated with parallel lines in calculations.	5	Throughout this unit, when numerical calculations are considered, simple numbers should be used, so that if students understand the reasoning and method, the question can be done quickly. Initially, some questions may be answered orally. For harder questions, students are encouraged la set out their work in a clear, logical and economical way. Reasons should be given for each deductive step, but these should be kept brief, and a system of abbreviation agreed upon. e.g. alt. ∠s for alternate angles.
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FORM I

UNIT 12

Unit No.	Basic Content/Objectives	Detailed Content	Time Ratio	Notes on Teaching
12	More about negative numbers *Objectives:* (1) To understand more about negative numbers intuitively. (2) To acquire a practical and intuitive meaning for the multiplication and division of negative numbers.	12.1 Operations with brackets: insertion and removal of brackets.	4	This is essentially an extension of Unit 7 and its chief aim is to enable students to deal efficiently with negative numbers in calculations. By now students should be quite capable of handling simplification of a long string of positive and negative numbers like –7 + 5 – 10 + 12. After that it is only a step further to introduce brackets into the expressions. Some teachers may prefer to distinguish clearly between the negative sign "–" in front of a negative number and the operation minus "–". Students may nevertheless be confused and find difficulty in applying even the simplest rules of signs in the insertion and removal of brackets. Hence it is recommended that only for high ability groups should teachers approach this topic in a rigorous manner. The average student readily accepts the type of argument that follows: $\because \quad 12-(7-5)=12-2=10$ and $12-7+5=5+5=10$ $\therefore \quad 12-(7-5)=12-7+5$ For simplicity, there is no harm in categorising brackets into positive and negative. Their insertion and removal are then governed by rule, which if, the students so desire, can be committed to memory.
		12.2 Intuitive approach to the multiplication and division of two negative numbers.	4	Teachers should provide one or two illustrative examples to give an explanation of the meaning of the product of two negative numbers. in these examples, generally two scales are necessary. For instance, if we take *s* km/h for the velocity of a car (going east as positive, going west as negative) and *t* hours (before as negative, after as positive) relative to a particular moment when the car passes O, a point of observation, then it is not difficult to see that when both *s* and *t* are negative, their product, i.e. the distance from O (east as positive, west as negative), is positive.

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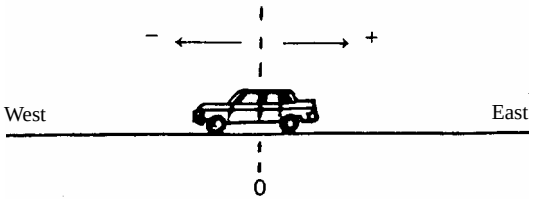
UNIT 12

Unit No.	Basic Content/Objectives	Detailed Content	Time Ratio	Notes on Teaching
12				 As a further illustration to show the results of the multiplication of negative numbers, teachers can make out on the board a multiplication table as follows:

x	+3	+2	+1	0	–1	–2	–3
+3	+9	+6	+3	0			
+2	+6	+4	+2	0			
+1	+3	+2	+1	0			
0	0	0	0	0	0	0	0
–1				0			
–2				0			
–3				0			

Students should be guided to discover the pattern by completing the empty boxes, firstly those for the product of positive numbers and negative numbers and secondly, those for the product of two negative numbers. Similarly a division table can be constructed.

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UNIT 12

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
12		12.3	Justification of the above.	3	From the foregoing, a possible approach is: $\because \quad 12-(0-5)=12-0+5$ $\therefore \quad 12-(-5)=12+5$, and it follows that to subtract a negative number is in fact to add a positive number. Once this is accepted, it can be shown that $\because \quad (-1)(5)+(-1)(-5)=(-1)\times\big((5)+(-5)\big)$ (Distributive property) $=(-1)\times 0$ $=0$ $\therefore \quad (-1)(-5)=-(-1)(5)$ $=5$ However, if students find this difficult to accept, teachers can always resort to defining the meaning of a product of two signed numbers.
				11	

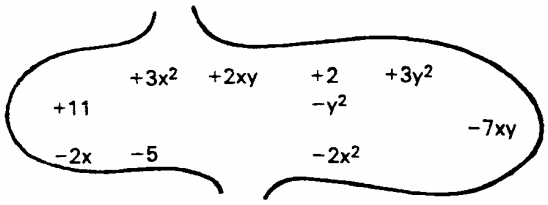
FORM I

UNIT 13

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
13	**Statistical data** *Objectives:* (1) To develop the ability for collecting data. (2) To understand the various ways of handling data. (3) To learn and to discuss the various methods of displaying data. (4) To understand the significance of statistical graphs and be able to draw conclusions from them.	13.1	Frequency and collection of data.	2	To begin with, students should be asked to collect data from their daily experience, e.g. the heights of the students in a class, the birth-months of the students in a class and so on. Special attention should be given to the organization and presentation of a large set of data. Difficulties in handling such data should be emphasized. This then leads to the idea of constructing a frequency distribution. Pre-planned work on an overhead projector is invaluable for this unit.
		13.2	Construction of bar charts, pictograms and pie charts from given data.	3	Different kinds of data can be given and ways of handling them discussed. The use of tables, bar charts, pictograms and pie charts should be explained.
		13.3	Construction and interpretation of histograms.	5	Histograms may be regarded as a graphical representation of the frequency distribution. (These graphs may be constructed from activities such as practical surveying.) The meaning and the use of class boundaries as well as the interpretation of histograms should be discussed in detail.
				10	

FORM I

UNIT 14

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
14	**More about algebraic expressions** *Objectives:* To handle algebraic expressions more competently.	14.1	Simple idea of exponents.	3	Numerical examples should always precede statements of technique.
		14.2	Terms in an algebraic expression.	3	Using our analogy, an algebraic expression is made up of parts like a machine. What do we call these parts? Terms. Like and unlike terms can be viewed as like and unlike parts in a machine and every term has a sign in front of it. How do we collect the terms of the following expression?  The use of brackets in the simplification of algebraic expressions can thus be introduced. Students should have more practice in operation with brackets which include negative times negative or negative divided by negative and the simplification of algebraic expressions which may involve the “like” and “unlike” terms.
		14.3	Coefficients and constant terms.	2	It should be emphasized that the sign is attached to the coefficient and not the unknown.

FORM I

UNIT 14

Unit No.	Basic Content/Objectives	Detailed Content		Time Ratio	Notes on Teaching
14		14.4	Addition, subtraction, multiplication of simple algebraic expressions.	5	Emphasis here is on technique and in the case of a product, long multiplication should be practised and in any case used as a check when the product can be written down immediately. For higher ability groups, divisions of one expression in one unknown by another simpler one in the same unknown can be considered.
				13	
			Total:	153	