INFORMATION TECHNOLOGY AND MATHEMATICS

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ABSTRACT

This paper deals with the how mathematics has changed from stone-age to present information technology age. In stone-age, it was represented by picture form. Then it changed to symbol form in which mathematics had its own language and symbols in different civilizations like Babylonian, Egyptians, Roman, Hindu Civilizations etc. Afterwards as time passed axiomatic mathematics came into account. Trends in mathematics keep on changing and now it has reached to the age of technology. Information technology is the new age of mathematics. There are numerous of software which has changed the look of mathematics.

Key words: Axiomatic Mathematics; Information Technology; Pictorial Mathematics; Software; Symbolic Mathematics

I.   INTRODUCTION

Life of human being is changing day by day. Reason behind this change is need and curiosity of humans. There was a time when mankind was living in caves and their need for survival helped then to invent life saviour tools and techniques. And our behaviour leads us to modern life style. The modern age is age of Technology. It has become integrated part of our life. Our day starts with it and ends with it. Technology not only influenced our daily routines but our study methods and patterns with Information Technology.

II. WHAT IS INFORMATION TECHNOLOGY (I.T.)?

 I.T. is the use of any computer, storage, networking and other physical devices, infrastructures and process to create, process, store, secure and exchange all forms of electronic data. In modern world every persons, knowingly or unknowingly, is using it. Our smarts phones, laptops, computers, online game stations, credit cards , online banking or net banking, e-commerce, modern lock systems, smart classrooms etc. everything nothing else but information technology. Internet is the biggest source of it and it is changing everyday as Bill Gates said, "If you take the way the Internet is changing month by month – if somebody can predict what's going to happen three months from now, nine months from now, even today, my hat's off to them. I think we've got a phenomenon here that is moving so rapidly that nobody knows exactly where it will go."

Like others subjects of Science and Humanities, Mathematics also could not keep itself unaltered with influence of I.T. As David Tall said, 'We live in changing times. Noble species which have been on the earth for millions

of years such as the whale and the elephant are threatened with possible extinction by mankind and now a human sub-species, the mathematician, may be under threat from the competition of information

technology." Information Technology not only influenced mathematics but the new research on mathematics seems impossible without I.T. I.T. changed our approach to teach mathematics too.

Before talking about information technology we should have a look on traditional methods of mathematics.

III. TRADITIONAL METHODS OF MATHEMATICS:

3.1 Pictorial Mathematics:

Mathematics' history in human life is as old as human itself. It was present in our life even in that time when there was not proper language. 30,000 -40,000 years ago, in Stone Age, Mathematics was in pictorial form. That time caveman was counting by making straight scratches on stone or wooden log. These straight lines are called ' Tally Marks'. The tally marks or sticks have a long history with them and the evidence of it is that the tallies are found in cave of south Spain. These were painted by hunters about 20,000 years ago. Ishango bone was found at the Ishango fishing site in Zaire, Africa. It is 8000 years old. The tallies on it are assumed to represents the marks of moon, so that this bone is probably one of the most ancient calendars in existence.
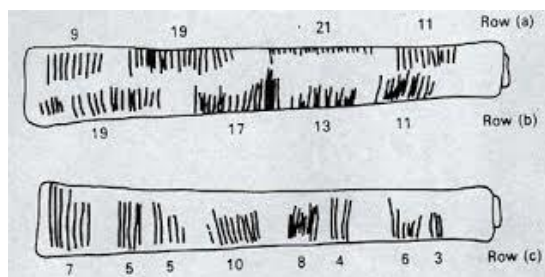

3.2 Symbolic Mathematics: As civilisation developed, their living standard also changed. Language developed. There was need of proper method to keep an account of their production of wheat and other necessary things. That time a language or mathematics also took shape. Civilizations like Babylonians, Egyptians, Chinese, Roman, Indian, Arabs and many more created their own languages and number systems for mathematics. All of them had their own symbols for their Number Systems for example:

3.2.1   **Babylonian developed number system** around 3100 BC. Their number system was based on two symbols < and |. The number | was used to represent one and < was for 10. This number system was based on place value system and Babylonian used 60 as their base. .

3.2.2 **The Egyptian Number system** was developed around 3400 B.C. this symbol introduced new   symbols for the powers of ten. The following diagram shows the symbols used in this number system.
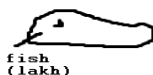
staff
(one)
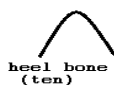
heel bone
(ten)

scroll
(hundred)

flower
(thousand)

pointing fingre
(ten thousand)

fish
(lakh)

astonished person
(ten lakhs)

3.2.3 **The Roman numerals** are

I =1, V = 5, X= 10, L = 50, C =100, D=500, M=1000

Other counting numbers are represented by either addition or subtraction of these basic numerals. For example 12= XII, 9=IX. In 12 we add II in X and in 9 we subtract I from X.

3.2.4 **Hindu-Arabic Number System**: The Hindu Arabic system that we use today was developed around the year A.D.800. The Hindu- Arabic system of numerals was never used extensively by the Arabs. The Arabs were primarily the translators. Al-Khwarismi was an Arab traveller and mathematician who brought manuscripts from India. These manuscripts contained the knowledge about the Hindu mathematics and the numerals. Al-Khwarismi brought these manuscripts to Baghdad, from where this knowledge was spread to all over the world. This was the first number system which has the symbol for 'nothing'. The Indian Mathematician 'Aryabhatt' gave the concept of **zero** which means nothing. Initially it was called 'Kha', later it named 'Shuneya'. Now it is called Zero all over the world. The basic symbols which are used in system are 0,1,2,3,4,5,6,7,8,9. These are also called digits. This number system is based on the place value system with base 10.

3.3 Axiomatic Mathematics:

Around 330 BC, Euclid gave axiomatic approach to mathematics and deduced principle of 'Euclidean Geometry', Geometric Algebra. In 1482, Euclid's book 'Element' was printed first time in Venice. 'Element' is one of the very earliest mathematical book which was to be printed after the invention of printing press. 'Data' was another book which contained 94 propositions which deals with nature and implication of given information in geometrical problem. Euclid gave other concept of mathematics like Catoptrics, Phaenomena, Optics , On Divison of Figures etc. His work influenced Archimedes. Archimedes did work on Integral Calculas, Pi, Levers , Archimedes Screw, Hydrostatics, Infinitesimals, Archimedes's Screw and many more. Many axiomatic systems were devolved in the nineteen century including non-Euclidean geometry, the foundation of real analysis, Cantor's set theory, Frege's work on Foundations and Hilbert's 'new' use of axiomatic method as research tool.

The latest approach to mathematics is using Information Technology.

IV HOW DOES INFORMATION TECHNOLOGY CHANGE MATHEMATICS?

The use of technology when studying mathematics is not a new issue, since humankind always has been looking for solutions to avoid time consuming routine work. The use of technology has a long history in mathematics education. Starting from sticks, leather which was used as paper, book, Blackboard, radio, Slide rule video tape, projectors, Television, Calculator, computers these all are methods of technology. Now we have Geo boards which are useful for introducing geometric concepts. Clinometers are useful for teaching and learning of Trigonometry. Abacus is ancient technology which was used to solve arithmetic problems and to do large calculations with ease. In these days it is used as toys for children and it helps young children to learn mathematics while playing.

The technology which is used worldwide is Information Technology. Computers, Laptops and Smart classrooms, Smart Phones are major sources of it. Computer helps us to carry out lengthy calculations, which are not possible to solve manually, with the help of right soft ware. There are now smart class rooms where multi-task can be performed. In smart class rooms, while doing or working on maths problem, we can also visualise them graphically or in three dimensions. This method helps to develop higher skills and scientific inquiry in students.

Before I.T, the mathematics was restricted to academic domain. But I.T. changed this. Now Mathematics has entered the domain of technology and Industry. Operation Research, Control Theory Signal Processing, Game Theory, Numerical Analysis and Cryptography are some new fields in mathematics which need technology. Computer and soft ware, related to mathematics, saves so much time and reduce the effort to solve some such problems which can't be easy to solve manually. This helps students to increase their focus more. There are softwares which are especially for mathematics and some of the mathematics soft-wares are given below:

4.1 LATEX SOFTWARE: There was a time when it was difficult to write or type mathematical language and its symbols but information technology helped in it too. As technology advances, there was origin of mathematical soft-wares too. There is software LaTeX which helps to type complex mathematical formulas and for advanced typesetting of mathematics there is AMS-LaTeX.

4.2 MATLAB SOFTWARE: MATLAB is the software which is used in Numerical Analysis, to analyse data, developing algorithms or creating models. To express computational mathematics, the natural way is the matrix-based MATLAB language. It combines a high-level language with a desktop environment tuned for iterative engineering and scientific workflows. There is in-built math function which supports engineering and scientific analysis. 2D and 3D plotting functions enables students or researchers to visualize and communicate data.

4.3 MICROSOFT MATHEMATICS: This software is offered by Microsoft. It helps maths students to solve complex maths problem. It deals with algebra and equips them with a graphic calculator to be able to draw 2D and 3D diagrams. It solves a complex equation in step by step manner.

4.4 MATH EDITOR: Math Editor helps to create mathematical equations with Greet symbols, square root and other symbols. It helps to create, save and edit equations. It allows the writer to copy any equation and paste directly in world document or paint as an image. It is compatible with formats like JPEG, GIF, PNG, TIFF and BMP.

4.5 PHOTOMATH: PhotoMath is android app which is helpful to students so much. It is also available in IPHONE app store. It uses smart phone's camera to scan the math equation and teaches how to solve questions step by step.

4.6 MAXIMA: Differentiation, integration, Taylor Series, Laplace Transforms, Ordinary Differential equations, systems of Linear Equations, Polynomials, Sets, Vectors, Matrices, Tensors and to solve Numerical expressions we can use MAXIMA. It can also plot functions in two and three dimensions.

4.7 GAP(Groups, Algorithms , Programs) : it is a system for computational discrete algebra, with particular emphasis on Computational Group theory.

SAGE, Octave, Scilab, OpenMath, Axiom, YACAS, GeoGebra, GraphSketch, SMathStudio and many more systems are present in this technology world which takes mathematics to new heights. These softwares or systems not only give us better understanding regarding the subject but also helps us to visualize then graphically in two dimension or three dimension.

When technology was not in use, then student had only one teacher but now due to information technology, there are unlimited teachers available on our phones. We can see their videos on you-tube and on many other websites in any language we want. The practical applications of mathematical concepts are available on GOOGLE, YAHOO search engines. Different methods to solve any problems can be seen on our computers, laptops or phones

Though there are many uses of information technology but this too have drawbacks. Mathematics software has their own language which a non-computer person or teacher can find difficult. A teacher or student who doesn't know how to write or create a programme will always need a computer person on his/her side if a little problem occurs in solving problem. These soft-wares are costly. Every person can't afford it. It also requires a working Net Connection. If the Net connection will not work, then we can stick. Also not everyone who is working in mathematics field is aware of these softwares. Only some universities are doing research on mathematics and information technology together. So there is need of more awareness about this new age of mathematics.

V CONCLUSION:

Mathematics has a totally new look with the help of information technology. The use of I.T. allows us to feel mathematics and helps us to visualize it. I.T. frees us from long calculations which we do manually. It also helps students to increase their interest in this subject as they can see its applications and understand while playing mathematical games. But the main drawback of information technology in mathematics is that - it is limited to developed countries and some more universities. There should be teaching programme on world-wide level to aware teachers and students about these. To understand software language the computer knowledge is must. The mathematics student or teachers also has to study computer science also.

At last every method, technology has its usefulness and drawbacks but the as the coming generation or time is technology's time so mathematics also has to adopted it fully and the main necessity is to spread it to whole world than to some small bunch of people.

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