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Teaching of History of Mathematics in Indian Universities

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At the present situation in India almost every teacher of mathematics has a feeling that their pupils in general are no longer interested in the cold logic of geometrical demonstration given in the classes. The main reason for this attitude perhaps is due to the fact that a very meagre percentage of students coming out of the universities and colleges get further facilities to work in the higher field of mathematics either as a research scholar or as a teacher. It must be frankly admitted that when a student cuts off connection with university for a number of years, after a university degree is obtained, he forgets everything of mathematical jugglery he had once acquired in the university. The reason for this is that there is no powerful binding force which the students may visualize from wider perspectives. The study of history of mathematics may act as such a binding force. Hence it is to be of interest if we discuss in the paper three things, viz. the facilities that may be accrued from the study of history of mathematics, activities on history of mathematics in European countries, and some suggestions towards teaching of the subject in the Indian Universities.

1. Facilities

The knowledge on history of mathematics :

1.1 : helps teachers to illumine the ideas and interest of the students, if the lectures are often interspersed with historical remarks and anecdots ;

Illustration : A class in mathematics will be pleased to hear how Tartaglia (1499-1557) and Cardano (1501-76) challenged each other on the problem of solution of an equation of the type :

$ax^3+bx^2+cx+d=0$, before the equation is actually taken up for solution in the class, or, how Newton (1642-1727) praised De Moivre (1667-1754), the young contemporary, to his fellow professors before De Moivre's theorem is actually taken up for discussion.

1.2 : warns scholars against any hasty conclusions ;

1.3 : shows how apparently distinct branches have been found to possess unexpected connected links ;

1.4 : saves students from unnecessary wastage of time and energy upon problems which were perhaps solved long since ;

1.5 : discourages students from attacking an unsolved problem by the same method which has led other mathematicians to failure ;
Illustration : The problem on quadrature of a circle has attracted inspite of thousands of great failure, so many a scholar from the time of Archimedes (287-212 B.C.) in Greek mathematics, and from scholars of different cultural areas and even after the discovery of the most powerful tool, differential calculus, because of the ignorance of history and of the fact that the quadrature of the circle with ruler and compass only, is impossible. The solution actually came from a diffierent angle from the pen of J. H. Lambert who showed that the ratio of the circumference of a circle to its diameter is irrational. The ratio is also transcendental, which has been established ultimately with actual proof by F. Lindeman.

1.6 : ascertains the trend of mathematical research ;
Illustration : H. S. White ('Forty Years' Fluctuations in Mathematical Research', Science, N.S. 42, 105-13, 1915) made a survey of mathematical publications from 1870 to 1909, roughly for about forty years. He found that the total annual publication doubled during these forty years and out of the publications, 30% was devoted to applied mathematics, 25% geometry, 20% analysis, 18% algebra 7% history and philosophy. The reason and character of such trend in different fields of mathematics may be ascertained.

1.7 : gives an idea of man's cultural pattern and intellectual progress throughout the ages.

2. History of Mathematics in European Countries :

Interest in the subject is found to have been created from the middle of 18th century A. D. Scholars like Montucla (1725-99), Delambre (1749-1822), Dugald Stewart (1753-1828), Kastner Isaac Todhunter (1820-84), Cantor (1829-1920), Tannery (1843-1904) have written multi-volumes on history of mathematics and astronomy. Well known are the scholars of the nineteenth and the first half of the twentieth centuries like H. G. Zeuthen (1839-1920), Heinrich Wieleitner (1874-1931), D. E. Smith (1860-1944) and his assistants (R. C. Archibald, F. Cajori and L. E. Dickson), E. T. Bell, D. J. Struik, George Sarton (1884-1956), H. W. Turnbull (1885-), Neugebauer (Ex-Professor of History of Mathematics, Brown University), Joseph Needham, Victor E. Thoren (Teacher of History of Astronomy in the Indian University), Curl B. Boyer (Teacher of History of Mathematics, Brooklyn College), Christoph J. Scriba (Teaches History of Mathematics in the University of Humburg), E. S. Kennedy (Visiting Professor of the History of Mathematics, Brown University) and David Pingree (Professor of History of Mathematics, Brown University) to mention a few. An idea of their achievements may be available from their publications.

A few journals also are published exclusively on history of mathemetics and astronomy. It is of importance to note, that recently two other journals viz. **Journal of History of Astronomy** (1970) and **Historia Mathematics** (1972), exclusively devoted to the study of mathematical sciences, have begun to play more significant role in the field.

Quite a number of international congresses had been held on history of mathematics. A great deal of interest in the subject has been created by congresses on History of Science which always makes a section on History of Mathematics and Astronomy and extends invitations to scholars attached to this field. Recently another international Congress : The role of History of Mathematics on Mathematics Education, held in 1972 in England between 29 August and 2 September, discussed the subject in seven heads viz. the role of history of mathematics in schools, Colleges and Universities, Mathematics Education, and focussed on the Problems of Historical interrelationship of History and Philosophy of Mathematics and Mathematics curriculum, the History of Mathematics as an element in the History of Culture, and the sources and development of mathematical ideas.

After the deliberation of the Congress was over the following recommendations were made :

i) Production of more classroom materials in history of mathematics should be encouraged,

ii) History of mathematics courses for teachers should be recognised as important in helping teachers to interest, integrate, suggest applications and humanize the students, perception of mathematics,

iii) Teachers should look for exciting experience in tracing the development of mathematical ideas, and should study the evolution of mathematics teaching and philosophy of Mathematics.

3. Discussion

Up-till now the Universities in India have taken no interest to give lesson on history of mathematics except a few like Bihar University which has included one paper on history of mathematics as a part of its Honours curriculum, and Calcutta and Lucknow Universities which included research and/or teaching on history of Hindu mathematics under their respective auspices. From our discussion we find that while almost all developed countries in Europe have started teaching and research and made substantial work in the field, the Universities in India have shown no considerable interest to it. Our discussion will serve no worthwhile purpose unless the mathematicians themselves come forward, appreciate and give serious thoughts to the task. It is no denying the fact that at least one full paper on history of mathematics in mathematics curricula of Graduate and Post-graduate courses in mathematics is a must, if the subject of mathematics has to win proper appreciation from the studies in general. To facilitate these activities, a tentative syllabus of a full paper of 200 Marks has been appended at the end of this paper.

HISTORY OF MATHEMATICS
Paper IX Marks 100

Babylonian, Egyptian, Chinese, Greek mathematics, and their characteristics ; Greek schools ; Pythagoras, Euclid, Ptolemy, Diophantus ;

Planetary model and theories; the knowledge of geometry, arithmetic and algebra; Roman mathematics; Impact on Indian mathematics.

Indian mathematics; sulba sutras and vedanga Jyautisa; the astronomical siddhantas; Aryabhata I, Varahamihira, Bhaskara I, Brahmagupta, Bhaskara II and others; naksatra system; decimal place value system; Indeterminate equations - first degree and second degree; Planetary theories; Impact on Arabic mathematics.

Arabic mathematics; al khwarizmi, al Biruni, Omar Khayyam, at Tusi; algebra; experimental nature of astronomy; astronomical tables; Instruments and their use in navigation.

Latin Europe; translation of Indian, Arabic and Greek mathematical works; Leonardo of Plsa; scholasticism and the medieval universities; awakening in algebra, geometry and trigonometry.

Bag, A.K.— **Mathematics in Ancient and Medieval India**, chaukhamba orientalia, Benares, 1979.

Datta, B.— The Science of Sulba, Calcutta University, 1932.

Datta, B.— **History of Hindu Mathematics**, 2 vols, Lahore, 1955, 1938; Reprinted Asia Publishing House, Bombay.

Heath, T.— **A History of Greek Mathematics**, 2 vols, Oxford, 1921; New edition, 1931.

Mlkami, Y. **The Development of Mathematics in China and Japan**, Leipzig, 1913.

Needham, J. **The Science and Civilization in China**, Vol. 3, Cambridge, 1959.

Neugebauer, O.— **The Exact Science in Antiguity** (Babylonian and Egyptian Mathematics), Princeton, 1952.

Smith, D. E.— **History of Mathematics**, 2 vols, Boston, 1923; Reprinted - Dover Publications.

Paper X - Marks 100

Survey of sixteenth, seventeenth, eighteenth and nineteenth century European mathematics; the Renaissance in mathematics; characteristics.

Copernicus, Kopler, Descartes, Pascal, Galileo, Newton, Leibniz, Euler, Lagrange, Laplace, Fourler, Gauss, Cauchy, Lobatchewsky, Abel,

Jacobi, Hamilton, Galois, Sylvester, Welerstrass, Boole, Kronecker, Riemann, Dedekind, Poincare, and Cantor.

Telescopic astronomy; calculus non-Euclidean geometry and geometry of n dimensions; mechanics; algebra; theory of equations and theory of groups; the theory of relativity; Impact of Indian mathematics.

Boyer, C. B.— **History of Analytical Geometry**, New York, 1956.

Boyer, C. B.— **The History of Calculus and its Conceptual Development**, New York, 1959.

Cajori, F.— **A History of Mathematics**, New York, 1895.

Hofman, J. E.— **Classical Mathematics**, London, 1960.

Kline, M.— **Mathematics in Western Culture**, London, 1954.

Prasad, G.— **Some great Mathematicians of the 19th Century**, 2 vols, Benares, 1933-34.

Struik, D. J.— **A Concise History of Mathematics**, London, 1959.

Turnbull, H.W.— **The Great Mathematicians**, 4th edition, London, 1962.

Wilder, R.L.— **Evolution of Mathematical Concepts**, New York, 1968.