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A HISTORY OF MATHEMATICAL SCIENCES IN NEPAL

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ABSTRACT
The history of teaching mathematics is as old as the human civilization. The history of mathematics is a powerful tool for a disseminating an understanding of mathematics. The history of mathematics teaching in Nepal started with the starting of " Gurukula" in ancient period whereas the modern education system in Nepal seems to follow the world's educational system. The aim of this paper is to present a brief historical account of the Nepalese mathematicians up to nineteenth century and their remarkable contributions to the mathematical sciences in Nepal.

INTRODUCTION
Education as a system can be called the brain of any society and it is backbone of any system. Mathematics is a vast adventure in ideas, an exact science and truly saying the mirror of civilization. According to Perry [6], mathematical education began because it was useful, it continues because of the usefulness of its results. Now days, even the social sciences are becoming more and more mathematical. Most mathematical creations are the result of intuition. The direction of modern mathematics has without a doubt been greatly influenced by the developments in other disciplines. The mathematical sciences have changed significantly during the past few decades. The most obvious change is the enormous growth of mathematics. Even the latest scientific and technological developments have extended each branch of mathematics and have proved mathematics as a powerful tool for any scientific achievements.

The history of teaching mathematics is as old as the human civilization. Mathematics shows much more durability in its attention to concepts and theories than do other sciences. These days history of mathematics is a powerful tool for a disseminating an understanding of mathematics. We look at history as a way of motivating the learner to see the significance of the area being studied. We consider to history as a route to help the learner understand the path of development to a mathematical concept or process. With the history of mathematics, students will come to know that mathematics and science is a work of all civilizations and teachers will find more confidence in teaching. But the goals of mathematics education differ according to the country's socio-economic condition and the innovation of science and technology in the society and the existing educational status of a country. Nevertheless, mathematics is taught in all levels of education in every country in the world. The history of mathematics reflects some of the noblest thoughts of countless generations. Nepalese mathematical system is highly influenced by the world's mathematical system.

The objective of this paper is to briefly analyze the history of mathematics in Nepal. In this paper, we have presented the history of mathematics in Nepal. In this paper, we have presented the history in condense form by subjecting to strict discipline, sketching the unfolding of a few main ideas and minimizing reference to other developments. It is hoped that, despite various restrictions; namely, unavailability of written documents on the history of mathematics in Nepal, we have been able to give a fairly honest description of the main trends in the development of mathematics throughout the ages and of the social and cultural setting in which it took place. The main work in the paper has been divided into two parts: Historical Background and Modern Period. Historical background includes the survey work of mathematical activities in Nepal during Lichchavi Era (143 – 1243 A.D.), Malla Era (1243 – 1493 A.D.), Shah Era (since 1493 A.D.).

Historical background

In 1918 A.D., a formal and systematic way of teaching Mathematics in intermediate level has been firstly started in western manner in Tri-Chandra College. But in 1853 A.D., Durbar school was started and Mathematics had been taught in English medium. In this school, only the higher-level students were allowed to study in this school. So mathematics subject were not familiar to common people in those days in Nepal. In the period of Rana Prime minister **Dev Samser**, many other schools were opened throughout the country and in terms of earlier Astrology, mathematics had been taught. Durbar school was affiliated to Calcutta University. Students had to go to Calcutta to appear matriculation examination and then they had to pass to get the certificates. In 1890 A.D., Rana Prime minister **Chandra Samser** was the first Nepali who had appeared that matriculation examination of Calcutta University and passed the mathematic subject in the age of 20 years. During this period, the major subjects in mathematics curriculum were Algebra, Arithmetic and Geometry. The textbooks were from the famous British mathematician of that period. Algebra from Knight and Hall (1887 A.D.) had not been introduced at that time. In 1877 A.D., Sanskrit school was first established. In terms of jyotish shastra, basic mathematics courses had been taught in Sanskrit schools. In this school, there were separate teachers for teaching mathematics and astrology. Teachers teaching Jyotish were teaching popular mathematics book written in Sanskrit.

About 125 years ago, there were no mathematics books written in Nepal. Students in those days used to go to **Kashi** (Banaras) to learn Sanskrit and there, they were taught famous books on mathematics like Siddhant Siromani of Bhaskaracharya (**II**). Among four units of Sidhant Siromani, Lilavati and Bijganita (Algebra) were quite famous. So it is found that there was a great influence of Indian mathematics culture in Nepalese system. After returning back, teachers used to teach Bhaswati, Lilawati (Paati mathematics), Algebra, Geometry. It is not possible to teach all parts of Bhaskaracharya's Lilabati and Algebra to junior levels as those books are abstract books in mathematics. It is found that Yadav Chandra Chakravorty's arithmetic is about 10 times larger in size than Lilabati but only one fourth of the content from Lilabati has been included in Chakravorty's arithmetic. Geometry of Jagannath was the core subject to teach at that period. Since the trigonometry of Baskaracharya's geometry was included in the curriculum so the teacher's used to teach trigonometry or, Jyotish based on Shiddhant Shiromany book of Bhaskaracharya **II**. In this paper, we shall concentrate only on the works and contribution of Nepali Mathematicians.

On the basic of old Vedas, Jyotish and Surya Sidhanta, it is found that the first Jyotish book in Nepal "Sumati Tantra" was written in 556 – 960 A.D.. But only the book is available and its writer is still not known, and it is interesting to note that it was written in Kathmandu valley. Latter in 1409 A.D., a great astrologer loret Dharmapati Bardhan translated this

sumati siddhanta in the form of Jyotish Book. Even in Malla Era, for future prediction and to make calendars easily, astrologers usually took the help to this Sumati Tantra and Sumati Siddhanta. Sumati Tantra has been purely written in Sanskrit whereas Sumati Siddhanta has been written in mixed Language of Newari (local language in Kathmandu Valley) and Sanskrit. It is found that even in Lichchavi Era and mid-period, these books were found useful for astrologers for their calculations.

Many Great astrologers had made suitable callenders based on Surya Sidhhanta. In 1099 A.D., a famous astrologer Satananda from Udise state (India) had made Bhashwati book. This book was so populars that was found teaching as mathematics courses by Jyotish teachers at many places. In connection with this, in 1494 A.D. (during Malla Era), famous teacher Daibagnya Balbhadra from Jumla region had made Balbodhani Tika of this Bashwati book as a text book of mathematics. Since Bhashwati had helped a lot of count calendars (panchang) and also to help teaching addition, subtraction, multiplication and division, etc as basic mathematics books, so Bhashwati had been as the first book of supplement mathematics. There is a strong relationship between mathematics and Astrology. So in old ages, people used to go to jyotish teachers to learn mathematics. Jyotish helped their students to learn mathematics. Assignments from Bhashwati had helped them for complete calculation in Panchang. For more mathematics knowledge, people used to read Lilabati.

Bhashwati was so popular in different part of country that many of hand written Slokas (Tikas) are found from Bhashwati at different places. It is found that some of the tikas made by scholar Bal Bhadra from Jumla was even popular in India. Famous Nepalese Royal strologer **Laxmi Pati Pande** (1758 – 1813 A.D.) in the period of Bahadur shah (1757 – 1797 A.D.) had written the tikas of Bhashwati and started his mathematics and Jyotish study. He is found to be the first Nepali astrologer that has written the Nepali meaning of his slokas. His contribution has shown that Bhashwati was the initial textbook of mathematics in Nepal then after only students of high level used to read Lilabati for more knowledge in mathematics. Astrologers had calculated planets-stars calendar and eclipses on the basis of this Bhashwati. They taught their students making Tikas of this book. Laxmi Pati pande is known to be a great theologian in Nepal. He was honored as a royal astrologer. He was not only the mathematician but he had a nice idea about the timings of stars – planets counting. In the kingdom of **Ran Bahadur Shah**, he had made a solar watch. Since it was made following the classical jyotish Rules, so it had helped a lot to know the time at that time. He translated many important articles from mathematics & astrology in Nepal. We find the list of about 40 books that was either copied or written by Laxmi Pati Pande in Laxmi Pati Sangraha. Among these books, notable books are Ratnadeep, Lilabati, Bhashwati, Tika, Griha Laghava Kalarnav Dipika, etc. The son of Laxmi Pati Pande, Lila Nath Pande was also a Royal astrologer and great scholar of mathematics. It is found that he had written a book in Nepali namely Siddhant Jyotish, but it had not been published. It is seen that perhaps this book was the first written unpublished book in the history of Nepalese mathematics. The last published Tikas of Bashwati was from Tika Ram Panthi in A.D. 1931.

The first book of mathematics written in Nepali language is found to be “Wyokta Chandrika” and it was published in 1883 A.D. This book was based on the Lilabati of Bhaskacharya (**II**). The great mathematician and teacher **Pd. Gopal Pande** (1847 – 1920 A.D.) wrote this book. He was the great mathematician of that period. He had shown his individuality and originality to find out square root and cube root. He has published his book and made it as the textbook of mathematics. His book was the best book for teaching mathematics at that time. Pd. Gopal Pande was the first to formulate Trizoidiacle Rule [3], useful for calculating square and cube

roots. This new approach is considered as a remarkable contribution of Gopal Pande in Nepalese mathematics.

From 1883 – 1914 A.D., Pd. Gopal Pande had written four editions of his books and only his third edition was published in Hindi to make this book familiar in India too. Due to his contributions and achievements, Gopal Pande was a great scholar and theologian of mathematics in Nepal. In the history of mathematics of Nepal, Gopal Pande is not only the first who had written and published his mathematics book in Nepali language but he is the first person who analytically argued on the others' mathematics - Jyotish articles with his own proof and published many research papers. He had proved his capabilities in many circumstances. In 1884 A.D., first calendar was published in Nepal. In this calendar, it was quoted that there is an emergence sending of lunar eclipse of Aswin Sukla. But Gopal Pande with his own calculation claimed that it is false. And after a long discussion, it was found that Gopal Pande's result was true. Due to this achievement, he was honored with Royal Astrologer. Thus, Gopal Pande was the first writer of mathematics books of Nepal, great mathematician and scholars of other subject too. His popular book is "Lokanu Smiriti". It deals with a nice explanation of Loktantra. He had also a sound knowledge of Architecture and engineering. His engineering idea helped the then Government to make a huge ground so called "Tundikhel", which is located at the heart of Kathmandu city. Other famous scholar and writers in mathematics were **Noor Dutta Pande** (second son of Gopal Pande), master Meru Nath Pande, Kavi Raj Pande, Ganga Prasad Shrestha, etc. Noor Dutta Pande had written first, second, third and fourth parts of "Gorkha Bijaganita". This shows his great ability of algebra. Also he has composed the mathematics book so called "Bichitra Ganita". Master Meru Nath Pande and poet Raja Pande had written "Saral Bija Ganita" in Nepali language. Another great scholor Nay Raj Pant [2] has highly appreciation the contribution of Pandita Gopal Pande and paid all attribute to this book.

Twenty five year before Laxmi Pati Pande, Royal priest of famous king Dravya shah in the 15th century A.D., **Chakra Pani Aryal**, had written a Jyotish book in Sanskrit namely "Uttan Mathematics" that was useful for calculation of solar and lunar eclipses. This book was published by scholar Padma Nav Keshari Aryal in 1934 A.D. and freely distributed to other scholars. Some other books of Jyotish written by Chakra Pani are Ganita Chudamani, Grahan Tatwa, Surya Grahan Sarani, etc. This has been proved on the basis of available documents in Bil Library and National Library. Also these facts have been proved by the research works of both the sons Mahesh Raj Pant and Dinesh Raj Pant of Shree Naya Raj Pant. Ganga Prasad Shrestha had written a textbook so called "Ganita Sagar". Also Bekhalal had written Saral Anka Ganita and that was the textbook in the schools during the time of ruling Prime Minister Shree Chandra Samser.

Other remarkable writers of mathematics book in Nepal are Pahalman Singh Sunwar, Raja Prithvi Bahadur Singh, etc. About seventy years ago in 1833 A.D., one Nepali lady **Chandra Kala Dhananjay** has written and published "Shishu Bodhini Ragini Ganita", in Slokas form. In this book, simple addition, multiplication, divisions have been explained in simple way to understand. It includes two parts. She has been supposed to be the first lady mathematician and teacher in Nepal who had a sound knowledge of mathematics at that time. No lady mathematician has been seen before and after her to have such ability in mathematics. There is a still lot of research work to do about her contributions to Nepalese mathematics.

While talking about mathematics books in Sanskrit, Nepalese Mathematicians have also written both mathematics and Jyotish books in Nepal. A great scholar **Shree Nay Raj Pant**

(1913 – 2002 A.D.) and group of his students namely Mangal Das Manandhar, Shankar Man Rajbanshi, Gautam Bajracharya, Mahesh Raj Pant and Dinesh Raj Pant (1965 – 1967 A.D.) have published many articles about some famous Nepali mathematicians and their contributions in the history of Nepalese mathematicians. Pd. Nay Raj Pant first time translated the formulae of old Hindu Trigometry as "Vyakta Ganita" with various examples and published it in Nepali language. This book is the collection of articles published by Nay Raj Pant in the journal PURNIMA. This is the first journal in Nepal established in V.S. 2021. Mangal Das Pradhanang, a student of Nay Raj Pant, was the first to graduate in Mathematics from Tribhuvan University in V.S. 2024.

In nineteenth century, we find some books translated in Nepali language. Among those, we have Arithmetic of Narendra Mani Acharya that was translation of arithmetic of Yadav Chandra Chakravarti. Similarly, Nepal Bhasa Prakasiri Samiti has published "Nepal Arithmetic" in 1834 A.D., similar to the arithmetic of Chakravarti. Its language is grammatically true. Mathematics words in English used in this book have been translated by Nepali words in correct manner. Various high standard schools and other public schools had followed his book as textbook and up to high grades, this book had maintained the standard and was taught by teachers appreciating it.

It is found that the trend of writing books of mathematics in Nepal has been started just before 250 years ago at the time of writing books on mathematics and astrology. Later on, some other books on mathematics and astrology have been published in Nepal. For example, Pandita Harinath Pokhrel from Gorkha has published books like the Bramhand Darpan in 1913 A.D., Miti Drarpan in 1922 A.D. and Panchanga Darpan in 1928 A.D., etc in Nepal.

MODERN PERIOD

In 1947 A.D., both B.A. and B.Sc. in mathematics were started in Tri-Chandra College. After one decade in 1957 A.D., T.U was established first time in Nepal. In 1959 A.D., M.A./ M.Sc. mathematics classes were started. Due to lack of teachers in mathematics, teachers were hired from India under Colombo Plan Scheme. There were about 30 - 32 students in first batch of mathematics classes in the master level. Only four students had passed the final examination. Bengali mathematician Prof. **Asutosh Ganguli** was the first head of Department in Master level mathematics courses at Tri-chandra College. In 1968 A.D. (Bhadra), the classes were started at the Central Department of Mathematics at Kirtipur. Not only the Colombo Plan Scholars, but also Scholars from Statistics Department, Government services, Professor of Economics, had helped teaching related mathematics courses. Rest of the teachers was Nepali scholars. Semester system started in mathematics in 1973 A.D. Students had to pass 4 semesters in 2 years and the pass mark was 20. Internal evaluation in classes was compulsory. In each paper, Students had to get 8 marks out of 20 marks as an internal evaluation. It continued for 6 years. During these periods, both syllabus and textbooks were twice reviewed and modified.

Since 1957 A.D., mathematics courses were divided into 8 papers, among 2 were elective. In 1st year, there were four papers and in second year, there were four papers. Students had to pass all the papers. In the earlier syllabus of mathematics courses, there were many subjects like Algebra, Analysis, Static and Dynamics, Differential Equations, Spherical trigonometry, Astronomy, Complex Variable, Statistics, Quantitative mechanics, Relativity, etc. Now days, these courses are not taught and some modern courses have been introduced like Topology,

Functional Analysis, Numerical Method, etc. In 1997/98, the syllabus had been re-evaluated and many of the master level courses have been kept in graduate level mathematics curriculum. Now days a curriculum has been extremely modified. The attraction in mathematics has been increased. Move than one dozen Ph.D. holders are available in Nepal. Since 20 years, central department of mathematics of Tribhuvan University has been publishing research journal "Nepali Mathematical Science Report". But still we are lack behind the recent worldwide development in mathematics. Teaching approaches have been improved.

In the past one decade, Nepalese higher education system has undergone sudden expansion from one university to five universities. The existing five universities in Nepal are Tribhuvan University (1959), Mahendra Sanskrit University (1986), Kathmandu University (1991), Purbanchal University (1995) and Pokhara University (1996). The detail of mathematical activities such as various courses, curriculum, evaluation schemes, teaching aspects, teachers' training, research activities and various organizations relating to mathematical activities in Nepal, has been briefly explained in the paper of Tuladhar and Jha [9]. Looking back the need of people, Nepalese Government is in process to establish some new universities. Thus, there will be more programs in mathematics and so we expect more mathematical activities and achievements in near future.

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