Pb. Univ. Res. J. (Sci) Vol. 75, 2025, pp. 20-34

CENTURY OF THE PUNJAB SCHOOL OF MATHEMATICS

Surinder Pal Singh Kainth[1], Arun Kumar Grover[2]

[1]Department of Mathematics, Panjab University, Chandigarh
[2]Former Vice Chancellor, Panjab University, Chandigarh

Abstract

The Punjab School of Mathematics, whose origin lies in the vibrant intellectual milieu of pre-partition Lahore, has completed a hundred years of remarkable contribution to number theory and related fields. This article presents a comprehensive account of its evolution, from the pioneering work of Sarvadaman Chowla—its true nucleator—to the foundational contributions of Hansraj Gupta and the enduring legacy of Ram Prakash Bambah, who left us just four months before his 100th birthday. Drawing upon archival sources and recent scholarship, the article traces the School's development through the turbulent mid-twentieth century, its re-establishment at Panjab University, Chandigarh, and its rise to national prominence as a Centre for Advanced Study in Mathematics. It highlights the School's rich research culture, its collaborations with global luminaries, and the significant achievements of successive generations of mathematicians, including several distinguished women scholars. By documenting this century-long journey, the article seeks not only to honour the architects of the Punjab School of Mathematics but also to underscore its continuing influence on the landscape of mathematics and beyond.

Introduction

It is a moment of reflection that the centenary of the Punjab School of Mathematics coincides with the birth centenary of one of India's most distinguished mathematicians, Professor Ram Prakash Bambah (1925–2025). His passing away earlier this year lends a solemn dimension to the celebrations, providing an occasion not only to honour a century of mathematical excellence at Panjab University[1] but also to commemorate the extraordinary life and legacy of Professor Bambah, together with Professors Hans Raj Gupta and Sarvadaman Chowla, whose pioneering contributions laid the very foundations of the *'Punjab School of Mathematics'*. In this article, our focus will primarily be on these legends.

As we reflect on this remarkable century, it is imperative to highlight the way Punjab has secured a legacy that resonates across the Indian and global mathematical community. The ongoing legacy of this tradition is meticulously documented in Purabi Mukherjee's book *Research Schools on Number Theory in India* published by Springer (Mukherjee, 2020). The book positioned the Punjab School prominently on the international stage, surpassed in recognition only by the globally renowned South Indian School, whose origin is associated with the iconic genius Srinivasa Ramanujan

1 The name and location of this university have undergone various changes throughout its history, most notably as the University of the Punjab at Lahore and later as Panjab University, Chandigarh (see Sethi et al. 1968). We will use the common abbreviation **PU** to refer to all these incarnations.

Corresponding Author: Surinder Pal Singh Kainth: spsingh.math@gmail.com
Received: 02nd November, 2025 Accepted 31st December 2025

(1887–1920), the likes of whom are born very rarely, even in a millennium. The *Punjab School of Number Theory*, which was initiated in Lahore, evolved into the *Punjab School of Mathematics* in post-independence era at Chandigarh.

1. Sarvadaman Chowla: The Nucleus of the Punjab School

Professor Sarvadaman Chowla

After Ramanujan's passing away in 1920, the school at Madras was continued by Anand Rau, who also earned a Ph.D. with G. H. Hardy and was a contemporary of Ramanujan at Cambridge. The nucleator of the Punjab School at Lahore was undoubtedly Sarvadaman Singh Chowla alias Sarvadaman Chowla (1907–1992), whom Wikipedia refers to as an *England-born American mathematician of Indian origin.*

1.1 Early Spark and Cambridge Sojourn

Sarvadaman, nicknamed Servi, was born to Mrs. Shakuntala and Bhai Gopal Singh Chawla, M.A. (Mathematics) of Government College Lahore (GCL). The latter was on a two-year study leave (1906–08) from GCL to Trinity College, Cambridge. After his return to Lahore, he was promoted to Professor of Mathematics in 1910. Servi was born in England in 1907.

Bhai Gopal Singh Chawla was among the first cohort of Indian educators in government colleges in colonial India who were deputed for studies abroad under a scheme introduced in the wake of the Indian Universities Act of 1904, a common Act for the then five Indian universities at Madras, Allahabad, Bombay, Calcutta, and Lahore. Notably, Panjab University, Chandigarh, in independent India, continues to operate under a modified version of that same 1904 Act.

The remarkable mathematical ability of B.A. student Servi started to get noted nationally, as he commenced providing solutions from 1925 onwards to the mathematical problems presented in the *Journal of the Indian Mathematical Society* (JIMS, in publication since 1910). In 1925 and 1926, he published eight papers in JIMS, which included the solution to a question due to Ramanujan and three questions posed by the mathematics teacher, Principal Hem Raj Gupta of Dyal Singh College, Lahore, in the same journal in 1924.

Servi completed his M.A. from GCL in 1928, and by the end of 1929, he had published 18 mathematical notes and original papers in JIMS. Father (GSC) and son (Servi) had both participated in the Annual Meeting of the Indian Mathematical Society held in December 1928, where Servi gave talks on three of his latest papers published in JIMS to his peers from the rest of India. The senior Chowla (GSC) also had a separate publication in the 1928 issue of JIMS. The name of Servi had appeared in JIMS for the first time in 1924, when he posed two mathematics problems in it (see Huard et al. 1999 and Chowla, 1924). Servi had built up a reputation as a college student for having a special ability to provide solutions to problems due to Ramanujan; in all, he solved 34 problems posed in JIMS between 1925 and 1931.

Bhai Gopal Singh had accompanied his son for admission as a Ph.D. student at Trinity College, Cambridge in 1929, unfortunately he himself

succumbed to pneumonia while travelling in Europe in December 1929 (see Sinha, 2023). Luckily, S. Chowla did not abandon his studies at Cambridge; his housemate during his sojourn (1929–31) was the Lahore-born Subrahmanyan Chandrasekhar (1910–1995), son of C. S. Ayyar, elder brother of the would-be Nobel Laureate (1930) in Physics, C. V. Raman. Chowla and Chandrasekhar maintained life-long correspondence with each other.

Chowla had enrolled for Ph.D. under the supervision of J. E. Littlewood, with whom Ramanujan had also interacted during his stay at Cambridge while working with the distinguished mathematician G. H. Hardy during 1914–19. Chandrasekhar's Ph.D. supervisor at Cambridge was R. H. Fowler, with whom Homi Bhabha and D. S. Kothari also worked as doctoral students immediately after Chandrasekhar. Chen-Ning Yang and Tsung-Dao Lee were once the only two students in a graduate course taught by Chandrasekhar at University of Chicago (see Johnson, 2025). These two students were awarded the Nobel Prize in 1957, whereas their teacher, S. Chandrasekhar, was honoured with the Nobel Prize in Physics in 1983 for ideas he had propagated at Cambridge in the 1930s.

Chowla completed his Ph.D, titled *Contributions to the Analytical Theory of Numbers*, within just two years at Cambridge. His friend Chandrasekhar obtained his Ph.D. a little later in 1933. In 1934, Sir C. V. Raman included both Chandrasekhar and Chowla among the sixty-five scholars who initiated the Indian Academy of Sciences as founding members.

1.2 Teaching and Collaborations in India before Independence

After returning to India in 1931, Chowla took up his first teaching position at St. Stephen's College, Delhi. There he married a Bengali Brahmo, Himani Majumdar, younger sister of political activist Sucheta Majumdar (later Kriplani), who went on to become independent India's first woman Chief Minister of Uttar Pradesh (1963–67).

Dr. Sarvadaman Chowla moved from Delhi to Banaras in 1932 as Lecturer in Mathematics at Banaras Hindu University (BHU), on the invitation of Pt. Madan Mohan Malaviya (founder of BHU), to fill the vacancy created by the departure of polymath D. D. Kosambi to Aligarh Muslim University (AMU) at the inducement of Professor André Weil, Chair Professor of Mathematics there. While at BHU, Chowla met the young French mathematician André Weil, later to become one of the most impactful mathematicians of the 20th century. He had returned to Europe after a two-year stay in India. André also co-founded, with a few others, the famous Bourbaki group of mathematicians in France. Another legendary mathematician of India, Harish Chandra (1923-1983), is known to have been influenced by the Bourbaki School. Harish Chandra had commenced research under Homi Bhabha at Indian Institute of Science, Bangalore (IISc) in 1944 after his M. Sc. in Physics from University of Allahabad. Bhabha sent him to work with Nobel Laureate Paul Dirac at Cambridge as he moved to Bombay (now called Mumbai) to establish Tata Institute of Fundamental Research. Harish Chandra obtained his Ph.D. in 1947 working on *Infinite Irreducible Representations of Lorentz Groups* at Cambridge. He later became a Professor of Mathematics at the Institute of Advanced Study Princeton, USA, where Chowla also moved in 1948 after the partition of India. Harish Chandra had been short listed for the coveted Fields Medal in Mathematics

in 1958. Both Chowla and Harish Chandra received Padma Bhushan from the Government of India after independence.

Chowla had stayed at BHU for only one year. Dr. Sarvepalli Radhakrishnan, the second Vice Chancellor of the newly established Andhra University, Waltair, appointed him as a Reader and the Head of Department of Mathematics at the suggestion of his friend Chandrasekhar, who had declined the same position offered to him first. It may be pointed out that Dr. Radhakrishnan later became the President of India in 1962.

Nobel Laureate Sir C. V. Raman had moved from Calcutta to accept Directorship of IISc Bangalore in 1934. A year later, he invited his nephew Subrahmanyan Chandrasekhar to join him as a faculty member at IISc, but his father persuaded him not to accept the offer. Chandrasekhar, in turn, is believed to have suggested Chowla's name to his uncle, but in vain. Chowla had described his isolation as a mathematics researcher at Waltair to his friend Chandrasekhar some months earlier.

After spending three years (1933–35) at Waltair, Chowla had the opportunity to return to Government College, Lahore—his alma mater—as Professor of Mathematics in 1936. Professor J. E. Littlewood, Fellow of Royal Society, England described him as the "*most promising Indian mathematician Cambridge has had since the war"*, while supporting his candidature at the University of the Punjab, Lahore (see page 6). Professor Sarvadaman Chowla was inducted into the Indian Education Service while at Lahore in 1939.

At Waltair, Chowla's teaching at the postgraduate level had inspired the young C. R. Rao (1920–2023), who progressed to become a *living legend* in independent India first, and in the United States later, after superannuation from the Indian Statistical Institute (ISI), Kolkata in 1982. Chowla authored a series of research papers with C. R. Rao in the 1940s, when the latter was at ISI, Calcutta. C. R. Rao was honoured with the Padma Bhushan in 1968. He was honoured with the U.S. National Medal of Science in 2001, India Science Award in 2010, and the International Prize in Statistics in 2023, a few months before his passing at the age of 102.

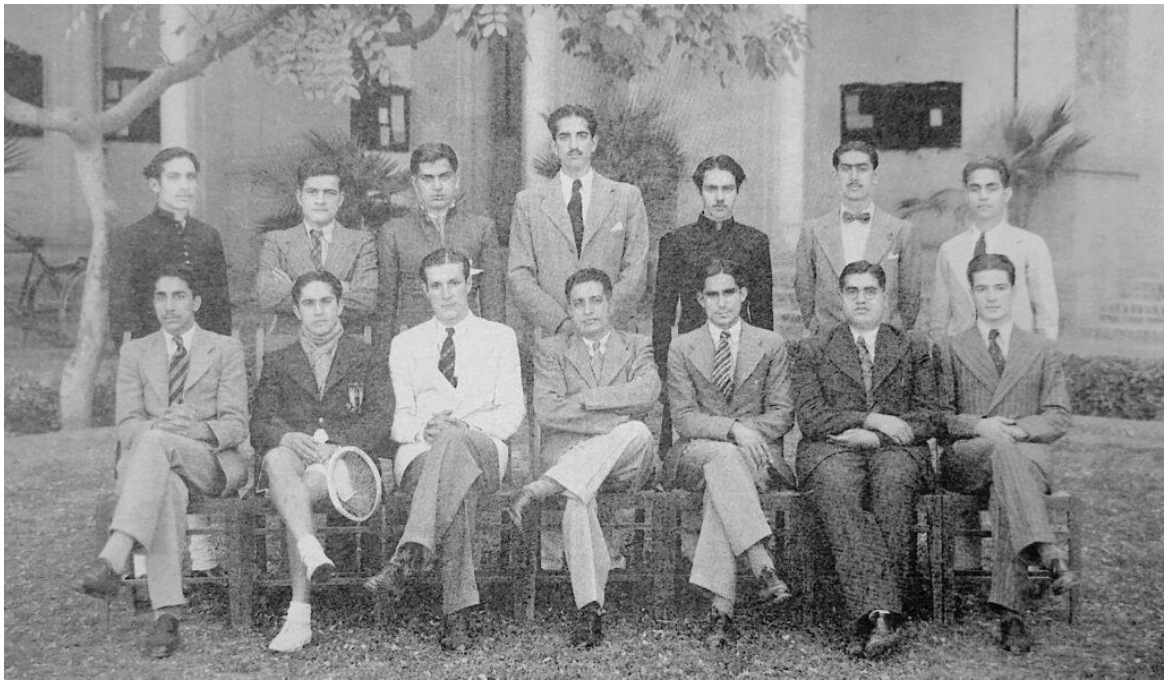
Chowla maintained his collaborations with the native mathematicians of the South Indian School throughout, as they spread out to different institutions across colonial India wherever jobs became available. The most notable of his collaborators before independence was S. S. Pillai (1901–50), with whom he maintained mathematical correspondence for two decades until Pillai perished in a plane crash in Egypt on his way to the Institute for Advanced Study at Princeton (Sury et al. 2012). Chowla also co-authored papers with K. Anand Rau, S. Sastry, R. C. Bose, T. Vijayaraghavan, D. B. Lahiri, et al., before independence (cf. Mukherjee, 2020).

1.3 Nurturing the Next Generation at Lahore

At Lahore, the first research student of Chowla was the would be theoretical physicist Faqir Chand Auluck (FCA), the topper of 1934 M.A. (Mathematics) examination and was working as a temporary lecturer on leave vacancy to teach Mathematical Physics to M.Sc. students. FCA wrote numerous papers in Number Theory, working with Chowla as well as alone. While teaching at PU (1935–37) and Dyal Singh College, Lahore (1938–42), FCA came in contact with physicists Dr. P. K. Kichlu and Dr. D. S. Kothari (both former students of Professor Meghnad Saha at Allahabad University). FCA had also started to work on issues in Astrophysics and Statistical Physics at Lahore. Kothari later served as the

Scientific Advisor to the Ministry of Defence during 1948 to 1961 and as the Chairman of the University Grants Commission during 1961-1973. Kothari had also been selected to initiate the Department of Physics of Delhi University (DU) and he offered FCA a teaching position in 1942 to teach Mathematical Physics there. FCA earned Ph.D. in Physics from DU in 1943, and he was also awarded D.Sc. in Mathematics by PU in 1945. Along with FCA, S. Chowla's younger brother Inder Chowla also worked on several important problems in Number Theory, both with him and independently. Inder went on to obtain a Ph.D. in Mathematics at Cambridge with H. Heilbronn in 1942. Unfortunately, he passed away at a very young age in 1943.

Hans Raj Gupta, Daljit Singh, Abdul Majid Mian, Raj Kumar Talwar, Ram Prakash Bambah, Jagdish Chandra Luther, Mahendra Raj, Abdus Salam and Fakir Chand Kohli were some noteworthy collaborators and students of Chowla at Lahore. Hans Raj (1902–1988), in fact, studied under his father as an M.A. student of GCL during 1923–24. Bambah topped the M.A. (Mathematics) examination with 600 out of 600 marks in 1945. Abdus Salam was one year junior to him and bettered Bambah's performance in all previous examinations other than M.A. examination. Salam provided an elegant new solution to a problem due to Ramanujan, posed to B.A. students by Chowla, and the latter himself proceeded to get it published in the journal *Mathematics Student* in 1943 in the name of Abdus Salam (cf. Aravinda et al. 2020). Salam proceeded to study at Cambridge in 1946 through a grant made available by a new NGO in Punjab. In 1979, Abdus Salam was honoured with the *Nobel Prize* in Physics.



S. Chowla (seated, centre, front row) with students and colleagues at Government College , Lahore in the early 1940's. Source: ICTP Library

Fakir Chand Kohli and Ram Prakash Bambah were both honoured with Padma Bhushan in

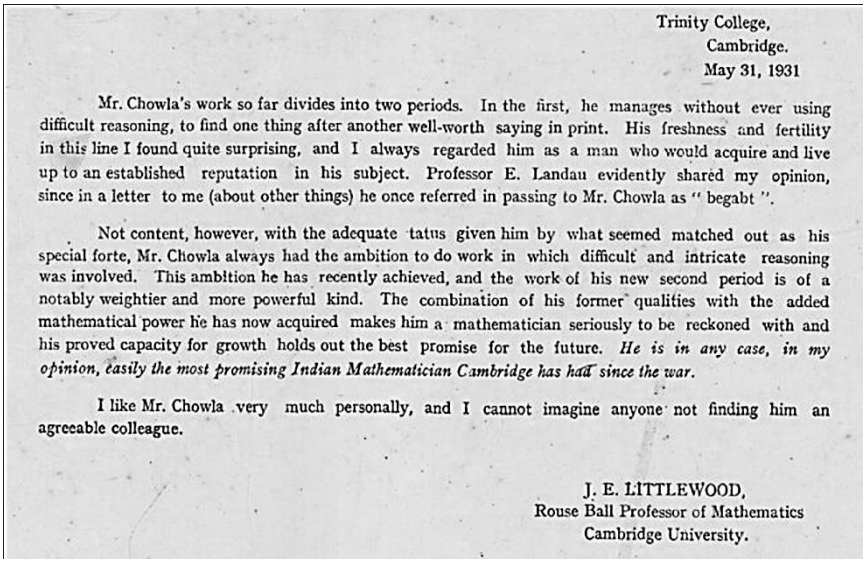
independent India. The latter had progressed to become the Vice Chancellor of Panjab University, Chandigarh from 1985 to 1991. However, he had needed help from his teacher Chowla to get his first teaching appointment. There was a moratorium on hiring in government jobs in Punjab soon after the second world war. Chowla, therefore, had to arrange for Bambah a stopgap assignment to teach Mathematics at Government College at Hoshiarpur, where Hans Raj Gupta was the Head of the Department of Mathematics. Bambah returned to Lahore to work as a research assistant to Chowla, and together they wrote 15 papers between April 1946 and February 1947. Thereafter, due to impending Partition of India, Bambah moved to Delhi to accept a leave vacancy position in lieu of F. C. Auluck, to teach Mathematical Physics to M.Sc. students at Delhi University. Dr. Auluck had proceeded on three years study leave to accept Senior Fellowship of National Institute of Sciences. Coincidentally, Dr. P. K. Kichlu had also left Lahore in January 1947 to join the Physics Department of Delhi University.

F. C. Kohli went on to became a co-founder and the first Chief Executive Officer (CEO) of Tata Consultancy Services (TCS). Raj Kumar Talwar later served as the Chairman of the State Bank of India. Jagdish Chandra Luther went on to become the Deputy Governor of the Reserve Bank of India. Mahendra Raj progressed to become one of India's most influential structural engineers, the designer of iconic buildings, like Mumbai's Usha Kiran, Hall of Nations at Pragati Maidan in Delhi, and the Salar Jung Museum in Hyderabad. He also worked in collaboration with Le Corbusier on the planning of Chandigarh.

1.4 From Post-Partition Struggles to Global Recognition

In July 1947, Chowla and his family were able to leave Lahore with the help of his wife's sister Sucheta Kriplani. Around this time, Chowla applied for a Senior Fellowship at the National Institute of Sciences in India, having already applied the previous year for a position at DU. Eminent mathematicians such as Mordell, Davenport, Littlewood, and Hardy wrote strong letters of recommendation for him. In one of them, Littlewood described him as "*the most promising Indian mathematician Cambridge has had since the war"* (see the picture below). Yet, despite such testimonials, Chowla, a professor from Lahore, was unable to secure a position in independent India.

At that time, universities had very few positions for faculty recruitment. Typically, in universities, there was only one professor in each department, who also served as its head. After independence, DU had no separate Department of Mathematics—mathematics professors were appointed only in the Department of Physics. Independent India was thus unable to accommodate many potential researchers in the basic sciences. To address this situation, the Government constituted the Radhakrishnan Commission on November 4, 1948 and Dr. Sarvepalli Radhakrishnan was appointed as its chairman (cf. Radhakrishnan, 1950). Evidently, S. Chowla could not wait for the recommendations of the committee to arrive. Had Chowla joined the Mathematics Department of Panjab University at Hoshiarpur, alongside Professor Bambah in 1950s, the academic history of this region might have been very much different.



Trinity College,
Cambridge.
May 31, 1931

Mr. Chowla's work so far divides into two periods. In the first, he manages without ever using difficult reasoning, to find one thing after another well-worth saying in print. His freshness and fertility in this line I found quite surprising, and I always regarded him as a man who would acquire and live up to an established reputation in his subject. Professor E. Landau evidently shared my opinion, since in a letter to me (about other things) he once referred in passing to Mr. Chowla as " begabt ".

Not content, however, with the adequate tatus given him by what seemed matched out as his special forte, Mr. Chowla always had the ambition to do work in which difficult and intricate reasoning was involved. This ambition he has recently achieved, and the work of his new second period is of a notably weightier and more powerful kind. The combination of his former qualities with the added mathematical power he has now acquired makes him a mathematician seriously to be reckoned with and his proved capacity for growth holds out the best promise for the future. *He is in any case, in my opinion, easily the most promising Indian Mathematician Cambridge has had since the war.*

I like Mr. Chowla very much personally, and I cannot imagine anyone not finding him an agreeable colleague.

J. E. LITTLEWOOD,
Rouse Ball Professor of Mathematics
Cambridge University.

Recommendation from his Ph.D. advisor J.E. Littlewood

In 1948, Professor Sarvadaman Chowla left Delhi on an official Government of India passport and joined a temporary lecturer position (supported by funds from India) at the Institute for Advanced Study in Princeton. There, he had world-famous number theorist colleagues such as Paul Turán, Carl Ludwig Siegel, Paul Erdős, and Atle Selberg. Thus began a new chapter for Chowla in the West. In U.S.A., he also worked at the University of Colorado and the University of Kansas. In 1963, he was appointed Research Professor at Pennsylvania State University, a position he held until his formal retirement in 1976. He continued research for a decade more.

During his long research career (1925–1986), he wrote 350 research papers and guided 25 Ph.D. students, including his own daughter, Promita Chowla. He collaborated with the leading number theorists of his era and wrote papers with about 60 co-authors. Numerous important theorems and results in mathematics bear his name. These include the Ankeny–Artin–Chowla congruence, Bruck–Ryser–Chowla theorem, the Chowla–Selberg formula, the Mian–Chowla sequence, and the Chowla–Mordell theorem. His collected works and correspondence with other leading mathematicians were published in three volumes by the Université de Montréal, Canada, in 1999, comprising a total of 1,417 pages. They trace a journey that began in Lahore's classrooms and culminated on the world stage of mathematics. According to Ayoub et al., Chowla was regarded as "*one of the best known number theorists from India to follow in the tradition of Ramanujan* whose *fertile and creative imagination"* earned him the epithet "*poet of mathematics"* among his contemporaries (see Ayoub et al. 1998).

Atle Selberg recalled that the death of Mrs. Himani Chowla around 1970 was a great blow to Chowla. His later years, Selberg noted, were clouded by ill health, financial difficulties, and an unwise lifestyle, though he remained unfailingly generous. was advised to move to Wyoming, where a Hindu resident cared for him. Selberg observed that, despite little exercise, Chowla's rugged constitution carried him to a ripe age. He recalled an excursion on the Trail Ridge Road—over 13,000 feet high—where he had run ahead of the group. Selberg saw Chowla sprinting uphill without losing breath, and remarked that *beneath*

his outlook there was hidden the makings of a Sikh

2. Hansraj Gupta: Pioneer of Partition Theory

Professor Hansraj Gupta

Chowla's key contribution at Govt. College Lahore was disproving a conjecture of Ramanujan. For this, he used the partition function tables published by Hansraj Gupta. This brought international recognition to Hansraj Gupta, who was born in Rawalpindi (now in Pakistan), then part of British India on October 9, 1902. His father, Jati Ram Gupta, served the then princely state of Patiala as a petty official.

Hansraj published a multi-year calendar during his school days (see pp. xvi–xvii, Hans-Gill, 2013). In 1923, it was displayed in London at the British Empire Exhibition, earning Hansraj a certificate of merit and a medal.

In the year 1925, Hansraj completed his M.A. with a high second division, ranking first in the university. After his M.A., however, he was jobless for a year and then worked at Sadiq Egerton College in Bahawalpur (now in Pakistan) for two years. In 1928, he joined as a mathematics teacher at Government Intermediate College, Hoshiarpur (GCH). In 1947, it attained the status of a degree college, and Hansraj Gupta was elevated to the position of Lecturer in Mathematics.

(see Huard et al. 1999 or Selberg 1995).

2.1 Early Education

After matriculating from University of Punjab at Lahore, in 1919, Hansraj Gupta passed the intermediate examination from Mohindra College, Patiala (MCP) in 1921, earning a first division and scholarships at both the school and college levels.

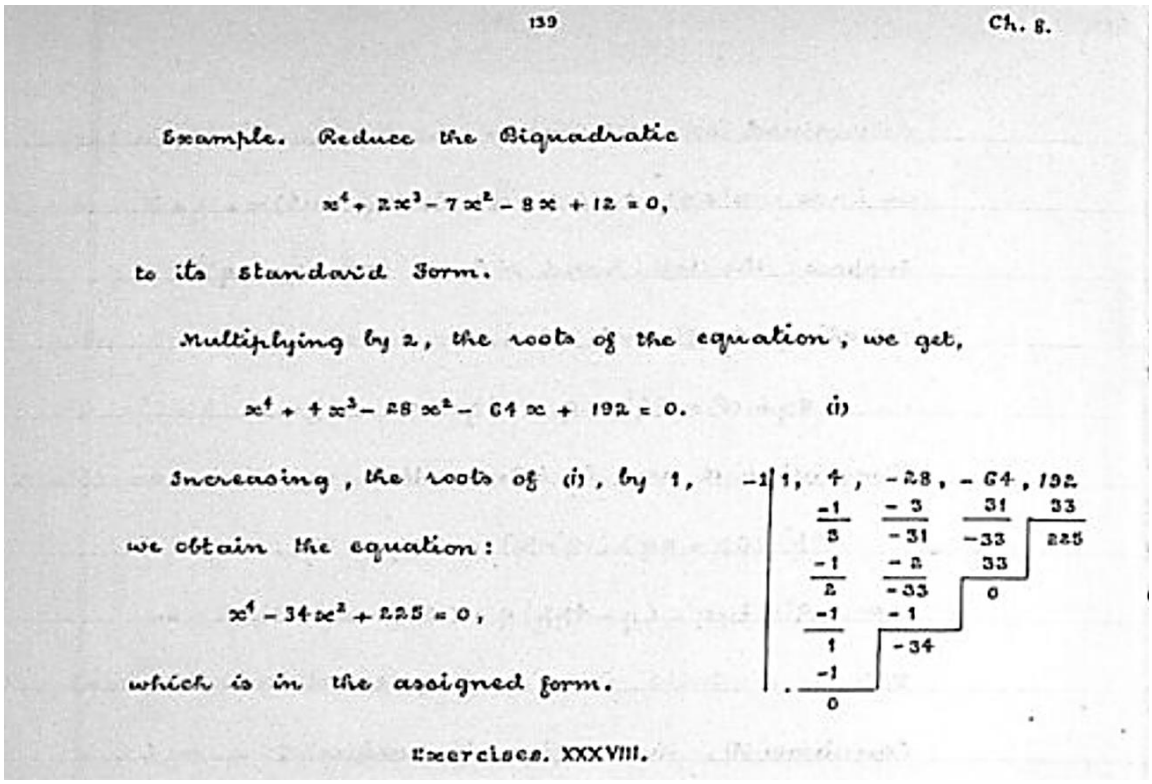
Hansraj Registered for M.A. in Mathematics at MCP which was affiliated with University of Punjab at Lahore. Since it lacked any formal teaching arrangements, Hansraj was not required to attend any classes, allowing him to complete it a year early. During 1924, he enrolled in the second year of his M.A. at Dyal Singh College in Lahore. The principal of this college, Pandit Hemraj was an esteemed educator and mathematician noted for his contributions to number theory and his leadership. He was also a member of the executive committee of the Indian Mathematical Society (IMS). At that time, university professors used to teach M.A. jointly at the three colleges in Lahore.

2.2 Later Career and Challenges

Because of limited academic facilities at Hoshiarpur, Hansraj regularly visited Lahore to consult books and scholarly journals in its libraries. Supported administratively by his Principal, Dr. Bihari Lal Bhatia (D.Sc., Zoology, Punjab University, 1932), he ultimately submitted his Ph.D. thesis to the University of Punjab, Lahore, in 1935. He was awarded the first Ph.D. in Mathematics in 1936 by PU in its over 50-years history. The thesis, entitled *Contribution to the Theory of Numbers,* was examined by J. E. Littlewood and G. H. Hardy, the two leading number theorists of the time. Hansraj Gupta's

handwriting was remarkably neat—almost resembling typescript—so he was given special permission to submit his thesis in handwritten form. Hansraj continued working at GCH until 1954.

Hansraj was promoted to the gazetted rank of the Punjab Education Service, Class II, in 1945, and later to Class I in 1954. Following Partition, GCH came under the administration of Panjab University, and Hansraj was appointed Professor at the Department of Mathematics. In 1958, this department was relocated to Chandigarh.



139 Ch. 8.

Example. Reduce the Biquadratic

$$x^4 + 2x^3 - 7x^2 - 8x + 12 = 0,$$

to its standard form.

Multiplying by 2, the roots of the equation, we get,

$$x^4 + 4x^3 - 28x^2 - 64x + 192 = 0. \quad \text{(i)}$$

Increasing, the roots of (i), by 1, we obtain the equation:

$$x^4 - 34x^2 + 225 = 0,$$

which is in the assigned form.

	1,	4,	−28,	−64,	192
−1		−3	31	33	
	3	−31	−33	225	
−1		−2	33		
	2	−33	0		
−1		−1			
	1	−34			
−1					
	0				

Exercises. XXXVIII.

A sample page from the notebook of Hansraj Gupta while he was at Dayal Singh College

At PU, his colleagues included Ram Prakash Bambah and Indar Singh Luthar. Under their leadership, the Mathematics Department at Panjab University, Chandigarh, made such rapid progress that the UGC granted it the status of a Centre for Advanced Study in Mathematics. After retiring in 1966, Hansraj continued his association with the Department of Mathematics as an Honorary Professor.

2.3 Passion for Partitions

For the greater part of his career, Hansraj Gupta served in small towns without adequate library facilities or fellow mathematicians for academic discussion. As a result, he was largely unaware of contemporary developments and did not even know that the problem he had chosen to investigate was not entirely new. Nonetheless, he developed a deep passion for partition theory and its congruence properties, to which he made significant contributions throughout his life. His first publication on the subject had title *A Table of Partitions.* With the publication of extended versions of these tables by the Royal Society of London in 1958, Dr. Hansraj Gupta gained international recognition, and the tables later found

applications in disciplines such as computer science and statistical mechanics.

Hansraj Gupta recalled that sometime in 1929 or 1930, a student brought him a problem from an algebra textbook that stated, *"In how many ways can four mangoes be distributed among four persons when there is no restriction as to the number of mangoes any of them may receive?"* (see Chopra, 2024).

The student had previously approached another teacher, who assumed the mangoes to be all distinct and arrived at the answer $4^4 = 256$. As this did not agree with the answer provided in the book, the student approached Prof. Hansraj Gupta for an explanation. Professor Gupta assumed the mangoes to be indistinguishable and approached the problem accordingly. The answer agreed with the textbook, and the student was pleased that the problem had been resolved correctly. Yet, as Prof. Hansraj Gupta later noted:

"Here the student's problem ended, but mine had begun. I had noticed that what I had done was to partition 4 into at most four parts. I asked myself: 'How many partitions will a given number have into a given number of parts?' This is what I started investigating." (see Chopra, 2024).

Professor Hansraj Gupta was elected as President of the Indian Mathematical Society (IMS) in 1963. In December of that year, at the 29th Annual Conference of the IMS in Madras, he presented a presidential (technical) address on the topic "Partitions: A Survey," where he reviewed various types of partitions and related problems. He worked in discrete mathematics and combinatorics, and made significant contributions to partition theory.

Professor Hansraj Gupta published around 70 research papers on partitions, solved numerous conjectures, and posed many original problems. During an academic career spanning more than six decades, he published 190 research papers, six books and monographs, and collaborated with 16 mathematicians.

3. Ram Parkash Bambah: An Institution Builder

Professor Ram Parkash Bambah

Another legendary number theorist of the Panjab School of Mathematics was Professor Ram Prakash Bambah**,** a distinguished student of S. Chowla at GCL. He passed away earlier this year, on May 26, 2025, in the hundredth year of his life. To honour his remarkable contributions to mathematics, the Department of Mathematics had planned to organize an international conference as part of the centenary celebrations of Professor Bambah's birth. We had all eagerly looked forward to celebrate his 100th birthday with him on September 30, 2025, but destiny had other plans. He left us merely four months before reaching that extraordinary milestone. While he is no longer with us in person, his spirit, scholarship, and vision continue to illuminate our paths.

Ram Parkash's father, Bhagat Ram Bambah, was a Railway Guard who later rose to become a Chief Yard Master. His mother, Lajwati, had no formal education but possessed a sharp mind for mental calculation, having learned to calculate and write Punjabi at a Gurdwara school. Ram Parkash

Bambah was the sixth child in the family, with only two surviving elder sisters.

In 1954, while returning from England by ship, Bambah met Saudamini Parija who was also returning India after becoming a Fellow of the Royal Colleges of Physicians at U.K. She was the daughter of Prana Krushna Parija, a Padma Bhushan awardee and former Vice-Chancellor of Utkal University. They got married on 23rd February 1956 and were blessed with a daughter in a year, Bindu Bambah who grew up to be a famous physicist with a doctorate from University of Chicago. Bindu has a younger sister Sucharu Bambah.

The Bambahs were known for their warm hospitality on Panjab University campus. Saudamini was quite active in the social life of the campus and of Chandigarh at large. She served as member of the PGI Ethics Committee at PGI Chandigarh and President of the Chandigarh Chapter of the Indian Society of Blood Transfusion. She was also one of the founders of Ankur School on the PU campus. Saudamini passed away on 14th November 2011 after a brief illness (see Aravinda et al. 2020 and Hans-Gill et al. 2015).

3.1 From Lahore to Cambridge

In 1946, after his M.A. and a brief stint in undergraduate teaching, Chowla enabled R. P. Bambah to obtain a research scholarship at GCL. Chowla introduced Bambah to the τ–function of Ramanujan, and the latter proved several results for this function. During 1936–1940, Hardy presented a series of lectures on the work of Ramanujan, the 10^{th} lecture of which was on the τ function. Bambah was highly inspired by these talks and published a series of 10 research papers along with S. Chowla, D. B. Lahiri, and Hansraj Gupta on this function. The τ-function holds a central place in modern mathematics due to its deep connections with elliptic curves, modular forms, and other key concepts, that were instrumental in proving Fermat's Last Theorem.

In late 1945, while awaiting his official M.A. results, a serendipitous opportunity arose. Professor Chowla recommended him to Hansraj Gupta at Government College, Hoshiarpur, to fill in for a faculty member on leave. Bambah went merely to "see the place," but Gupta, a man of action and generosity, took him to meet the Principal. "You start teaching tomorrow," the Principal declared. Unprepared, with few belongings and no place to stay, Bambah was hesitant. But Gupta, with a kindness that would define their lifelong friendship, offered him a bed in his own home and even lent him shirts. This three-month period in Hoshiarpur solidified a deep bond between Bambah and the Gupta family (see Aravinda et al. 2020 or p. 66-67 Mukherjee, 2020).

In February 1947, Bambah joined Delhi University at the invitation of D. S. Kothari, taking up the Research Fellowship earlier held by F. C. Auluck. This fellowship was supported by the National Institute of Science of India, presently known as the Indian National Science Academy (see Aravinda et al. 2020). He was strongly supported by both Kothari and Auluck. Acting on their advice, he applied for the '1851 Exhibition Scholarship' and subsequently earned his Ph.D. in 1950 from the University of Cambridge, working under the eminent number theorist L. J. Mordell.

Around this period, H. Minkowski developed geometric approaches for proving inequalities related to numbers, which eventually evolved into the thrust area of number theory, now known as the 'Geometry of Numbers'. Bambah worked in this vibrant environment, surrounded by eminent

number theorists working in the 'golden age' of this area. In 1951, he produced four research papers from his thesis, further developing results previously published by Mordell.

During the final year of his '1851 Exhibition Scholarship', Bambah spent some time at University College, London. In 1950–51, he co-authored three papers with C. A. Rogers, H. Davenport, and K. F. Roth, the latter being a future Fields Medallist (1958). Between 1952 and 1955, he was an elected Fellow of St John's College, Cambridge, an honour earlier conferred on Abdus Salam, a student of Chowla. In 1951, Bambah returned to India and rejoined his earlier post at Delhi University, and in 1952 he was appointed Reader at Panjab University, Hoshiarpur (Mukherjee, 2020, pp. 66–67).

3.2 Establishing a Centre for Mathematical Excellence

In 1952, at the time of his appointment as Reader at Panjab University (PU), Hoshiarpur, Bambah received an offer of membership at the Institute for Advanced Study, Princeton. The then Vice-Chancellor of PU sanctioned special leave, allowing him to spend two years in the U.S.A. He returned in 1954 to continue teaching at Hoshiarpur with Dr. Hansraj Gupta, teaching M.A. classes.

After a stint of another year at Notre Dame University (1957–1958) on leave of absence, Dr. Bambah returned to contribute to the development of a vibrant Department of Mathematics at Panjab University, Chandigarh, along with Hansraj Gupta. Their efforts were supported by successive Vice-Chancellors and strengthened by new initiatives under the UGC. Bambah's academic partnership with Hansraj Gupta was remarkable, especially in an academic environment often marked by strong individualism. Their collaboration ensured the continuation of the Punjab School of Mathematics in post-independence India. Bambah was subsequently promoted to Professor. With faculty members such as Bambah, Luthar, and Gupta, the Department of Mathematics at Chandigarh attained UGC Centre for Advanced Study (CAS) status as early as 1963. In 1983, when the Government of India established the National Board for Higher Mathematics, this centre was selected as its first regional hub.

3.3 Research Contributions

Bambah made notable contributions to number theory, geometry of numbers, theory of coverings, in determining thinnest lattice coverings, densities of spheres, advancing work begun by Dirichlet in 1842 and inspiring further developments in the field. Professor Bambah, along with his students Vishwa Chander Dumir and Rajinder Jeet Hans-Gill, contributed notably to non-homogeneous quadratic forms, covering problems and Minkowski's conjecture.

In 1899, the conjecture was proved by Minkowski for n=2. By the early 1970s, proofs had been given by various mathematicians for n= 3, 4 and 5, but these proofs were complicated, and for n=5 the proof was not quite rigorous. Bambah, together with A. C. Woods, provided proofs in these cases which were simpler and rigorous. He continued to work on related problems and promoted studies on the conjecture. Later, Professors R. J. Hans-Gill, Madhu Raka, and Dr. Leetika of the Punjab School of Mathematics extended this work for n = 7, 8 and 9.

Bambah authored around 70 research papers during 1946 to 2000. He was designated as Emeritus Professor of Mathematics at Panjab

University in 1993, two years after he relinquished Vice Chancellorship (1984-91) at PU. He received a Sc D degree (Doctor of Science) from Cambridge University in 1970 (see Hans-Gill, 2013). He was also awarded D.Sc. (*Honoris Causa)* by PU for his outstanding contributions in 2016. Professor Bambah held elected Fellowships of all three major Indian science academies—the Indian National Science Academy, the Indian Academy of Sciences, and the National Academy of Sciences—and was additionally a Fellow of The World Academy of Sciences (TWAS).

3.4 A Rich Mathematical Tapestry: Notable Women and Others at PU

Apart from the above three stalwarts, the Punjab School has produced several other notable mathematicians. Among them, Professor Indar Singh Luthar stands out for his contributions to diverse branches of number theory. His four Ph.D. students—Jagdish Chander Parnami, Sudesh Kaur Khanduja, Ashwani Kumar Bhandari, and Poonam Trama—served as faculty members in this department until their superannuation. A prolific writer, Professor Luthar, together with another stalwart of this department, Professor Inder Bir Singh Passi, authored a remarkable four-volume series of textbooks on Groups, Rings, Modules, and Fields.

Professor A. R. Rajwade, another prominent number theorist of the Punjab School, made significant contributions to Algebraic Number Theory, particularly in three areas: cyclotomy and roots of unity, arithmetic on elliptic curves with complex multiplication, and products and sums of squares in rings and fields. His collaborators included Dr. M. K. Agarwal, Dr. J. C. Parnami, and several of his students. Notably, he verified the Swinnerton-Dyer conjecture for elliptic curves. Professor S. A. Katre, a student of Professor Rajwade, advanced work in cyclotomy by resolving ambiguities in cyclotomic numbers and Jacobi sums.

Among India's distinguished number theorists is Professor Rajinder Jeet Hans-Gill, who completed her B.A. (Hons.) and M.A. (Hons.) from Government College, Ludhiana, and later joined the Department of Mathematics at Panjab University for her Ph.D., where she worked under the supervision of Professor Bambah. In 1962, Bambah left for Ohio State University for a period of about two years, and fellowships were arranged there for his research scholars as well. Accordingly, Hans-Gill and Dumir moved to the United States and earned their Ph.D. degrees from Ohio State University in 1965 under Bambah's supervision. Their research contributions covered number theory and the geometry of numbers, particularly in maximal and minimal packing and covering problems, non-homogeneous quadratic forms, and work related to a conjecture of Watson. Professor Hans-Gill was awarded the D.Sc. (Honoris Causa) by Panjab University in 2025.

Another leading woman number theorist from the Punjab School is Professor Madhu Raka, who completed her Ph.D. under Professor Hans-Gill in 1979. She is widely recognized for contributions to the Geometry of Numbers and Algebraic Coding Theory. She is a Fellow of NASI and currently a NASI Senior Scientist (Platinum Jubilee Fellow) at Panjab University, she has helped resolve significant cases of classical conjectures—particularly those of Minkowski, Woods and Watson in higher dimensions.

Professor Sudesh Kaur Khanduja is another prominent woman number theorist from the Punjab School. She topped in PU in all years of her B.A. in Mathematics from Dev Samaj College for Girls, Ambala and completed her M.A. and Ph.D.

at Panjab University, Chandigarh, under the supervision of Professor I. S. Luthar in 1976. Her main research interests lie in Algebraic Number Theory, Function Field Theory, and Valuation Theory. She notably generalized the classical Schönemann–Eisenstein and Ehrenfeucht–Tverberg irreducibility criteria using Valuation Theory. Additionally, she extended certain theorems of Dedekind to valued fields. She has developed novel approaches to deal with classical problems in Algebraic Number Theory through the use of valuations, thereby enabling the potential extension of classical results to a broader class of rings.

Both Professor R. J. Hans-Gill and Professor S. K. Khanduja are Fellows of all three major science academies of India and of TWAS.

Enduring Legacy that Continues to Inspire

To conclude, the coincidence of the hundred years of the Punjab School of Mathematics and the birth centenary of Professor R. P. Bambah marks a special moment for the mathematical community to reflect and celebrate. Beginning with the seminal contributions of Sarvadaman Chowla and distinguished figures such as Hansraj Gupta, and culminating in the far-reaching influence of Professor Bambah, the Punjab School of Mathematics developed a unique identity in number theory. Through pathbreaking research, engagement with leading global luminaries, and committed mentorship, they laid the foundations of a thriving mathematical culture in North India.

Four mathematicians of PU have received the coveted CSIR-Shanti Swarup Bhatnagar Prize in Mathematics, namely, Surinder Kumar Trehan (1931–2004) in 1976, Inder Bir Singh Passi (1939–2020) in 1983, Surender Kumar Malik (1942–2001) in 1985, and Tarlok Nath Shorey (1945-) in 1987. Panjab University has produced five mathematicians who went on to serve as Presidents of the Indian Mathematical Society (IMS), namely, Hansraj Gupta (1963–64), R. P. Bambah (1969–70), I. B. S. Passi (2006–07), A. K. Aggarwal (2008–09), and Madhu Raka (2024–25).

Appendix

The Department of Mathematics recently organized an International Conference on Algebra and Number Theory to commemorate the birth centenary of Professor R. P. Bambah. The event featured 12 distinguished speakers from India and abroad and attracted more than 120 participants (see Kainth, 2025). In this conference, Professor Sudesh Kaur Khanduja awarded three Best Paper Presentation Awards and proposed to donate more funds to ensure the continuation of these awards every year in celebration of Professor Bambah's birthday.

In 2015, Panjab University instituted the Annual Sarvadaman Chowla Memorial Lecture to commemorate the legacy of Professor Sarvadaman Chowla. The inaugural lecture, delivered by Fields Medallist Professor Manjul Bhargava to mark the 90th birth anniversary of Professor R. P. Bambah, set an inspiring precedent. This lecture series continues to encourage and shape young researchers in the discipline.

It is pertinent to add that the Mathematics Department block on the PU campus is named *Hans Raj Gupta Hall* and the *International Guest House of PU is named after Sarvadaman Chowla.* From September 30, 2025 onwards, the Auditorium of the Department of Mathematics has been named the *Professor R. P. Bambah Auditorium.*

ACKNOWLEDGEMENTS: The authors are indebted to Professor Sudesh Kaur Khanduja for

her constructive feedback, which substantially strengthened this article.

References

Aravinda, C. S. and Rao, S. 2020. From the Land of Five Rivers: R. P. Bambah in conversation with C. S. Aravinda and Sudhir Rao, *Bhāvanā: The Mathematics Magazine*, January 2020, 4 (1). https://bhavana.org.in/from-the-land-of-five-rivers/

Ayoub, R. G., Huard, J. G., and Williams, K. S. 1998. Sarvadaman Chowla (1907–1995), *Notices of the American Mathematical Society*, May 1998, 45(5). https://www.ams.org/notices/199805/comm-chowla.pdf

Chopra, S. D. 2024. Hansraj Gupta: Fountainhead of a Continuing Legacy. *Bhāvanā: The Mathematics Magazine*. January 2024, 8(1). https://bhavana.org.in/hansraj-gupta-fountainhead-of-a-continuing-legacy/

Chowla, S. 1924. Questions 1346 and 1348, Journal of the Indian Mathematical Society, Vol. 15, 167.

Hans-Gill, R. J., and Raka, M. (Eds.). 2013. *Collected Papers of Professor Hansraj Gupta*, Ramanujan Mathematical Society, (Vol. 1).

Hans-Gill, R. J. and Khanduja, S. K. 2015. *R. P. Bambah: Renowned mathematician, enthusiastic teacher and an able administrator*, Living Legends in Indian Science, Current Science, 109(6), 1182-1183.

Huard, J. G., and Williams, K. S. 1999. *The Collected Papers of Sarvadaman Chowla. Volume I, 1925–1935*. Centre de Recherches Mathématiques, Université de Montréal.

Johnson, G. 2025. Chen Ning Yang, Nobel-Winning Physicist, Is Dead at 103, *The New York Times*, 18 Oct. 2025. https://www.nytimes.com/2025/10/18/science/chen-ning-yang-dead.html

Kainth, S. P. S. 2025 Celebrating 100 Years of Prof. R. P. Bambah, The Mathematics Consortium Bulletin, October 2025, 7(2), 27-28.

Kainth, S. P. S. and Grover, A. K. 2025, 100 years of Punjab School of Mathematics, The Tribune, November 2, 2025, https://www.tribuneindia.com/news/spectrum/100-years-of-punjab-school-of-mathematics/

Mukherjee, P. 2020. *Research Schools on Number Theory in India,* Springer.

Radhakrishnan, S. 1950. *The Report of the University Education Commission, December 1948-August 1949,* Ministry of Education, Government of India

Selberg, A. 1995. Letter on Sarvadaman Chowla, Shelby White and Leon Levy Archives Center, Institute for Advanced Study, Princeton, NJ. https://albert.ias.edu/entities/archivalmaterial/684a0d64-38cc-44dc-ab81-f94230abc0c7

Sethi, R. R. and Mehta, J. L. 1968. A History of the Panjab University, Chandigarh, 1947-1967, Panjab University Publication Bureau.

Sinha, K. 2023. Sarvadaman Chowla: The Perpetual Ambassador for Number Theory, *Bhāvanā: The Mathematics Magazine*, 2023, 7(2).

https://bhavana.org.in/sarvadaman-chowla-the-perpetual-ambassador-for-number-theory/

Sury, B., and Thangadurai, R. 2012. “S. Chowla and S. S. Pillai: The Story of Two Peerless Indian Mathematicians.” *Resonance*, Sept. 2012, 17(9), 855-883.

https://www.isibang.ac.in/~sury/chowlapillai.pdf