Shree H. N. Shukla Group of Colleges, Rajkot

Bachelor of Computer Applications

Sem-1

CS-07 Mathematics in Ancient India: Exploring the rich Heritage of Vedic Mathematics

UNIT-2

Biography of Remarkable Indian Mathematicians

In this unit we will study the biography of following great Indian mathematicians

- Srinivasa Ramanujan
- C. R. Rao
- P. C. Mahalanobis
- D. R. Kaprekar
- Satyendranath Bose
- Shakuntala Devi

SRINIVASA RAMANUJAN

- Srinivasa Ramanujan was a great Indian mathematician. He is counted among the greatest mathematicians of modern times.

- He was the second Indian to become a member of the Royal Society and the first to become a member of Trinity College in Cambridge.

- Based on his talent and passion, he made wonderful inventions in mathematics and simultaneously illuminated the name of India in the whole world.

- He contributed Mathematical Analysis, Number Theory, Infinite Serie and continued Fractions.

Early Life

- Ramanujan was born on December 22, 1887, in the village of Kumbakonam, Tamil Nadu, to a Brahmin family. His father worked as a clerk in sari store, while his mother was a homemaker who sang at a neighboring temple.

- They lived in a small traditional home on Sarangapani Sannidhi Street in the town of Kumbakonam. The family home is now a museum.

- Ramanujan's intellectual growth as a youngster differed from that of other children. Ramanujan did not learn to talk until he was three years old. As a result, his parents wondered if he was mentally ill.

Adulthood in India

- On 14 July 1909, Ramanujan married Janaki (Janakiammal; 21 March 1899 – 13 April 1994), a girl his mother had selected for him a year earlier and who was ten years old when they married.

- After the marriage, Ramanujan developed a hydrocele testis. The condition could be treated with a routine surgical operation that would release the blocked fluid in the scrotal sac, but his family could not afford the operation. In January 1910, a doctor volunteered to do the surgery at no cost.

- After his successful surgery, Ramanujan searched for a job. He stayed at a friend's house while he went from door to door around Madras looking for a clerical position. To make money, he tutored students at Presidency College who were preparing for their Fellow of Arts exam.

Contacting English Mathematicians

- Ramanujan wrote to G.H. Hardy, he was an academician at Cambridge University, he was a prominent English Mathematician, known for his achievements in Number Theory and Mathematical Analysis.
- Hardy recognized some of his formula but other seemed scarcely possible to believe.
- Hardy's one colleague, E. H. Neville, later remarked that "not one [theorem] could have been set in the most advanced mathematical examination in the world".
- Hardy invited Ramanujan to Cambridge but Ramanujan refused to leave his country to "go to a foreign land".

Ramanujan's Honours

- Ramanujan was awarded a Bachelor of Arts by Research degree(later calledPhD degree) in March 1916 for his work on highly composite numbers.
- On 6 December 1917, Ramanujan was elected to the London Mathematical Society.
- On 2 May 1918, he was elected a Fellow of the Royal Society, the second Indian admitted, after Ardaseer Cursetjee in 1841. At age 31, Ramanujan was one of the youngest Fellows in the Royal Society's history.
- On 13 October 1918, he was the first Indian to be elected a Fellow of Trinity College, Cambridge.

Illness & Death

- Ramanujan had numerous health problems throughout his life.
- He was diagnosed with tuberculosis and a severe vitamin deficiency, and confined to a sanatorium.
- In 1919, he returned to Kumbakonam, Madras Presidency, and in 1920 he died at the age of 32.
- After his death, in 1994 Dr. D.A.B. Young analysed his records and concluded he had hepatic amoebiasis.

Personality & Spiritual life

- A person with a somewhat shy and quiet disposition, a dignified man with pleasant manners.
- He credited his acumen to his family goddess, Namagiri Thayar (Goddess Mahalakshmi) of Namakkal.
- Ramanujan often said, "An equation for me has no meaning unless it expresses a thought of God."

Ramanujan-Hardy Number

- The number 1729 is known as the Hardy–Ramanujan number.

- Hardy arrived in a cab numbered 1729 to see Ramanujan at a hospital. In hardy's words:

I remember once going to see him when he was ill at Putney. I had ridden in taxi cab number 1729 and remarked that the number seemed to me rather a dull one, and that I hoped it was not an unfavourable omen. "No", he replied, "it is a very interesting number; it is the smallest number expressible as the sum of two cubes in two different ways."

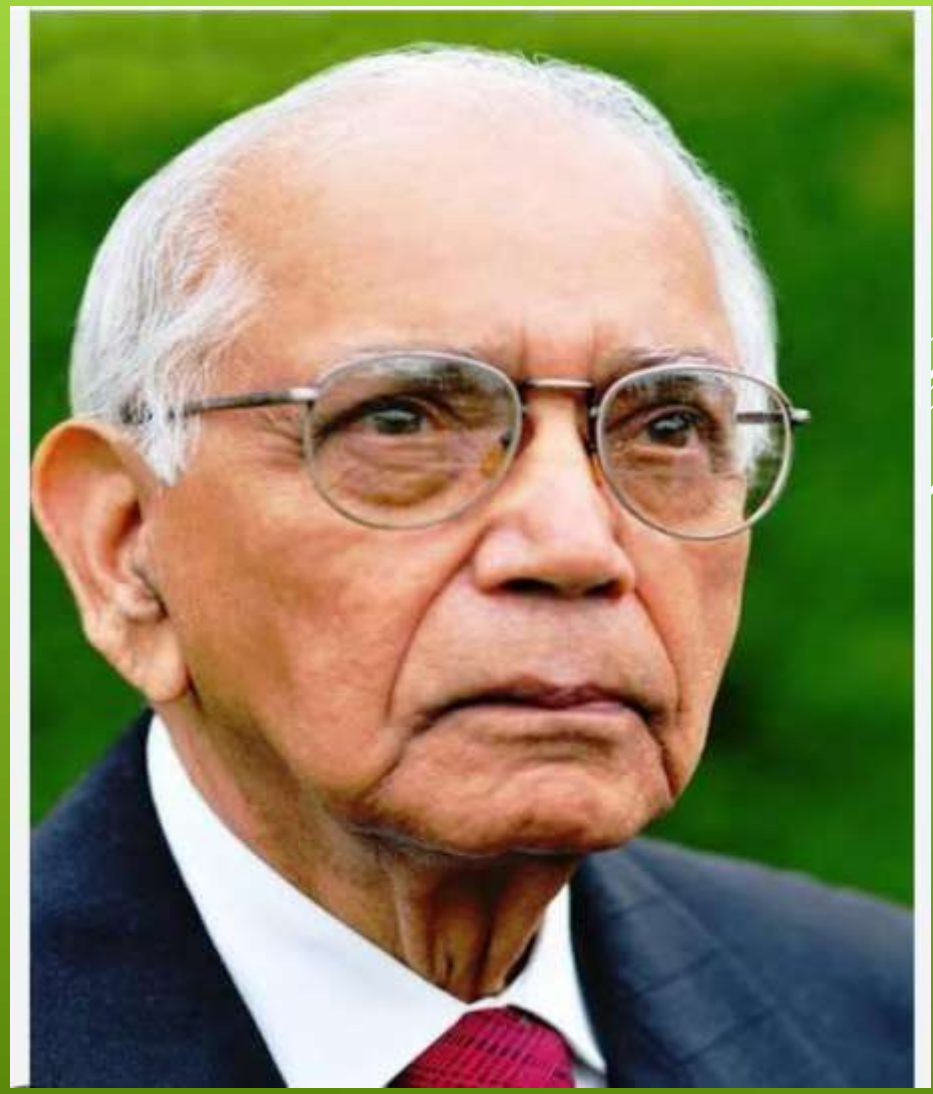
$$1729 = 1^3 + 12^3 = 9^3 + 10^3$$

Recognition

- Ramanujan's home state of Tamil Nadu celebrates 22 December (Ramanujan's birthday) as 'State IT Day'.
- 22 December annually celebrated as Ramanujan Day by the Government Arts College, Kumbakonam, where he studied, and at the IIT Madras in Chennai.
- In 2011, on the 125th anniversary of his birth, the Indian government declared that 22 December will be celebrated every year as National Mathematics Day. Then Indian Prime Minister Manmohan Singh also declared that 2012 would be celebrated as National Mathematics Year and 22 December as National Mathematics Day of India.

CALYAMPUDI RADHAKRISHNA RAO

- **Calyampudi Radhakrishna Rao** was an Indian-American mathematician and statistician.
- He was professor emeritus at Pennsylvania State University and Research Professor at the University at Buffalo.
- Rao was honored by numerous colloquia, honorary degrees, and festschrifts and was awarded the US National Medal of Science in 2002.



- The American Statistical Association has described him as "a living legend whose work has influenced not just statistics, but has had far reaching implications for fields as varied as economics, genetics, anthropology, geology, national planning, demography, biometry, and medicine.“
- *The Times of India* listed Rao as one of the top 10 Indian scientists of all time.
- In 2023, Rao was awarded the International Prize in Statistics, an award often touted as the "statistics’ equivalent of the Nobel Prize".
- Rao was also a Senior Policy and Statistics advisor for the Indian Heart Association non-profit focused on raising South Asian cardiovascular disease awareness.

Early Life

- Calyampudi Radhakrishna Rao was born on 10 sep, 1920 at hadagali in Karnataka, India.
- His schooling was completed in Gudur, Nuzvid, Nandigama, and Visakhapatnam, all in the present state of Andhra Pradesh.
- He received an MSc in mathematics from Andhra University and an MA in statistics from Calcutta University in 1943.
- He obtained a PhD degree at King's College, Cambridge, under R. A. Fisher in 1948, to which he added a DSc degree, also from Cambridge, in 1965.

Career

- Rao first worked at the Indian Statistical Institute and the Anthropological Museum in Cambridge.

- Later he held several important positions, as the Director of the Indian Statistical Institute, Jawaharlal Nehru Professor and National Professor in India, University Professor at the University of Pittsburgh and Eberly. Professor and Chair of Statistics and Director of the Center for Multivariate Analysis at Pennsylvania State University.

- As Head and later Director of the Research and Training School at the Indian Statistical Institute for a period of over 40 years, Rao developed research and training programs and produced several leaders in the field of Mathematics. On the basis of Rao's recommendation, the Asian Statistical Institute (ASI), now known as the Statistical Institute for Asia and Pacific, was established in Tokyo to provide training to statisticians working in government and industrial organizations.

- Among his best-known discoveries are the Cramér–Rao bound and the Rao–Blackwell theorem both related to the quality of estimators. Other areas he worked in include multivariate analysis, estimation theory, and differential geometry. His other contributions include the Fisher–Rao theorem, Rao distance, and orthogonal arrays. He was the author of 14 books and published over 400 journal publications.

- Rao received 38 honorary doctoral degrees from universities in 19 countries around the world and numerous awards and medals for his contributions to statistics and science. He is a member of eight National Academies in India, the United Kingdom, the United States, and Italy.

Areas of Research Contributions

- Estimation theory
- Statistical inference & linear models
- Multivariate Analysis
- Combined Designs
- Orthogonal Arrays
- Biometry
- Statistical Genetics
- Generalized Matrix Inverses
- Functional equations

Awards

- Rao has received 38 honorary doctoral degrees from universities in 19 countries around the world and numerous awards and medals for his contributions to statistics and science.
- Rao was awarded with the United States ***National Medal of Science***, which is the nation's highest award for lifetime achievement in fields of scientific research, in June 2002.
- He was given the ***India Science Award*** in 2010, the highest honor conferred by the government of India in a scientific domain. In 2013, he was nominated for the Nobel Peace Prize, along with Miodrag Lovric and ***Shlomo Sawilowsky***, for their contribution to the ***International Encyclopedia of Statistical Science***.
- He was most recently honored with his 38th honorary doctorate by the Indian Institute of Technology, Kharagpur, on 26 July 2014 for his contributions to the foundations of modern statistics.

- He has received many recognitions including the ***Padma Bhushan*** and fellow of the Royal Society UK.

- He was awarded with the ***Padma Vibhushan.***

- The ***American Statisticalc Association*** has described him as "a ***living legend*** whose work has influenced not just statistics, but has had far reaching implications for fields as varied as economics, genetics, anthropology, geology, national planning, demography, biometry, and medicine.

- The C. R. Rao Award for statistics was instituted in his honor, to be given in 2 years.

Recognition & Death

- He died in Buffalo, New York, U.S., on 22 August 2023, at the age of 102.
- The Pennsylvania State University has established C. R. and Bhargavi Rao Prize in Statistics.
- C R Rao Advanced Institute of Mathematics, Statistics and Computer Science.
- National Award in Statistics established by Ministry of Statistics and Programme Implementation (MoSPI), Government of India.
- The road from IIIT Hyderabad passing along Central University of Hyderabad crossroads to Alind Factory, Lingampally is named as "Prof. C.R. Rao Road".

PRASANTA CHANDRA MAHALANOBIS

- **Prasanta Chandra Mahalanobis** was an Indian scientist and statistician.
- He is best remembered for the Mahalanobis distance, a statistical measure, and for being one of the members of the first Planning Commission of free India.
- He made pioneering studies in anthropometry in India.
- He founded the Indian Statistical Institute, and contributed to the design of large-scale sample surveys.
- For his contributions, Mahalanobis has been considered the Father of statistics in India.

Early Life

- Prasanta Chandra Mahalanobis was born on 29th June,1893 at Calcutta, Bengal.
- Mahalanobis received his early schooling at the Brahmo Boys School in Calcutta, graduating in 1908.
- He joined the Presidency College, then affiliated with the University of Calcutta, where he was taught by teachers who included Jagadish Chandra Bose, and Prafulla Chandra Ray. Others attending were Meghnad Saha, a year junior, and Subhas Chandra Bose, two years his junior at college.

- Mahalanobis received a Bachelor of Science degree with honours in physics in 1912. He left for England in 1913 to join the University of London.
- After missing a train, he stayed with a friend at King's College, Cambridge. He was impressed by King's College Chapel and his hostel's friend M. A. Candeth suggested that he could try joining there, which he did.
- He interacted with the mathematical genius Srinivasa Ramanujan during the latter's time at Cambridge.
- After his Tripos in physics, Mahalanobis worked with C. T. R. Wilson at the Cavendish Laboratory.

- He took a short break and went to India, where he was introduced to the Principal of Presidency College and was invited to take classes in physics.

- After returning to England, Mahalanobis was introduced to the journal *Biometrika*. This interested him so much that he bought a complete set and took them to India.

- He discovered the utility of statistics to problems in meteorology and anthropology, beginning to work on problems on his journey back to India.

Indian Statistical Institute

- Many colleagues of Mahalanobis took an interest in statistics. An informal group developed in the Statistical Laboratory, which was located in his room at the Presidency College, Calcutta.

Contributions to statistics

1. Mahalanobis distance

2. Sample survey

Later Life

- In later life, Mahalanobis was a member of the planning commission contributed prominently to newly independent India's five-year plans starting from the second. In the second five-year plan he emphasized industrialization on the basis of a two-sector model.
- In the 1950s, Mahalanobis played a critical role in the campaign to bring India its first digital computers.

- Mahalanobis also had an abiding interest in cultural pursuits and served as secretary to Rabindranath Tagore (about whom he would write in the *Journal of the Oriental Society of Australia*), particularly during the latter's foreign travels, and also worked at his Visva-Bharati University, for some time.
- He received India's second highest civilian award, the Padma Vibhushan from the Government of India for his contribution to science and services to the country.
- Mahalanobis died on 28 June 1972, a day before his seventy-ninth birthday.

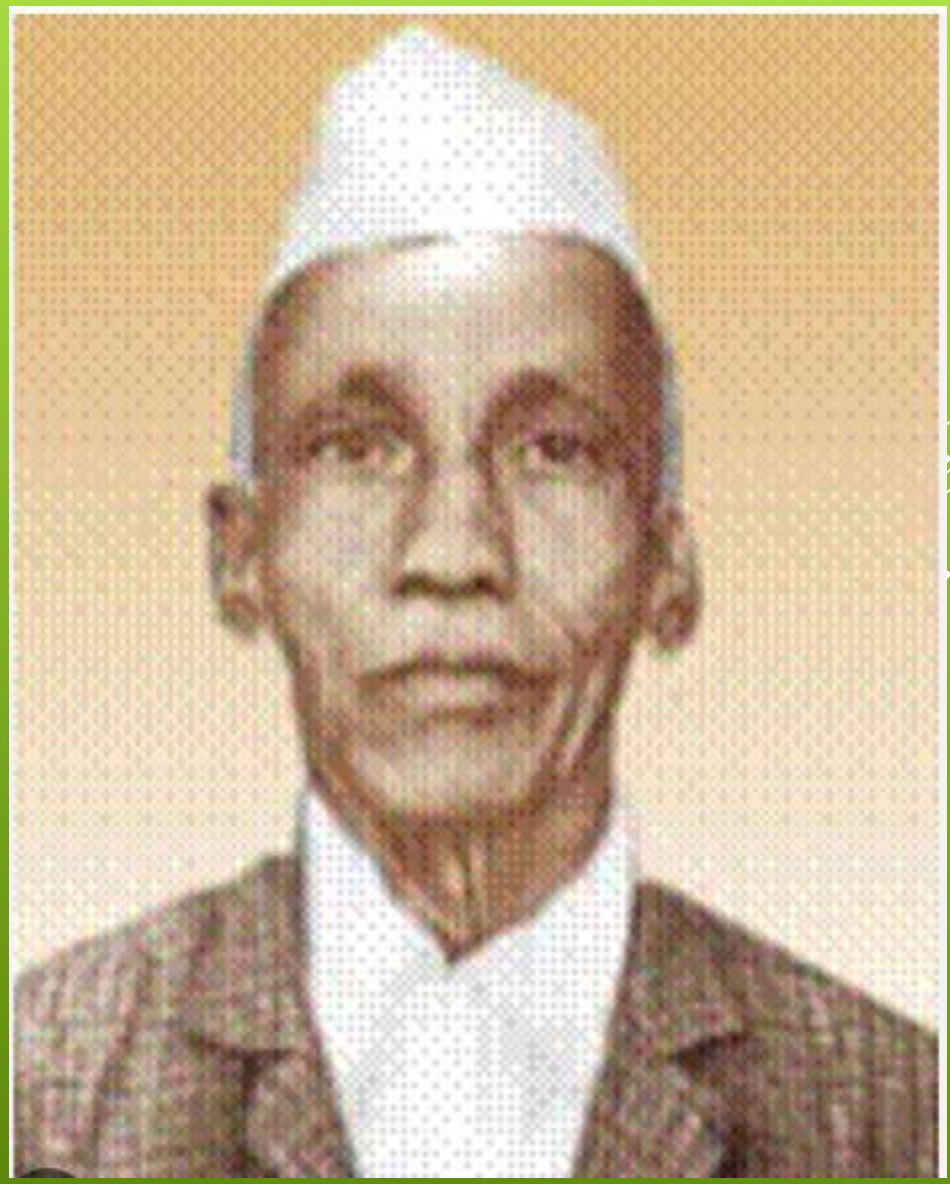
Honours

- Fellow of the Indian Academy of Sciences (FASc, 1935)
- Fellow of the Indian National Science Academy (FNA, 1935)
- Officer of the Order of the British Empire (Civil Division), 1942 New Year Honours list.
- Weldon Memorial Prize from the University of Oxford (1944)
- Fellow of the Royal Society, London (1945)
- President of Indian Science Congress (1950)
- Fellow of the Econometric Society, US (1951)
- Fellow of the Pakistan Statistical Association (1952)
- Honorary Fellow of the Royal Statistical Society, UK (1954)

- Sir Deviprasad Sarvadhikari Gold Medal (1957)
- Foreign member of the Academy of Sciences of the USSR (1958)
- Honorary Fellow of King's College, Cambridge (1959)
- Fellow of the American Statistical Association (1961)
- Durgaprasad Khaitan Gold Medal (1961)
- Desikottam by Visva Bharati University (1961)
- Padma Vibhushan (1968)
- Srinivasa Ramanujan Gold Medal (1968)
- The government of India decided in 2006 to celebrate Prasanta Chandra Mahalanobis's birthday, 29 June, every year as "National Statistics Day" of India.

DATTATREYA RAMCHANDRA KAPREKAR

- Dattatreya Ramchandra Kaprekar was an Indian recreational mathematician who described several classes of natural numbers including the Kaprekar, harshad and self numbers and discovered the Kaprekar's constant, named after him.
- Despite having no formal postgraduate training and working as a school teacher, he published extensively and became well known in recreational mathematics circles.



Early Life

- Dattatreya Ramchandra Kaprekar was born on 17th January,1905 at Dahanu, Bombay.
- Ha received his secondary school education in Thane and studied at Cotton College in Guwahati.
- In 1927, he won the Wrangler R. P. Paranjpye Mathematical Prize for an original piece of work in mathematics.
- He obtained his bachelor’s degree from University of Mumbai in 1929. He never received any formal postgraduate training.

Career

- For his entire career (1930–1962) he was a schoolteacher at the government junior school in Devlali Maharashtra, India.
- Cycling from place to place he also tutored private students with unconventional methods, cheerfully sitting by a river and "thinking of theorems".
- He published extensively, writing about such topics as recurring decimals, magic squares, and integers with special properties.
- He is also known as "Ganitanand". He died at the age of 81 in 1986.

Discoveries

- Working largely alone, Kaprekar discovered a number of results in number theory and described various properties of numbers.
- In addition he discovered Kaprekar Number, Kaprekar constant, Self number or Devlali number the Harshad numbers and Demlo numbers.
- He also constructed certain types of magic squares related to the Copernicus magic square.

- Initially his ideas were not taken seriously by Indian mathematicians, and his results were published largely in low-level mathematics journals or privately published, but international fame arrived when Martin Gardner wrote about Kaprekar in his March 1975 column of *Mathematical Games* for *Scientific American*.
- Today his name is well-known and many other mathematicians have pursued the study of the properties he discovered.

Kaprekar’s Constant

- The number 6174 is known as Kaprekar's constant after the Indian mathematician D. R. Kaprekar.
- This number is renowned for the following rule: Take any four-digit number, using at least two different digits (leading zeros are allowed).
- Arrange the digits in descending and then in ascending order to get two four-digit numbers, adding leading zeros if necessary.
- Subtract the smaller number from the bigger number.
- Go back to step 2 and repeat.

- The above process, known as Kaprekar's routine, will always reach its fixed point, 6174, in at most 7 iterations.
- Once 6174 is reached, the process will continue yielding 7641 – 1467 = 6174.
- For example choose 6789

  9876 – 6789 = 3087

  8730 – 0378 = 8352

  8532 – 2358 = 6174

  7641 – 1467 = 6174

Kaprekar Number

- A Kaprekar number is a positive integer with the property that if it is squared, then its representation can be partitioned into two positive integer parts whose sum is equal to the original number.

- Kaprekar numbers are 45, 703, 2728, 9, 99, 999,….

- For example: $45^2 = 2045$ and 20 + 25 = 45.

  $9^2 = 81$ and 8 + 1 = 9.

  $99^2 = 9801$ and 98 + 01 = 99.

Devlali of Self Number

- A self number or Devlali number is an integer that cannot be written as the sum of any other integer n and the individual digits of n.

- For example: 21 is not devlali number because, 15+1+5=21 while 20 is devlali number.

SATYENDRA NATH BOSE

- **Satyendra Nath Bose** was an Indian mathematician and physicist specializing in theoretical physics.
- He is best known for his work on quantum mechanics in the early 1920s, in developing the foundation for Bose–Einstein statistics and the theory of the Bose–Einstein condensate.
- He was a Fellow of the Royal Society.
- He was awarded India's second highest civilian award, the Padma Vibhushan, in 1954 by the Government of India.
- He had a wide range of interests in varied fields, including physics, mathematics, chemistry, biology, mineralogy, philosophy, arts, literature, and music.
- He served on many research and development committees in India after independence.

Early Life

- Satyendra Nath Bose was born on 1st January,1894 at Calcutta, Bengal.
- He was eldest and only male among seven children.
- His schooling began at the age of five, near his home.

Research Career

- From 1916 to 1921, he was a lecturer in the physics department of the Rajabazar Science College under University of Calcutta. Along with Saha, Bose prepared the first book in English based on German and French translations of original papers on Einstein's special and general relativity in 1919.

- In 1921, Bose joined as Reader in the Department of Physics of the recently founded University of Dhaka (in present-day Bangladesh).

- Bose set up whole new departments, including laboratories, to teach advanced courses for MSc and BSc honours and taught thermodynamics as well as James Clerk Maxwell's theory of electromagnetism.

- Bose, along Meghnad Saha, presented several papers in theoretical physics and pure mathematics from 1918 onwards.

Honours

- In 1937, Rabindranath Tagore dedicated his only book on science, *Visva–Parichay*, to Satyendra Nath Bose.
- Bose was honoured with the title Padma Vibhushan by the Indian Government in 1954.
- In 1959, he was appointed as the National Professor, the highest honour in the country for a scholar, a position he held for 15 years.
- In 1986, the S.N. Bose National Centre for Basic Sciences was established by an act of Parliament, Government of India, in Salt Lake, Calcutta.
- Bose became an adviser to the then newly formed Council of Scientific and Industrial Research.

- He was the president of the Indian Physical Society and the National Institute of Science.
- He was elected general president of the Indian Science Congress.
- He was the vice president and then the president of Indian Statistical Institute.
- In 1958, he became a Fellow of the Royal Society.
- He was nominated as member of Rajya Sabha.
- Partha Ghose has stated that Bose's work stood at the transition between the 'old quantum theory' of Planck, Bohr and Einstein and the new quantum mechanics of Schrödinger, Heisenberg, Born, Dirac and others.

Nobel Price Nomination

- Bose was nominated by K. Banerjee (1956), D.S. Kothari (1959), S.N. Bagchi (1962), and A.K. Dutta (1962) for the Nobel Prize in Physics, for his contribution to Bose–Einstein statistics and the unified field theory.

Legacy

- Bosons, a class of elementary subatomic particles in particle physics were named by Dirac after Satyendra Nath Bose to commemorate his contributions to science.

- Although seven Nobel Prizes were awarded for research related to S N Bose's concepts of the boson, Bose–Einstein statistics and Bose–Einstein condensate, Bose himself was not awarded a Nobel Prize.

- When Bose himself was once asked that question, he replied, "I have got all the recognition I deserve" - probably because in the realms of science to which he belonged, what is important is not a Nobel, but whether one's name will live on in scientific discussions in the decades to come.

- One of the main academic buildings of University of Rajshahi, the No 1 science building has been named after him.

SHAKUNTALA DEVI

- Shakuntala Devi was an Indian mental calculator and writer, popularly known as the **"Human Computer"**.
- Her talent earned her a place in the 1982 edition of *The Guinness Book of World Records*.
- Devi was a precocious child and she demonstrated her arithmetic abilities at the University of Mysore without any formal education.

Early Life

- Shakuntala Devi was born on 4 November 1929 at Bangalore, Karnataka to a Kannada Brahmin family. Her father, C V Sundararajan Rao, worked as a trapeze artist, lion tamer, tightrope walker and magician in a circus

- Her Father discovered his daughter's ability to memorise numbers while teaching her a card trick when she was about three years old.

- Her father left the circus and took her on road shows that displayed her ability at calculation. She did this without any formal education. At the age of six she demonstrated her arithmetic abilities at the University of Mysore.

- In 1944, Devi moved to London, United Kingdom with her father.

Mental Calculator

- Devi travelled to several countries around the world demonstrating her arithmetic talents. She was on a tour of Europe throughout 1950 and was in New York City in 1976.

- In 1980, at the Imperial College London she correctly multiplied two 13-digit numbers in 28 seconds. The feat was even more remarkable because it included the time to recite the 26 digit solution.

- It earned her a place in the 1982 edition of the *Guinness Book of World Records*. additionally, she also came to be known as “the human computer”.

- Shakuntala Devi explained many of the methods she used to do mental calculations in her 1977 book *Figuring: The Joy of Numbers*.

Personal Life

- In the mid 1960s, when Shakuntala returned home after displaying her mathematical skill to professors and researchers in London, she married Paritosh Bannerji, an IAS offices from Kolkata.

- They divorced in 1979 due to personal problems.

- In 1980, she contested the Lok Sabha elections as an independent candidate for Mumbai South and for Medak in Andhra Pradesh (now in Telangana).

- In Medak she stood against the former Prime Minister Indira Gandhi, saying she wanted to "defend the people of Medak from being fooled by Mrs. Gandhi". she came ninth, with 6,514 votes. She returned Bangalore in the early 1980s.

- In addition to her work as a mental calculator, Devi was a notable astrologer and an author of several books, including cookbooks and novels.
- She started with writing short stories and murder mysteries, and had a keen interest in music.

Book on Homosexuality

- In 1977, she wrote *The World of Homosexuals*, the first published academic study of _ in India, for which she was criticised.

- In the documentary *For Straights Only*, she said that her interest in the topic was because of her marriage to a homosexual man and her desire to look at homosexuality more closely to understand it.

Death & Legacy

- In April 2013, Shakuntala Devi was admitted to a hospital in Bangalore with severe respiratory problems. Over the following two weeks she had heart and kidney complications.
- She died in the hospital on 21 April 2013. She was 83 years old. She is survived by her daughter Anupama Banerjee.
- On 4 November 2013, Devi was honoured with a Google Doodle on what would have been her 84th birthday.
- film on her life titled *Shakuntala Devi* was announced in May 2019. The film stars Vidya Balan in the lead title role and features Sanya Malhotra, Amit Sadh, and Jisshu Sengupta in the supporting roles.

Thank You