

हंसराज महाविद्यालय

दिल्ली विश्वविद्यालय महात्मा

हंसराज मार्ग,

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NAAC ACCREDITED 'A++' GRADE COLLEGE

2024-2025

Name of the Event: Ramanujanotsav

Organised by: Pi: Department of Mathematics

Date of the Event: 22nd December 2024

Duration/Event Timing: 12PM to 2PM

Venue of the Event: Online (Via Zoom)

Name of Coordinator(s): Dr. Manisha Saini

Name of Convener: Dr. Ram Pratap

Event Description (About 250 Words)

On the occasion of Ramanujan Day, as a part of the Mathematics Department's flagship event "Anantam," the department hosted an engaging speaker session to honor the legendary Indian mathematician, Srinivasa Ramanujan. Held on 22nd December 2024, the event also coincided with the birth anniversary of Ramanujan. This year, we were privileged to welcome Dr. Krishnan Rajkumar, Assistant Professor at Jawaharlal Nehru University, New Delhi, as the keynote speaker.

Dr. Rajkumar, an accomplished academic and researcher, presented a webinar on the topic: "Continued Fractions from Ramanujan's Notebooks and the Work of Madhava." Having a thesis on Analytic Number Theory in his PhD and possessing an enduring interest and teaching experience in the same, he was all we could have anticipated for! The lecture brilliantly elucidated the historical and mathematical contributions of Ramanujan and the pioneering Indian mathematician Madhava of Sangamagrama. The session attracted mathematics enthusiasts, students, and faculty alike, who were deeply inspired by the blend of mathematical history and advanced concepts.

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Highlights of Dr. Rajkumar's profile include:

- MSc from IIT Kanpur and PhD from the Institute of Mathematical Sciences, Chennai.
- Research expertise and interests include Analytic Number Theory, Cryptography, and Machine Learning, Applied Probability and Statistics among various others.
- Have taught rigorous courses in subjects related to Statistics, Data Analytics, Cryptography, Data Science etc.
- Merited with highly esteemed awards such as Junior and Senior Research Fellowship from IMSC, Indian National Mathematics Olympiad etc.
- Publications under scholarly publications like the Journal of Number Theory, Journal of Approximation Theory, conference papers and such.
- Have an abundance of experience in fields such as teaching (as an Assistant Professor at Jawahar Lal Nehru University currently, at Shiv Nadar University in the past) and software (as a software engineer in Infosys Technologies Limited).

The session ended with an interactive rapid-fire round, where students actively engaged with Dr. Rajkumar, posing questions on mathematical principles and their modern applications. Overall, this intellectually stimulating session celebrated the brilliance of Indian mathematics and Ramanujan's unparalleled contributions.

Short Caption (About 30 Words)

Celebrating the genius of Srinivasa Ramanujan on his birth anniversary, the Mathematics Department of Hansraj College hosted an enlightening session 'Ramanujanotsav' with Dr. Krishnan Rajkumar, exploring 'Continued Fractions from Ramanujan's Notebooks and the Work of Madhava.' A day of deep insights, historical reflections, and engaging discussions on the rich legacy of Indian mathematics.

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QUES 5.
A TRIANGLE HAS SIDE LENGTHS OF 3 CM, 4 CM, AND 5 CM. WHAT IS ITS AREA?
A) 6 CM² C) 8 CM²
B) 7 CM² D) 9 CM²

12. Continued Fractions
Now let t tend to ∞ . By using the reflection formula for the gamma function and Stirling's formula, we deduce that
$$\lim_{t \rightarrow \infty} \frac{\Gamma(2t+2t+1) \Gamma(2t+2t+1)}{\Gamma(2t+2t+1) \Gamma(2t+2t+1)} = 2$$

and so Entry 25 readily follows, since the continued fraction above converges uniformly in a neighborhood of $t = \infty$ under the stated hypotheses. \square
We next offer another proof of Entry 25 that is due to D. Masson [7]. In [1], [2], and [3], Masson employs second-order linear recurrence relations and a theorem of Puschke [13] to represent a general class of continued fractions by quotients of hypergeometric functions. He also determines the rate of convergence of the continued fractions and establishes connections with several types of orthogonal polynomials. However, we shall not discuss the latter topics here.
Consider the recurrence relation
$$X_{n+1} - b_n X_n - a_n X_{n-1} = 0, \quad (5.2)$$

References
[1] This is a digital image of Madhava drawn up with inputs provided by his descendants and released in 2014 by the Madhava Ganitha Kendram, a Kashi based voluntary association working to revive his works.
[2] K. V. Sarma with explanatory notes in English by K. Ramasubramanian, M. D. Srinivas and M. S. Sriram (2008). *Ganita-Yukti-Bhaskara of Jyesthadeva. Volume I – Mathematics*. Hindustan Book Agency.
[3] Bruce C. Berndt (1999). *Ramanujan's Notebooks, Part II*. Springer.
[4] C. K. Raju (2007). *History of Science, Philosophy and Culture in Indian Civilization. Centre for Studies in Civilizations (CSC), New Delhi*.
[5] P. Rajasekhara (2011). *Derivation of remainder term for the series expansion of π as described in Yuktibhasya and its proof*.

More continued fractions from [3]
• Entry 32(ii) related to $\frac{2}{3}$
$$1 + 2x \sum_{k=1}^{\infty} \frac{(-1)^k}{x+2k} = \frac{1}{x} + \frac{1 \cdot 2}{x} + \frac{2 \cdot 3}{x} + \dots$$

• Corollary to Entry 30 related to $\zeta(2) = \frac{\pi^2}{6}$
$$2 \sum_{k=0}^{\infty} \frac{1}{(x+2k+1)^2} = \frac{1}{x} + \frac{1^4}{3x} + \frac{2^4}{5x} + \dots$$

• Entry 32(iii) related to $\zeta(3) = \sum_{k=1}^{\infty} \frac{1}{k^3}$
$$\sum_{k=1}^{\infty} \frac{1}{(x+k)^3} = \frac{1}{2x^2+2x+1} - \frac{1^6}{3(2x^2+2x+3)} - \frac{2^6}{5(2x^2+2x+7)} - \dots$$

A continued fraction
• Corollary to Entry 29 [3]
$$2 \sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{x+2k-1} = \frac{1}{x} + \frac{1^2}{x} + \frac{2^2}{x} + \frac{3^2}{x} + \dots$$

• Continued fraction interpretation
Continued fraction
We say that
$$L = a_0 + \frac{b_1}{a_1} + \frac{b_2}{a_2} + \dots$$

if the fractions $\frac{p_n}{q_n} = a_0 + \frac{b_1}{a_1 + \frac{b_2}{a_2 + \dots \frac{b_n}{a_n}}}$ converge to L .

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Attach Attendance Sheet: NA

Instructions need to be followed strictly for booking:

1. Poster uploading (Two days before the event)
2. Report of the event (250 words in Hindi and English)
3. Short caption report for social media (30 words)
4. Photograph of the event (2-4 photo maximum with Geo Tag)

Note: If any of the above instructions are not followed, no further bookings will be given to that society, student, or convener in the future.