

## **Symposium in Number Theory**

*Jointly organised by*  
**IISER, Pune and BP, Pune**

**Venue: Bhaskaracharya Pratishthana, Pune**

**31<sup>st</sup> May - 3<sup>rd</sup> June, 2011**

**Organising Committee:**

**Prof. K. N. Ganesh, Director, IISER**

**Prof. N. S. Gopala Krishnan, Director, BIM**

**Prof. D. V. Kulkarni, Custodian, BP**

**Prof. S. A. Katre, Univ. of Pune (Convener)**

**Dr. Baskar Balasubramaniam, IISER      Dr. Sreekar Shastry, IISER, Pune**

**The activity is sponsored by IISER, Pune.**

### **Speakers and abstracts of talks:**

**Bruce Berndt, Professor [Department of Mathematics University of Illinois at Urbana-Champaign](#)**



### **Abstracts**

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Ramanujan's Life and Notebooks  
B.C. Berndt

Ramanujan was born in southern India in 1887 and died there in 1920 at

the age of 32. He had only one year of college, but his mathematical discoveries, made mostly in isolation, have made him one of this century's most influential mathematicians. An account of Ramanujan's life will be presented. Most of Ramanujan's mathematical discoveries were recorded without proofs in notebooks, and a description and history of these notebooks will be provided. The lecture will be accompanied by photographs depicting Ramanujan, his home, his school, his notebooks, and those influential in his life, including his mother and wife.

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## **Ramanujan's Lost Notebook**

B. C. Berndt

2 Lectures

In the spring of 1976, while searching through papers of the late G. N. Watson at Trinity College, Cambridge, George Andrews found a sheaf of 138 pages in the handwriting of Srinivasa Ramanujan, generally regarded as India's greatest mathematician. In view of the fame of Ramanujan's earlier notebooks, Andrews naturally called these papers Ramanujan's "lost notebook." This work, comprising about 650 results with no proofs, arises from the last year of Ramanujan's life and represents some of his deepest work.

First, we provide a history of the lost notebook. Second, a general description of the topics found in the lost notebook will be provided. For some of the topics, in particular,  $q$ -series, theta functions, mock theta functions, continued fractions, partitions, and infinite series, we offer some details. In the time remaining, the third portion of the lecture will be devoted to a more detailed discussion of one of the topics prominently addressed in the lost notebook, namely continued fractions.

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## The Circle and Divisor Problems, Bessel Function Series, and Weighted Divisor Sums

B. C. Berndt

Abstract: A page in Ramanujan's lost notebook contains two identities for trigonometric sums in terms of doubly infinite series of Bessel functions. One is related to the famous "circle problem" and the other to the equally famous "divisor problem." These relations are discussed as well as various attempts to prove the identities. Our methods also yield new identities for certain trigonometric sums, for which analogues of the circle and divisor problems are proposed. The research to be described is joint work with Sun Kim and Alexandru Zaharescu.

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**S. D. Adhikari**

Harish-Chandra Research Institute, Allahabad

(Nice, 1992) [click to enlarge](#)



There will be 3 talks. Two talks will be on zero-sum problems and one talk on two problems related to integer lattice points in the plane.

1. Introduction to zero-sum problems: Part I

We shall introduce two invariants related to zero-sum problems and find their values in some special cases.

2. Introduction to zero-sum problems: Part II

We continue with the invariants, and discuss relation between them.

3. Two problems related to integer lattice points in the plane.

Abstract: We shall discuss a couple of problems related to integer lattice points in the plane.

The first one involves finite colourings of integer lattice points in the plane. The question may be said to belong to the subject of Euclidean Ramsey Theory and is related to a conjecture which was suggested by Gurevich which says that for any finite colouring of the Euclidean plane  $\mathbb{E}^2$ , there always exists a triangle of unit area with monochromatic vertices.

The second problem is on a question of Erdős regarding visibility of integer lattice points in the plane.

For both the problems, before going into the exact problems involved, we give necessary introductions to those themes. We also mention results related to these problems in the higher dimensions.

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**Prof. Dinesh Thakur**

Professor of Mathematics, University of Arizona, USA  
and  
Adjunct Professor, Bhaskaracharya Pratishthana



Topics:

**First Talk: Bernoulli numbers for number fields and function fields**

**Second Talk: Probability, randomness and number theory.**

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**Prof. S. A. Katre**

Dept. of Mathematics, Univ. of Pune

Topic: Waring's problem for matrices over orders in algebraic number fields

Abstract: Waring's problem for natural numbers deals with writing natural numbers as sums of  $k$ -th powers. Waring's conjecture for fourth powers was proved by R. Balasubramanian, J-M. Deshouillers, and F. Dress in 1986. Similar problem for matrices over rings has been considered by many authors. D. R. Richman showed that, for  $n \geq k$ , any  $n \times n$  matrix which can be written as sum of  $k$ -th powers, can be written as sum of seven  $k$ -th powers, and he also obtained conditions under which a given matrix can be written as a sum of  $k$ -th powers. We shall discuss some aspects of this problem for matrices over various rings and in particular discuss when every matrix over the ring of integers or an order in an algebraic number field can be written as sum of  $k$ -th powers.

## Time Table

Registration: 9.30 am on 31<sup>st</sup> May 2011.

	31 <sup>st</sup> May (Tues )	1 <sup>st</sup> June (Wed)	2 <sup>nd</sup> June (Thur)	3 <sup>rd</sup> June (Fri)
10-11	Adhikari	Adhikari	Adhikari	Anuradha Garge (9.30-10.30)
11.30-12.30	K. Wadikar	S. A. Katre	B. C. Berndt	Dinesh Thakur (10.30-11.30)
				B. C. Berndt (12-1)
2.30-3.30	Aditi Phadke	Somjit Dutt	V. V. Acharya	Dinesh Thakur (2.30-3-30)
4.00-5.00	B.C. Berndt	B. C. Berndt (Special lecture)	D. Shirolkar	Valedictory Fun.

**\*The lecture on 1st June 2011 at 4pm is on life and work of Ramanujan and all are welcome to attend this talk.**

### **List of participants**

1. Nishad Mandlik : B.S. I, IISER, Pune
2. Aditi Phadke: S. P. College, Pune
3. Somjit Dutt: Engg. College, Pune
4. Devendra Shirolkar
5. V. V. Acharya: FC College, Pune
6. Anuradha Garge: CBS, Mumbai
7. K. Wadikar: SSPMS Engg. College, Pune
8. Rahul Kitture: Univ. of Pune
9. Rupali Khedkar: BP, Pune
10. Vikas Jadhav: Wadia College, Pune
11. Anjali Pendse: Engg. College, Pune
12. Aseem Pathan, MSc II , University of Pune
13. -----To be updated