Curriculum Vitae

Sankha S. Basu

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Education

2008 - 2013	Penn State University, University Park, PA Ph.D. in Mathematics, thesis adviser Stephen G. Simpson
2006 - 2008	Marquette University, Milwaukee, WI M.S. in Mathematics
2002 - 2004	University of Calcutta, Kolkata, India M.Sc. in Pure Mathematics
1999 - 2002	University of Calcutta, Kolkata, India B.Sc. (Honours) in Mathematics

Academic Employment

August 2015 - present	Visiting Assistant Professor, Dept. of Mathematics, University of Tennessee at Chattanooga
2013 - 2015	Lecturer, Dept. of Mathematics, Penn State University
2011 - 2015 (Summers)	Instructor, Continuing Education, Penn State University
2008 - 2013	Graduate Teaching Assistant, Dept. of Mathematics, Penn State University
2011 - 2013 (Summers)	Graduate Lecturer, Dept. of Mathematics, Penn State University
2010 (Summer)	Graduate Research Assistant, Department of Mathematics, Penn State University
2006 - 2008	Graduate Teaching Assistant, Department of MSCS, Marquette University
2006 (January - August)	Junior Research Fellow, Centre for Cognitive Science, Jadavpur University, India

2005 (September - December) Project Assistant, Centre for Cognitive Science, Jadavpur University, India

Awards

- Harold F. Martin Graduate Assistant Outstanding Teaching Award. 2013

  This is a university-wide teaching award that recognizes graduate assistants for outstanding teaching performance. To find more about this award, visit http://www.gradschool.psu.edu/index.cfm/graduate-funding/fellowships/programs/gradteach/

- Graduate Teaching Associate Status. 2010

  This is awarded by the Department of Mathematics at Penn State. To find more about this award, see https://www.math.psu.edu/grad/gta/resources/teach-asct.pdf

- Department of Mathematics Graduate Student Teaching Award. 2010

  This is awarded by the Department of Mathematics at Penn State and recognizes successful undergraduate teaching by a graduate student.

- Qualified the Joint CSIR-UGC Junior Research Fellowship and Eligibility for Lecturer-ship (National Eligibility Test) in Mathematical Sciences. 2005

  (CSIR stands for Council for Scientific and Industrial Research, India; UGC stands for University Grants Commission, India)

Research Interests

Mathematical Logic and Foundations of Mathematics including, but not limited to, the following areas.

- Intuitionistic logic and set theory
- Other non-classical logics
- Computability theory

My doctoral dissertation, titled *A model of intuitionism based on Turing degrees*, discusses sheaves over topological spaces as models for higher-order intuitionistic logic. The results obtained by varying the underlying topological space for such sheaf models show the exciting interplay of logic and geometry. Moreover, in the special case where the topological space is the poset of Turing degrees, we see connections between intuitionistic logic and recursion theory. This model, which we call the *Muchnik topos*, is an extension of the famous Kolmogorov/ Muchnik interpretation of intuitionistic propositional calculus via Muchnik degrees, i.e., mass problems under weak reducibility.

I am currently working on extending the work on the Muchnik topos. I am also studying the *realizability* interpretations of intuitionistic logic, which provide 'natural' connections between intuitionism and computability as well. I plan to work next on sheaf models for intuitionistic higher-order logic similar to the Muchnik topos, for example the sheaf models over the poset of *arithmetical degrees* or *hyperarithmetical degrees*. The purpose of the study is to separate foundational principles and to compare the various models.

Publications

1. Sankha S. Basu and Stephen G. Simpson. Mass problems and intuitionistic higher-order logic. *Computability*, 5(1):29–47, February 2016.

2. A. A. Muchnik (Translators: Sankha S. Basu and Stephen G. Simpson). Strong and weak reducibility of algorithmic problems. *Computability*, 5(1):49–56, February 2016.[1]

3. Sankha S. Basu and Stephen G. Simpson. Mass problems and intuitionistic higher-order logic. arXiv:1408.2763 [math.LO], 44 pages, August 2014.[2]

4. Sankha S. Basu. *A model of intuitionism based on Turing degrees*. Ph.D. dissertation, The Pennsylvania State University, 2013. VI + 109 pages, http://etda.libraries.psu.edu/paper/19078/.

Research/ Travel Grants

- Travel grant to cover local expenses in Japan while attending and presenting at the JAIST Logic Workshop Series 2015 in Kanazawa, Japan, March 2015, Japan Advanced Institute of Science and Technology (JAIST), Japan

- Travel grant of $1,100 for attending and presenting at the JAIST Logic Workshop Series 2015 in Kanazawa, Japan, March 2015, Department of Mathematics, The Pennsylvania State University, USA

- Travel grant of $500 for attending and presenting at the 2015 ASL North American Annual Meeting, University of Illinois at Urbana-Champaign, Urbana, March 2015, Department of Mathematics, The Pennsylvania State University, USA

- Research grant of $2,000, August 2013, Department of Mathematics, The Pennsylvania State University, USA

Talks

- *Realizability interpretation of intuitionistic arithmetic*

  University of Tennessee at Chattanooga, Department of Mathematics Colloquium, November 2015

- *Mass problems and intuitionistic higher-order logic* (Special session on Constructive Mathematics)

  2015 ASL North American Annual Meeting, University of Illinois at Urbana-Champaign, Urbana, March 2015

[1] The original paper (in Russian) was published in *Sibirskii Matematicheskii Zhurnal (Siberian Mathematical Journal)*, Volume IV, No. 6, November–December, 1963. Our translation was based on a rough translation produced in March 1964 by the Joint Publications Research Service, Office of Technical Services, United States Department of Commerce. We have corrected some typographical and translation errors and updated some bibliographical references.

[2] This is the version of Item 1 and Item 2 combined that was originally submitted for publication. This document contains some material that was later deleted from the final version of Item 1.

- *Mass problems and intuitionistic higher-order logic* (Contributed)

  JAIST Logic Workshop Series 2015, Constructivism and Computability, Shiinoki Cultural Complex, Kanazawa, Japan, March 2015

- *Mass problems and intuitionistic higher-order logic* (Contributed)

  14th Asian Logic Conference (ALC), IIT Bombay, Mumbai, India, January 2015

- *The Muchnik topos*

  Penn State Logic Seminar, October, 2014

- *Mass problems and higher-order intuitionistic logic* (Contributed)

  2014 ASL North American Annual Meeting, University of Colorado, Boulder, May 2014

- *Introduction to Kleene's realizability interpretation of intuitionistic number theory*

  Penn State Logic Seminar, April 2014

- *Mass problems and higher-order intuitionistic logic* (Invited)

  Florida Atlantic University Logic Seminar, March, 2014

- *A model of intuitionism based on Turing degrees* (Invited)

  Marquette University, Department of MSCS Colloquium, November, 2013

- *A model of intuitionism based on Turing degrees*

  Penn State Logic Seminar, October, 2012

- *Borel Determinacy* (two talks)

  Penn State Logic Seminar, February-March, 2012

- *Sheaf semantics for higher-order intuitionistic logic*

  Penn State Logic Seminar, November, 2010

- *Logic and Automata*

  Project Report Presentation, May 2010

- *Paraconsistent Logics*

  Marquette University Logic Seminar, November, 2006

- *Free Logics*

  International Workshop on Logic and Semantics, Centre for Cognitive Science, October, 2005

- *Relevant Arithmetic or Meyer's Arithmetic* (series)

  Calcutta Logic Circle, India, March-April, 2005

Professional Affiliations

- American Mathematical Society
- Association for Symbolic Logic
- Association for Logic in India
- Calcutta Logic Circle

Teaching Experience

University of Tennessee at Chattanooga, August 2015 - present

- Math 1730 *Combined Precalculus* Fall 2015

  This 4-credit course is designed primarily for students majoring in Mathematics, the Physical Sciences, and Engineering who intend to take the calculus sequence. Topics include polynomials, rational, exponential and logarithmic functions, complex numbers, the fundamental theorem of algebra, trigonometric functions, inverse trigonometric functions, laws of sines and cosines, verifying trigonometric identities, solving trigonometric equations, trigonometric forms of complex numbers, DeMoivre's theorem, polar coordinates, conic sections, sequences and series.

- Math 1830 *Calculus for Management, Life, and Social Sciences* Fall 2015

  This 3-credit course introduces students majoring in the the subjects mentioned in the title to concepts in calculus, including limits, continuity, differentiation, integration and the fundamental theorem of calculus. The course then discusses applications of calculus, for example, optimization, marginal analysis, and computing areas between curves.

- Math 1950 *Calculus with Analytic Geometry I* Spring 2016

  This 4-credit course is the first course in the Calculus sequence and introduces students to the calculus of functions of one real variable. Topics covered include precise definitions of limits, derivatives, and integrals including Riemann sums; applications of these concepts and the Fundamental Theorem of Calculus.

Penn State University, 2009 - 2015

- Math 017 *Finite Mathematics* Fall 2010

  This 3-credit course introduces the foundations of modern mathematics, viz., formal logic and naive set theory and then discusses applications of these concepts in elementary probability theory.

- Math 018 *Elementary Linear Algebra* Spring 2011

  This 3-credit course is an introduction to linear functions, matrices, vectors, methods of solving systems of linear equations, linear transformations, and linear programming.

- Math 021 *College Algebra I* Fall 2011, Spring 2012, Summer 2012

  This 3-credit course introduces the algebraic methods of solving linear and quadratic equations; factoring polynomials; rational, exponential and radical expressions; basic functions; and complex numbers.

- Math 022 *College Algebra II* Spring 2009, Fall 2009, Spring 2010, Fall 2012, Summer 2013

  This 3-credit course provides in-depth coverage of college algebra topics, including quadratic, general polynomial, rational, exponential and logarithmic functions and techniques for graphing these.

- Math 026 *Plane Trigonometry* Spring 2013

  This 3-credit course covers right-triangle relationships, the unit circle, the various trigonometric functions and their applications, inverse trigonometric functions, identities, and trigonometric form of complex numbers.

- Math 110 *Techniques of Calculus I* Summer 2012

  This 4-credit course covers functions, graphs, limits, continuity, derivatives, integrals, techniques of differentiation and integration. Emphasis is placed on applications.

- Math 140 *Calculus with Analytic Geometry I* Fall 2013, Spring 2014, Fall 2014

  This 4-credit course is the first course in Calculus for students in science, engineering and related fields. It covers the basic concepts of Calculus, including limits, continuity, differentiability, and techniques of differentiation and integration. Trigonometric functions are included in every topic. The course also covers some applications of calculus into natural and social sciences.

- Math 141 *Calculus with Analytic Geometry II* Summer 2011, 2012, 2013, 2014, 2015, Spring 2015

  This 4-credit course is the second in the Calculus sequence for students in science, engineering and related fields. It covers advanced techniques of integration, improper integrals, sequences and series.

- Math 496 *Independent Study Course in Category Theory* Summer 2014

  In this 3-credit course, we covered the basics of Category Theory, including the definitions of categories, morphisms, functors, natural transformations and their properties. The texts used were *Abstract and Concrete Categories: The Joy of Cats* by Adámek, Herrlich and Strecker, *Category Theory* by Awodey, and *Categories for the Working Mathematician* by Mac Lane.

The above courses were taught with full instructional responsibility. For more details, visit www.personal.psu.edu/ssb168/teaching.html

TA Experience

Marquette University, 2006 - 2008

- Math 070 *Finite Mathematics* Fall 2006, 2007
- Math 071 *Elements of Calculus 1* Spring 2007, 2008

Duties included helping students during office hours and grading exams.

Training

Penn State University

- Completed *"The Penn State Course in College Teaching"*, offered by the Schreyer Institute for Teaching Excellence, in Spring 2013.

  For more details about this course, visit http://www.schreyerinstitute.psu.edu/CCT

- Attended the talk titled *"Memorization or Understanding: Are we teaching the right thing?"* given by Professor Eric Mazur. This was organized by the Schreyer Institute for Teaching Excellence in April, 2012

- Attended the talk titled *"If You Digitize It, Will They Read? Digital Textbooks in the Classroom, The Advent of Digital Textbook Utilization: A Faculty Perspective"*. This was organized by the Schreyer Institute for Teaching Excellence in November, 2011

- Attended several Mathematics Department Teaching seminars.

  For details about Teaching seminars, visit https://www.math.psu.edu/grad/gta/seminar.php

- Attended the PSU Mathematics Department GTA Training, Fall 2008.

  For details about this program, visit https://www.math.psu.edu/grad/gta/program.php

Departmental Service

University of Tennessee at Chattanooga

- Member of the Freshman Math Award Committee. 2015 - 2016
- Member of the TMTA (Tennessee Mathematics Teachers Association) Exam Committee. 2015 - 2016

Penn State University

- Mentor for two first time graduate student teachers. Spring 2012
- Mentor for two first time graduate student teachers. Fall 2011
- Mentor for a first time graduate student teacher. Fall 2010