Statement of Teaching

Dr. Tarun Kumar Sheel

Present Position
Research Assistant
Universite Catholique de Louvain
Batiment Euler, 4 Av. G. Lemaitre
1348 Louvain-La-Neuve, BELGIUM
Tel: +32-10-47-8055
Fax: +32-10-472180
E-mail: tarun.sheel@uclouvain.be

Permanent Position
Associate Professor in Mathematics
Shahjalal Univ. of Sci. and Tech.
Sylhet 3114
BANGLADESH
Tel: +88-0821-713491/Ext. 256
Fax: +88-0821-715257
E-mail: tksheel@sust.edu

URL: http://tksheel.tripod.com/index.html

1 Teaching Philosophy

My appointment at Shahjalal University of Science and Technology in August 1998. I served as a lecturer in mathematics from August 1998 to July 2001 and as an assistant professor from August 2001 to July 2008. Now I am serving as an associate professor in the same department since August 2008. I have been teaching in both undergraduate and graduate levels students in the department and its related disciplines from the date of joining. At present I am working as a postdoctoral researcher in the center for system engineering and applied mechanics of Universite Catholique de Louvain, Belgium since April 2009.

My emphasis in teaching is on learning. My teaching goal is to facilitate learning (helping students learn) and I believe that teaching plays a major role in that. Learning is primarily the student's responsibility, whereas teaching is my responsibility. My emphasis is on helping the student to learn, rather than just dispensing my knowledge to them. In order to aid students in reaching their desired learning goals, the teacher must have a clear set of objectives. I feel that teachers should serve a number of purposes. First and foremost, they should act as guides, pointing students in the direction they should go to find answers and solve problems by providing them with the essential information they need to do so. They should also act as advisors or facilitators, especially in the university setting. Students at this level need input and more assistance in deciding on courses to best reach their personal academic and career goals. Instructors should help these students in making important decisions in these areas. Students also need to feel comfortable approaching their instructor for discussion outside of class. By instructors acting as mentors and friends to students, the students can begin to make professional contacts, find professors to aid in career plans and use for recommendations, and have an academic source to call upon when stresses of classes begin to be overwhelming. Instructors need to make education as enjoyable and beneficial as possible to for students. By teachers acting in all of these manners, a student's education will be more complete and enjoyable than one in which a student only sees the teacher in the classroom.

A teacher should be totally involved with the class, dedicated to his/her students and be prepared to devote time and energy for them. Love for teaching evokes passion and dedication. The enthusiasm of a motivated teacher rubs off on his/her students, who derive the inspiration and encouragement which actuate their desire to learn. This keeps the students interested and they tend to retain the course material very well. Every module should clearly state a take home message for the students. I know through experience that whenever my past students approach me for help

for another course, I am pleased to realize during the discussions that they have retained most of the important concepts.

I believe that effective teaching is comprised of two necessary and related elements: knowledge of the content and ability to communicate it. Knowing the material is not enough to be effective in teaching it; likewise, communication skills won't work alone. Thus, I take care to understand the concepts I expect to cover and to make them understandable to the students. I organize my presentations with the student's learning in mind and keep my knowledge up to date. I also emphasize the importance of communication by using humor and a variety in teaching techniques to make learning enjoyable so as to motivate the students to learn.

In order to achieve the ultimate goal of student learning, I strive to implement strategies that create a collaborative and safe atmosphere and encourage the application of knowledge to new situations. I believe that these strategies help students become ready and able to utilize their knowledge in their studies and in their future employment.

2 Previous Teaching

Here I will state briefly of my past teaching at Shahjalal University of Science & Technology, Sylhet, Bangladesh. The courses are offered in mathematics and its related disciplines. The following courses have been teaching in 1998-2003 and/or in 2008-2009 during my availability in the university. I was on leave for my PhD in Japan from September 2003 to March 2008. Again I am on leave as a postdoctoral researcher in Belgium from April 2009.

Responsibilities: Given lecture to both in the undergraduate and in the graduate students in mathematics and its related discipline with project after each semester. Instruction having full control for the course, writing the course syllabus, quizzes, exams and grading. Supervise graduate students for their project and thesis at the end of final semester. Basically I superivise on numerical methods and scientific computing.

- **Calculus I, II & III**
  - **Contents:** Functions, limit, continuity, differentiation of explicit and implicit functions, maxima and minima of several variable functions, asymptotes, curvature, applications of derivatives, integration, techniques of integration, definite integrals, applications of integrals.
  - **References:** Thomas and Finney, Calculus and Analytical geometry
- **Higher Algebra**
  - **Contents:** The main focus of this course is to study the basic theory an d knowledge of transform mapping and its basic property, set theory, polynomial theory, determinant, matrix, inequalities, theory and ways of linear equations, vector space, linear transform, quadrics, euclidean space and so on.
  - **References:** Lindsay N. Childs, A Concrete Introduction to Higher Algebra
- **Analytical Geometry 2D and 3D**
  - **Contents:** The coordinate systems, Equations and properties of straight lines, pair of straight lines, circle, ellipse, parabola, hyperbola, plane, sphere, cones etc.
  - **References:** 1. Askwith, Analytic Geometry; 2. L. P. Siceoff, George Wentworth, and D. E. Smith, Analytic Geometry; 3. Thomas and Finney, Calculus and Analytic Geometry

- **Linear Algebra**
  - **Contents:** Vectors and matrix algebra, Systems of linear equations, Square matrices, Vector spaces and subspaces, Basis and dimension, Change of basis, Eigenvalues and Eigenvectors. **Applications:** Linear models in Economics and Engineering, Computer models in aircraft design, Space flight and control systems etc.
  - **References:** 1. Keith Mathews, Elementary Linear Algebra; 2. Gilbert Strang, Linear Algebra and its Applications
- **Mathematical Programming**
  - **Contents:** Introduction to Linear Programming, The Simplex Method, Duality and Sensitivity Analysis, Transportation Model and its Variants, Game theory, Introduction to Nonlinear Programming. Different languages for formulation of mathematical programs (MP), Different software for solving MP problems, Decomposition methods and utilization of the matrix structure in variants of the simplex method, Valid inequalities and generation of cuts in discrete MP problems, Presolve and automatic reformulation of MP problems
  - **References:** 1. H. P. Williams, Model Building in Mathematical Programing; 2. Stephen P. Bradley, Arnoldo C. Hax, and Thomas L. Magnanti, Applied Mathematical Programing
- **Applied Mathematical Methods**
  - **Contents:** The geometry of function, Fourier Series: introduction, calculation, differentiation, Notes on vibrating string, Traveling waves, PDEs in space, Ordinary differential operators, Green funcions, Eigenfunctions, Using conformal mapping to construct Green funcions, Some advanced topics.
  - **References:** 1. Dasgupta, Applied Mathematical Methods, 2. Michio Masujima, Applied Mathematical Methods in Theoretical Physics
- **Discrete Mathematics I** & **II**
  - **Contents:** This course aims to lay a foundation for systemically studying subsequent data organization and computer science. It focuses on the study of Fundamental Principle of Counting, Fundamentals of Logic, Set Theory, Properties of the Integers: Mathematical Induction, Relations and Functions, Languages: Finite State Machines, Relations: The Second Time Around, The principle of Inclusion and Exclusion, Generating Functions, Recurrence Relations, An Introduction to Graph Theory, Trees, Optimization and Matching Boolean Algebra and Switching Functions
  - **References:** M. O. Albertson and J. P, Huchinson, Discrete Mathematics with Algorithms
- **Differential Equations I** & **II**
  - **Contents:** Separable and homogeneous first-order ordinary differential equations, Linear first-order differential equations, Second-order linear homogeneous differential equations with constant coefficients, The method of undetermined coefficients, Variation of parameters, Power-series solutions, Bessel functions, Fourier and Laplace transforms. Second and high-order partial differential equations. Initial and Boundary Value Problems.

- *Advanced DE:* Theory and application of Laplace transforms; explicit and implicit numerical approximations to ordinary differential equations; exact and numerical solution techniques for partial differential equations; qualitative nonlinear analysis; inverse problems.
- **References:** 1. S. L. Ross, Introduction to Ordinary Differential Equations; 2. Stanley J. Farlow, Partial Differential Equations for Scientists and Engineers

- **Numerical Analysis I, II & III**
  - **Contents:** Computer arithmetic; Root finding: bisection, secant and Newton's method; Interpolation: polynomial and Newton's divided difference interpolation; Numerical differentiation and integration: Runge-Kutta method, Trapezoidal rule, Simpson rule and Gauss quadrature rule, Cubic Spline, Initial and Boundary Value problems. Finite Element Method, Finite Volume Method. Higher order FEM for engineering applications.
  - **References:** 1. J. B. Scarborough, Numerical Mathematical Analysis; 2. Burden: Numerical Analysis; 3. S. S. Sastry: Introductory Numerical Method; 4. J. N. Reddy, Introduction to Finite Element Method.

- **Computational Fluid Dynamics**
  - **Contents:** Introduction to Fluid Mechanics & Heat Transfer, Numerical Methods for PDEs, Numerical Modelling for Steady & Unsteady Incompressible Flows, Numerical Modelling for Steady & Unsteady Compressible Flows, Classical Turbulence Modelling, Advanced Turbulence Modelling and Simulation: LES & DNS, High Performance Computing for CFD, Managing Uncertainty in Simulations: Validation & Verification, Grid Generation / CAD, Data Analysis, Data Fusion & Post Processing, The Role of Experimental Data in CFD.
  - **References:** 1. F. M. White, Fluid Mechanics; 2. Joel H. Ferziger, Computational Methods for Fluid Dynamics

- **Finite Element Methods**
  - **Contents:** The basic concepts in FEM; one-dimensional problems, Extension of the concepts to higher-order and two-dimensional problems, Eigenvalue and Time-Depenedent problems, Numerical/computational issues, Introduction to viscous flow problems etc.
  - **References:** 1. J. N. Reddy, Introduction to Finite Element Method; 2. Roger T. Fenner, Finite Element Methods for Engineers

- **Scientific Computing**
  - **Contents:** Introduction to Computer Arithmetic; Software Tools for Scientific Computing; High Performance Computing Architecture; Numerical Solution of Systemes of Linear Equations, Ordinary and Partial Differential Equations; Error Analysis; Performance Analysis and Optimization.
  - **References:** 1. Rubin H. Landau, A first course in scientific computing; 2. Press, Numerical Recipe in C, FORTRAN 90; 3. Karniadakis and Kirby II, Parallel Scientific Computing in C++ and MPI