

**Centre for Mathematical sciences (CMS)
Apaji Institute of Mathematics & Applied Computer Technology
Banasthali University
Banasthali 304022 (Rajasthan)**

National Workshop
on
MATHEMATICAL MODELING

December 15-19, 2009
Sponsored
by
Department of Science & Technology
Government of India, New Delhi

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MATHEMATICAL MODELING

Mathematical modeling is the process of constructing mathematical objects whose behavior and properties correspond in some way, to a particular real world system. So that it can also be defined as the art of translating problems from an application area into tractable mathematical formulations, whose theoretical and numerical analysis provides insight, answers, and guidance useful for the originating application.

A wide variety of application areas exist where mathematical modeling is used extensively in Fluid mechanics, Biology, Medicine, and other areas are Architecture, Artificial intelligence, Astronomy, Chemistry, Computer Science, Criminal justice, Finance, Fine arts, Geosciences, Material science, Meteorology, Psychology.

The goal of modeling is to adequately portray realistic phenomenon. Once a model, is developed properly a great deal can be learned about the real-life counterpart by manipulating a model's variables and observing the results. Real-world decisions involve an overwhelming amount of detail, much of which may be irrelevant for a particular problem or decision. Models allow the user, to eliminate the unimportant details so that the user can concentrate on the relevant decision variables that are present in a situation. This increases the opportunity to fully understand the problem and its solution.

The workshop was intended for young faculty and researchers from Mathematical sciences, Computer Science, Electronics and Biological Sciences who was interested in the field. The participants were required to be familiar with non-linear partial differential equations.

Eminent speakers in the field of who have consented to deliver talks were:

1. Prof. J.B. Shukla, LNM IIT, Jaipur
3. Prof. Karmeshu, JNU, Delhi
4. Prof. Arvind Kumar Misra, BHU, Varanasi
5. Prof. G.C. Sharma, Agra University, Agra
6. Prof. P.G. Siddheshwar, Bangalore University, Bangalore
7. Prof. G.N. Purohit, Banasthali University, Banasthali.

Participants: Participation was invited from all over the country by sending invitation to the Heads of the Departments of Statistics/ Mathematics/Computer Science various Institutes/ Universities and Research Organizations and also announcing the workshop on the website of Banasthali University www.banasthali.org. The advisory committee scrutinized the applications received and short-listed based on the relevance **MATHEMATICAL BIOLOGY** of the area of specialization with their research interest. The application of sixty-five candidates from all over India had been received and thirty-five candidates were shortlisted and invited. In addition to this, faculty members and students from Banasthali Vidyapith also participated.

Programme: The programme comprised of theory sessions in addition to Inaugural and Valedictory session. The detailed Program Schedule was as follows:

Centre for Mathematical Sciences (CMS)
Apaji Institute of Mathematics & Applied Computer Technology
 Banasthali University
PROGRAM SCHEDULE
National Workshop in Mathematical Modeling
 (December 15-19, 2009)

Sessions Date	9:00 AM to 10.00 AM	10.00 AM to 10.30 AM	10.30 PM to 11:15 PM	11.15 PM to 12:45 PM	12.45 PM to 2.30 PM	2.30 PM to 3.45 PM	3.45PM to 4.00 PM	4.00 PM to 5.00 PM
Dec 15, 2009	Registratio n CMS Building	Inaugural Session (CMS Auditorium)	High Tea	Lecture By Prof. J.B. Shukla	Lunch	Lecture By Prof. A.K. Mishra	Tea	Interactio n

Sessions Date	Lecture : I		Lecture : II	Lecture : III		Lecture : IV		Lecture : V
	9:30am- 10.45 am		11.00 am- 12.15pm	12. 15 pm 1:30 pm		2:30 pm 3:45 pm		4:00 pm 5:15 pm
Dec16,200 9	K-1	A E T	K-2	K-3	H H C N D L	K-4	A E T	AKM - 2
Dec17,200 9	GCS-1		GCS-2	GNP-1		GCS-3		*
Dec18,200 9	PGS-1		GCS-4	GNP-2		PGS-2		Interaction
Dec19,200 9	PGS-3		SST-1	Velidictory				

**Banasthali Visit 4.00 PM (December 17, 2009)*

Prof. J. B. Shukla (JBS):

Some Mathematical Models in Nature

Prof. A. K. Mishra (AKM) :

Environmental Modelling

Prof. G.N.Purohit (GNP):

Stochastic Modelling of Epidemics

Prof. Karmeshu (K) :

Modeling: Deterministic and Stochastic Frameworks.

Prof. G.C. Sharma (GCS) :

Mathematical Modeling of some Human Diseases.

Prof. Pradeep G Sidheshwar (PGS) :

Some nonlinear differential equations in fluid dynamical problems and their solution by homotopy methods.

Shri Shyam Singh Thakur

Indian Mathematical Heritage

Venue for lectures CMS Lecture Theatre

Report of the Program

The inaugural ceremony commenced with the lighting of the lamp by a group of dignified persons- Prof. J.B.Shukla (LMNIT, Jaipur), Dr. Arvind Mishra (Reader, BHU), Prof. Chitra Purohit (Secretary, Banasthali University), Prof.G.N. Purohit (Convenor) and Dr.Sarla Pareek (Coordinator) and the program was followed by Saraswati-Vandana. Dr. Sarla Pareek formally welcomed to all the dignitaries on the dais and participants from the various parts of the country. She also spoke about some aspects of Mathematical Modeling and how the participants will be benefited from this workshop. Prof. J.B. Shukla first praised the campus and appreciated the education system of Banasthali University. Then he defined what is Mathematical Modeling and how it helps us in real life problems. He opined that Mathematical Modeling is an effective tool to predict the behavior of any real world phenomena.

On this occasion, Dr.A.K.Misra spoke about the process of building mathematical models from real world problems and insisted the participants to concentrate more on the analysis part of the problem. He also emphasized on the theme of mathematical modeling in such a way that it should be applicable to our society in general. At the end he thanked everyone and added that he is very much delighted to be a part of this workshop.

Prof.G. N. Purohit summarized the words of Prof. Shukla by saying that –For every physical act there is some mathematical phenomena and for every mathematical phenomenon there may be some physical act. He discussed the objectives of CMS and its activities. He revealed origin and evaluation of CMS right from the beginning till up to date activities of CMS, regarding the collaboration between DST, New Delhi and Banasthali University and how this centre is helping and promoting the young researchers. He added that DST proposed this pre-ICM workshop as an activity of India Mathematics Year 2009 (IMA 2009). After that Prof.Chitra Purohit wished that every participant should take total advantage of this workshop in the best possible way. She showered her blessings on the students and wished for their success in their respective research activities

Dr. Deepa Sinha offered a vote of thanks to all including Prof. Aditya Shastri, Director CMS and Vice Chancellor, Banasthali University without him this event wouldn't have been possible. She thanked all the dignitaries on the dais for gracing the occasion by their presence and to all the participants of the workshop who are the main ingredient of this workshop.

In the second day of the workshop, Prof. Karmeshu, JNU, talked on the topic 'Stochasticity and Nonlinearity in Modeling of Social Systems'. He started with probability theory, Central limit theorem and said that Monte Carlo techniques and entropy frameworks are powerful computational tools. He discussed both linear and non-

linear approach to mathematical modelings in Geometric Brownian motion with drift, Euler-Maruyama scheme, Milstein procedure, Shannon's entropy.

In the third day of the workshop Prof. G.C. Sharma delivered three lectures. In the first lecture he discussed about many fundamental concepts of fluid mechanics such as conservation of mass, Navier-Stoke's equation, finite difference methods etc. In the next lecture he discussed 'A theoretical approach for activation of pro-drug by conjugate and its localization in cancer chemotherapy. He also discussed a two-step pharmacokinetic mathematical model for drug distribution, the concentration of conjugate in micro-vessel and tissue regions was supported by equations and analysis. Prof. Sharma also discussed the topic "A theoretical approach for activation of Plo- drug by conjugate and its localization in cancer chemotherapy". He developed a two-step Pharmacokinetic mathematical model for drug distribution. He also talked about Bio-distribution Pharmacokinetics and conjugate permeability in case of chemotherapy and discussed the concentration of conjugate in micro-vessel and tissue region. Finally he detailed out the effect of the chemical reaction on conjugate concentration.

The last session of the day was a lecture on queuing model by Prof. G.C. Sharma spoke on the topic performance analysis of $M\alpha/a/1$ priority queue with balking and application to Channel allocation in mobile computing. Beginning with the distribution of two types of the single channel queuing system followed by the virtual waiting time. He also discussed the performance measure, like Completion time, blocking probability for type-1 packet, delayed busy cycle for p-packet etc.

The fourth day morning session started with the lecture of Prof. P.G. Siddheshwar and first he gave the conceptual idea of Maxwell equation, physical meaning of divergence and curl and discussed about Faraday's law of induction and then he gave the idea of Non-linear equations and Multi grid method.

The second session of the day was started after tea break and Prof. G.C Sharma talked on the topic 'Application of porous media for flow in biological tissues'. He discussed about Mass diffusion in tissues, MRI application in Porous media, Flow convection in biological tissues, and Darcy model for flow in biological tissues. He also gave a model for the transport through the tumor and its application in bioheat problems. In two days Prof. Sharma gave many lectures in versatile areas of research and which brought interest to the participants in versatile directions.

Prof.G.N.Purohit devoted the third session of the fourth day with an interesting lecture. Prof. Purohit discussed on the topic 'Stochastic Modeling of Epidemics'.

After lunch, Prof. Siddheshwar discussed one of his papers titled 'Computer assisted solution of the DARCY-BRINKMAN-FORCHHEIMER equation using the continuation method for flow through rectangular porous channels and cylindrical porous annulus. He

explained the mathematical formulation of cylindrical porous tube and annulus occupied by a Newtonian liquid. In his concluding lecture he discussed the Homotopy method for finding solutions of linear and non-linear differential equations. He also discussed about matrix differential method.

In the interaction session, seven of the participants volunteered to give a talk on their topic of modelling which according to the experts was one of the new and good step for the success of such programs.

The program ended with the valedictory session

Valedictory Session: Beginning with the coordinator, Dr. Sarla Pareek giving a brief of the proceedings and seminar statistics, the session had expressions and feelings from both the experts and the participants. Prof. G.N.Purohit expressed his satisfaction on the arrangements of the seminar and cooperation from the participants from outside instrumental in the success of the academic activity. Prof. Pradeep G. Sidheshwar has marked this event in the series of top class event of Mathematical modeling in the country. He appreciated the fact that Banasthali University enthusiastically participates in research activities necessary for the promotion of research in Mathematical Sciences. Participants presented their views on behalf of all, where they expressed that the quality of all the lectures was par excellence and they benefited by new techniques to solve the linear and nonlinear problems required in modeling.

The best speakers in the interaction session were awarded token prizes and consolation prizes were given to the participants to keep up their zeal.

At last, Dr. Deepa Sinha on behalf of organizing committee thanked the university staff, DST and all other involved in the managing of the workshop

Lecture notes: The hard copy as well as soft copy of the lectures notes procured from experts has been provided to the participants.

Conclusion: The seminar, sponsored by DST, under CMS had very positive outcomes as follows:

It has given a chance to the faculty and students to interact with the distinguished experts from the field of Mathematical modelling.

It established the fact that Centre for Mathematical Sciences, Banasthali University organizes activities for the promotion of research in Mathematical Sciences thereby providing a platform for the researchers. It introduced and exposed the participants to the range of support for various academic initiatives by DST.