Report of

‘Science Academies’ Lecture Workshop on

*Applications of Differential Equations in Engineering and Biology*

March 09, 10 & 11, 2017

Sponsored by

Indian Academy of Sciences (IAS) Bangalore

Indian National Science Academy (INSA) New Delhi

The National Academy of Sciences (NASI) India, Allahabad
Report of the workshop

A differential Equation is a mathematical equation that relates some function with its derivatives. In applications, the functions usually represent physical quantities, the derivatives represent their rates of change, and the equation defines a relationship between the two. Because such relations are extremely common, differential equations play a prominent role in many disciplines including Engineering, Physics, Economics and Biology. Differential Equations play an important role in modelling virtually every physical, technical, or biological process from celestial motion, to bridge design, to interactions between neurons. In biology and economics, differential equations are used to model the behavior of complex systems. In view of several important applications, the three-day workshop on Applications of Differential Equations in Engineering and Biology is conducted at Sri Venkateswara University, Tirupati during March 9, 10 & 11, 2017, sponsored by the three academies.

We have sent invitations to several colleges in and around Chittoor district and university departments in Southern India. From these colleges we have received 270 applications and we shortlisted 229 applications on the first come first serve basis. 184 students comprising of PG and Research scholars and 45 Faculty members, Resource Persons: 8; Supporting Staff: 4 of engineering and PG/Degree colleges attended the workshop. Hence the total number of participants for the program is 241.

Total number of beneficiaries

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particulars</th>
<th>No. of Students/ Research scholars</th>
<th>No. of Faculty</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Sri Venkateswara University, Tirupati, VIT, Tiruvalluvar University (Vellore), Bangalore University (Bangalore), Yogi Vemana University (Kadaps), Sri Padmavathi Mahila Viswavidyalayam, Tirupati, S.V. Engg. college (Karakambadi), Sree Vidyanikethan Engg. College, Yogananda Engg. College, Tirupati, Siddhartha Engg. College, Puttur, MITS, Madanapalle.</td>
<td>184</td>
<td>45</td>
<td>229</td>
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</table>
The invited talks of the following resource persons were enjoyed by the participants over a period of three days.

1. Dr. P.V.Arunachalam, FNASc, FAPAS, Dravidian University, Kuppam
2. Dr. A.S. Vasudeva Murthy, Tata Institute of Fundamental Research, Bangalore
3. Dr. I.S. Shivakumara, FNASc, Bangalore University, Bangalore
4. Dr. T Amaranath, FNASc, University of Hyderabad, Hyderabad
5. Dr. M. Venkatachappala, FNASc, Bangalore University, Bangalore
6. Dr. P. Kandaswamy, FNASc, Bharathiar University, Coimbatore
7. Dr. G. Sarojamma, FAPAS, Sri Padmavathi Mahila Viswavidyalayam, Tirupati
8. Dr. N.M. Bujurke, FNASc, FNA, Karnataka University, Dharwad
Participants attending in the Workshop

Invited talk by Prof. M. Venkatachalam

Invited talk by Prof. G. Sarojamma

Invited talk by Prof. I.S. Shivakumara

Invited talk by Prof. P. Kandaswamy

Speech by Prof. P. Kandaswamy at the time of Valedictory Function
09.03.2017 (Thursday)

The workshop started at 9.30 am on 09.03.2017 with prayer, followed by the inaugural keynote address by the President Prof. P.V. Arunachalam, FNASc, FAPAS Dravidian University, Kuppam. Dr. M. Bhaskar, Rector, Sri Venkateswara University, Tirupati was the Chief Guest and Dr. M. Devarajulu, Registrar, Sri Venkateswara University, Tirupati was the Guest of Honour. The course outline and the importance of academy activities were explained briefly by Dr. P. Kandaswamy, FNASc., Bharthiar University, Coimbatore. Dr. P.V. Arunachalam, FNASc, Dravidian University, Kuppam has graciously delivered the keynote address. His talk explained the need of learning both theoretical and practical aspects of mathematics with particular reference to Applications of Differential Equations in Engineering and Biology. Dr. M. Bhaskar, Rector, Sri Venkateswara University, Tirupati explained the applications of Differential Equations in understanding blood flows in arteries and Dr. M. Devarajulu, Registrar, Sri Venkateswara University, Tirupati explained the importance of nonlinear differential Equations. After tea break Dr. P.V. Arunachalam, FNASc, Former Vice-Chancellor, Dravidian University explained some applications of differential equations. He discussed how to find the $1/2^{th}$ derivatives of the functions. His lecture was very interesting and completely exhaustive. Dr. T. Amanath, FNASc, University of Hyderabad gave a lecture on “A complete general solution of unsteady Brinkman equation”. His talk derived the unsteady Brinkman equation by applying Stoke’s theorem.
The afternoon session started with the lecture of Dr. N. M. Bujurke, FNASc, FNA. Karnataka University exposed the participants about Differential Equations models of Lubrication. He also explained Ramanujan’s contributions to number theory, Partition of numbers in particular and discussed about Gauss Conjecture and Diophantine Equations.

10.03.2017. (Friday)

The morning session was started by Dr. A. S. Vasudeva Murthy, Tata Institute of Fundamental Research, Bangalore explained the applications of Nonlinear Differential Equations. After tea break, the session started with the lecture of Dr. N.M. Bujurke, FNASc, FNA. He gave a Lecture on Differential Equations models of lubrication.

After lunch, the session started with the lecture of Dr. M. Venkatachalappa, FNA, Bangalore University gave a lecture on Differential Equations models of Atmospheric waves. After tea break, the session started with the lecture of Dr. I.S. Shiva Kumara., FNASc., Bangalore University. He explained the Differential equations models of natural convection. He also discussed about mathematical modelling and explained this topic with examples like population growth and Improvement: logistic model.

11. 03. 2017. (Saturday)

The morning session was started by Dr. G. Sarojamma., FAPAS, Former Vice-Chancellor, Sri Padmavathi Mahila Viswavidyalayam. She gave a lecture on Mathematical models using Casson fluid-Applications to blood flows. In this connection, her talk explained about the concepts of systematic circulation, Pulmonary circulation, rheology of blood and stenosis. Also she explained how to solve the governing equations of casson fluid model by Homotopy method. After tea break, Dr. M. Venkatachalappa, FNA, Bangalore University gave a lecture on Differential Equations models of waves in fluids.

The afternoon session started with the lecture of Dr. I.S. Shiva Kumara., FNASc, Bangalore University. He gave a lecture on different modes of Heat Transfer. In this connection, he explained about how to derive the governing equations of Boussinesq fluid model. After tea break, the session started with the lecture of Dr. P. Kandaswamy., FNASc, Bharatiar University. He gave a lecture on mathematical model of Human Immune System.
The Valedictory function held on 11.03.17. at 5.00 pm. The meeting was presided over by Dr. S. Sreenadh, FAPAS, S.V.U College of sciences, Sri Venkateswara University, Tirupati. Dr. P.V. Arunachalam., FNASc, FAPAS, Former Vice-Chancellor, Dravidian University, Tirupati addressed the audience on the various applications of differential equations models in Engineering and Biology. The highlights of the workshop were explained by Dr. P. Kandaswamy and vote of thanks was proposed by Dr. S. Sreenadh., FAPAS, S.V.U College of sciences, Sri Venkateswara University, Tirupati.

Highlights

- Interactive sessions with the resource persons were arranged after the lectures. All the resource persons stayed at least one evening and spent their valuable time with the participants which resulted in fruitful discussions.
- Participants were informed about the publications of the academy and good interest was evinced among the participants in knowing the activities of the academy.