Brief Report


22-25th February 2017

The Department of Basic Sciences and Social Sciences and Department of Mathematics, North-Eastern Hill University (NEHU), Shillong, jointly organized the Lecture Workshop in collaboration with Science Academies’. The Lecture workshop was sponsored by three academies’ viz The Indian academy of Science (IAS), Bangalore, Indian National Science Academy (INSA), New Delhi and The National Academy of Sciences (NASI), Allahabad and NEHU, Shillong. The four-day lecture workshop on the topic “Hyperbolic Partial Differential Equation and Conservation Laws” was organized on 22-25th February 2017 at Seminar Hall of School of Physical Sciences, NEHU.

The primary objective of this lecture workshop was to provide the students an opportunity to interact with experts in the field and to establish constructive network among students of various institutions and to motivate the young minds to do research in the field Hyperbolic Partial Differential Equation and Conservation Laws (HPDECL) and its various applications.

Following four experts shared their thoughts and ideas with the young participants enlightening them about various aspects of HPDECL: (See Annex I)

1. Prof. Phoolan Prasad, FNASc, FASc, FNA (Convener)
   Department of Mathematics, Indian Institute of Science, Bangalore – 560012

2. Dr. K. R. Arun, School of Mathematics, Indian Institute of Science Education and Research, Trivandrum, CET Campus, Engineering College P.O., Trivandrum- 695016

3. Dr. Angom Tiken Singh, Department of Mathematics, NEHU, Shillong- 793022.

4. Dr. Jibitesh Dutta, Department of Basic Sciences and Social Sciences, NEHU, Shillong- 793022.

Prof. Phoolan Prasad explained the following topics in six lectures:

Simple Waves and Centred Waves, Solution of Riemann Problem, Bicharacteristics and rays of hyperbolic systems of PDEs in several space variables. The first three lectures were focussed on introducing the concept of simple wave solutions. The instructor started with the 2x2 system of isentropic Euler equations of gas dynamics and derived the Riemann invariants and simple wave solutions. As an application, the piston problem was discussed in great detail. Later, the theory of simple waves was extended to a general hyperbolic system in one
Dr. K. R. Arun discussed the following topics in six lectures:

Single conservation law in one dimension, weak solutions, entropy admissible weak solutions and numerical solution by upwind and central difference schemes. In the first lecture, the instructor started with systems of conservation laws and briefed about the state of current research in the field. Afterward, for the sake of exposition, only scalar conservation laws in one dimension were considered. In the second and third lectures, the instructor proved the local existence and uniqueness of classical solutions rigorously using the theory of characteristic curves. After showing the breakdown of classical solutions, the concept of weak solutions was introduced and the Rankine-Hugoniot jump relations were derived. The fourth lecture was devoted to solving initial value problems for the Burgers’ equation containing shocks. The fifth lecture consisted of the introduction of the concept of entropy and various forms of the entropy admissibility criteria. The final lecture was on the numerical solution of conservation laws and the notions of stability and the CFL condition were discussed.

Dr. Angom Tiken Singh gave two lectures on various aspects of wave equations and Dr. Jibitesh Dutta gave complete insight to the first order partial differential equations (PDE) and he motivated young minds about various applications in two lectures.

In total, 78 participants from NEHU and local institutions benefitted from the workshop.

Retd. Prof. Phoolan Prasad from Department of Mathematics, Indian Institute of Science, Bangalore was the Convener & Dr. Jibitesh Dutta, Assistant Professor, Department of Basic Sciences and Social Sciences, NEHU, Shillong worked as Coordinator for the Lecture workshop.

Dr. Jibitesh Dutta

Coordinator, Lecture workshop (HPDECL-2017)
Annexure I
Timetable for HPDECL - 2017

1. Registration will be at Science Cluster Seminar Hall from 8:30 - 8:50 am.
2. Inaugural Function will be from 8:50 - 9:20 am.
3. Tea & Refreshment from 9:20 - 9:30 am.

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1. Professor Phoolan Prasad (PP), IISc Bangalore
2. Dr. K. R. Arun (KRA), IISER Trivandrum
3. Dr. A. T. Singh (ATS), NEHU, Shillong
4. Dr. Jibitesh Dutta (JD), NEHU, Shillong