DEPARTMENT OF CHEMISTRY  
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur – 440 033.

Refresher Course on Contemporary Nonequilibrium Thermodynamics and  
Statistical Mechanics  
(20 October – 2 November, 2010)

THE REPORT

The Refresher Course on Contemporary Nonequilibrium Thermodynamics and Statistical Mechanics was held at the Department of Chemistry, R.T.M. Nagpur University, Nagpur during October 20 – November 2, 2010. This activity has been organized as a part of Science Education Programme of the three national Science academies, namely Indian Academy of Sciences, Bangalore, Indian National Science Academy, New Delhi and National Academy of Sciences of India, Allahabad. This activity has been entirely funded by these three national academies and was executed by Indian Academy of Sciences, Bangalore. The salient features of this Refresher Course are described below.

1. For holding this Refresher Course Indian Academy of Sciences, Bangalore sanctioned an amount of Rs. 4.50 lac and before the start of this event advanced us Rs. 4.15 lac in two installments of Rs. 1.15 lac and Rs. 3.00 lac. The actual expenditure incurred has been Rs.2, 94,145 (Rs. Two lac ninety four thousand one hundred forty five only). As a result the unspent amount of Rs. 1,20,855 (Rs. One lac twenty thousand eight hundred fifty only) was electronically refunded through bank to the academy on 27-01-2011. The receipt and expenditure statement of accounts has been audited by the University approved chartered Accountant and a copy of the same is enclosed as enclosure – II.

2. Professor Debshankar Ray of Indian Association for the Cultivation of Science, Jadavpur, Kolkata consented to be the Course Director, Professor Anil A. Bhalekar, “Emeritus Scientist, CSIR” and Professor Lalitmoohan J. Paliwal, Head of the Department of Chemistry were the Course Coordinators. However, unfortunately Professor Debshankar Ray could not come over to Nagpur during entire duration of the Refresher Course due to sad demise of his father. Still his initial support acted in fetching this prestigious activity from the Academy and proved in shaping well this activity to the desired heights. Particularly with initiative of Professor Ray two renowned Professor one each from IASc Bangalore and IIT Kanpur were kind enough to act as Resource Persons.
3. On October 20, 2010 the Refresher Course was inaugurated by the Hon’ble Vice Chancellor of R.T.M. Nagpur University, B.V.G. Reddy Commissioner Nagpur Division. Hon’ble Dr. (Ms.) Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University was the Chief Guest, Professor Dr. Ingo Muller, Professor Emeritus, Technical University Berlin, Germany was the Guest of Honour and Professor M.V. Kaulgud, former Professor in Physical Chemistry in this Department was the special invitee.

4. The Resource Persons those obliged us by delivering stimulating lectures and holding highly interactive tutorial sessions were both from home and abroad. We are particularly indebted to Professor Ingo Muller, Professor Emeritus, TU Berlin, Germany and Professor David Jou, Department of Physics, Autonomous University of Barcelona, Bellaterra, Spain as both of them did not charge for their international and within India air travel. Thus, in all 12 Resource Persons delivered allotted lectures and every day one tutorial session was held that was engaged by these renowned teachers, researchers and scientists. The list of the Resource Persons with affiliation details is enclosed as enclosure – III.

5. The total number of applications received for participation in this Refresher Courses were 43. Out of which initially we selected 35 participants giving emphasis on the spread over the country and the enthusiasm shown by them. Even the young promising research scholars were also selected. The final number of participants tuned out to be 31 out of which 16 were outstation participants from other parts of the country and its all corner. The list of the participants those attended this Refresher Course with their affiliation as contact details are enclosed as enclosure – IV.

6. As title of the Refresher Course indicated we planned to focus on two broad topics, namely nonequilibrium thermodynamics and statistical mechanics.

(a) In the field of nonequilibrium thermodynamics the participants were substantially exposed to Extended Irreversible Thermodynamics, Rational Thermodynamics, Classical Irreversible Thermodynamics, Foundations of Nonequilibrium Thermodynamics, Nonequilibrium Thermodynamics as applied to Electrochemical Processes, Quantum Heat Engines and Finite – Time Thermodynamics.

Thus, all participants were imparted a substantial quanta of exposure to the contemporary status and state – of – art prevailing over in nonequilibrium thermodynamics by Professors Ingo Muller, David Jou, R.S. Johal, Sunil Nath, M.V. Sangaranarayanan and A.A. Bhalekar.

(b) The statistical mechanical quanta was comprised of Bayesian Statistical Kinetic Theory of Non-uniform Systems, Chandrasekhar Equation in Chemical Dynamics, Ordered Disordered systems, Percolation problems of Dilute Magnetic systems, Spin Glasses, Structural Glasses, Random field systems, Stochastic Kinetics and Enzymology, Stochastic of Molecular Motors, Nonequilibrium Statistical Mechanics of Liquids and Dynamics of Phase Transitions in spatially Extended systems. The Resource Persons those
shouldered this responsibility were Professors D. Chowdhury, B.L. Tembe, C. Dasgupta, R. Venkatesh, P.M. Gade and R.S. Johal.

(c) For the sake of a little change Dr. S.S. Dhondge discussed the Role of Gibbsian Statistics in Reaction Rate Theories and Professor P.M. Gade discussed the Role of Physicists in Economics.

7 Those Resource Persons provided material of their lectures and tutorials, the set of photocopy material were distributed to the participants along with soft copy of the same on C.D. which was about 150 pages of print material. Besides two cheap edition books were also distributed to the participants namely (1) Elements of Nonequilibrium Statistical Mechanics by Balkrishnan (2) Statistical Mechanics by K. Huang.

Besides this each participants have been given Refresher Course Bag + Two 200 pages registers + a pen and other relevant materials.

8 A Half Day excursion tour was arranged to Ramtek about 60 Km. away from Nagpur on 1st November 2010.

9 The Valedictory Function was held in the afternoon 2nd November 2010. Professor A.M. Khurad, Director, BUCD, RTM Nagpur University Presided over the function, Prof. G.S. Parashar, Ex- V.C. of RTM Nagpur University was Chief Guest and Professor M.K.N. Yenkie, Registrar of RTM Nagpur University was the special Invitee. The Participation Certificate with signatures of the two Course Coordinators was also issued to each participant. Two representative speeches from the participants were also held describing their experiences regarding this course.

We, the Coordinators wish to put over heartiest thanks to Indian Academy of Sciences, Bangalore, Professor D.S. Ray, Kolkata, Hon’ble Vice Chancellor, RTM Nagpur University and all the University administration who directly and indirectly helped in realizing their activity with a successes.

A.A. Bhalekar

COURSE COORDINATOR

REFRESHER COURSE ON CONTEMPORARY NON-EQUILIBRIUM THERMODYNAMICS AND STATISTICAL MECHANICS at NAGPUR (20 OCTOMBER-2 NOVEMBER, 2010)
Enclousure- IV

Department of Chemistry,
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur – 440 033

Refresher Course on Contemporary Nonequilibrium Thermodynamics and Statistical Mechanics
(20 October – 2 November, 2010)

LIST OF PARTICIPANTS

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<td>S. No.</td>
<td>Names</td>
<td>Lectures and Tutorials engaged</td>
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Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur – 440 033

**Refresher Course on**
Contemporary Non-Equilibrium Thermodynamics and Statistical Mechanics

(20 October – 2 November, 2010)

**Sponsored By**
Indian Academy of Sciences, Bangalore, Indian National Science Academy, New Delhi and The National Academy of Sciences, India, Allahabad

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<th>No.</th>
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<th>Department and College</th>
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</tbody>
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**Course Coordinator**
Refresher Course on Contemporary Non-Equilibrium Thermodynamics and Statistical Mechanics at Nagpur
(20 October-2 November, 2010)
An Overview of the Lectures Delivered by Resource Persons

<table>
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<tr>
<th>S. No.</th>
<th>Resource Person/Dates of Lectures</th>
<th>Lecture Topics</th>
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</table>
| 1.     | David Jou (Bellsterra, Spain) (25-27 Oct 2010) | An introduction to Extended Irreversible Thermodynamics:  
1) Transport equations with memory, and generalization of the second law: heat waves  
2) Non-local effects and heat transport in nanosystems: phonon hydrodynamics and boundary conditions  
3) Continued-fraction expansions of non-local transport equations: application to nano-systems  
4) Memory and non-local effects in generalized hydrodynamics  
5) Microscopic foundations of extended thermodynamics  
6) Rheology and thermodynamics: polymer solutions |
2) Rational Thermodynamics.  
3) Kinetic Theory of Gases.  
4) Extended Thermodynamics. |
| 5.     | Sunil Nath (IIT, Delhi) (27 - 29 Oct 2010) | 1. Revision and Basics: Tutorial to understand the attendees' level  
2. Flux-Force Relationships: Lecture  
3. Description of Coupled Phenomena in Biology: Lecture cum Tutorial |
<table>
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<th>No.</th>
<th>Name</th>
<th>Affiliation</th>
<th>Topic</th>
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</table>
| 6.  | C Dasgupta               | IISc, Bangalore   | 1) Quenched and annealed disorder; phase transitions in systems with quenched disorder; the Harris criterion. 
2) The percolation problem; dilute magnetic systems. 
3) Random field systems. 
4) Spin glasses and structural glasses. |
| 8.  | D Chowdhury             | IIT, Kanpur      | (1) Stochastic chemical kinetics and single-molecule enzymology: general theory 
(2) Stochastic mechano-chemistry of molecular motors: general theory 
(3) Application of NESM to cytoskeletal motors 
(4) Application of NESM to Nucleic-acid based motors |
| 9.  | M V Sangaranarayanan    | IIT Chennai       | 1) Non-Equilibrium Thermodynamics formalism for chemical kinetic schemes 
2) Onsager's Flux-Force formalism for electron transfer processes at electrode/electrolyte interfaces |
| 10. | R Venkatesh             | BHU, Varanasi     | Statistical Mechanics of liquids: Correlation functions and Integral equations with introduction to Laplace transforms and Fourier transforms and Exact solution of Percus Yevick's integral equation for hard spheres |
| 11. | P M Gade                | RTMNU, Nagpur     | 1. Role of Physicists in Economics 
2. Dynamic Phase Transitions in Spatially Extended Systems |
| 12. | S S Dhondge             | SKP College, Nagpur | Gibbsian Statistics and Reaction Rates |
| 13. | A A Bhalekar            | RTMNU, Nagpur     | Some Foundational Aspects of Non-equilibrium Thermodynamics |