



Science Academies' Refresher Course on

Mathematical Methods in Physics & their Applications

In Collaboration with

Department of Physics (Autonomous), University of Mumbai

October 17- 29, 2016

Sponsored by

Indian Academy of Sciences, Bangalore

Indian National Science Academy, New Delhi

The National Academy of Sciences, India, Allahabad



University of Mumbai

Participation:

The two-week refresher course is primarily aimed at college teachers of Physics at the UG / PG level. It will cover basics of the subject through lectures and tutorials.

Students pursuing Ph.D. degree in Physics may also apply. College/ university teachers of Physics will be given preference.

Resource Persons:

Prof. Abbas Rangwala (University of Mumbai)

Prof. Sreerup Raychaudhuri (T.I.F.R., Mumbai)

Prof. Amol Dighe (T.I.F.R., Mumbai)

Prof. Kedar Damle (T.I.F.R., Mumbai)

Prof. Dibyendu Das (I.I.T., Bombay)

Prof. Amita Das (IPR, Gandhinagar)

Course:

The course will consist of six modules. In addition, there will be interactive sessions and tutorials aimed at clarifying basic concepts and improving the pedagogical skills of participants.

Module 1: Vector & Tensor Analysis

Module 2: Linear Vector Spaces

Module 3: Complex Analysis

Module 4: Introduction to Group Theory

Module 5: Ordinary differential equations & their applications in Physics

Module 6: Partial differential equations & their applications in Physics

Course Director:

Prof. Amita Das.

Institute of Plasma Research,

Gandhinagar-382428

Gujarat - INDIA

Course Coordinator:

Prof. Anuradha Misra.

Department of Physics,

University of Mumbai,

Santa Cruz (E), Mumbai-400098, India

Phone: +912226526250

E-mail: misra@physics.mu.ac.in

Use following link to send your application: <http://web-japps.ias.ac.in:8080/Refreshcourse/RMMPA.jsp>

Alternatively, application in the prescribed format may be sent by email to: rcmm2016@mu.ac.in

Please note that participants have to attend the full duration of the course. Selected participants will be provided with local hospitality and round trip bus/train (III A/C)fare by the shortest route.

Last date for receiving applications: **5th September 2016.**

Participation:

Teachers who wish to participate should send their applications online using the following link

<http://web-japps.ias.ac.in:8080/Refreshcourse/RMMPA.jsp>

Alternatively, applications in the prescribed format may be sent by email to RCMM2016@mu.ac.in

Please note that participants have to attend the full duration of the Course

Students pursuing Ph.D. degree in Physics may also apply. College/University teachers of Physics will be given preference.

Last date for receiving applications: 5th September 2016.

How to reach:

The Vidyanagari campus of the University of Mumbai is located centrally at Kalina, and is easily accessible by both the Central and Western railway lines, and connected by local trains, and is also very close to the domestic Airport.

Outstation candidates alighting at CST/Lokmanya Tilak Terminus/Dadar can board a train to Kurla and travel from Kurla station by bus/autorickshaw. Similarly, candidates alighting at Mumbai Central may board a train to Santacruz and complete their journey by bus/autorickshaw.

Organising committee:

Course Director:

Prof. Amita Das
Institute of Plasma Research,
Gandhinagar-382428
Gujarat – INDIA

Course Coordinator:

Prof. Anuradha Misra
Department of Physics,
University of Mumbai,
Santa Cruz (E), Mumbai-400098, India
Phone: +912226526250
E-mail: misra@physics.mu.ac.in



Science Academies' Refresher Course on **Mathematical Methods in Physics & their Applications**

University of Mumbai



In Collaboration With
**Department of Physics
(Autonomous),
University of Mumbai**

October 17- 29, 2016

Sponsored by
Indian Academy of Sciences, Bangalore
Indian National Science Academy, New Delhi
The National Academy of Sciences, India,
Allahabad

Venue
Department of Physics (Autonomous),
University of Mumbai,
3rd floor, Lokmanya Tilak Bhavan,
Vidyanagari, Santacruz,
Mumbai – 400098.
Tel: 022-26526250

Preamble:

Refresher Courses form an important segment of activities under the Science Academies' programmes. A two week Refresher Course on the theme "**Mathematical Methods in Physics & their Applications**" will be held at University of Mumbai during December **October 17- 29, 2016**. The Course is primarily aimed at college teachers of Physics at the UG / PG level. It will cover basics of the subject through lectures and tutorials.

The Department of Physics at the University of Mumbai has taken the initiative to organize this course, mainly for the benefit of teachers of M.Sc. Level Atomic Physics courses. The main aim of this course is to prepare the teachers who will be teaching at the PG level at the various centres of the University.

Resource persons:

The resource persons of the course are experienced lecturers and researchers in this field, with good pedagogical skills, so that even participants who know the subject quite well already, will be able to improve their presentation skills.

The course will consist of six modules. In addition, there will be interactive sessions and tutorials aimed at clarifying basic concepts and improving the pedagogical skills of participants.

Module 1: Vector and Tensor Analysis:

Vectors, matrices and tensors: use of Levi-Civita and summation convention for simplification, contravariant and covariant tensors, worked-out examples and assignments.

Abbas A. Rangwala, University of Mumbai.

Module 2 : Linear Vector Spaces:

Binary operations, field and vector space, norm and inner product, Cauchy-Schwartz and triangle inequalities, orthogonal basis, Gram-Schmidt process, linear operator, matrices, dual space and dual basis, adjoint operator, change of basis, eigenvalues and eigenvectors, Hermitian operators, Cauchy sequence, Hilbert space, harmonic analysis, (if time permits) formal structure of quantum mechanics.

Sreerup Raychaudhuri, TIFR Mumbai

Module 3: Complex Analysis: Complex numbers and functions, Analyticity and singularity, Complex differentiation and contour integration, Cauchy's integral theorem, Taylor series and Laurent series, Residue theorem and applications to integration, Steepest descent method, Analytic continuation

Amol Dighe, TIFR Mumbai

Module 4: : Introduction to Group Theory: Groups of symmetries: discrete vs continuous, irreducible representations of

discrete symmetry groups, character tables and reduction into irreducible representations, applications to some physics problems, irreducible representations of SU(2) and SU(3), applications to some physics problems.

Kedar Damle, TIFR Mumbai

Module 5: Ordinary Differential Equations and their applications in Physics:

Homogeneous and inhomogeneous ODEs, Wronskian, notion of Green functions, zeros of the solutions – Sturm's theorems, types of singular points, initial value problems, power series, Frobenius method, hypergeometric and confluent hypergeometric equations, boundary value problems, Sturm-Liouville theory, eigenfunctions and eigenvalues, orthogonality, generating functions.

Dibyendu Das, IIT Bombay

Module 6: Partial Differential Equations and their applications in Physics:

Kinds of PDE and their common examples, method of solution: separation of variables, method of characteristics, boundary conditions, nonlinear PDEs – KdV and nonlinear Schrödinger equations – their application in shallow water waves, plasmas, laser plasma systems, eigenvalue problems, etc.

Amita Das, IPR Gandhinagar