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### CENTRE FOR MATHEMATICAL AND STATISTICAL SCIENCES (CMSS)

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## SERB (DST) – sponsored 11th SERB School on
# Matrix Methods & Fractional Calculus
**(28th April 2014 to 23rd May 2014, four weeks)**

Organized by the **Centre for Mathematical and Statistical Sciences (CMSS)** in collaboration with the **Kerala State Council for Science, Technology and Environment (KSCSTE)**, and **Kerala Forest Research Institute (KFRI), Peechi, Kerala**

Applications are invited to the all-India SERB School on Matrix Methods and Fractional Calculus; **30 seats**; all expenses met by SERB (DST); **closing date of applications**: 26th February 2014

**ELIGIBILITY:** Young faculty below 35 years of age, post-doctoral fellows, research scholars, M.Phil students, and if seats are available then a few M.Sc graduates and final year M.Sc students will be admitted

**Minimum qualification**: B.Sc (with Mathematics as a subject), M.Sc degree or final year in M.Sc program in Mathematics/ Statistics/ Theoretical Physics/ Theoretical Computer Science. Desirable: exposure to basic probability and statistics and good background in calculus

**Topics to be covered:** Vector-Matrix differential operators, Jacobians of matrix transformations, functions of matrix argument, multivariate analysis; fractional calculus, fractional differential equations and applications; generalized inverses and patterned matrices; systems of equations, linear and non-linear analysis, see details below.

**Apply on plain paper** to the Director, CMSS, with the following details: name, age, male/female, married /single, full postal address, e-mail, phone number, copies (not originals) of all certificates plus permission certificate if employed. Send to the following email address: dilipkumar.cms@gmail.com , naijumt@gmail.com , cmspala@gmail.com , directorcms458@gmail.com  Acknowledgement will be sent by e-mail. If acknowledgement by post is needed then enclose a self-addressed empty envelope with Rs 5/- stamp affixed.

**Faculty:** Distinguished researchers: Professor Dr F. Mainardi (Italy), H.J. Haubold (Austria), A.M. Mathai (Canada/India), R. Gorenflo (Germany),  V. Gejji (India). Additional proposed: Professor Dr R.B. Bapat (India), Peeyush Chandra (India),  N. Mukunda (India).

**Lectures:** Monday-Friday; 08.30-10.30, 14.00-16.00. Problem-solving sessions + coffee: 10.30-13.00, 16.00-18.00; no lectures on Saturdays and Sundays; free voluntary training in Tex, Latex, Maple on week-ends; class tests every week, cumulative grades appear in the certificates.

**Aim** of SERB Schools conducted by CMSS is not to engage a large number of lecturers and mention a large number of topics but rather to teach a few topics in depth from zero level to research level by engaging the leading researchers in the world on each topic.

## Details of topics to be covered

Under Matrix Methods, one of the areas will be one of the frontline areas of functions of matrix argument. These are real-valued scalar functions where the argument is a matrix (finite dimensional) or matrices in the real or complex domain. Lectures in this area will be useful to people doing research or intending to do work on the following areas/ topics: Operator theory of vector-matrix differential operators (finite dimensional), Jacobians of matrix transformations; zonal polynomials; group representation theory; special functions of matrix argument; matrix-variate statistical distributions, multivariate statistical analysis, multiple regression, principal components analysis, canonical correlation analysis, factor analysis; econometric models; systems of equations, linearized non-linear systems; optimization of bilinear forms with quadratic constraints, optimization of quadratic forms with linear / quadratic constraints etc

Under Matrix Methods, a second area will be generalized inverses of matrices, patterned matrices, general matrix theory and applications. These lectures will be useful to researchers and people interested to start research in the following areas/ topics: Singular system of linear equations; non-orthogonal designs in design of experiments; singular or near singular situations in multiple regression analysis; linear and non-linear least square analysis; semigroups; graph theory; stochastic processes; structures involving singular systems; over-specified models in model building; testing of statistical hypotheses on covariance structures etc

Another area of the School is Fractional Calculus. Generally speaking, fractional calculus is applicable wherever calculus is applicable. Lectures will be useful to researchers working or people intending to do work in the following areas/ topics: Special functions; differential equations (total, partial), integral equations; reaction, diffusion, reaction-diffusion problems in physics, chemistry, biological and medical sciences; random walk problems and stochastic processes in general; model building; various types of engineering and communications problems which are formulated in terms of differential equations; statistical distribution theory. Recently introduced general definitions (2013, 2014) combining all existing fractional integrals and fractional derivatives, fractional calculus of matrix-variate functions, fractional calculus of complex variables and matrices in the complex domain, fractional derivatives in the matrix-variate case, open problems etc will also be discussed.

Director