Global Initiative of Academic Networks(GIAN)
course on
FRACTIONAL DERIVATIVES AND ITS APPLICATIONS
January 30-February 03, 2018
at
Department of Mathematical Sciences,
Indian Institute of Technology (Banaras Hindu University) Varanasi, Varanasi, UP, India

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Overview

The idea of fractional calculus (FC) is as old as traditional calculus. It was formulated in 1695, shortly after the development of classical calculus, and the original question that led to the name fractional calculus was: Can the meaning of a derivative of integer order $\frac{d^n y}{dx^n}$ be extended to have a meaning when n is a fraction? Since then, several mathematicians contributed to the development of FC, including Riemann, Liouville, Abel, Grunwald, Letnikov, Weyle and Riesz. Until recently, research on FC was confined to the field of mathematics. However, in the last two decades, many applications of FC in various fields of engineering, science, mathematics, bioengineering and economics have been found. As a result, FC has become an important topic for researchers in various fields.

The principal goal of this course is to present a systematic introduction to the fractional derivatives and its need to the current research areas including real life applications. Further, some problems of interest such as the 1) problem of the fractional variational calculus 2) introduction to the problem of fractional optimal control problem, and 3) fractional Strum-Liouville problem will be addressed. In the study of the fractional variational calculus the participants will be introduced to the Fractional Variational Calculus as Agrawal's Principle and related concepts. This principle invented by prof. Agrawal has been recognized by several authors in their books on "Fractional Variational Calculus". To conclude, some problems will be outlined, and challenges involved in solving them will be discussed, motivating M.Sc., B.Tech, M.Tech., and Ph.D. students to engage in research problems in this rapidly developing area of research.

Course Title	**FRACTIONAL DERIVATIVES AND ITS APPLICATIONS**
Course Dates	**January 30 – February 03, 2018**
Who Can Attend?	▪ M.Sc./B.Tech./M.Tech./Ph.D. students from various institutes, universities and research organizations across the country. ▪ Faculty/Researchers/Scientist from academic/technical institutions and R&D Centre across the country
Registration Process & Fees	**Step 1: One-time Registration on GIAN portal** (if already registered, go to step 2 for details regarding institute registration for this course) **Web link: http://www.gian.iitkgp.ac.in/GREGN/index** Note that registration to the portal is one-time affair and will be valid for lifetime of GIAN. Once registered in the portal, an applicant will be able to apply for any number of GIAN courses as and when necessary. **Step 2: Institute Registration:** All participants are required to pay the appropriate registration fee as given below. **Student Participants: ₹ 1000** **Faculty/Scientist/Researchers from academic/technical institutions: ₹ 2500** **Industry Participants: ₹ 3500** **Participants from abroad: US $100**

	Participants are requested to email the scanned copy of duly filled registration form given at the end, along with the receipt of prescribed fee submitted through State Bank Collect, on or before **January 15, 2018**, with the subject '**GIAN STC 2018 Participant**' to rkpandey.mat@iitbhu.ac.in The procedure for making the fee payment is as follows. **Payment Instructions:** Access **https://www.onlinesbi.com** Click on **SB Collect**. Click Checkbox to accept 'Terms & conditions'. Then click on '**Proceed'.** Select state as '**Uttar Pradesh'.** Select type of category as '**Educational Institutions'.** Click on '**Go'.** Select the name of institutions as '**Indian Institute of Technology (B.H.U.), Varanasi'.** Select payment category as '**GIAN-short term course participation fee'.** Fill up the form and pay the fee according to your participation category. Save the receipt for record and get SB collect reference number; you need to fill it on registration form.
Accommodation	The participants may be provided with accommodation at the Institute Guest House/ Hostels on nominal payment basis subject to availability. Request for accommodation has to be sent in advance. Otherwise, participants will have to make their own stay arrangement.
Further Information	▪ Number of participants for the course will be limited to forty. ▪ The selected participants will be informed through email by **January 20, 2018**. ▪ Accommodation will be provided on first come first serve basis. ▪ Bring your fee receipt, registration form, and selection confirmation to attend the course. ▪ Participants will be provided registration kit and course material covering the entire course. The registration fee includes all instructional materials, computer use for tutorials and assignments, and free internet facility. ▪ After successful completion of the course, all participants will get participation certificate.
Main Topics	▪ Introduction to Fractional Derivatives and Practical Engineering Applications where Fractional Derivatives are applied. ▪ Definitions of Various Fractional Integrals and Derivatives including Riemann Liouville fractional Integral, Riemann Liouville, Caputo Fractional, Hilfer and other Fractional Derivatives; Fractional Differential Equations ▪ Variational Calculus and its Various Applications ▪ Fractional Variational Calculus and Fractional Euler-Lagrange Equation ▪ Generalized Variational Calculus and Generalized Euler-Lagrange Equations ▪ Analytical and Numerical Solutions of Fractional Variational Problems ▪ Fractional Optimal Control Problems and Their Solutions ▪ Fractional Sturm-Liouville Eigenvalue Problems ▪ Fractional Riemann-Liouville Inequalities

The Faculty

Dr. Om P. Agrawal is a full professor in the Department of Mechanical Engineering and Energy Processes at Southern Illinois University, Carbondale, IL. Since 1997, Professor Agrawal has been actively involved and promoting in the area of Fractional Derivatives and Their Applications. He has made significant contributions to the field including: Formulation of fractional variational calculus and fractional Euler-Lagrange equations, Deterministic and stochastic analysis of fractional dynamic and fractional optimal control systems, and analytical and numerical tools and techniques for fractional systems. Dr. Agrawal has been a plenary keynote speaker and invited speaker at several symposia, conferences, and universities. He has received various awards for his contributions in the field of Fractional Derivatives.

In 2003, he organized the First Symposium on Fractional Derivatives and Their Applications in Chicago. This symposium was the first symposium to bring together at one place many people from different fields (engineering, science, economics and finance, mathematics, bioengineering, etc.) working on the application of Fractional Derivatives. In 2004, Professor Agrawal led a US team in a US-French collaboration on Fractional Derivatives and Their Applications. One of his works was recently called the *Agrawal Principle* by some experts in the field. Along with Prof. Tenreiro Machado and Dr. Sabatier, Professor Agrawal has co-edited a special issue of Nonlinear Dynamics and a book on Recent Advances in Fractional Calculus. Currently, Professor Agrawal is an associate editor of the Journal of Computational and Nonlinear Dynamics and the Indian Journal of Theoretical Physics. He is also a member of the editorial board of the International Journal of Differential Equations and Fractional Dynamic Systems.

Dr. Rajesh K. Pandey is Associate Professor at Department of Mathematical sciences, Indian Institute of Technology (BHU) Varanasi. He is recipient of the Indo-US Research Fellowship for the year 2012-13. He has also been awarded Best Research Paper award to one of the paper by MESA, committee of ASME 2013 IDETC held at Portland, Oregon, USA. His research areas are Spectral methods for Integral equations and Integro-differential equations, Fractional Derivatives and its Applications, and Image Processing applications.

Course Co-ordinator

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1. Name ....

2. a) Age .... b) Sex: M/F ....

3. Designation ....

4. Organization ....

5. Address for correspondence

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E-mail.. Phone/Mobile...

6. Highest Academic Qualification...

7. Specialization ....

8. Category of Participant

+ Faculty/Research Scholar/Student of IIT (BHU) ☐
+ Faculty/Research Scholar/Student of other institutions ☐
+ Industry Participant ☐
+ Foreign Participant ☐

9. IIT (BHU) Accommodation Required Yes ☐ No ☐

10. Payment Details

+ Amount (Rs.) ....
+ SB Collect Reference Number ....

Payment mode: Through SB collect (see brochure for details regarding payment procedure)

Please register me for the course on **Fractional Derivatives And Its Applications** to be held at IIT (BHU) Varanasi.

Date.....................

Place ....   Signature of the Participant