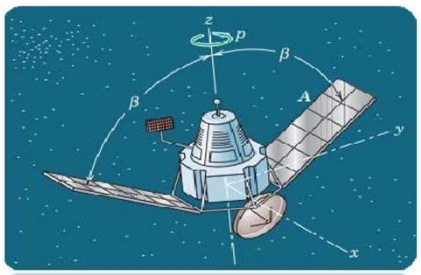
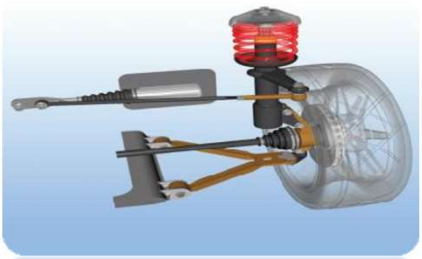
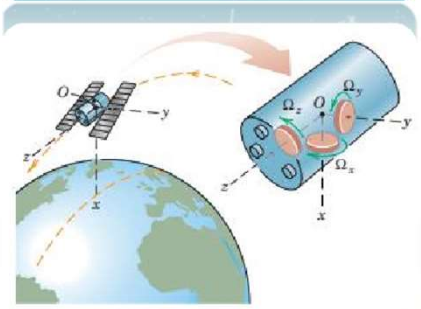
Introduction to Dynamics of Rigid Bodies via Kane's Method

Date: March 03 – March 07, 2025

(Online course)




Organized by:
Department of Aerospace Engineering and Applied Mechanics
and
Department of Mechanical Engineering
under the aegis of
Office of Dean International Relations and Alumni Affairs
Indian Institute of Engineering Science and Technology (IIEST), Shibpur
West Bengal, INDIA

Dept. of Aerospace Engineering & Applied Mechanics (AE&AM), and Dept. of Mechanical Engineering, IIEST, Shibpur

About Organizing Institute

The Indian Institute of Engineering Science and Technology, Shibpur (IIEST Shibpur) is a prestigious institution with a rich history dating back to 1856. Its evolution from the Civil Engineering College to an Institute of national importance highlights its significance in India's educational landscape. The wide array of programs offered at IIEST Shibpur, including undergraduate, postgraduate, and doctoral studies in engineering, science, architecture and planning, reflects its commitment to comprehensive education. Apart from regular program, the Institute's emphasis on interdisciplinary learning, innovation, and research is crucial in today's dynamic technological environment. The well-equipped laboratories and research centres provide students with the opportunity to engage in hands-on learning, enhancing their educational experience. Overall, IIEST Shibpur stands out as a leading institution that not only honours its historical roots but also adapts to contemporary educational needs, making it an attractive choice for aspiring engineers and scientists.

About Aerospace Engineering and Applied Mechanics Department

The Department of Applied Mechanics at IIEST Shibpur indeed boasts a rich history since its establishment in 1947. Its transition to the Department of Aerospace Engineering and Applied Mechanics in 2008 highlights its commitment to adapting to the evolving landscape of engineering education. The focus on engineering mechanics and aerospace engineering, along with ongoing research in multiple areas, underscores the department's dedication to providing a cutting-edge curriculum. This diverse range of programs not only imparts essential theoretical knowledge but also emphasizes practical skills, effectively preparing students for the challenges they will face in the aerospace and engineering sectors. By fostering an environment of innovation and hands-on learning, the department plays a crucial role in shaping future engineers equipped to tackle contemporary issues in these dynamic fields.

About Mechanical Engineering Department

The Department of Mechanical Engineering was established in 1921.The department has completed 102 years of its existence. Since its inception, the department has come a long way and has witnessed remarkable evolutions during its long journey. The first degree level course in Mechanical Engineering started on 18th July 1930. Post-graduate course in the department was started in the year 1954. Over the years, through its high level of teaching and research in mechanical engineering, the Department, has earned a name and fame for itself, making significant contributions to the country and around the world. The Department offers Undergraduate (UG) and Postgraduate (PG) courses in Mechanical Engineering, along with the PhD program.

Dept. of Aerospace Engineering & Applied Mechanics (AE&AM), and Dept. of Mechanical Engineering, IIEST, Shibpur

Course Overview

Kane's Method is a popular and celebrated approach for formulating the equations of motion for complex multibody engineering systems. It requires less effort and yields simpler equations compared to classical methods. This course provides a comprehensive introduction to Kane's Method. Beginning with the fundamental theorem on vector differentiation in two reference frames, it covers concepts such as angular velocity, partial angular velocity, generalized coordinates, and generalized speeds. The course also explores topics like mass center, the moment of inertia dyadic, and generalized active forces. Finally, it introduces Kane's equations of motion for both constrained and unconstrained systems. This course aims to equip participants with the tools to tackle complex, real-life dynamics problems in mechanical and aerospace systems.

Course Instructor – Dr. Arun Kanti Banerjee

Dr. Arun Kanti Banerjee, a distinguished alumnus of IIEST Shibpur, retired as the Principal Research Scientist from Lockheed Martin Advanced Technology Center, Palo Alto, USA. Previously, he worked for Martin Marietta Corporation and Northrop Corporation. With a rare distinction of having two PhD degrees (IIT Kharagpur and University of Florida), Dr. Arun Kanti Banerjee is one of the leading experts in the world on the subject of Flexible Multibody Dynamics. He has contributed numerous journal publications on Flexible Multibody Dynamics, presented papers in several prestigious International conferences and has authored a textbook on Flexible Multibody Dynamics.

Who can attend

Faculty members and Practicing Engineers related to Mechanical, Aeronautics and Aerospace Engineering disciplines, working in Dynamics, would find the course beneficial.

Course Contents

- **Introduction**
- **Simple rotations, Body-3 rotations, Direction Cosine Matrices (DCM), Rigorous Definition of Angular Velocity, Fundamental Theorem on Differentiation of a Vector in Two Frames**
- **Euler Angles and Euler Angle Rates and their Singularity, Quaternions, their use in DCM, Relation with Angular Velocity, Successive Rotations and Use in Attitude Control**
- **Four Fundamental Theorems in in Kinematics, Applications in Rigid Body and Flexible Body Dynamics, Angular Acceleration Kane's Definition of Generalized Speeds, Partial Velocities, Partial Angular Velocities Moment of Inertia Dyadic, Determining Principal Moments of Inertia, Generalized Inertia Forces, Generalized Active Forces (GAF), GAF due to Potential and Dissipation Functions.**
- **Kane's Equations for Constrained Systems, Kane's Equations vs Lagrange's Equations, Kane's Method of Deriving Linearized without deriving the Non-Linearized Equations, Dynamics of an Arbitrary Flexible Body, Dynamics of an arbitrary flexible body.**

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Course Fee (including GST)

Participants	National	International
Industry Personnel	INR 5000	USD 500
Faculty Member	INR 3000	USD 300
Research Scholar and others	INR 1000	USD 100

Registration Steps

1. The registration fee is to be paid through the following account:
   Name: CONTINUING EDUCATION CENTRE BESUS
   A/c No.: 1532010011963
   IFSC: PUNB0153220
   Bank Name: Punjab National Bank
   Branch: BESUS
2. After successful payment, please fill in and submit the Google form along with the payment receipt using the link below:
   https://forms.gle/ocCnWm8U1dvtvJA88

3. Last date of registration: March 2, 2025

Note:

- ✓ Link will be provided to participants applying for online mode via registered email.

Course Coordinator
Dr. Indrajit Mukherjee
Assistant Professor
Mobile: +91 9986150962
Email: imukherjee.aero@faculty.iiests.ac.in
Department of Aerospace Engineering and Applied Mechanics, IIEST, Shibpur

Joint Course Coordinator
Dr. Apurba Das
Assistant Professor
Mobile: +91 8900644320
Email: apurbadas.mech@faculty.iiests.ac.in
Department of Mechanical Engineering, IIEST, Shibpur