Course title: Railroad Vehicle Dynamics (3-0-0-9)

Course objective: Introduction to analytical tools for modeling, analysis and design of railway vehicles.

Prerequisite: Dynamics

Desirable: ME 625, ESO 209a (or equivalents)

Instructor: N. S. Vyas

Other interested faculty members: Bishakh Bhattacharya, Nachiketa Tiwari

Lectures per week: 3 hrs

Eligibility: PG, UG (III, IV yrs)


Lecture-wise Break-up:
1. Introduction (2 hrs)
2. Dynamic Formulations (6 hrs)
   General Displacement, Rotation Matrix, Velocities and Accelerations, Newton-Euler Equations, Joint Constraints, Augmented Formulations, Trajectory Coordinates, Embedding Techniques, Virtual Work
3. Rail and Wheel Geometry (6 hrs)
   Theory of Curves, Geometry of surfaces, Rail Geometry, Definitions and Terminology, Geometric description of track, Wheel Geometry
4. Contact and Creep-Force Models (6 hrs)
   Hertz Theory, Creep Phenomenon, Wheel/Rail contact approaches, Creep-force theories
5. Multibody Contact Formulations (10 hrs)
   Parameterisation of Wheel and Rail surfaces, Constraint Contact Formulations, Augmented constraint contact formulation, Embedded constraint contact formulation, Elastic Contact Formulation (Algebraic Equations, Nodal Search), Planar Contact Profile Parameters Coupling between surface parameters
6. Modelling and Simulation (10 hrs)
   Multi-body and constraint algorithms, Track models, Creep calculations, Measurements
   Damping Elements, Maglev models, Stability Models

Suggested Textbooks:
5. Railway Noise and Vibration, David Thompson, Elsvier