

Proposed syllabus of  
ANALYTICAL DYNAMICS, 1953-54

1/17 5/17/54

- I. Foundations of Dynamics  
Fundamental concepts. Newton's laws. Galilean principle of relativity. Inertial forces.
- II. Linear Motion of a Particle  
Equation of motion. Energy integral. Potential energy. Linear oscillator. Damping. Forced oscillations. Resonance. Non-linear force.
- III. Particle in Space  
Equations of motion. Conservation of energy. Central field of force. Conservation of angular momentum. Inverse square law. Constraints.
- IV. Lagrange's and Hamilton's Equations  
Derivation and applications.
- V. Motion of Rigid Body  
Equations of motion. Moments of inertia. Rotation about fixed axis. Free rotation. The top. Non-holonomic systems.
- VI. System of Particles  
Two-particle system. General system. Coupled oscillators. Normal coordinates.
- VII. Vibrating String  
Wave equation. String as limit of system of particles. Normal coordinates. Wave propagation. Reflection and standing waves. Variable tension and density. Perturbation theory.
- VIII. The Vibrating Membrane  
Equation of motion. Rectangular membrane. Circular membrane.
- IX. Vibrations of Elastic Solid  
Stresses. Strains. Hooke's law. Equilibrium equations. Equations of motion.

## Analytical Dynamics (cont.)

### X. Fluid Dynamics

Flow concepts. Equation of continuity. Euler's equations. Irrotational flow and velocity potential. Incompressible fluids and Stokes-Navier equations.

### XI. Variational Principles

Hamilton's principle. Principle of least action. Principle of least curvature.

### XII. Transformation Theory of Dynamics

Contact transformations. Poisson brackets. Hamilton-Jacobi equation. Action and angle variables.

### XIII. Relativistic Dynamics

Analysis of concepts of space and time. Michelson-Moreley experiment. Lorentz transformation. Particle motion in special relativity theory. Mass, energy and momentum.

Note: - Order of topics may be re-arranged after consultation with teachers of differential equations, vector analysis, and function theory to improve coordination of material in parallel courses.

Nathan Rosen

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