

Course Code : ME 755

Course Title : Advanced Dynamics

Credit Hours : 3

Course Description

Introduction to particle dynamics – particle motion, Systems of particles, Constraints and configuration on space-work, energy and momentum – impulse response, Lagrange and Hamilton Equations, Hamilton's equation – integrals of motion, Impulsive response – analytical methods, Kinematics and dynamics of rigid bodies – kinematical preliminaries, Dyadic notation – basic rigid body dynamics, Impulsive motion, Equations of motion: differential approach, Equations of motion: differential approach, Boltzman-Hamel equation – the general dynamical equation – a fundamental equation, Equation of motion: Integral approach, Transitional relations and Introduction to numerical methods.

Course Objectives

The aim of this course is to present the dynamics of particles and rigid bodies in some breadth, with examples illustrating the strengths and weaknesses of the various methods of dynamical analysis. In the course there is some emphasis on systems of great generality. Geometrical approaches are used to illustrate the nature of constraints.

Course Topics

- Week no. 1: Introduction to particle dynamics – particle motion
- Week no. 2: Systems of particles
- Week no. 3: Constraints and configuration on space-work, energy and momentum – impulse response
- Week no. 4: Lagrange and Hamilton Equations
- Week no. 5: Hamilton's equation – integrals of motion
- Week no. 6: Impulsive response – analytical methods
- Week no. 7: Kinematics and dynamics of rigid bodies – kinematical preliminaries / 7th week evaluation.
- Week no. 8: Dyadic notation – basic rigid body dynamics
- Week no. 9: Impulsive motion
- Week no. 10: Equations of motion: differential approach
- Week no. 11: Boltzman-Hamel equation – the general dynamical equation – a fundamental equation
- Week no. 12: The Gibbs-Appell Equation – constraints and energy rates / 12th week evaluation

Week no. 13: Equation of motion: Integral approach

Week no. 14: Transpositional relations

Week no. 15: Introduction to numerical methods

Week no. 16: Final Examination

References

Green Wood, D.T. advanced dynamics, UK Cambridge University 2003.

Kane T.R. and Levinson D.A., dynamics theory and applications, N.Y. McGraw Hill, 1985.

Desloge, E.A. classical mechanics, vol1 N.Y., Wiley 1982.

Pars, L.A.A. treatise on analytical dynamics, London, William Heinemann 1965.

- Papastavridis, T.G. analytical mechanics, Oxford University press, 2002.