10590 – 712 (8) Lagrange and Hamilton Mechanics (1.5L, 1.5L)

2019

Course summary:

Degrees of freedom, generalised co-ordinates, Lagrange equations of the first and second kind, applications, small oscillations, variational calculus, Hamilton's principle, Noether's theorem.

Module relevance in programme:

In Physics 712 the Lagrange and Hamilton formulation of Classical Mechanics is studied. It is one of the core formalisms which every Physics student should master. All relevant equations are derived from first principles. The examples are mostly taken from mechanical systems. This course also provides a theoretical foundation for more advanced studies in field theory. The Lagrange function or density, introduced in this course, plays a critical role in the path integral formulation of physical systems which is studied in Physics 721 and Physics 719. This course is also very important for Physics 755 where the concept of canonical quantization in field theory is introduced.

Outcomes of course:

This course skills the student in the techniques and use of Lagrangian- and Hamiltonian Mechanics. Legendre transformations and the variational principle.

Emphasis is placed on problem solving. This course is the basis of all further courses in classical mechanics and also lays the foundation for more advanced courses in quantum mechanics.

Lecturer:

Prof BIS van der Ventel
Telephone number: (021) 808-3388
E-mail address: bventel@sun.ac.za
Office: Room 1019, Merensky Physics Building.

Mentor:

The Department of Physics has appointed a staff member as mentor for each year of its physics programme to be available to students for consultation. Students should feel free to discuss general issues related to the physics programme or specific modules in the programme with the relevant mentor, in addition to usual consultations with their individual lecturers of modules.

The mentor for the Honours programme and its modules is Dr CM Steenkamp.

Course content:

The formulation of classical mechanics from a very general viewpoint in terms of generalized coordinates etc; conservation laws and their relationship to Hamilton and Lagrange formalisms and symmetries; the analyses and approximation of many-body systems through normal modes; Lagrange and Hamilton mechanics as a formal basis of quantum mechanics.

Practical (Tutorials):

Wednesday 09h00 till 11h00

Study material

Notes will be sent via email to all students
Additional textbooks will be placed on reserve in the Physics library

Learning opportunities:

Lectures
Tutorials

Assessment:

Methods of Assessments
Continuous Evaluation: One test, two homework assignments and tutorials tests

Venue and time of assessment opportunities
To be announced in class.

Availability of marks:
In reasonable time

Calculation of final mark for the module:
Final mark = 0.25*(Tutorial tests) + 0.25*(Test) + 0.25*(Assignment 1) + 0.25*(Assignment 2))