Level five

Classical Mechanics (2)

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
PHY	303	Classical Mechanics (2)	3	3	0	1	PHY 105, MAT 203

Objectives:

At the end of the unit the student should:

- understand the notions of configuration space, generalized coordinates space in mechanics
- be able to obtain the Euler-Lagrange equations from a variational principle
- understand the relation between Lagrange's equations and Newton's laws
- be able to use Lagrange's equations to solve complex mechanical problems
- be able to obtain the Hamiltonian formulation of a mechanical system

Syllabus:

List of Topics	No. of Weeks	Contact Hours
Coordinate Systems and Transformation: Cartesian coordinates; circular cylindrical coordinates; spherical coordinates.	1.5	6
Some Methods in the Calculus of Variations: Euler's equation, the second form of the Euler equation, functions with several dependent variables, Euler's equation when auxiliary conditions are imposed.	2	8
Lagrangian& Hamiltonian Mechanics: Hamiltonian's principle, generalized coordinates, Lagrange's equations of motion in generalized coordinates, Lagrange's equations with undetermined multipliers, a theorem concerning the kinetic energy, conservation theorems, canonical equations of motion – Hamiltonian mechanics.	4	16
Central Force Motion: reduced mass, conservation theorems-first integrals of the motion, planetary motion-Kepler's problem.	2.5	10
Motion in a noninertial reference: frame: rotating coordinate systems, centrifugal and Coriolis forces, motion relative to the earth.	2	8
Mechanics of rigid Bodies: inertia tensor, angular momentum, principal axes of inertia, moments of inertia for different body coordinate systems, Eulerian angles, Euler's equations for a rigid body.	2	8

References:

- Classical Dynamics of Particles and Systems, Jerry Marion and Stephen T., Brookes Cole, 5th Edition (2003)
- Mechanics, L. Landau and E. Lifshitz, 3rd Edition. Butterworth-Heinmann, Oxford, (1976)
- Classical Mechanics; John R. Taylor; University Science Books (2005)
- Classical mechanics; Goldstein, Safko& Poole; Addison Wesley; 3rd Edition (2001).