King Saud University

Department of Physics and Astronomy

Course : PHYS 312

Title : Classical Mechanics (3-0) 3

Textbook : Classical Dynamics of Particles And Systems By S. Thornton And J. Marion, Brooks Cole; 5th Edition (2003).

Course Description:

Normal coordinates, some methods in the calculus of variations, Hamilton's and Lagrangian's principles. Lagrangian's and Hamiltonian's dynamics, central force motion, dynamics of a system of particles, dynamics of rigid bodies, motion in a non-inertial reference frame, coupled oscillations.

Grading Policy:

Exam 1:	**20%**
Exam 2:	**20%**
Homework and Quizzes:	**20%**
Final Exam:	**40%**

SYLLABUS
by Sections Numbers

Week	*Material*	Examples	Problems
1	*Introduction.* *Course requirements and syllabus* *Wha tis Classical Mechanics and why study it? What is the validity of Classical Mechanics?*		
2	*Chapter1.Matrices,Vectors,and Vector Calculus* *1.3 –Coordinate Transformations;.* *1.4 -Properties of Rotation Matrices;.* *1.7 -Geometric Significance of Transformation Matrices;.* *1.8,–Definition of a Scalar and a Vector*	*1.1, 1.4, 1.5*	
3	*Chapter6. Some Methods in the Calculus of Variations* *6.1- Introduction* *6.2 – Statement of the problem* *6.3 -Euler's Equation;.* *6.4 –The Second Form of the Euler Equation;.* *6.6 –Euler Equations and Auxiliary Conditions*	*6.1, 6.2, 6.3, 6.4, 6.5, 6.6,*	
4	*Chapter7.HamiIton'sPrinciple-Lagrangianand HamiltonianDynamics* *7.2 – Hamilton's Principle* *7.3 –Generalized Coordinates;* *7.4 -Lagrange's Equations;* *7.5- Lagrange's Equations with Undetermined Multipliers* *7.9 –Conservation Theorems;.* *7.10 -Canonical Equations of Motion-Hamiltonian*	*7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.11, 7.12,*	
5,6	*Chapter8.Central Force Motion.* *8.2 – Reduced Mass* *8.3 – Conservation Theorems – First Integrals of the Motion* *8.4 – Equations of Motion* *8.5 – Orbits in a Central Field* *8.7 -Planetary Motion- Kepler's problem;*	*8.1, 8.2, 8.3, 8.4,*	

7,8	Chapter9.Dynamics of a System of Particles 9.1 - Introduction 9.2 –Center of Mass; 9.3 –Linear Momentum of the System 9.4- Angular Momentum of the System; 9.5 – Energy of the system	*9.1, 9.2, 9.3, 9.4,*	
9,10	*Chapter10. Motion in a Noninertieal Reference Frame* 10.1 – Introduction 10.2 – Rotating Coordinate Systems 10.3 –Centrifugal and Coriolis Forces; 10.4 –Motion Relative to the Earth	*10.1, 10.2, 10.3, 10.5,*	
11,12	*Chapter11.DynamicsofRigidBodies* *11.3 -Inertia Tensor;* *11.4 –Angular Momentum;* *11.5 –Principal Axes of Inertia;* *11.6 –Moments of Inertia for Different Body; Coordinate System;* *11.8 -Eulerian Angles;* *11.9 -Euler's equations for a Rigid Body*	*11.3, 11.4, 11.5, 11.6, 11.9, 11.10*	
13,14	*Chapter12.CoupledOscillations* *12.2 -Two-coupled Harmonic Oscillators*		
15	**Repetitionand preparation forthefinal exam**		