مدونة المناهج السعودية

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الموقع التعليمي لجميع المراحل الدراسية

في المملكة العربية السعودية

مختصر توصيف المقرر

معلومات المقرر* **(Course Information)**

اسم المقرر:	ميكانيكا كلاسيكية 2
رقم المقرر:	فيز 2122
اسم ورقم المتطلب السابق:	فيز 2112
اسم ورقم المتطلب المرافق:	--
مستوى المقرر:	الرابع
الساعات المعتمدة:	3 (3+0+0)

Module Title:	Classical Mechanics II
Module ID:	PHYS 2122
Prerequisite (Co-requisite):	PHYS 2112
Co-requisite:	--
Course Level:	Forth
Credit Hours:	3 (3+0+0)

وصف المقرر : **Module Description**

In this course the students will study: Systems of particles, Applications to vibrating systems, rockets and collisions, Plane motion and space motion of rigid bodies, Lagrange's equations and Hamiltonian theory.

أهداف المقرر : **Module Aims**

1	The students will learn the Fourier series to solve the boundary problems.	1
2	To study the D'Alembert's principle, rockets and application.	2

مخرجات التعليم: **Learning Outcomes:**

1	**Knowledge** Understand D'Alembert's principle and Hamiltonian theory. Describe and understand the application of systems, rockets and collisions.	1
2	Solve the Lagrange's equations. Apply Lagrangian & Hamiltonian methods to complex motion problems.	2
3	**Interpersonal Skills & Responsibility** Work in a group and learn time management. Learn how to search for information through library and internet. Present a short report in a written form and orally using appropriate scientific language	3
4	**Communication, Information Technology, Numerical** Students will be able to ask questions during the lecture and will be fully confident to solve the problems related to Newtonian mechanics Illustrate deal with confidence with differential equations, integrations, and differentials.	4
5	**Psychomotor** Not applicable.	5

Course Contents: **محتوى المقرر:**

ساعات التدريس (Hours)	عدد الأسابيع (Weeks)	قائمة الموضوعات (Subjects)
9	3	**Chapter 1: Systems of Particles** Discrete and continuous; density; rigid and elastic bodies; degree of freedom; center of mass; center of gravity; momentum of a system of particles; motion of the center of mass; conservation of momentum; angular momentum of a system of particles; total external torque acting on a system; relation between angular momentum and total external torque; conservation of angular momentum; kinetic energy of a system if particles; work; potential energy; conservation of energy; motion relative to the center of mass; impulse; constraints; holonomic and non-holonomic constraints; virtual displacements; statics of a system of particles; principle of virtual work; equilibrium in conservative fields; stability of equilibrium; D'Alembert's principle.
6	2	**Chapter 2: Applications to vibrating systems, rockets and collisions** Newton's Vibrating system of particles; problems involving changing mass; rockets; collisions of particles; continuous system of particles, the vibrating string; boundary value problems; Fourier series; odd and even functions; convergence of Fourier series.
9	3	**Chapter 3: Plane motion of rigid bodies** Rigid bodies; translations and rotations; Euler's theorem; instantaneous axis of rotation; degrees of freedom; general motion of rigid bodies; Chasle's theorem; plane motion of a rigid body; moment of inertia; radius of gyration; theorems on moments of inertial; parallel axis theorem; perpendicular axes theorem; special moments of inertia; couples; kinetic energy and angular momentum about a fixed axis; motion of a rigid body about a fixed axis; principles of angular momentum; principle of conservation of energy; work and power; impulse; conservation of angular momentum; the compound pendulum; general plane motion of a rigid body; instantaneous center; space and body centrodes; statics of a rigid bvody; principle of virtual work and D'Alembert's principle' principle of minimum potential energy; stability.
6	2	**Chapter 4: Space motion of rigid bodies** General motion of rigid bodies in space; degree of freedom; pure rotation of rigid bodies; velocity and angular velocity of a rigid body with one point fixed; angular momentum; moments of inertia; products of inertia; moment of inertia matrix or tensor; kinetic energy of rotation; principal axes of inertia; angular momentum and kinetic energy about the principal axes; the ellipsoid of inertia; Euler's equations of motion; force free motion; the invariable line and plane; Poinsot's construction; Polehode; Herpolehode; space and body cones; symmetric rigid bodies; rotation of

		the earth; the Euler angles; angular velocity and kinetic energy in terms of Euler angles; motion of a spinning top; Gyroscopes.
9	3	**Chapter 5: Lagrange's equations** General methods of mechanics; generalized coordinates; notation; transformation equations; classification of mechanical systems; Scleronomic and rhenomic systems; Holonomic and non-holonomic systems; conservative and non-conservative systems; kinetic energy; generalized velocities; generalized forces; Lagrange's equations; generalized momenta; Lagrange's equations for non-holonomic systems; Lagrange's equations with impulsive forces.
6	2	**Chapter 6: Hamiltonian theory** Hamiltonian methods; the Hamiltonian; Hamilton's equation; the Hamiltonian for conservative systems; ignorable or cyclic coordinates; phase space; Liouville's theorem; the calculus of variations; Hamilton's principle; canonical or contact transformations; condition that a transformation be canonical; generating functions; the Hamilton-Jacobi equation; solution of the Hamilton-Jacobi equation; case where Hamiltonian is independent of time; phase integrals; action and angle variables.
		EXAMS

Textbook and References: **الكتاب المقرر والمراجع المساندة:**

سنة النشر Publishing Year	اسم الناشر Publisher	اسم المؤلف (رئيسي) Author's Name	اسم الكتاب المقرر Textbook title
1995	Wiley	Tai L. Chow	Classical mechanics
سنة النشر Publishing Year	**اسم الناشر Publisher**	**اسم المؤلف (رئيسي) Author's Name**	**اسم المرجع Reference**
1980	Addison-Wesley	Goldstein	Classical Mechanics
1998	Cambridge University Press	Hand L. N., Finch J. D.	Analytical mechanics
2005	University Science Books	Taylor J.R.	Classical Mechanics