Hashemite University
Faculty of Science
Department of Physics
First Semester 2016/2017
Physics 322

Course Information	
Course Title	Waves and Vibrations
Course Number	Phys 322
Prerequisites	Phys 281
Instructor	Dr. Nabil Al-Aqtash
Office Location	Physics 104
Office Hours	Monday and Wednesday 10-11
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Course Description

1- Simple harmonic motion with applications to include additions, subtractions and modulations.

2- Damped harmonic motion to include the variables of this motion and energy dissipation. The quality factor.

3- Forced oscillations to include : the concept of impedance, resonance and the resonance power curve.

4- Coupled oscillations to include mechanical and electrical systems. The coupling strength. To introduce the concept of degrees of freedom. Coupling in extended systems as a prerequisite to wave motion.

5- Transverse waves: wave variables, wave equation, impedance, group and phase velocities. Wave propagation in periodic structures. Reflection and transmission of waves .

6- Longitudinal Waves.

7- Waves in more than one dimension.

Text Book	
Title	The Physics of vibrations and Waves
Author(s)	H. G. Pain
Publisher	John Wiley and sons
Year	2005
Edition	Sixth
Book Website	Not avaliable
References	Vibrations and Waves By: G. C. King Vibrations and Waves By: A.P.French Waves By : D. Tilley

Assessment Policy		
Assessment Type	**Expected Due Date**	**Weight**
First Exam	To be announced	25%
Second Exam	To be announced	25%
Final Exam	To be announced	40%
Assignments	At the end of each chapter	10%

Course Objectives	Weights
Simple Harmonic Motion of mechanical and electrical systems. The equation of motion, variables of the motion, solution of the equation of motion using the force method, the energy method. Phasors. Addition of	20%

more than one harmonic motions .	
Explore the importance of resonance, resonance power curves and the quality factor	20%
Understand the concept of mechanical and electrical impedances.	10%
Understand the concept of the degrees of freedom and the evolution of waves as a result of coupled motion.	20%
Understand the origin of wave motion and the concept of reflection and transmission of waves at different boundaries.	20%
Waves in more than one dimension: Plane wave representation in two and three dimensions. Normal modes and method of separation of variables in one, two and three dimensions	10%

Teaching & Learning Methods
Typical chalk and talk lectures aided with demonstrations inside the class.

Related Objective(s)	Reference(s)
1- Waves in more than one dimension: Plane wave representation in two and three dimensions. Normal modes and method of separation of variables in one, two and three dimensions	Chapters 1 and 2
2- Explore the importance of resonance, resonance power curves and the quality factor	Chapter 3
3- Understand the concept of mechanical and electrical impedances.	Chapters 3+5+6
4- Understand the concept of the degrees of freedom and the evolution of waves as a result of coupled motion.	Chapter 3
5- Understand the origin of wave motion and the concept of reflection and transmission of waves at different boundaries.	Chapters 5+6+9

Course Content		
Week	**Topics**	**Chapter in Text (handouts)**
1+2	Simple Harmonic Motion of mechanical and electrical systems. The equation of motion, variables of the motion, solution of the equation of motion using the force method, the energy method. Phasors. Addition of more than one harmonic motions .	1
3+4	Damped Harmonic Motion, amplitude decay, logarithmic decrement, relaxation time , the Q-Value.	2
5+6	Forced Harmonic Motion: The mechanical forced oscillator, it's equation of motion, the solution of the equation of motion. The vector operator(I). The electrical oscillator, equation of motion, concept of impedance, the mechanical impedance, variables of, motion (displacement, velocity and acceleration).Power absorption, the amplification factor.	3
7+8+9	Coupled oscillators: The equation of motion. The normal coordinates and the normal modes of vibrations. Electrically coupled oscillators. Coupling of many oscillators. Wave motion.	4
10+11+12	Transverse Wave motion: Mathematical approach to the wave equation . particle phase velocity. The wave equation in a string. The string as a forced oscillator. The characteristic impedance of a string. Reflection and transmission of transverse waves at a boundary .Standing waves on a string of fixed length. Normal modes, energy in a normal mode of oscillation. Wave groups and dispersion. Transverse waves in a periodic structure.	5
13+14	Longitudinal waves: Wave equation, Sound waves in gases. Energy distribution in a sound wave. Specific impedance of a sound wave. Longitudinal waves in a solid structure.	6
15+16	Waves in more than one dimension: Plane wave representation in two and three dimensions. Normal modes and method of separation of variables in one, two and three dimensions.	9