هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Vibrations and Waves**
Course Code:	**2032201- 4**
Program:	**Bachelor in Physics**
Department:	**Physics Department**
College:	**College of Science**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: 4
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 6th Level/ 2ed Year
4. Pre-requisites for this course (if any)**:** **Calculus (1) 2021204-4**
5. Co-requisites for this course (if any)**: None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	**7**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	50
2	**Laboratory/Studio**	20
3	**Tutorial**	
4	**Others** (specify)	
	Total	**70**

B. Course Objectives and Learning Outcomes

1. Course Description

This course meets 3 times per week 2 for lecture and 1 for Lab. It is an intermediate-level course dealing with vibrations and waves in mechanical, electromagnetic, and quantum contexts. Students will learn almost a broad range of phenomena classified by the presence of vibrations and waves. If you take any system and disturb it from a stable equilibrium, the resultant motion will be waves and vibrations. Example for this is guitar string—pluck the string, it vibrates. The sound waves generated make their way to ears.

2. Course Main Objective

Establishes a foundation in vibration and waves in preparation for more advanced courses. Provide student with the concepts and mathematical tools necessary to understand and explain a broad range of vibrations and waves

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Identify oscillators in terms of displacement, velocity and energy exchange, giving various examples.	K1
1.2	Name the difference between the types of oscillators using equation of motion	K1
2	**Skills :**	
2.1	Classify the waves and oscillators types .	S1
2.2	Solve problems involving to un-damped, damped and force oscillators and superposition of oscillations	S2
3	**Values:**	
3.1	Work effectively in groups and exercise leadership when needed.	V2
3.2	Act responsibly and be able to prepare a written scientific report	V3

C. Course Content

No	List of Topics	Contact Hours
Part1		
1	Unit1: **Simple Harmonic Oscillations**. • Displacement, Amplitude, Frequency, Time Period and Phase. • Velocity, Acceleration,. Kinetic, Potential and Total Energy Reference Circle. Rotating. Differential Equation of SHM and its Solution	**6**
2	Unit2: **Free Oscillations of Systems with One Degree of Freedom:** • Mass-Spring system (horizontal and vertical). • Simple Pendulum. • Torsional Pendulum. • Compound pendulum • Oscillations in a U-Tube, Oscillations in Electrical Circuits (LC circuit)	**6**
3	Unit3: **The Damped Harmonic Oscillator:** ▪ The Equation of Motion for a Damped Harmonic Oscillator. ▪ Light damping- Heavy damping - Critical damping. ▪ Rate of Energy Loss in a Damped Harmonic Oscillator. ▪ The quality factor Q of a damped harmonic oscillator. Damped Electrical Oscillations.	**6**
4	Unit4: **Forced Vibrations and Resonance:** ▪ The Equation of Motion of a Forced Harmonic Oscillator ▪ Forced oscillations with damping ▪ Power Absorbed During Forced Oscillations ▪ Resonance in Electrical Circuits ▪ Transient Phenomena The Complex numbers and Complex	**6**
5	Unit5: **Superposition of Two Collinear Harmonic Oscillations :-** ▪ Linearity and Superposition Principle. ▪ Oscillations having Equal Frequencies ▪ Oscillations having Different Frequencies (Beats). Superposition of Collinear Harmonic Oscillations with Phase Differences	**5**

6	Unit6: **Superposition of Two Perpendicular Harmonic Oscillations :** • Superposition of Two Perpendicular Simple Harmonic Motions Lissajous Figures and their Uses.	**4**
7	Unit7**: TRAVELLING WAVES** ▪ Physical Characteristics of Waves ▪ Travelling Waves ▪ Travelling sinusoidal waves ▪ The Wave Equation ▪ The Equation of a Vibrating String ▪ The Energy in a Wave and transport of Energy by a Wave Waves in Two and Three Dimensions	**6**
8	Unit8**: STANDING WAVES** ▪ Standing Waves on a String ▪ Standing Waves as the Superposition of Two Travelling Waves ▪ The Energy in a Standing Wave ▪ Standing Waves as Normal Modes of a Vibrating String ▪ The superposition principle	**4**
9	Unit9**System with Two Degrees of Freedom** : ▪ Coupled Oscillators. ▪ Normal Coordinates and Normal Modes. ▪ Energy Relation and Energy Transfer. ▪ Normal Modes of N Coupled Oscillators	**4**
10	**Revision**	**3**
Part2		
1	**Experiment 1:** Simple Pendulum	**2**
2	**Experiment 2:** Compound pendulum	**2**
3	**Experiment 3:** Mass-Spring system	**2**
4	**Experiment 4:** Oscillations in Electrical Circuits (LC circuit	**2**
5	**Experiment 5:** Damped Oscillations	**2**
6	**Experiment 6:** Driven Harmonic Oscillator	**2**
7	**Experiment 7:** Resonance in electric circuit	**2**
8	**Experiment 8:** Velocity of Sound using Resonance Tube	**2**
9	**Experiment 9:** Sonometer	**2**
10	**Revision**	**2**
Total		**70**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Identify oscillators in terms of displacement, velocity and energy exchange, giving various examples.	Lecture Discussion	Written exam
1.2	Name the difference between the types of oscillators using equation of motion	Lecture Discussion	Written exam
2.0	**Skills**		
2.1	Classify the waves and oscillators types .	Problem solving	Written exam Activities
2.2	Solve problems involving to un-damped, damped and force oscillators and superposition of oscillations	Problem solving	Written exam Activities
3.0	**Values**		
3.1	Work effectively in groups and exercise leadership when needed.	Practical	Lab reports Lab exam Activities
3.2	Act responsibly and be able to prepare a written scientific report	Practical	Lab reports Lab exam

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm exam	6th	20%
2	Activities	Periodically	10%
3	Lab reports	Weekly/ 10th	20%
4	Final Lab Exam	10th	10%
5	Final exam	11th	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- Each faculty member is assigned a group of students for continuous academic advice during six office hours weekly (6 hrs./week).
- Also teaching staff are available for individual student consultations during office hours

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Vibrations and Waves, A.P. French , imprint: CRC Press (2017) ISBN: 9781482289350
Essential References Materials	- VIBRATIONS AND WAVES, George C. King, A John Wiley and Sons Ltd, Great Britain, Wiltshire (2009) ISBN 978-0-470-01188-1 (HB) ISBN 978-0-470-01189-8 (PB)
Electronic Materials	• Interactive simulations for science and math: https://phet.colorado.edu/
Other Learning Materials	• CD associated with the text books (when available). • Lecture notes and PowerPoints presentations prepared by the lecturer.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classrooms Vibration and waves physics laboratory
Technology Resources (AV, data show, Smart Board, software, etc.)	• Data show • Laptop • Smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students	Indirect
Evaluation of Teaching	Pear reviewer Program coordinator Departmental council Faculty council	Indirect
Improvement of Teaching	Program coordinator Relevant committee	Direct
Quality of learning resources	Students Instructor Faculty	Indirect
Extent of achievement of course learning outcomes,	Program coordinator Instructor	Direct
Course effectiveness and planning for improvement	Program coordinator Instructor	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	October 2, 2022