

EC522- Acoustics

CREDIT HOURS

3 Hours

CONTACT HOURS (Hours/week)

Lecture: 2; Tutorial: 2

COURSE COORDINATOR

Dr. Ashraf Mamdouh

TEXT BOOK

BERANEK L.L., "Acoustics".

COURSE DESCRIPTION

Acoustic wave and velocity of sound - The one-dimensional wave equation - Impedance of mediums - Three-dimensional wave equation and spherical wave - Sound intensity and power - Energy density and levels - Multiple sources and loudness - Environmental acoustics - Equivalent sound pressure level and assessment of noise - Analogy between acoustical and electrical circuits - Transducers and sensitivity of MICs and loudspeakers - Hi-fi system and introduction of underwater acoustics - Velocity profiles and SONAR

PREREQUISITE:

EC 341

RELATION OF COURSE TO PROGRAM

Elective

COURSE INSTRUCTION OUTCOMES

The student will be able to:

- Describe the nature of the acoustic wave equation and its solutions.
- Define the acoustic power and energy.
- Define the sound levels.
- Describe the environmental acoustics.
- Define the Electro-acoustic transducers.
- Describe the underwater acoustics.

TOPICS COVERED

- Acoustic wave and velocity of sound: Velocity of sound in air and water and metal.
- The one-dimensional wave equation / Impedance of mediums: The one-dimensional wave equation Condensation.
- Solution of the one dimensional wave equation: The general solution of the one dimensional wave equation Definition of impedance's. Freely traveling plane wave.

- Three-dimensional wave equation and spherical wave: 3D wave equation, The spherical wave equation and freely traveling spherical wave.
- Sound intensity and power, Impedance of the freely traveling spherical wave, Intensity, power, energy density, levels and loudness.
- Energy density and levels: Acoustic power and directivity, Energy density.
- Multiple sources and levels (power, intensity), Multiple sources, Loudness.
- Environmental acoustics: Environmental acoustics; weighted SPL.
- Equivalent SPL and assessment of noise: Combination of levels, Assessment of noise, L_{eq} , L_d , L_n , L_{dn} .
- Analogy between mechanical and electrical circuits: Introduction, Mechanical circuit elements, Analogy between mechanical and electrical circuits.
- Analogy between mechanical and electrical circuits: Velocity of sound in air and water and metal, Analogy between acoustical and electrical circuits.
- Acoustical resonators and filters: Acoustical resonator and filters, Transducer.
- Transducers and sensitivity of microphones and Loudspeakers: Sensitivity and types of mics, Efficiency and types of Loudspeakers, hi-fi multispeaker system.
- Hi-fi system and underwater acoustics: Introduction to underwater acoustics, Velocity of sound in seawater, Sound transmission loss in seawater.
- Velocity profile and SONAR: Thermocline and velocity profiles, Refraction of sound in seawater, SONAR.

CONTRIBUTION OF COURSE TO MEET THE REQUIREMENTS OF CRITERION 5:

Professional component Content			
Math and Basic Sciences	Engineering Topics	General Education	Other
	✓		

RELATIONSHIP OF COURSE TO STUDENT OUTCOMES:

	Student Outcomes	Course aspects
A	An ability to apply knowledge of mathematics, science, and engineering	a ₁ a ₂
B	An ability to design and conduct experiments, analyze and interpret data.	b ₁ b ₂ b ₃ b ₄
C	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability	
D	An ability to function on multi-disciplinary teams.	
E	An ability to identify, formulate, and solve engineering problems	
F	An understanding of professional and ethical responsibility	
G	An ability to communicate effectively	
H	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social content	h ₁ h ₂ h ₃ h ₄
I	A recognition of the need for, and an ability to engage in life-long learning.	
J	A knowledge of contemporary issues within and outside the electrical engineering profession.	j ₁ j ₂
k	An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.	k