

California State University, Fresno
Department of Communicative Disorders and Deaf Studies

CDDS 103

Speech and Hearing Sciences

Introduction and Course Description:

The purpose of CDDS 103 is to provide students with basic information concerning the physics of sound, and the scientific bases of human speech production and perception. The course is taught based on the philosophy that an understanding of the scientific processes of speech production and perception are essential to students in our field, whether their career goals are to be clinicians, teachers, researchers, or any combination of these professional interests.

Required Text

Borden, G.J., Harris, K.S., & Raphael, L.J. (2007). Speech science primer: Physiology, acoustics and perception of speech (5th edition). Baltimore, MD: Williams and Wilkins.

Optional Syllabus

CDDS 172 Speech and Hearing Science Power Point Slides (2010). Available at Master Copy Center, 4974 North Cedar Avenue, Fresno, CA 93726-1063, (559) 225-7814.

Note: A calculator will also be required for the successful completion of this course.

Assignments

1. Midterm and Final Examinations. There will be two regular examinations and one comprehensive final examination in this class. Examinations will focus primarily on class lectures, assigned text-book readings, guest lectures and thought-provoking questions (TPQs), The tentative dates for these examinations are:

Exam #1 Midterm (Sections 1, 2, & 3) – _____

Exam #2 Midterm (Sections 4, 5, 6, & 7) – _____

Exam #3 Final Exam – (Section 8) As scheduled during _____

There will be three 100-point examinations. The examinations will be objective in nature, and consist of multiple choice, matching, and/or fill in the blank type questions.

2. Small Group Discussion of Thought Provoking Questions (TPQs). Students are expected to come prepared and actively participate in small group discussions of their completed TPQs for successful completion of this course. Groups will consist of 4-6 students and will be facilitated by one of the students in the class. The TPQ discussion groups will also serve to prepare students for the midterm and

final examinations. Students who are late or do not attend the small group discussion TPQ groups will not get credit. The dates for small group discussions of TPQs are:

TPQ #1 – _____

3. Attendance and Active Class Participation

Students are required to attend, be on time, and actively participate during class for successful completion of this course. Each student is requested to let the instructor know (in advance) if she/he is unable to attend class via email or phone call to the instructor. Should an absence become necessary, it is the student’s responsibility to acquire the lecture notes from a peer student.

Grading Requirements

The final course grade will be derived by adding the three test scores and dividing by three. The derived score will be translated into a letter grade for the course based on the following scale:

Derived Score	Letter Grade	Total Points
90 – 100	A	270 – 300
80 – 89	B	240 – 269
70 – 79	C	210 – 239
60 – 69	D	180 – 209
Below 60	F	< 180

It is important that examinations be taken when scheduled. Make-up exams will only be administered under extraordinary circumstances, when there is a documented reason of a serious and compelling nature. Students must get oral permission to take a make-up test before it is administered in the class. A message left on the phone or an e-mail message sent to the instructor to say that a test could not be taken on a prescribed day and that a make-up date is requested does not constitute permission to take the test at a different time.

While every effort will be made to access phone and e-mail messages frequently, the student should not assume that message sent just before the class will have been accessed. Note, however, that in the case of documented emergencies and sickness, the student can always take a test at a later time. All reasonable requests will be honored. In the event that a make-up exam becomes necessary, it will be based on the same general information and will include both objective and essay questions.

According to the University, final examination schedules cannot be changed to suit individual needs; please do not make travel or other kinds of plans that might conflict with the final examination schedule. Except for a documented emergency, all finals must be taken at scheduled times. Finals missed for a reason other than emergency will not be rescheduled and the grade given with a zero assigned to the missed final.

Course Schedule

Dates	Topics	Readings
	Course Introduction Section 1: Pioneers in Speech and Hearing Science	Ch 2
	Section 1: Pioneers in Speech and Hearing Science Section 2: Speech, Language and Thought Section 3: Acoustics: The Physics of Sound	Ch 1
	Class Canceled – Labor Day	
	Guest Speaker: Dr. Cindy Cavazos – Cochlear Implants Class: 5:30 to 6:30 pm	Ch 3
	Section 3: Acoustics: The Physics of Sound	Ch 3
	Section 3: Acoustics: The Physics of Sound	Ch 1,2,3
	TPQ Discussion Groups (Note: TPQs are to be completed)	Ch 4
	Midterm Examination I	Ch 4
	Section 4: Neurophysiology of Speech Section 5: Respiration	Ch 5
	Section 6: Phonation Section 7: Articulation and Acoustics of Speech Sounds	Ch 5
	Section 7: Articulation and Acoustics of Speech Sounds	Ch 5
	TPQ Discussion Groups (Note: TPQs are to be completed)	Ch 5

	Guest Speaker: Diagnosis and Treatment of Voice and Resonance Disorders – Dave Foushee – Central California ENT Group	Ch 5
	Midterm Examination II	Ch 4,5
	Section 8: Anatomy and Physiology of the Auditory System	Ch 6
	Section 8: Models of Speech Perception	Ch 6
	Final Examination (5:45 PM- 7:45 PM)	Ch 6

Course Policies & Safety Concerns

Cell phones must be deactivated, turned off, or set to the vibratory mode during this class. There are no visitors allowed in class. Use of tobacco products is prohibited on any California State University campus.

Statement on Cheating and Plagiarism

The University has a written policy on cheating and plagiarism that includes specific steps that will be taken in the event that an incident of cheating or plagiarism is suspected or alleged. The full text of the document is available in the office of the Vice President for Student Affairs in the Joyal Administration Building, room 262. University definitions of cheating and plagiarism may be found in the section on “Legal Notices” in the current “Schedule of Courses.”

Statement on Services for Students with Disabilities

The University is committed to providing reasonable academic accommodation to students with disabilities. Services for Students with Disabilities provides university academic support services and specialized assistance to students with disabilities. Individuals with physical, perceptual, or learning disabilities as addressed by the American with Disabilities Act should contact Services for Students with Disabilities for information regarding accommodations. Please notify your instructor so that reasonable efforts can be made to accommodate you.

Primary Learning Outcomes

Following successful completion of this course, students will derive an understanding of the basic scientific principles of human communication, and will gain the knowledge necessary to form the foundation for more advanced study in the field of Communication Disorders.

Tentative Course Schedule

The following course sequence may be altered as the course progresses due to variability in class discussion and overall class participation. The tentative sequence of topics will be as follows:

Introduction & Course Description

Section 1: Pioneers in Speech and Hearing Science

- Description of the Study of Speech and Hearing Science
- Pioneers in Speech and Hearing Science
 - Hermann von Helmholtz: Acoustics of Speech
 - Henry Sweet: Descriptive Phonetics
 - Alexander Graham Bell: Teaching the Deaf
 - R.H. Stetson: Speech Physiology
 - Homer W. Dudley: Electronic Synthesis of Continuous Speech
 - Franklin Cooper, Alvin Liberman and Pierre Delattre: Speech Perception and the Pattern Playback
- Current Applications of Speech and Hearing Science

Section 2: Speech, Language and Thought

- The Speech Chain
- Model of Speech Production
- The Language Tool
- From Thought to Speech

Section 3: Acoustics: The Physics of Sound

- Definition of Sound
- Properties Common to the Medium of Air
 - Mass, Inertia and Elasticity
 - Spring-Mass Oscillator Model
- Energy Source and Vibrating Body
- Simple Harmonic Motion
 - Elasticity and Inertia
 - The Swing Analogy: Velocity Gradation in Simple Harmonic Motion
 - Particle Movement in Sound
 - *Velocity, Acceleration and Displacement*
 - *Damping*
 - Pressure Wave Movement in Sound
- Spatial Concepts
 - Amplitude
 - Wavelength
- Temporal Concepts
 - Cycle
 - Period
 - Frequency
 - Frequency-Period Relationship
 - Frequency-Pitch Relationship
 - Mel Scale
 - Frequency-Wavelength Relationship

- *Velocity*
- Longitudinal Waves Versus Transverse Waves
 - Longitudinal Waves
 - Transverse Waves
- Resonance
 - Free Vibration
 - Forced Vibration
 - Acoustic Resonator
 - Sharply Shaped Resonator
 - Broadly Shaped Resonator
 - Filters
- Sound Propagation and Interference
 - *Inverse Square Law*
 - Signal-to-Noise Ratio
- Interference Patterns and Waveforms
 - Phase
 - *Periodic Waveforms*
 - Fourier Analysis
 - Aperiodic Waveforms
- Harmonics: Characteristics of Periodic Complex Tones
- Complex Periodic Sounds
- Aperiodic Complex Sounds
- Sound Spectrograph
- The Decibel: A Measure of Relative Intensity
 - Intensity Level
 - *Sound Pressure Level*
- Intensity and Loudness
 - Loudness and the Phon Scale
 - Equal Level Loudness Contours
 - Hearing Level
 - Sensation Level

Section 4: Neurophysiology of Speech

- Division of the Neurological System
- Hemispheres, Lobes and Landmarks
 - Brain
 - Frontal Lobe
 - Parietal Lobe
 - Occipital Lobe
 - Temporal Lobe
 - The Insula (Island of Reil)

- Semihemispheric Structures
 - Cerebellum
 - Thalamus
 - Hypothalamus
 - Medulla
- The Neuron
- Peripheral Nervous System
- Autonomic Nervous System

Section 5: Respiration

- Modification of Airstream for Speech Sounds
- Phonation and Creation of Consonant Sounds
- Negative-Pressure Breathing (Boyle's Law)
- The Respiration Mechanism
- Inspiration
 - For Quiet Breathing
 - For Speech Breathing
- Expiration
 - For Sustained Phonation
 - For Speech

Section 6: Phonation

- Myoelastic Aerodynamic Theory of Phonation
- Framework of the Larynx
- Vocal Fold Adjustments During Speech
 - Voiceless Consonants
 - Phonated Speech Sounds
- Subglottal Air Pressure
- The Bernoulli Effect
- Vocal Fold Vibration
- Fundamental Frequency
- Voice Quality
- Relation Between Frequency and Intensity

Section 7: Articulation and Acoustics of Speech Sounds

- Generative or Modularly System of Speech Production
- The Vocal Tract: Variable Resonator and Sound Source
 - Types of Sound Sources
 - Simultaneous Combination and Sequences of Sound Sources
- Landmarks of the Vocal Tract
 - Pharynx
 - Oral Cavity
 - Velum

- The Tongue: Extrinsic Musculature
- The Tongue: Intrinsic Musculature
- The Lips
- Acoustic Theory of Vowel Production
 - Resonance
 - Sympathetic Vibration
 - Sounding Board Effect
 - Cavity (Acoustical) Resonance
 - Resonance of a Tube Open at One End
 - Resonance of Male Vocal Tract
- Source and Filter
 - Vowels /i/, /a/, and /u/
 - High Front Unrounded Vowel /i/
 - Low Back Vowel /a/
 - High Back Rounded Vowel /u/
 - Relationship Between Acoustics and Articulation
 - Relationship Between Acoustics and Vocal Tract Size
 - Tense and Lax Vowels
- Diphthong Production
- Resonant Consonant Production
 - The Semivowels
 - The Nasals
 - The Fricatives
 - The Stops
 - The Affricates
- Feedback Mechanism in Speech
 - Auditory Feedback
 - Tactile Feedback
 - Proprioceptive Feedback
 - Internal Feedback

Section 8: Hearing and Speech Perception

- Outer Ear
- Middle Ear
- Inner Ear
- Auditory Nerve
- Auditory Pathways
- Auditory Cortex
- Acoustic Cues in Speech Perception
 - Vowel Perception
 - Diphthong Perception
 - Consonant Perception
 - Suprasegmental Perception
- Issues in Speech Perception

- Invariance, Linearity and Segmentation
- Intra- and Interspeaker Normalization
- Minimal Unit of Perceptual Analysis
- Categorical Perception
- Perceptual Constancy (Perceptual Invariance)
- Other Perceptual Phenomena
 - Dichotic Listening
 - Auditory Illusions
 - Verbal Transformation Effect
 - Phonemic Restoration Effect
- Theories of Speech Perception
 - Passive Versus Active Theories
 - Bottom-Up Versus Top-Down Theories
 - Autonomous Versus Interactive Theories
 - Motor Theory
 - Revised Motor Theory
 - Analysis-by-Synthesis Theory
 - TRACE Model
 - Logogen Theory
 - Cohort Theory