Acoustics-Related Courses at BYU

Last Updated: September 21, 2006

Audiology and Speech-Language Pathology

320. Speech Anatomy. (3:3:1) F Prerequisite: Zool 260.
Basic anatomy and physiology of speech mechanisms

321. Speech Science. (3:3:0) W Prerequisite: ASLP 320, Phscs 167.
Laboratory investigation of scientific bases of normal and disordered speech perception and production; for audiologists and speech language pathologists.

334. Basic Hearing Science. (3:3:0) F, W Prerequisite: Phscs 167.
Hearing anatomy, physiology, and science.

544. Psychoacoustics. (2:2:1) Alt. term
Advanced studies in human psychoacoustics and hearing science.

657. Voice and Resonance Disorders. (3)
Assessment and treatment of disorders of the speaking voice.

Civil and Environmental Engineering

112. Engineering Drafting with CAD Applications. (3:3:0) F, W
Structural and component drafting, emphasizing computer-automated (CAD) systems. Concepts include applied and descriptive geometry, multiview representation, sectional views, dimensional practices, and axonometric sketching.

506. (CEEn-MeEn) Continuum Mechanics and Finite Element Analysis. (3) Prerequisite: Math 334; CEEn 321 or MeEn 372; or equivalent.
Equilibrium, constitutive, and compatibility equations; closed-form solutions from elasticity; finite element theory, programming, and usage; membrane, axisymmetric, and solid elements. Application to heat transfer, fluid mechanics, and seepage.

508. (CEEn-MeEn) Dynamics and Stability of Structures. (3) Prerequisite: Math 334; CEEn 321 or MeEn 372; or equivalent.
Dynamic analysis of single degree-of-freedom, discrete multi-degree-of-freedom, and continuous systems. Static and dynamic stability of structures.

606. Mechanics and Finite Elements for Plates and Shells. (3) Prerequisite: CEEn-MeEn 506.
Bernoulli-Euler beam theory; Kirchhoff and Reissner plate theories; axisymmetric shell theory; finite elements for thin plates, thick plates, axisymmetric shells, and general shells.

608. (CEEn-MeEn) Nonlinear Analysis of Structures. (3) Prerequisite: CEEn-MeEn 506, 508.

   Geometrically nonlinear analysis of trusses, frames, membranes, and plates, including buckling and large deformation analysis. Materially nonlinear analysis, including plasticity and viscoelasticity.

Computers and the Humanities (Linguistics)

287. Programming Humanities Applications 1. (3:3:0) Prerequisite: CHum 180 or computer experience.

   Computer programming for language and humanities applications in a visual environment: data types, character representation, flow of control, file input/output, string manipulation.

387. Programming Humanities Applications 2. (3:3:0) Prerequisite: CHum 287.

   Advanced computer programming for the humanities: advanced string manipulation and format conversions, data structures, integrating modules written in another programming language, software design, performance issues.

Computer Science

124. (CS-ECEn) Introduction to Computer Systems. (3:3:2) F, W, Su Prerequisite: C S 142 or concurrent enrollment.

   How a computer works, from hardware to high-level programming. Logic circuits, computer instructions, assembly language, binary arithmetic, C programming, program translation, data structures, and algorithm analysis.

142. Introduction to Computer Programming. (3:3:0) F, W, Sp, Su Prerequisite: knowledge of algebra.

   Introduction to object-oriented program design and development. Principles of algorithm formulation and implementation.

224. (CS-ECEn) Fundamentals of Digital Systems. (3:3:2) F, W, Sp, Su Prerequisite: ECEn 124.

   Digital logic: theory, design, and implementation or combinational and sequential logic. Laboratory experience in construction of digital logic circuits. Fee.

235. Data Structures and Algorithms. (3:3:0) F, W, Sp, Su Prerequisite: C S 142.

   Fundamental data structures and algorithms of computer science; basic algorithm analysis; recursion; sorting and searching; lists, stacks, queues, trees, hashing; object-oriented data abstraction.

236. Discrete Structures. (3:3:0) F, W, Sp, Su Prerequisite: C S 235.
    Introduction to grammars and parsing; predicate and propositional logic; proof techniques; sets, functions, relations, relational data model; graphs and graph algorithms.

240. Advanced Programming Concepts. (3:3:0) F, W, Alt. term Prerequisite: C S 236.
    Advanced software development with an object-oriented focus. Development and testing of several 1500 to 2000 line modules from formal specifications. UNIX and C++ environment.

450. Introduction to Digital Signal and Image Processing. (3:3:0) On dem. Prerequisite: CS 312, Math 119, 343, or equivalent.
    One- and two-dimensional signal-processing fundamentals, including sampling, noise, transforms, filtering, enhancement, and compression. Hands-on experimentation with speech, music, still images, and full-motion video.

Construction Management

155. Architectural Drafting. (3:2:3)
    Developing residential plans; floor, foundation, plot, elevations, sections, and details. Introduction to architectural CAD.

320. Mechanical Systems. (3:3:0)
    Basic plumbing and HVAC principles, materials; installation and application methods. Systems sizing and design, heat loss/gain calculations, and payback analysis. Managing the plumbing and HVAC trades.

Electrical and Computer Engineering

124. (ECEn-CS) Introduction to Computer Systems. (3:3:2) F, W, Su Prerequisite: C S 142 or concurrent enrollment.
    How a computer works, from hardware to high-level programming. Logic circuits, computer instructions, assembly language, binary arithmetic, C programming, program translation, data structures, and algorithm analysis.

224. (ECEn-CS) Fundamentals of Digital Systems. (3:3:2) F, W, Sp, Su Prerequisite: ECEn 124.
    Digital logic: theory, design, and implementation or combinational and sequential logic. Laboratory experience in construction of digital logic circuits. Fee.

301. Elements of Electrical Engineering. (3:3:1) F, W, Sp Prerequisite: Phscs 220, Math 334.
    Linear electrical circuits, computer organization, and logic circuits for nonmajors. Fee.

380. Signals and Systems. (5:4:3) F, W, Sp Prerequisite: ECEn 212, Math 334.

Time and frequency domain analysis of discrete or continuous systems subjected to periodic or nonperiodic input signals.

425. Real-Time and Embedded Systems. (4:3:3) F Prerequisite: ECEn 224.

Hardware/software interface, real-time kernel internals, implementation of high-level language constructs, issues in realtime application software development.

483. Feedback Control of Dynamic Systems. (4:3:3) F Prerequisite: ECEn 380.

Analysis of feedback control: stability, root-locus, Nyquist criteria, Bode constraints, state space methods. Design of PID, phase lead/lag, observer-based state feedback controllers.

487. Introduction to Discrete-Time Signal Processing. (4:3:3) W Prerequisite: ECEn 380.

Digital signal processing, fast Fourier transforms, digital filter design, spectrum analysis, Applications in speech processing, SONAR, communications, etc.

541. Active and Passive Filter Design. (3:3:0) F alt yr. Prerequisite: ECEn 313, 380; or equivalents.

Design methods for electronic filters based on passive components, active components, and integrated circuit components.

550. Microelectromechanical Systems (MEMS). (3:3:0) Prerequisite: ECEn 450 or MeEn 372 or equivalent.

Design, fabrication, and applications of microelectromechanical systems (MEMS). Mechanical properties governing design and reliability of MEMS and the processing technologies used to fabricate them.

670. Stochastic Processes. (3:3:0) Prerequisite: ECEn 380 or equivalent; Stat 421 or equivalent; graduate standing or instructor's consent.

Review of elementary probability, introduction to random processes: definitions, properties, covariance, spectral density, time average, stationarity, ergodicity, linear system relations, mean square estimation, Markov processes.

671. Detection and Estimation Theory. (3:3:0) W Prerequisite: ECEn 582; Stat 421 or equivalent; graduate standing or instructor's consent.

Sufficiency, completeness; Neyman-Pearson and Bayes detector; maximum likelihood, Bayes, minimum mean square, and linear estimation; Kalman filters; selected topics.

672. Mathematics of Signals and Systems. (3:3:0) F Prerequisite: ECEn 380, Math 343 (or equivalents); graduate standing or instructor's consent.

Introduction to mathematics of signal processing, communication, and control theory; linear spaces, Eigenvalue and singular-value decompositions, quadratic forms, linear operators, adjoints, dual spaces.

682R. Special Topics in Signals and Systems. (1-3) F, W, Sp, Su Prerequisite: graduate standing or instructor 's consent.

773. Linear System Theory. (3) Prerequisite: ECEn 483, 582.

Mathematical introduction to time-varying linear systems; state space descriptions, controllability, observability, Lyapunov stability, observer-based control. Design of linear quadratic regulators and infinite-horizon Kalman filters.

777. Digital Signal Processing. (3) Prerequisite: ECEn 487, 580, 582; graduate standing or instructor's consent.

Advanced theory and applications including optimal statistical processing, adaptive processing, and array processing methods.

Engineering and Technology Education

502. Advanced Applied Engineering Math 1. (3:3:0) F Prerequisite: Math–EngT 302, 303; or equivalents.

Topics in modern engineering mathematics, including applications of differential and integral equations and vector spaces.

503. Advanced Applied Engineering Math 2. (3:3:0) W Prerequisite: EngT 502 or equivalent.

Topics in modern engineering mathematics, including applications of partial differential and integral equations and numerical analysis.

595R. Special Topics in Engineering and Technology. (1–3:Arr.:0 ea.) F, W, Sp, Su

Special topics in engineering and technology that relate to current research areas or issues related to industry.

Geography

422. Principles of Urban Design. (2:2:0) F Prerequisite: Geog 310, 410.

Theories and principles of urban design emphasizing specific design criteria. Planning and design tools used within the U.S. by local government. Basic principles of architecture and landscape architecture. Field trips.

Geology

560. Applied Geophysics 2. (3:3:0) W alt. yr. Prerequisite: Geol 375, 559, Phscs 121, 123, 220.

Principles, tools, and methods used in seismic geophysics, with exploration, engineering, environmental, and hydrological applications. Includes acquisition, processing, and interpretation of seismic data. Field trips.

Industrial Design

214R. Model Making and Prototyping. (3:2:4 ea.) Prerequisite: InDes 133A and TTE 229 or concurrent enrollment.

Theories and fundamentals of model making and prototype construction. Creative use of multiple materials and processes. Plastic, composites, foam core, wood, metal, and found objects.

Information Technology

346. Audio and Video Systems. (3:2:3) F alt. yr. Prerequisite: EET 245.

Audio and video components, circuits, and systems used in modern recording and broadcasting, including recent digital formats. FCC regulations.

421. Control Systems. (3:2:3) F Prerequisite: IT 327.

Analog and digital control of position, temperature, velocity, or other external variables, Laplace and Z transforms, first- and second-order systems, feedback, and transfer functions. Systems design.

431. Digital Signal Processing. (3:2:3) W Prerequisite: Math 113, CS 142, IT 241.

Processing engineering data using digital computers. Encoding data for storage or transmission. Frequency-domain techniques for improving signal filtering. Cryptography and other important signals algorithms. Practical experience with DSP processors.

441. Embedded Computer Systems. (3:2:3) F Prerequisite: IT 344.

Real-time embedded systems development using microprocessors and microcontrollers. Multitasking, hardware/software interfacing, operating systems, and various CPU architectures.

444. Instrumentation and Computers. (3:2:3) W Prerequisite: IT 241, 344.

Design and application of sensors, transducers, and instrumentation. Computer interfacing. Software design for instrumentation. Applications in industrial automation and in embedded systems.

540. Computer-Aided Testing. (3:2:2) F alt. yr. Prerequisite: instructor's consent.

Applying distributed intelligence to testing. Instrumentation bus standards, IEEE 488, fieldbus, and others. Advanced instrumentation.

Mathematics

311. Introduction to Numerical Methods. (3:3:0) F, W Prerequisite: calculus and knowledge of a programming language.

Root finding, interpolation, curve fitting, numerical differentiation and integration, multiple integrals, direct solvers for linear systems, least squares, rational approximations, fourier and other orthogonal methods.

347. Introduction to Partial Differential Equations. (3:3:0) W, Su Prerequisite: Math 303 or 334.

Boundary value problems; transform methods; Fourier series; Bessel functions; Legendre polynomials.

511. Numerical Methods for Partial Differential Equations. (3) Prerequisite: Math 311, 343; 213 or 434. Recommended: Math 347.

Finite difference and finite volume methods for partial differential equations. Stability, consistency, and convergence theory.

547. Partial Differential Equations. (3) Prerequisite: Math 214, 334; or equivalents.

Topics from elliptic equations, heat equations; wave equations, stability, Fourier methods, energy methods, existence of solutions, etc.

Mechanical Engineering

312. Fluid Mechanics. (3:3:1) F, W, Sp or Su Prerequisite: MeEn 273, 321, 363.

Physics and modeling of fluid flow; fluid statics, dimensional analysis, momentum, internal and external viscous flow, compressible flow, and fluid machinery.

363. Elementary Instrumentation. (3:2:3) F, W, Sp or Su Prerequisite: Phscs 123, Math 334.

Fundamentals of mechanical measuring systems; sensors, signal conditioning, statistical error analysis, dynamic response, standards.

435. Dynamic System Modeling and Analysis. (3:3:1) F, W Prerequisite: Math 334, MeEn 273, 363, CEEn 204.

Formulating mathematical models for mechanical, electrical, fluid, and combined systems; numerical solution of motion equations; first- and second-order systems, frequency response, and transfer functions.

502. (MeEn-CEEn) Composite and Smart Structures. (3:3:0) On dem. Prerequisite: Math 334; CEEn 321 or MeEn 372; or equivalent.

Analysis of advanced composite structures; classical and energy approaches; design consideratons; introduction to smart-structures concepts

506. (MeEn-CEEn) Continuum Mechanics and Finite Element Analysis. (3:3:0) F Prerequisite: Math 334; CEEn 321 or MeEn 372; or equivalent.

Equilibrium, constitutive, and compatibility equations; closed-form solutions from elasticity; finite element theory, programming, and usage; membrane, axisymmetric, and solid elements. Application to heat transfer, fluid mechanics, and seepage.

512. Intermediate Fluid Dynamics. (3:3:0) W Prerequisite: MeEn 312 or instructor's consent.

Review of fluid properties, Navier-Stokes equations, exact and similarity solutions, introduction to potential flows, stream functions, lift and drag, boundary layers, vorticity, and turbulence.

531. Design of Control Systems. (3:3:0) W Prerequisite: MeEn 435.

Classical frequency response and time domain design of control systems. State variable control and computer simulation of control systems.

532. (MeEn-ECEn 511) Introduction to Linear Systems Theory. (3:3:0) F Prerequisite: ECEn 411 or MeEn 435 or instructor's consent.

Finite-dimensional linear systems. State variable realizations, canonical forms, controllability, observability, minimality. Time and frequency domain design of controllers and observers.

533. Digital Control Systems. (3:3:0) Sp Prerequisite: MeEn 531.

Design of digital controllers for mechanical systems, analysis using the z-transform, digital filter implementation, application of transform-based classical design methods, and modern state-space techniques.

534. Dynamics of Mechanical Systems. (3:3:0) F Prerequisite: MeEn 435 or equivalent.

Hamiltonian and Lagrangian dynamics, generalized coordinates, linear and angular momentum, Euler angles, rigid-body motions, and gyroscopic effects. Theory taught with applications integrated.

535. Mechanical Vibrations. (3:3:0) Su Prerequisite: MeEn 435 or equivalent.

Introduction to energy methods for system modeling, eigenvalues and mode shapes, frequency response, and spectral characterization of vibrations.

564. Digital Instrumentation and Mechatronic Systems. (3:2:3) F Prerequisite: MeEn 363 or equivalent.

Design and analysis of instrumentation systems, fundamental sensor characteristics, and computer data acquisition; time and frequency domain modeling with analog and digital components.

Music

251. Audio: Basic Principles. (2:2:2) F, W
       Basic recording studio procedures and principles. Intended as overview of the field, course is not for those seeking emphasis in sound recording technology.

256. Recording Studio 1. (2:2:2) F Prerequisite: Math 110 or equivalent, Phscs 167, and music major status or instructor's consent.
       Basic recording theory, operational techniques, and procedures.

257. Recording Studio 2. (2:2:2) W Prerequisite: Music 256.
       Continuation of Music 256.

351 A, B. Audio Applications 1, 2. (1:1:1 ea.) F Prerequisite: Math 110 or equivalent; Phscs 167.
       Explores two computer music technology applications. Block 1: Digital editing and introduction to Pro Tools. Block 2: Theatre sound, including computer applications.

352 A, B. Audio Electronics 1, 2. (1:1:0 ea.) W Prerequisite: Music 351A,B.
       Introduction to electronics as encountered in audio applications. Block 1: Basic DC and AC circuits. Block 2: Introduction to systems and acoustic design.

355R. Recording Workshop. (1:1:5 ea.) F, W Prerequisite: Music 251 or 257.
       Studio projects in multitrack recording for records, broadcast, film, and television.

363. Vocal Pedagogy. (3:3:0) W Prerequisite: junior standing as vocal performance or choral music education major or instructor's consent.
       Introduction to physiology, acoustics, and pedagogy of singing.

Physics

167. Descriptive Acoustics of Music and Speech. (3:3:0) F, W, Sp Prerequisite: PhyS 100 or equivalent.
       Introductory acoustics course, emphasizing physical principles underlying production and perception of music and speech.

230. Computational Physics Lab 1. (1:0:3) F, W Prerequisite: Phscs 123 or concurrent enrollment.
       Numerical and symbolic differentiation, integration, and differential equations, using Maple. Applications in mechanics, optics, and special relativity.

318. Introduction to Classical Field Theory. (3:3:0) F, W, Sp Prerequisite: Math 334 or concurrent enrollment. Recommended: Phscs 230.
Classical equations of physical fields; algebra of complex variables; applying Fourier analysis, Fourier transforms, and orthogonal functions.

321. Mechanics. (3:3:0) W, Su Prerequisite: Phscs 121, Math 334 or concurrent enrollment. Recommended: concurrent enrollment in Phscs 330.
Newton's laws applied to particles and systems of particles, including rigid bodies. Conservation principles and Lagrange's and Hamilton's equations.

330. Computational Physics Lab 2. (1:0:3) W, Su Prerequisite: Phscs 230; 321 or concurrent enrollment; Math 334 or equivalent.
Numerical solution of ordinary differential equations, linear algebra and eigenvalues, chaos theory. Applications to dynamics. Introduction to programming in Matlab.

340. Electronics Lab. (1:1:2) F, Sp Prerequisite: Phscs 220.
Introduction to analog and digital circuits.

430. Computational Physics Lab 3. (1:0:3) F, Sp Prerequisite: Phscs 222, 318, 330.
Static and dynamic boundary value problems, partial differential equations. Applications in electrostatics, thermodynamics, waves, and quantum mechanics. Programming with Matlab.

441. Electrostatics and Magnetism. (3:3:0) F, Sp Prerequisite: Phscs 122, 318. Recommended: concurrent enrollment in Phscs 430.
Classical theory of static electric and magnetic fields.

442. Electrodynamics. (3:3:0) W, Su Prerequisite: Phscs 441.
Maxwell's equations, radiation, interaction of electromagnetic fields with matter, and special relativity.

471. Principles of Optics. (3:3:1) W Prerequisite: Phscs 123, 220. Recommended: Phscs 318.
Electromagnetic wave phenomena, including polarization effects, interference, coherence, dispersion, ray theory, diffraction; introduction to quantum nature of light. Laboratory component emphasizes applications.

517, 518. Mathematical Physics. (3:3:0 ea.) 517:F; 518:W Prerequisite: Phscs 318, Math 334.
Topics in modern theoretical physics, including applications of matrix and tensor analysis and linear differential and integral operators.

561. Fundamentals of Acoustics. (3:3:0) F Prerequisite: Phscs 123 or equivalent; Math 303 or 334 or equivalent. Recommended: Phscs 318 or equivalent, Phscs 321 or equivalent.
Sound generation, transmission, reflection, and reception. Vibrating systems, elastic media, mechanical energy, and radiation. Sound in tubes and cavities. Acoustic filters. Noise measurement and perception.

562. Analysis of Acoustic Systems. (3:3:0) W Prerequisite: Phscs 561 or instructor's consent.

Analysis and modeling of electro-mechano-acoustic systems. Transducers, calibration, and acoustical measurements. Sound sources, arrays, coupling, radiation, and directivity. Duct acoustics. Energy-based acoustics.

641, 642. Mathematical Theory of Electricity and Magnetism. (3 ea.) Prerequisite: Phscs 442.

Advanced electrostatics and magnetostatics, Maxwell 's equations and electromagnetic waves, relativistic electrodynamics, radiation theory, and interaction of matter with electromagnetic fields.

661. Acoustics of Music, Speech, Architecture, and Audio. (3:3:0) W alt. yr. Prerequisite: Phscs 561 or instructor's consent.

Physics of sound production by musical instruments and the human voice. Sound reproduction and reinforcement. Enclosed sound fields. Acoustic reflection, absorption, and scattering. Architectural acoustics.

662. Interactions of Sound Fields and Vibrating Structures. (3:3:0) W alt. yr. Prerequisite: Phscs 561, 562; or instructor's consent.

Sound-structure interactions. Sound transmission through panels and sound isolation techniques. Advanced passive and active techniques in sound and vibration control.

721. Dynamics. (3) Prerequisite: Phscs 321.

Advanced treatment of classical mechanics, including Lagrange 's and Hamilton's equations, rigid body motion, and canonical transformations applications.

Psychology

370. Sensation and Perception. (3:3:0) Prerequisite: Psych 301, 302; or Neuro 105 for neuroscience majors.

Sensory basis of perception and principles of perceptual organization.

587. Sensory and Perceptual Processes. (3:3:0) Prerequisite: Psych 370, 381, 382; or instructor's consent.

Critical examination of sensory mechanisms and perceptual organization.

Statistics

361. Quality Improvement for Industry. (3:3:1) F, W, Sp Prerequisite: Math 112 or 119.

Quality management philosophies (Deming, etc.) Strategies for continuous improvement. Graphical and numerical methods of data analysis. Process control charts. Design and analysis of experiments for process characterization and improvement.

421. Probability and Distribution Theory. (3:3:0) F, W Prerequisite: Math 113 or equivalent.

Mathematical formulation of continuous and discrete random variables, including underlying probability models, distribution functions, conditional and marginal probability laws, convolutions and other functions of random variables, limiting distributions.

441. Statistical Theory 1. (3:3:0) F, W Prerequisite: Math 214.

Axiomatic probability theory for discrete and continuous random variables; moment-generating functions; conditional probability; stochastic independence; transformations; limiting distributions; stochastic convergence; central limit theorem.

442. Statistical Theory 2. (3:3:0) F, W Prerequisite: Stat 441.

Sufficiency and completeness; point and interval estimation; hypothesis testing; Cramer-Rao inequality; some asymptotic results; Bayesian methods.

510. Introduction to Statistics for Graduate Students. (3:3:1) F, W, Sp Su Prerequisite: Math 97 or equivalent. Recommended: Math 110 or equivalent.

Introductory statistics course for graduate students outside Statistics Department. Topics include probability, estimation, hypothesis tests, simple linear regression, analysis of variance.

511. Statistical Methods for Research 1. (3:3:2) F, W, Sp Prerequisite: Stat 510 or equivalent.

Basic statistical methodologies and experimental design. Topics include analysis of variance, multiple regression, analysis of covariance, common experimental designs.

512. Statistical Methods for Research 2. (3:3:2) W, Su Prerequisite: Stat 511.

Advanced statistical methodologies. Topics include repeated measures models, basic multivariate techniques, logistic regression, log-linear models.

Technology Teacher Education

200. Fundamentals of Woodworking Design and Processes. (3:2:4) F, W

Using hand and machine woodworking tools; sawing, joining, fitting, and fastening. Designing, planning, building, and finishing small piece of custom furniture. Fee.

229. Material Properties and Processes. (3:2:4) F

Solving real-world problems through layout, measurement, material properties, forming, molding, cutting, fastening, joining, finishing, and fabricating with wood, metal, plastic, and concrete. Fee.

300. Advanced Wood Processes. (3:2:4) Prerequisite: TTE 200.

Applying woodworking processes. Processing green wood, wood turning, veneering, bending, carving, and laminating. Designing and constructing small wood projects. Fee.

Theater and Media Arts

384R. Practicum: Special Topics in Media Arts. (1–6:Arr.:1 ea.)
	Fundamentals of special media skills. (Section 1: Sound acquisition for film.) (Section 9: Sound post production for film.)

568. Sound. (2:4:0) Prerequisite: major status; TMA foundation courses.
	Basics in sound design and reinforcement. Work on main season productions.