TABLE I

CORE COURSES

BIOENGINEERING & SYSTEMS BIOLOGY

FACULTY IN CHARGE:
Campas, McMeeking, Mezic, Moehlis, Petzold, Soh, Valentine

APPROVED COURSES:

ENGR 220A	Molecular Bioengineering
ENGR 220B	Cellular Bioengineering

Note 1: There is a strong and growing research focus at UCSB in Systems Biology as well as in Energy Efficiency. Several faculty members are active in these fields as well as part of the Center for Control, Dynamical Systems and Computation (CCDC) and the Institute for Energy Efficiency (IEE). Students interested in those fields are encouraged to discuss with their advisor which classes best fit their goals.

COMPUTATIONAL SCIENCE AND ENGINEERING

(See information on page 26 regarding adding the CSE emphasis to your diploma.)

FACULTY IN CHARGE:
Begley, Gibou, McMeeking, Meiburg, Mezic, Petzold,

CORE COURSES:

NUMERICAL METHODS

ME 210A	Matrix Analysis and Computation
ME 210B	Numerical Solution of ODEs
ME 210C	Numerical Solution of PDEs-Finite Difference Methods
ME 210D	Numerical Solution of PDEs-Finite Element Methods
ME 216	Level Set Methods and their Applications

PARALLEL COMPUTING

CS 240A or B	Parallel Computing and Program Parallelization

APPLIED MATHEMATICS

ME 244A,B	Advanced Theoretical Methods in Engineering
Math 214A	Ordinary Differential Equations
Math 214B	Chaotic Dynamics and Bifurcation Theory

Math 215A	Partial Differential Equations
Math 215B	Fourier Series and Numerical Methods

Credit will not be given for more than one of the above applied mathematics sequences. Advanced courses may be substituted, with approval, as follows:

Instead of Math 214:

Math 243A, B	Ordinary Differential Equations

Instead of Math 215:

Math 246A, B	Partial Differential Equations

<u>Note 2:</u> Optional Graduate Degree Emphasis in Computational Science and Engineering

The Departments of Chemical Engineering, Computer Science, Electrical and Computer Engineering, Mathematics, and Mechanical Engineering offer an interdisciplinary master's and Ph.D. degree emphasis in computational science and engineering (CSE).

CSE is a rapidly growing multidisciplinary area with connections to the sciences, engineering, mathematics, and computer science. Computer models and simulations have become an important part of the research repertoire, supplementing (and is some cases replacing) experimentation. Going from application area to computational results requires domain expertise, mathematical modeling, numerical analysis, algorithm development, software implementation, program execution, analysis, validation, and visualization of results. CSE addresses these issues.

DYNAMIC SYSTEMS, CONTROL AND ROBOTICS

FACULTY IN CHARGE:

Bamieh, Bullo, Mezic, Moehlis, Paden, Soh, Turner, Yang

CORE COURSES:

ME 201	Advanced Dynamics

ME 215A	Applied Dynamical Systems I
ME 215B	Applied Dynamical Systems II
ME 236	Nonlinear Control Systems
ME 237	Nonlinear Control Design
ME 243A	Linear Systems I
ME 243B	Linear Systems II

SOLID MECHANICS, STRUCTURES AND MATERIALS

FACULTY IN CHARGE:
Begley, Beltz, Daly, Levi, McMeeking, Soh, Turner, Valentine, Yang

CORE COURSES:

ME 219	Continuum Mechanics
ME 230	Elasticity
ME 262	Thermodynamics of Materials
ME 264	Mechanical Behavior of Materials
ME 265	Composite Materials
ME 271	Finite Element Structural Analysis
ME 275	Fracture Mechanics

THERMOFLUID SCIENCES

FACULTY IN CHARGE:
Bennett, Luzzatto-Fegiz, Matthys, Meiburg,
Meinhart, Moehlis, Pennathur

CORE COURSES:

ME 220A,B	Fundamentals of Fluid Mechanics
ME 221	Advanced Viscous Flow
ME 225PL	Wind & Tidal Energy Extraction
ME 240	Convective Heat Transfer
ME 252 A,B	Computational Fluid Dynamics

MICRO/NANOSCALE SYSTEMS

FACULTY IN CHARGE:
Begley, Meinhart, Pennathur Soh, Turner, Valentine

CORE COURSES:

ME 257	Introduction to Multiphysics Simulation
ME 291A	Physics of Transducers
ME 292	Design of Transducers
ECE 220A	Semiconductor Manufacturing

Note 3: Students in micro/nanoscale systems frequently specialize in a secondary area, taking core classes from Dynamics and Control; Solids, Structures, and Materials; or Fluid Mechanics. As this research area is interdisciplinary, courses may also be found in other departments (200 level or above). These should be chosen with the approval of your faculty advisor once you have identified a research area. Final approval for these courses is given by the Graduate Advisor.

Table II
Approved Courses

The approved courses for the PhD are all ME 200-level courses (except seminars, projects and research group studies) plus those listed below. The entire list in Table I is approved courses. Classes are listed below by area for convenience.

BIOENGINEERING & SYSTEMS BIOLOGY

FACULTY IN CHARGE:
Campas, McMeeking, Mezic, Moehlis, Petzold, Soh, Valentine

APPROVED COURSES:

ENGR 220C	Tissue and Systems Bioengineering
ME 246	Molecular and Cellular Biomechanics
ME 211	Pattern Formation and Self-Organization
ME 210B	Numerical Simulation
ME 215A	Applied Dynamical Systems I
ME 219	Continuum Mechanics
CHE 255	Methods in Systems Biology
ECE 235	Stochastic Processes in Engineering
CHE 202	Biomaterials and Biosurfaces
CHE 238A/B	Rheology of Complex Fluids

COMPUTATIONAL SCIENCE AND ENGINEERING

FACULTY IN CHARGE:
Begley, Gibou, McMeeking, Meiburg, Petzold

APPROVED COURSES:

MATRL 228	Computational Materials
CHE 213	Computational Methods in Materials Science
CHE 220A,B	Advanced Transport Processes-Laminar Flow & Convection
CHE 220C	Advanced Transport Processes-Mass Transfer
CHE 220D	Advanced Transport Processes-Turbulence Theory
Math 243C	Ordinary Differential Equations
Math 244C	Computational Fluid Dynamics
Math 246C	Partial Differential Equations
ECE 271A	Principles of Optimization
ECE 271B	Numerical Optimization Methods
ECE 271C	Dynamic Optimization

DYNAMIC SYSTEMS, CONTROL AND ROBOTICS

FACULTY IN CHARGE:
Bamieh, Bullo, Mezic, Moehlis, Paden, Soh, Turner

APPROVED COURSES:

ME 170D,P,L	Introduction to Robotics
Math 118A,B,C	Introduction to Real Analysis
Math 122A,B	Introduction to Theory of Complex Variables
Math 147A,B	Metric Differential Geometry
Math 201A,B,C	Real Analysis
Math 202A,B,C	Complex Analysis

SOLID MECHANICS, STRUCTURES AND MATERIALS

FACULTY IN CHARGE:
Begley, Beltz, Levi, McMeeking,
Soh, Turner, Valentine, Yang

APPROVED COURSES:

ME 162	Introduction to Elasticity
ME 167	Structural Analysis
ME 168	Applied Finite Element Analysis
ME 185	Materials in Engineering
ME 186	Manufacturing and Materials
Math 122 A,B	Introduction to Theory of Complex Variables
Math 202 A,B,C	Complex Analysis
MATRL 228	Computational Materials
CHE 230 A,B,C	Advanced Theoretical Methods in Engineering
MATRL 220	Mechanical Behavior of Materials
MATRL 221	Introduction to Structural Materials
MATRL 237	Advanced Deformation and Fracture
MATRL 251 A	Processing of Inorganic Mtrls.
MATRL 251B	Densification & Microstructural Control
MATRL 261	Composite Materials
MATRL 262	Structural Ceramics
MATRL 271A	Synthesis and Properties of Macromolecules
MATRL 271B	Structure and Characterization of Complex Fluids
MATRL 271C	Properties of Macromolecules

THERMOFLUID SCIENCES

FACULTY IN CHARGE:
Bennett, Luzzatto-Fegiz, Matthys, Meiburg, Meinhart, Moehlis, Pennathur

APPROVED COURSES:

CH E 160	Introduction to Polymer Science
CH E 220A,B,C	Advanced Transport Processes
CH E 222A,B	Colloid and Interfaces I, II
CH E 230D	Numerical Methods in Chemical Engineering
CH E 238A,B	Rheology of Polymeric Fluids
CH E 239	Light Scattering in Complex Fluids
ECE 235	Stochastic Processes in Engineering
MATRL 280	Structure and Characterization of Complex Fluids
Phys 141	Optics
Phys 144	Physics of Complex Fluids

MICRO/NANOSCALE SYSTEMS

FACULTY IN CHARGE:
Begley, Meinhart, Pennathur, Soh, Turner, Valentine

APPROVED COURSES:

141B	MEMS Semiconductor Processing and Device Characterization (with Lab)
MCDB 101A	Molecular Genetics I: Prokaryotes.
Phys 141	Optics
BMSE 216A	Spectroscopy of Biological Molecules

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