422 Classical Mechanics II  
Fall. 3(3-0) P:M: (PHY 321)  

423B Special Relativity  
Summer. 3 credits. P:M: (PHY 321) RB: Some understanding about electric and magnetic fields. Concepts of special relativity applied to coordinate transformations, mechanics, and electrodynamics. This course is given in the competency based instruction format.

425B Mathematical Physics  
Summer. 3 credits. RB: Calculus through differential equations. Some experience with complex variables. Fourier series and complex variables as applied to problems in quantum mechanics, electrodynamics, and mechanics. This course is given in the competency based instruction format.

431 Optics I  
Fall. 3(2-3) P:M: (PHY 192) and (PHY 184 or PHY 184B or PHY 234B or PHY 183A or PHY 294H) and (PHY 215 or PHY 215B) and completion of Tier I writing requirement. SA: PHY 331  
Lenses, aberrations, apertures, and stops. Diffraction, interferometry, spectroscopy, fiber optics.

440 Electronics  
Spring. 4(3-3) P:M: (PHY 192) and (MTH 235 or concurrently or MTH 255H or concurrently or LBS 220 or concurrently) and (PHY 184 or concurrently or PHY 184B or PHY 294H or LBS 272)  
Concepts of electronics used in investigating physical phenomena. Circuits, amplifiers, diodes, LEDs, transistors.

451 Advanced Laboratory  
Fall. 3(1-6) P:M: (PHY 440) and completion of Tier I writing requirement. R: Completion of Tier I writing requirement. General research techniques, design of experiments, and the analysis of results based on some historical experiments in modern physics.

471 Quantum Physics I  
Fall. 3(3-0) P:M: (PHY 215 or PHY 215B) and (PHY 321 or concurrently) and (MTH 235 or MTH 255H or concurrently or LBS 220 or concurrently) and (PHY 184 or concurrently or PHY 184B or PHY 294H or LBS 272)  
Schrödinger equation, hydrogen atom, harmonic oscillator, and other one-dimensional systems.

472 Quantum Physics II  
Spring. 3(3-0) P:M: (PHY 471) RB: A Mathematics course on Boundary-Value Problems  
Matrix formulation of quantum mechanics, perturbation theory, scattering.

480 Computational Physics  
Spring of even years. 3(3-0) RB: (CSE 131 or CSE 230)  
Applications of scientific computational techniques to solutions of differential equations, matrix methods, and Monte Carlo methods used in physics.

481 Electricity and Magnetism I  
Fall. 3(3-0) P:M: (MTH 234 or MTH 254H or LBS 220) R: Open only to juniors or seniors or graduate students. Electrostatics, dielectrics, magnetic fields of steady state currents, Faraday law of induction.

482 Electricity and Magnetism II  
Spring. 3(3-0) P:M: (PHY 481) RB: A Mathematics course on Boundary-Value Problems  
Maxwell’s equations, scalar and vector potentials, electromagnetic plane waves.

490 Senior Thesis  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 5 credits in all enrollments for this course. P:M: (PHY 390) and completion of Tier I writing requirement. Design, carry out, and analyze an original experiment or computation. A written and oral report is required.

491 Atomic, Molecular, and Condensed Matter Physics  
Fall. 3(3-0) P:M: (PHY 471 and PHY 410) and completion of Tier I writing requirement. Many-electron atoms. Molecules, crystal structure, lattice dynamics. Band models of metals and semiconductors. Transport properties.

492 Nuclear and Elementary Particle Physics  
Fall. 3(3-0) P:M: (PHY 471) and completion of Tier I writing requirement. RB: (PHY 472)  

493 Topics in Nuclear Physics  
Fall. 3(3-0) RB: (BS 111 and CEM 142)  
Neural function including autonomic nervous system, physiological control systems, endocrinology, reproduction and digestive function.

494 Topics in Particle Physics  
Spring. 3(3-0) RB: (PHY 431)  
Continuation of PHY 431. Function and regulation of the cardiovascular, respiratory, and renal systems. Control of tissue blood flow, blood pressure, blood gases, body fluid volume and electrolytes.

495 Topics in Quantum Mechanics  
Fall. 2(2-0) R: Open only to Physics majors. Completion of Tier I writing requirement.

496 Topics in Relativistic Quantum Mechanics  
Fall. 2(2-0) R: Open only to Physics majors. Completion of Tier I writing requirement. Selected topic in the functioning of the visual system in health and disease.

497 Topics in Relativity and Cosmology  
Fall. 2(2-0) R: Open only to Physics majors. Completion of Tier I writing requirement. Selected topic in the functioning of the visual system in health and disease.

498 Topics in Quantum Field Theory  
Fall. 2(2-0) R: Open only to Physics majors. Completion of Tier I writing requirement. Selected topic in the functioning of the visual system in health and disease.

499 Topics in Modern Physics  
Fall. 2(2-0) R: Open only to Physics majors. Completion of Tier I writing requirement. Selected topic in the functioning of the visual system in health and disease.

501 Current Issues in Physics  
Fall. 2(2-0) Not open to students with credit in PSL 250 or PSL 341 or PSL 432.  
Physiological bases of health issues of broad social significance, and new approaches for the treatment of specific disorders.

502 Introductory Physiology  
Fall, Spring. 4(4-0) R: Not open to students in Physiology.  
Function, regulation and integration of organs and organ systems of higher animals emphasizing human physiology.

530 Physiology and Biophysics  
Fall. 3(2-3) RB: BS 111 and completion of Tier I writing requirement.  
Experimental model membrane systems including planar lipid bilayers and liposomes. Biotechnological applications of lipid bilayer sensors.

531 Cell Physiology: Function of Specialized Cells  
Fall. 3(3-0) P:M: (BS 111 or LBS 145)  
Functions of differentiated cells, including mechanisms of cell communication, excitiable membranes, contraction, motility, transport, secretion, and extra cellular matrix.

540 Computational Problem Solving in Physics  
Fall. Spring. 3(3-0) RB: (PSL 432) R: Approval of department. Quantitative analysis of physiological data: mathematical models, curve fitting, data analysis and interpretation. Problem solving involving exponential and logistic growth. Cerebral blood flow, convective cooling, oxygen consumption, thermoregulation, other applications.

550 Membrane Biophysics: An Introduction  
Fall, Spring. 2(2-0) R: One year of college physics or chemistry, and one year of college mathematics. Biophysical and chemical aspects of biomembranes. Experimental model membrane systems including planar lipid bilayers and liposomes. Biotechnological applications of lipid bilayer sensors.

555 Human Physiology I  
Fall. 3(3-0) RB: (BS 111 and CEM 142)  
Neural function including autonomic nervous system, physiological control systems, endocrinology, reproduction and digestive function.

560 Topics in Human Physiology  
Fall, Spring. 2(2-0) R: Open only to Physiology majors. Completion of Tier I writing requirement. Critical discussion and evaluation of a selected problem of mammalian cell physiology including cell biophysics, molecular biology of the cell.

565 Topics in Endocrinology  
Fall, Spring. 2(2-0) R: Open only to Physiology majors. Completion of Tier I writing requirement. Selected topic on the role of hormones in the regulation of growth, metabolism, differentiation.

566 Topics in Cardiovascular Physiology  
Fall. 2(2-0) R: (PSL 432) R: Open only to Physiology majors. Completion of Tier I writing requirement. Selected topic in blood flow physiology.

567 Topics in Respiratory Physiology  
Fall of odd years. 2(2-0) R: (PSL 432) R: Open only to Physiology majors. Completion of Tier I writing requirement. Selected topic in the physiology of gas exchange and lung mechanics.

568 Topics in Environmental Physiology  
Spring of odd years. 2(2-0) R: (PSL 432) R: Open only to Physiology majors. Completion of Tier I writing requirement. Selected topic in environmental physiology with an emphasis on thermoregulation.

569 Topics in Visual Physiology  
Fall of even years. 2(2-0) R: (PSL 432) R: Open only to Physiology majors. Completion of Tier I writing requirement. Selected topic in the functioning of the visual system in health and disease.

101 Current Issues in Physiology  
Fall. 2(2-0) Not open to students with credit in PSL 250 or PSL 431 or PSL 432.  
Physiological bases of health issues of broad social significance, and new approaches for the treatment of specific disorders.

250 Introductory Physiology  
Fall, Spring. 4(4-0) R: Not open to students in Physiology.  
Function, regulation and integration of organs and organ systems of higher animals emphasizing human physiology.

323 Physiology and Hygiene of the Eye  
Fall of odd years. Summer of even years. 3(3-0) R: Not open to Physiology majors. Basic anatomy, physiology, and hygiene of the visual system: normal and abnormal visual function, methods of correction, and educational implications.

331 Cell Physiology: Function of Specialized Cells  
Fall. 3(3-0) P:M: (BS 111 or LBS 145)  
Functions of differentiated cells, including mechanisms of cell communication, excitiable membranes, contraction, motility, transport, secretion, and extra cellular matrix.

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