866. Research on Sports for Athletes with Disabilities
Fall of odd-numbered years. 3(0-0)
Performance capabilities of athletes with disabilities. Research on areas such as exercise physiology, sport biomechanics, sport psychology, sport sociology, motor development, and motor learning.

867. Practicum in Adapted Physical Activity
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 4 credits in all enrollments for this course.
C: PES 865 or PES 866. R: Approval of department. Supervised practice in teaching physical activities and/or coaching sports for persons with disabilities.

868. Physical Activity and Well-Being
Fall. 3(0-0)
Relationship of physical activity to human well-being. Influence of growth, biological maturity, aging, body composition, nutrition, training, and rest on health and performance.

869. Independent Study in Physical Education and Exercise Science (MTC)
Fall, Spring, Summer. 2 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course.
Selected topics in areas such as physiology of exercise, biomechanics, motor behavior, psychosocial aspects of activity, program design and evaluation, and athletic training.

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
P: PES 871.

910. Current Issues in Exercise Physiology
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.
P: PES 810. Selected topics in exercise physiology and related fields of study.

916. Research Methods in Physical Education and Exercise Science
Spring. 3(3-0) R: Open only to graduate students in Physical Education and Exercise Science.
Research and analytical methodology including survey, qualitative, historical, philosophical, descriptive, meta-analytical, creative, and experimental methods.

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 34 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to doctoral students.

PHYSICS

Department of Physics and Astronomy
College of Natural Science

170. Investigations in Physics
Fall. 3(0-0)
R: Approval of department. Experiments in optics, electronics, sound and mechanics; analysis of data using computers, library research and oral presentations.

181B. Basic Physics I, CBI
Fall, Spring, Summer. 3 credits.
P: MTH 132 or concurrently. R: Not open to students with credit in LBS 183B or PHY 183 or PHY 193H or PHY 231 or PHY 231B. Newton's laws of motion, conservation of angular momentum, energy conservation, thermal physics, waves, and sound. Competency based instruction.

182B. Basic Physics II, CBI
Fall, Spring, Summer. 3 credits.
P: LBS 164 or PHY 181B or PHY 183 or PHY 193H or PHY 231 or PHY 231B. R: Not open to students with credit in LBS 267 or PHY 184 or PHY 184B or PHY 232 or PHY 282 or PHY 284B. Electricity and magnetism, optical phenomena, interference and diffraction of light, atomic and subatomic topics. Competency based instruction.

183. Physics for Scientists and Engineers I
Fall, Spring. 4(5-0)
P: MTH 132 or concurrently. R: Not open to students with credit in PHY 183 or PHY 183B or PHY 193H or PHY 231 or PHY 231B. Mechanics, Newton's laws, momentum, energy conservation, rotational motion, oscillation, gravity, waves.

183A. Physics I, CBI
Fall, Spring. 1 credit.
P: PHY 181B. R: Not open to students with credit in PHY 183 or PHY 183B or PHY 193H or PHY 231 or PHY 231B. Newton's laws, momentum, energy conservation, rotational motion, oscillation, gravity, waves. Competency based instruction.

183B. Physics for Scientists and Engineers II
Fall, Spring. 4(5-0)
P: PHY 181B or PHY 183 or PHY 183B or PHY 193H or LBS 164. R: Open only to students with credit in LBS 183 or PHY 182 or PHY 193H or LBS 164. MTH 132 or concurrently. R: Not open to students with credit in LBS 267 or PHY 182 or PHY 184B or PHY 232 or PHY 282 or PHY 284B. Electricity and magnetism, electromagnetic waves, light and optics, interference and diffraction.
Descriptions — Physics of Courses

18A. Physics II, CBI
Fall, Spring, Summer. 1 credit.
P: PHY 182B. R: Not open to students with credit in PHY 182A or PHY 243H or PHY 252B.
Topics: standing wave phenomena, atoms, electromagnetic fields, alternating currents, optics, quantum mechanics, elementary particles. This course plus PHY 182B is equivalent to PHY 184B.

18B. Physics for Scientists and Engineers II, CBI
Fall, Spring, Summer. 4 credits.
P: PHY 181B or PHY 183 or PHY 183A or PHY 183B or PHY 193H or LBS 164; MTH 153 or concurrently. R: Not open to students with credit in LBS 267 or PHY 182B or PHY 184 or PHY 232 or PHY 252B or PHY 243H.
Electricity and magnetism, electromagnetic waves, light and optics, interference and diffraction. Competency based instruction.

191. Physics Laboratory for Scientists, I
Spring. 10(3-3)
P: PHY 181B or PHY 183 or PHY 183A or PHY 183B or PHY 193H or LBS 164 or concurrently. R: Not open to students with credit in PHY 251.
Error analysis, exercises in motion, forces, conservation laws and optics.

192. Physics Laboratory for Scientists, II
Fall. 10(3-3)
P: PHY 184 or PHY 184B or PHY 191 or PHY 243H or LBS 267 or concurrently. R: Not open to students with credit in PHY 252.
Electric and magnetic fields, circuits, wave optics, and radioactivity.

193H. Honors Physics I Mechanics
Spring. 3(4-0)
P: MTH 153 or MTH 153H or concurrently.

205. Directed Studies
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course. R: Approval of department. Guided individualized study in an area of physics.

215. Thermodynamics and Modern Physics
Fall, Spring. 3(4-0)
P: PHY 184 or PHY 185A or PHY 184B or PHY 243H or LBS 267. R: Not open to students with credit in PHY 215B.
Thermodynamics, atomic physics, quasistatic systems, nuclear physics, solids, elementary particles.

215B. Thermodynamics and Modern Physics, CBI
Fall, Spring, Summer. 3 credits.
P: PHY 184 or PHY 184A or PHY 185A or PHY 243H or LBS 267. R: Not open to students with credit in PHY 215B.
Thermodynamics, atomic physics, quasistatic systems, nuclear physics, solids, elementary particles. Competency based instruction.

231. Introductory Physics I
Fall, Spring. 3(4-0)
P: MTH 116 or concurrently. R: Not open to students with credit in PHY 191B or PHY 193B or PHY 193H or PHY 221B or LBS 164.
Mechanics, Newton's Laws, momentum, energy, conservation laws, thermodynamics, waves, sound.

231B. Introductory Physics I, CBI
Fall, Spring, Summer. 3 credits.
P: MTH 116 or concurrently. R: Not open to students with credit in PHY 191B or PHY 193B or PHY 193H or PHY 221B or LBS 164.
Mechanics, Newton's Laws, momentum, energy, conservation laws, thermodynamics, waves, sound. Competency based instruction.

232. Introductory Physics II
Fall, Spring. 3(4-0)
P: PHY 181B or PHY 183 or PHY 183A or PHY 193H or PHY 221B or LBS 164. R: Not open to students with credit in PHY 184 or PHY 184B or PHY 221B.
Electricity and magnetism; optics; atomic, nuclear, and subnuclear physics.

232B. Introductory Physics II, CBI
Fall, Spring. 3(4-0)
P: PHY 184 or PHY 183 or PHY 193H or PHY 221B or LBS 164. R: Not open to students with credit in PHY 184 or PHY 184B or PHY 221B.
Electricity and magnetism; optics; atomic, nuclear, and subnuclear physics. Competency based instruction.

233B. Calculus Concepts in Physics I, CBI
Fall, Spring. 2 credits.
P: PHY 231 or PHY 231B; MTH 132 or concurrently. Kinematics, dynamics, applications of Newton's laws. Competency based instruction. PHY 231B plus PHY 233B is equivalent to PHY 183B.

234B. Calculus Concepts in Physics II, CBI
Fall, Spring, Summer. 3 credits.
P: PHY 232 or PHY 232B; MTH 153 or concurrently. Electricity and magnetism. Competency based instruction. PHY 232B plus PHY 234B equals PHY 184B.

251. Introductory Laboratory Physics I
Fall, Spring, Summer. 10(3-3)
P: PHY 183 or PHY 183B or PHY 231 or PHY 231B or concurrently. R: Not open to students with credit in PHY 191.
Laboratory exercises involving simple mechanical systems.

252. Introductory Laboratory Physics II
Fall, Spring. 10(3-3)
P: PHY 251 or PHY 191 or LBS 164L. R: Not open to students with credit in PHY 192.
Laboratory exercises involving simple electromagnetic and optical systems.

264H. Honors Physics II—Electromagnetism
Fall. 3(4-0)
P: PHY 193H; MTH 224 or MTH 254H or concurrently. Electricity and magnetism, electromagnetic waves and optics.

305. Directed Studies
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course. R: Approval of department. Guided individualized study in an area of physics.

321. Classical Mechanics I
Spring, Summer. 3(2-3)
P: PHY 215 or PHY 254H or concurrently. MTH 235 or MTH 255H or concurrently. The mechanics of point particles as application of Newton's laws. Conservation of energy and momentum. Central force fields.

321B. Classical Mechanics II
Spring, Summer. 3(2-3)
P: PHY 215 or PHY 254H or concurrently. MTH 235 or MTH 255H or concurrently. The mechanics of point particles as application of Newton's laws. Conservation of energy and momentum. Central force fields.

348. Special Relativity, CBI
Spring. 3 credits.

351B. Mathematical Physics, CBI
Spring. 3 credits.
P: PHY 321, PHY 481. Fourier series and complex variables as applied to problems in quantum mechanics, electrodynamics, and mechanics. Competency based instruction.

351L. Optics I
Spring. 3(2-3)
P: PHY 184 or PHY 184B or PHY 243H; PHY 192; PHY 215 or PHY 215B. R: Completion of Tier I writing requirement.
Lenses, aberrations, spectors, and stops. Diffraction, interferometry, spectroscopy, fiber optics.
SA: PHY 331.