Physics Major with Concentration in Computational Neuroscience Requirements
Catalog Year: 2015-16
Degree: Bachelor of Arts
Physics Major Credit Hours: 60+

“PR” indicates a pre-requisite. “CO” indicates a co-requisite.

Courses within this major may also satisfy general education requirements. Please consult http://registrar.cofc.edu/general-edu for more information.

Required Courses

- PHYS 111 General Physics I (3) PR or CO: MATH 120 or equivalent or instructor permission; CO: PHYS 111L
- PHYS 111L General Physics I Lab (1) CO: PHYS 111
- PHYS 112* General Physics II (3) PR: PHYS 111 or HONS 157; CO or PR: MATH 220 or equivalent or instructor permission; CO: PHYS 112L
- PHYS 112L General Physics II Lab (1) CO: PHYS 112
- PHYS 230 Introduction to Modern Physics I (3) PR: PHYS 112 or HONS 158; CO or PR: MATH 211 or instructor permission
- PHYS 370 Experimental Physics (4) PR: PHYS 230 or instructor permission
- PHYS 419 Research Seminar (1) PR or CO: PHYS 370 or ASTR 377 or instructor and department chair permission
- PHYS 420** Senior Research (3) PR: PHYS 419 and instructor and department chair permission

OR

- PHYS 499** Bachelor’s Essay (1-6) PR: PHYS 419 and instructor and department chair permission. Credit will not be awarded for both PHYS 420 and PHYS 499

Notes: * Upon completion of PHYS 101 with a grade of B or better and successful completion of MATH 120, a student may transfer to PHYS 112. **Credit will not be awarded for both PHYS 420 and PHYS 499.

Select 11 credit hours from the following electives with department approval. Please note a maximum of 3 credit hours from each of the following groups are allowed (PHYS 381, PHYS 390 and PHYS 399) and (PHYS 260, PHYS 260L, PHYS 460L).

Physics Electives List

- PHYS 203 Physics and Medicine (3) PR: PHYS 102, PHYS 102L or PHYS 112, PHYS 112L or HONS 158
- PHYS 260 NASA Space Mission Design (2) PR: ASTR 130 or ASTR 306 or HONS 160 or GEOL 206 or PHYS 102 or PHYS 112 or HONS 158 or instructor permission; CO: PHYS 260L or 460L
- PHYS 260L NASA Space Mission Design Laboratory (1) CO: PHYS 260
- PHYS 298 Special Topics (1-3) PR: Instructor permission
- PHYS 301 Classical Mechanics (3) PR: PHYS 112 or HONS 158 and MATH 323 or PHYS 272 or permission of instructor
- PHYS 302 Classical Mechanics (3) PR: PHYS 301
- PHYS 308 Atmospheric Physics (3) PR: PHYS 112, PHYS 112L or HONS 158 or instructor permission
- PHYS 320 Intro to Electronics (4) PR: PHYS 102 and MATH 120 or PHYS 112 or HONS 158 or instructor permission
PHYS 331  Intro to Modern Physics II (3)  PR: PHYS 230

PHYS 340  Photonics (4)  PR: PHYS 112, PHYS 112L or HONS 158

PHYS 350  Energy Production (4)  PR: CHEM 111, CHEM 111L, (PHYS112, 112L or HONS 158) or (PHYS 102, 102L and MATH 120)

PHYS 381  Internship (1-4)  PR: Coordinator and department chair permission

PHYS 390  Research (1-3; repeatable up to 6)  PR: Department chair and instructor permission

PHYS 396  Biophysics Model and Excitable Cells (3)  PR: (BIOL 111 or HONS 151 and PHYS 112 or HONS 158 or permission of instructor

PHYS 397  Research Experience Physics and Astronomy (0)  PR: Only declared majors can take a Zero Credit Research course. Instructor and department chair permission required.

PHYS 399  Tutorial (3; repeatable up to 12)  PR: Junior standing and department chair and instructor permission

PHYS 403  Introductory Quantum Mechanics (3)  PR: PHYS 230 and MATH 323 or PHYS 272, or instructor permission

PHYS 405  Thermal Physics (3)  PR: PHYS 230 and MATH 323 or PHYS 272, or instructor permission

PHYS 407  Introduction to Nuclear Physics (3)  PR: PHYS 230 or instructor permission

PHYS 408  Introduction to Solid State Physics (3)  PR: PHYS 230 and MATH 323 or PHYS 272, or instructor permission

PHYS 409  Electricity and Magnetism (3)  PR: PHYS 112 or HONS 158 and MATH 323 or PHYS 272 or permission of instructor

PHYS 410  Electricity and Magnetism (3)  PR: PHYS 409

PHYS 412  Special Topics (1-3)  PR: Instructor permission

PHYS 415  Fluid Mechanics (3)  PR: MATH 323 and PHYS 301 or instructor permission

PHYS 456  Air Pollution Meteorology (4)  PR: PHYS 112, PHYS 112L or (PHYS 102, PHYS 102L and MATH 120) or HONS 158; CHEM 112, CHEM 112L or instructor permission

PHYS 457  Satellite Meteorology (3)  PR: PHYS 308 or PHYS 456 or (PHYS 105 and PHYS 112, PHYS 112L) or (PHYS 105 and PHYS 102, PHYS 102L and MATH 120) or (PHYS 105 and HONS 158)

PHYS 458  Climate Change (4)  PR: PHYS 112, PHYS 112L or HONS 158

PHYS 460L  NASA Space Mission Design Leadership Lab (1)  PR: Instructor permission; CO: PHYS 260

Mathematics Requirement

☐ MATH 120  Introductory Calculus (4)  PR: Placement or C- or better in MATH 111

☐ MATH 220  Calculus II (4)  PR: MATH 120 or HONS 115

☐ MATH 221  Calculus III (4)  PR: MATH 220 or equivalent

Optional:  Students may also select a concentration in Computational Neuroscience, Energy Production or Meteorology.
Computational Neuroscience Concentration (Credit Hours: 18+)

Required Courses

☐ CSCI 220  Computer Programming I (3) PR: CSCI 120 or CSCI 180 or MATH 111 or higher or department permission; CO: CSCI 220L

☐ CSCI 220L  Computer Programming Lab I (1) CO: CSCI 220

☐ BIOL 396  Biophysical Modeling of Excitable Cells (3) PR: BIOL 211, PHYS 102/PHYS 112/HONS 158 or permission of instructor

OR

☐ PHYS 396  Biophysics Model and Excitable Cells (3) PR: BIOL 111 or HONS 151 and PHYS 112 or HONS 158 or permission of instructor

☐ PHYS 394  Digital Signal and Image Processing with Biomedical Applications (3) PR: PHYS 112 and 112L or HONS 158 and 158L; CO: PHYS 394L

☐ PHYS 394L  Digital Signal and Image Processing with Biomedical Applications Laboratory (1) PR: PHYS 112 and 112L or HONS 158 and 158L; CO: PHYS 394

Complete a minimum of 7 credit hours from the following electives (each elective must be from a different group):

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Group I

BIOL 305  Genetics (3) PR: BIOL 111 and 111L or HONS 151 and 151L and BIOL 112 and 112L or HONS 152 and 152L; PR or CO: BIOL 211 and 211D and MATH 250 or instructor permission

BIOL 312  Molecular Biology (3) PR: One year of Chemistry and BIOL 111 and 111L or HONS 151 and 151L and BIOL 112 and 112L or HONS 152 and 152L; BIOL 211 and 211D and BIOL 305 or CHEM 232 and 232L; PR or CO: MATH 250

BIOL 313  Cell Biology (3) PR: One year of Chemistry and BIOL 111 and 111L or HONS 151 and 151L and BIOL 112 and 112L or HONS 152 and 152L; and BIOL 211 and 211D or CHEM 232 and 232L; PR or CO: MATH 250; BIOL 305 or CHEM 232 and 232L

BIOL 321  General and Comparative Physiology (4) PR: One year of Chemistry and BIOL 111 and 111L or HONS 151 and 151L and BIOL 112 and 112L or HONS 152 and 152L; BIOL 211 and 211D and BIOL 305 or CHEM 232 and 232L; PR or CO: MATH 250 or equivalent course in statistics or instructor permission

BIOL 343  Animal Behavior (3) PR: BIOL 111 and 111L or HONS 151 and 151L and BIOL 112 and 112L or HONS 152 and 152L and BIOL 211 and 211D and BIOL 305; PR or CO: MATH 250

BIOL 343L  Animal Behavior (1) PR: BIOL 111 and 111L or HONS 151 and 151L and BIOL 112 and 112L or HONS 152 and 152L and BIOL 211 and 211D and BIOL 305; PR or CO: BIOL 343, and MATH 250

BIOL 351  Principles of Neurobiology (3) PR: PSYC 103 and BIOL 111 and 111L or HONS 151 and 151L and BIOL 112 and 112L or HONS 152 and 152L; BIOL 211 and 211D or PSYC 214; PR or CO: MATH 250

OR

PSYC 351  Principles of Neurobiology (3) PR: PSYC 103, BIOL 111, 112, and BIOL 211 or PSYC 214, or instructor permission.

BIOL 352  Neurobiology and Behavior (3) PR: BIOL 351 or PSYC 351 or PSYC 214; PR or CO: MATH 250

OR

PSYC 352  Neurobiology and Behavior (3) PR: BIOL/PSYC 351 or PSYC 214, or instructor permission.

BIOL 446  Special Topics in Neuroscience (3) PR: Junior or senior standing and instructor permission; PR or CO: MATH 250

OR

PSYC 446  Special Topics in Neuroscience (3) PR: Junior or senior standing and instructor permission

BIOL 447  Seminar in Neuroscience (3) PR: BIOL 351 or PSYC 351 and BIOL 352 or PSYC 352; CO: BIOL 448 or PSYC 448; PR or CO: MATH 250

OR
PSYC 447  Seminar in Neuroscience (3) PR: BIOL/PSYC 351/352; CO: BIOL/PSYC 448 or instructor permission. Students engaged in independent research or a bachelor's essay will be given priority for enrollment.

PSYC 213  Conditioning and Learning (3) PR: PSYC 103

PSYC 214  Behavioral Neuroscience (3) PR: PSYC 103

PSYC 215  Cognitive Psychology (3) PR: PSYC 103

PSYC 216  Sensation and Perception (formerly PSYC 313) (3) PR: PSYC 103

PSYC 221  Abnormal Psychology (formerly PSYC 307) (3) PR: PSYC 103

PSYC 318  Comparative Psychology (3) PR: PSYC 103

PSYC 353  Hormones and Behavior (Cross-listed with BIOL 353) (3) PR: PSYC 103 and 214 or 216, or instructor permission. Note: This course is cross-listed with BIOL 353. If a student has received credit for BIOL 353, the student may not receive credit for PSYC 353.

PSYC 386  Behavioral Pharmacology (3) PR: PSYC 103; PSYC 214 or BIOL/PSYC 351; PSYC 211 and 220 (or 250 in lieu of 211 and 220) or BIOL 211 and MATH 250; or instructor permission

PSYC 387  Neuropsychology (3) PR: PSYC 103; PSYC 214 or BIOL/PSYC 351; PSYC 211 and 220 (or 250 in lieu of 211 and 220) or BIOL 211 and MATH 250; or instructor permission

PSYC 464  Advanced Behavioral Neuroscience with Lab (3) PR: PSYC 103, 214, 211, 220 (or 250 in lieu of 211 and 220) and junior or senior status

PSYC 466  Advanced Sensation and Perception with Lab (3) PR: PSYC 103, 216, 211, 220 (or 250 in lieu of 211 and 220) and junior or senior status

PSYC 468  Advanced Cognitive Psychology with Lab (3) PR: PSYC 103, 215, 211, 220 (or 250 in lieu of 211 and 220) and junior or senior status

Group II

MATH 207  Discrete Structures I (3) PR: MATH 105, MATH 111, or MATH 120

MATH 245  Numerical Methods and Mathematical Computing (3) PR: MATH 203 or MATH 220 or instructor permission; CO: MATH 246

MATH 246  Mathematical Computing and Programming Lab (1) PR: MATH 220 or instructor permission

MATH 307  Discrete Structures II (3) PR: MATH 207 or MATH 295 or instructor permission

MATH 440  Statistical Learning I (3) PR: MATH 203 and MATH 220 and MATH 350

MATH 441  Statistical Learning II (3) PR: MATH 440

MATH 445  Numerical Analysis (3) PR: MATH 203 and MATH 245 and MATH 323

MATH 451  Linear Programming and Optimization (3) PR: MATH 203 and MATH 221 and CSCI 220 or MATH 245 or instructor permission

MATH 452  Operations Research (3) PR: MATH 203 and MATH 430 and CSCI 220 or MATH 245

MATH 470  Mathematical Modeling (3) PR: MATH 203 and MATH 323 and MATH 246 or CSCI 220 or instructor permission

CSCI 221  Computer Programming II (3) PR: CSCI 220 with a C- or better, CSCI 220L with a C- or better; CO or PR: MATH 207

CSCI 230  Data Structures and Algorithms (3) PR: CSCI 221 with a C- or better, MATH 207

CSCI 334  Data Mining (3) PR: CSCI 221 with a C- or better, MATH 207, MATH 250
CSCI 360  Software Architecture and Design (3) PR: CSCI 230 with a C- or better; CO or PR: COMM 104
CSCI 362  Software Engineering (3) PR: CSCI 221 with a C- or better, MATH 207; CO or PR: COMM 104
CSCI 380  User Interface Development (3) PR: CSCI 221 with a C- or better, MATH 307
CSCI 470  Principles of Artificial Intelligence (3) PR: CSCI 230 with a C- or better
CSCI 480  Principles of Computer Graphics (3) PR: CSCI 230 with a C- or better, MATH 105 or MATH 120

Group III

PHYS 203  Physics and Medicine (3) PR: PHYS 102, PHYS 102L or PHYS 112, PHYS 112L or HONS 158
PHYS 270  Nanotechnology and Medicine (3) CO or PR: PHYS 102 or PHYS 112 or HONS 158 or instructor permission
PHYS 298  Special Topics (1-3) PR: Instructor permission
PHYS 320  Intro to Electronics (4) PR: PHYS 102 and MATH 120 or PHYS 112 or PHYS 158 or instructor permission
PHYS 340  Photonics (4) PR: PHYS 112, PHYS 112L or HONS 158
PHYS 381* Internship (1-4) PR: Coordinator and department chair permission
OR
PHYS 390* Research (1-3; repeatable up to 6) PR: Department chair and instructor permission
HONS 390* Special Topics (3 - 6) PR: None
PHYS 399  Tutorial (3; repeatable up to 12) PR: Junior standing and department chair and instructor permission
PHYS 405  Thermal Physics (3) PR: PHYS 230
PHYS 407  Introduction to Nuclear Physics (3) PR: PHYS 230 or instructor permission
PHYS 408  Introduction to Solid State Physics (3) PR: PHYS 230 or instructor permission
PHYS 412* Special Topics (1-3) PR: Instructor permission
PHYS 415  Fluid Mechanics (3) PR: MATH 323 and PHYS 301 or instructor permission
PHYS 420* Senior Research (3) PR: PHYS 419 and instructor and department chair permission
OR
PHYS 499* Bachelor’s Essay (6) PR: PHYS 419 or department chair permission; credit will not be awarded for both PHYS 420 and PHYS 499

Notes:

- With department approval, completion with grades of at least "B" in PHYS 101/101L and PHYS 102/102L, together with MATH 120 and MATH 220 may be substituted for PHYS 111/111L and PHYS 112/112L.
- Suggested programs of study leading to graduate school in physics, astronomy, astrophysics, meteorology and engineering are available from the department.