

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 460 L

- 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: <i>PHYS 230</i>
PHYS 340	Photonics (4) PR: <i>PHYS 112, PHYS 112L or HONS 158</i>
PHYS 350	Energy Production (4) PR: <i>CHEM 111, CHEM 111L; (PHYS112, 112L or HONS 158) or (PHYS 102, 102L and MATH 120)</i>
PHYS 381	Internship (1-4) PR: <i>Coordinator and department chair permission</i>
PHYS 390	Research (1-3; repeatable up to 6) PR: <i>Department chair and instructor permission</i>
PHYS 396	Biophysics Model and Excitable Cells (3) PR: <i>(BIOL 111 or HONS 151 and PHYS 112 or HONS 158 or permission of instructor</i>
PHYS 397	Research Experience Physics and Astronomy (0) PR: <i>Only declared majors can take a Zero Credit Research course. Instructor and department chair permission required.</i>
PHYS 399	Tutorial (3; repeatable up to 12) PR: <i>Junior standing and department chair and instructor permission</i>
PHYS 403	Introductory Quantum Mechanics (3) PR: <i>PHYS 230 and MATH 323 or PHYS 272, or instructor permission</i>
PHYS 405	Thermal Physics (3) PR: <i>PHYS 230 and MATH 323 or PHYS 272, or instructor permission</i>
PHYS 407	Introduction to Nuclear Physics (3) PR: <i>PHYS 230 or instructor permission</i>
PHYS 408	Introduction to Solid State Physics (3) PR: <i>PHYS 230 and MATH 323 or PHYS 272, or instructor permission</i>
PHYS 409	Electricity and Magnetism (3) PR: <i>PHYS 112 or HONS 158 and MATH 323 or PHYS 272 or permission of instructor</i>
PHYS 410	Electricity and Magnetism (3) PR: <i>PHYS 409</i>
PHYS 412	Special Topics (1-3) PR: <i>Instructor permission</i>
PHYS 415	Fluid Mechanics (3) PR: <i>MATH 323 and PHYS 301 or instructor permission</i>
PHYS 456	Air Pollution Meteorology (4) PR: <i>PHYS 112, PHYS 112L or (PHYS 102, PHYS 102L and MATH 120) or HONS 158; CHEM 112, CHEM 112L or instructor permission</i>
PHYS 457	Satellite Meteorology (3) PR: <i>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)</i>
PHYS 458	Climate Change (4) PR: <i>PHYS 112, PHYS 112L or HONS 158</i>
PHYS 460L	NASA Space Mission Design Leadership Lab (1) PR: <i>Instructor permission; CO: PHYS 260</i>

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) <i>PR: CSCI 230 with a C- or better; CO or PR: COMM 104</i>
CSCI 362	Software Engineering (3) <i>PR: CSCI 221 with a C- or better, MATH 207; CO or PR: COMM 104</i>
CSCI 380	User Interface Development (3) <i>PR: CSCI 221 with a C- or better, MATH 307</i>
CSCI 470	Principles of Artificial Intelligence (3) <i>PR: CSCI 230 with a C- or better</i>
CSCI 480	Principles of Computer Graphics (3) <i>PR: CSCI 230 with a C- or better, MATH 105 or MATH 120</i>

Group III

PHYS 203	Physics and Medicine (3) <i>PR: PHYS 102, PHYS 102L or PHYS 112, PHYS 112L or HONS 158</i>
PHYS 270	Nanotechnology and Medicine (3) <i>CO or PR: PHYS 102 or PHYS 112 or HONS 158 or instructor permission</i>
PHYS 298	Special Topics (1-3) <i>PR: Instructor permission</i>
PHYS 320	Intro to Electronics (4) <i>PR: PHYS 102 and MATH 120 or PHYS 112 or PHYS 158 or instructor permission</i>
PHYS 340	Photonics (4) <i>PR: PHYS 112, PHYS 112L or HONS 158</i>
PHYS 381*	Internship (1-4) <i>PR: Coordinator and department chair permission</i>

OR

PHYS 390*	Research (1-3; repeatable up to 6) <i>PR: Department chair and instructor permission</i>
HONS 390*	Special Topics (3 - 6) <i>PR: None</i>
PHYS 399	Tutorial (3; repeatable up to 12) <i>PR: Junior standing and department chair and instructor permission</i>
PHYS 405	Thermal Physics (3) <i>PR: PHYS 230</i>
PHYS 407	Introduction to Nuclear Physics (3) <i>PR: PHYS 230 or instructor permission</i>
PHYS 408	Introduction to Solid State Physics (3) <i>PR: PHYS 230 or instructor permission</i>
PHYS 412*	Special Topics (1-3) <i>PR: Instructor permission</i>
PHYS 415	Fluid Mechanics (3) <i>PR: MATH 323 and PHYS 301 or instructor permission</i>
PHYS 420*	Senior Research (3) <i>PR: PHYS 419 and instructor and department chair permission</i>
PHYS 499*	Bachelor's Essay (6) <i>PR: PHYS 419 or department chair permission; credit will not be awarded for both PHYS 420 and PHYS 499</i>

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.