SIU CARBONDALE Southern Illinois University

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Physics

As the most basic of the physical sciences, physics can serve as the building block for many different careers. Using their understanding of physical principles, physicists have been at the forefront of many of the most exciting discoveries of the twentieth century and will continue to lead the way to many exciting discoveries in the future. They have contributed to a wide range of areas, including, but not limited to, biology, chemistry, communication, computer science, electronics, engineering, finance, managerial consulting, geophysics, medical physics, and transportation.

The SIU Carbondale Physics program focuses on applied physics. Therefore the program seeks to provide undergraduate students with the skills necessary to apply their basic understanding of physics to real-world problems for which the solutions are of near-future concern. With this in mind, the physics program at SIU offers a first-rate undergraduate program with four different specializations in applied physics-biomedical physics, computational physics, materials and nanophysics, and the traditional physics curriculum. These specializations are targeted to high-demand areas of science and take advantage of the expertise of our faculty. Members of the physics faculty are involved in a wide range of physics research projects, both theoretical and experimental, including low temperature physics, surface physics, materials physics, superconductivity, magnetism, synchrotron radiation, infrared spectroscopy, solid-state physics, quantum mechanics, quantum computation, computational physics, and statistical mechanics. Participation in faculty research projects by students is strongly encouraged and can be very useful to students since it provides them with faculty mentors, and experience applying learned skills to real-world physics problem-solving.

Physics is an exciting field; its graduates are in high demand and enjoy high salaries and job security. Employment opportunities in physics are varied and abundant, from industrial research and development to teaching. Physicists are employed by all sectors of society, including health care, various corporations, government, and universities. Students who wish to learn more are encouraged to contact the physics program directly or visit the program web site at physics.siu.edu.

Bachelor of Science (B.S.) in Physics

A minimum GPA of 2.0 in all physics and mathematics course work is needed in order for a student to receive a degree in Physics. In terms of credit hour requirements toward a degree in Physics, a course will be counted only once. A student may not repeat a course or its equivalent in which a grade of B or better was earned without the consent of the program.

B.S. Physics - General Physics Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements	39
Foundation Skills	13
UNIV 101	1

Degree Requirements	Credit Hours
CMST 101	3
ENGL 101, ENGL 102	6
MATH 221	3
Disciplinary Studies	23
Fine Arts	3
Human Health	2
Humanities	6
CHEM 200 or CHEM 205H	3
Biological Sciences Course	3
Social Science	6
Integrative Studies (Multicultural/Diversity)	3
Requirements for Major	81
CHEM 200 or CHEM 205H, CHEM 201, CHEM 202 or CHEM 207H (3 hours included in the UCC Physical Science hours)	(3)+2
MATH 150, MATH 221, MATH 250, MATH 251, MATH 305 (3 hours included in the UCC Mathematics hours)	(3)+14
MATH 405 or MATH 406 or MATH 407 or MATH 409 or MATH 450 or MATH 455 or MATH 475	3
PHYS 100, PHYS 205A, PHYS 205B, PHYS 206A, PHYS 206B, PHYS 255A, PHYS 255B, PHYS 305, PHYS 355, PHYS 301, PHYS 310, PHYS 320, PHYS 420, PHYS 430, PHYS 440, PHYS 445, PHYS 450	39
Physics Electives: chosen from PHYS 390, PHYS 424, PHYS 425, PHYS 428, PHYS 431, PHYS 432, PHYS 458, PHYS 470, PHYS 476B, PHYS 476C, PHYS 476M, PHYS 476Q, PHYS 490, CS 215, CS 220, CS 475	16-17
Physics Major Requirements - Supportive Skills	
Biological Science (3 hours included in the UCC Life Science hours)	(3)+3
CS 201 or CS 202, CS 280, CS 300, ENGL 290 or ENGL 291 or ENGL 391; MATH 282 or MATH 483	3-4

Degree Requirements	Credit Hours
Total	120

B.S. Physics - Astrophysics Physics Specialization Degree Requirements

Degree Requirements	Credit Hours	
University Core Curriculum Requirements		39
Foundation Skills	13	
UNIV 101	1	
CMST 101	3	
ENGL 101, ENGL 102	6	
MATH 221	3	
Disciplinary Studies	23	
Fine Arts	3	
Human Health	2	
Humanities	6	
CHEM 200 or CHEM 205H	3	
Biological Sciences Course	3	
Social Science	6	
Integrative Studies (Multicultural/Diversity)	3	
Physics Major Requirements		81
CHEM 200 or CHEM 200H, CHEM 201, CHEM 202 or CHEM 202H (3 hours included in the UCC Physical Science hours)	(3)+2	
MATH 150, MATH 221, MATH 250, MATH 251, MATH 305, (3 hours included in the UCC Mathematics hours)	(3)+14	
MATH 405 or MATH 406 or MATH 407 or MATH 409 or MATH 450 or MATH 455 or MATH 475	3	
PHYS 100, PHYS 205A, PHYS 205B, PHYS 206A, PHYS 206B, PHYS 255A, PHYS 255B, PHYS 301, PHYS 305,	36	

Degree Requirements	Credit Hours
PHYS 355, PHYS 310, PHYS 320, PHYS 420, PHYS 430, PHYS 440, PHYS 445	
CS 202, PHYS 103, PHYS 302, PHYS 431, PHYS 476A	(3)+13
Physics Electives chooses from PHYS 328, PHYS 390, PHYS 424, PHYS 428, PHYS 432, PHYS 450, PHYS 458, PHYS 490; CS 215, CS 220, CS 475	6-7
Physics Major Requirements - Support Skills	
Biological Science (3 hours included in the UCC Life Science hours)*	(3)+3
CS 201-3 or CS 202-4, CS 280-3, CS 300-3, ENGL 290-3 or ENGL 291-3 or ENGL 391-3; MATH 282-3 or MATH 483-4;	3-4
Total	120

B.S. Physics - Biomedical Physics Specialization Degree Requirements

Degree Requirements	Credit Hours	
University Core Curriculum Requirements		39
Foundation Skills	13	
UNIV 101	1	
CMST 101	3	
ENGL 101, ENGL 102	6	
MATH 221	3	
Disciplinary Studies	23	
Fine Arts	3	
Human Health	2	
Humanities	6	
CHEM 200 or CHEM 205H	3	
Biological Science	6	
Social Science	6	

Degree Requirements	Credit Hours
Integrative Studies (Multicultural/Diversity)	3
Requirements for Major	81
CHEM 200 or CHEM 205H, CHEM 201, CHEM 202 or CHEM 207H (3 hours included in the UCC Physical Science hours)	(3)+2
MATH 150, MATH 221, MATH 250, MATH 251, MATH 305 (3 hours included in the UCC Mathematics hours)	(3)+14
MATH 405 or MATH 406 or MATH 407 or MATH 409 or MATH 450 or MATH 455 or MATH 475	3
PHYS 100, PHYS 205A, PHYS 205B, PHYS 206A, PHYS 206B, PHYS 255A, PHYS 255B, PHYS 301, PHYS 305, PHYS 310, PHYS 320, PHYS 355, PHYS 420, PHYS 430, PHYS 445	33
BIOL 211, BIOL 213, PHYS 476B	(3)+8
Physics Electives chosen from: PHYS 390, PHYS 424, PHYS 425, PHYS 428, PHYS 431, PHYS 432, PHYS 440, PHYS 458, PHYS 470, PHYS 476C, PHYS 476M, PHYS 476Q, PHYS 490, CHEM 210, CHEM 211, CHEM 212, CHEM 340, CHEM 341, CHEM 350, CHEM 351, MICR 301, MICR 302	17-18
Physics Major Requirements - Support Skills	
Biological Science (3 hours included in the UCC Life Science hours)* [1]	0
CS 201 or CS 202, CS 280, CS 300, ENGL 290 or ENGL 291 or ENGL 391; MATH 282 or MATH 483	3-4
Total	120

[1] **Biological Science requirement met through Biomedical Physics specialization requirement*

B.S. Physics - Computational Physics Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements	39
Foundation Skills	13
UNIV 101	1

Degree Requirements	Credit Hours
CMST 101	3
ENGL 101, ENGL 102	6
MATH 221	3
Disciplinary Studies	23
Fine Arts	3
Human Health	2
Humanities	6
CHEM 200 or CHEM 205H	3
Biological Sciences Course	3
Social Science	6
Integrative Studies (Multicultural/Diversity)	3
Requirements for Major	81
CHEM 200 or CHEM 205H, CHEM 201, CHEM 202 or CHEM 207H (3 hours included in the UCC Physical Science hours)	(3)+2
MATH 150, MATH 221, MATH 250, MATH 251, MATH 305 (3 hours included in the UCC Mathematics hours)	(3)+14
MATH 405 or MATH 406 or MATH 407 or MATH 409 or MATH 450 or MATH 455 or MATH 475	3
PHYS 100, PHYS 205A, PHYS 205B, PHYS 206A, PHYS 206B, PHYS 255A, PHYS 255B, PHYS 305, PHYS 355, PHYS 301, PHYS 310, PHYS 320, PHYS 420, PHYS 430, PHYS 440, PHYS 445	36
CS 202, CS 215, CS 220, PHYS 476C	15
Physics Electives chosen from PHYS 390, PHYS 424, PHYS 425, PHYS 428, PHYS 431, PHYS 432, PHYS 458, PHYS 470, PHYS 476B, PHYS 476M, PHYS 476Q, PHYS 490, CS 475	7-8
Physics Major Requirements – Supportive Skills	
Biological Science (3 hours included in the UCC Life Science hours)	(3)+3

Degree Requirements	Credit Hours
CS 201 or CS 202*, CS 280, CS 300, ENGL 290 or ENGL 291 or ENGL 391; MATH 282 or MATH 483 [1]	3-4
Total	120

[1] *CS 202 is a Computational Physics specialization requirement, not included as a Physics Major Requirement*

B.S. Physics - Materials and Nanophysics Specialization Degree Requirements

Degree Requirements		Credit Hours
University Core Curriculum Requirements		39
Foundation Skills		13
UNIV 101	1	
CMST 101	3	
ENGL 101, ENGL 102	6	
MATH 221	3	
Disciplinary Studies		23
Fine Arts	3	
Human Health	2	
Humanities	6	
CHEM 200 or CHEM 205H	3	
Biological Sciences Course	3	
Social Science	6	
Integrative Studies (Multicultural/Diversity)		3
Requirements for Major		81
CHEM 200 or CHEM 205H, CHEM 201, CHEM 202 or CHEM 207H (3 hours included in the UCC Physical Science hours)		(3)+2
MATH 150, MATH 221, MATH 250, MATH 251, MATH 305 (3 hours included in the UCC Mathematics hours)		(3)+14

Degree Requirements	Credit Hours
MATH 405 or MATH 406 or MATH 407 or MATH 409 or MATH 450 or MATH 455 or MATH 475	3
PHYS 100, PHYS 205A, PHYS 205B, PHYS 206A, PHYS 206B, PHYS 255A, PHYS 255B, PHYS 305, PHYS 355, PHYS 301, PHYS 310, PHYS 320, PHYS 420, PHYS 430, PHYS 440, PHYS 445, PHYS 450	39
PHYS 425, PHYS 476M	6
Physics Electives chosen from PHYS 390, PHYS 424, PHYS 428, PHYS 431, PHYS 432, PHYS 458, PHYS 470, PHYS 476B, PHYS 476C, PHYS 476Q, PHYS 490, CS 215, CS 220, CS 475	10-11
Physics Major Requirements - Supportive Skills	
Biological Science (3 hours included in the UCC Life Science hours)	(3)+3
CS 201 or CS 202, CS 280, CS 300, ENGL 290 or ENGL 291 or ENGL 391; MATH 282 or MATH 483	3-4
Total	120

Physics Minor

A minor in Physics requires 17 hours and must include PHYS 203A, PHYS 203B, and PHYS 253A, PHYS 253B, or PHYS 205A, PHYS 205B, and PHYS 255A, PHYS 255B, as well as PHYS 305 and PHYS 355 and five hours from any 300- or 400-level physics course except PHYS 470.

Technology Fee

The College of Agricultural, Life, and Physical Sciences assesses undergraduate majors a technology fee of $4.58 per credit hour up to 12 credit hours. The fee is charged Fall and Spring semester.

Physics Courses

PHYS100 - Undergraduate Seminar Lectures and discussions by students, faculty and invited guests on topics in physics. Will include discussions on employment opportunities, graduate school admission and undergraduate research. Graded: Pass/Fail. Credit Hours: 1

PHYS101 - Physics that Changed the World (University Core Curriculum) [IAI course: P1 901L] This course will survey some of the most important developments in physics which have occurred over the past two millennia. Along the way, students will be introduced to fundamental physical principles such as energy conservation. Topics will include early astronomy, laws of motion, electricity, magnetism, waves, quantum mechanics and relatively. Lab fee: $20. Credit Hours: 3

PHYS103 - Astronomy (University Core Curriculum) Fundamental concepts of the physical sciences are used in the exploration of the observable universe. Studies include the history and techniques of

astronomy, planets, stars, black holes, galaxies and cosmology. Lectures are supplemented by outdoor astronomical observations and/or indoor laboratory exercises. Lab fee: $20. Credit Hours: 3

PHYS176Q - Introduction to Classical and Quantum Logic In this course, we will explore the nature of these rules and recent discoveries of their consequences for communication and computing such as: teleportation, dense coding, quantum key distribution for quantum cryptography, and quantum computing. The course will have hands-on, in-class projects and discussions for learning how to program a quantum computer as well as exercises that are designed to give a conceptual understanding of the rules and advantages for this new type of computing. This course is designed for freshman and sophomore level Math, Science, and Engineering majors. This is a 3-hour course. The prerequisites are high-school level algebra and trigonometry as well as MATH 109 or MATH 111 with grade C or better. Credit Hours: 3

PHYS203A - College Physics (University Core Curriculum course) [IAI Course: P1 900] Mechanics, heat, and sound. Prerequisite: completing with grade C or better MATH 109 or 111 or 125 or 140 or 150. PHYS 203 A or B with PHYS 253 satisfies a Science Group I Core Curriculum requirement in lieu of PHYS 101 or 103. Credit Hours: 3

PHYS203B - College Physics (University Core Curriculum course) Electricity, magnetism, light, aspects of modern physics. Prerequisite: PHYS 203A. PHYS 203 A or B with PHYS 253 satisfies a Science Group I Core Curriculum requirement in lieu of PHYS 101 or 103. Credit Hours: 3

PHYS205A - University Physics (University Core Curriculum course) [IAI course: P2 900] Designed to meet requirements of physics, engineering and chemistry majors. Mechanics, heat and waves. Prerequisites: MATH 150 with grade of C or better. With PHYS 255A, satisfies the UCC Science Group I requirement instead of PHYS 101 or 103. Not for graduate credit. Credit Hours: 3

PHYS205B - University Physics (University Core Curriculum course) Designed to meet requirements of physics, engineering and chemistry majors. Electricity, magnetism and optics. Prerequisites: PHYS 205A and MATH 250 each with a grade of C or better. With PHYS 255B satisfies the UCC Science Group I requirement instead of PHYS 101 or 103. Not for graduate credit. Credit Hours: 3

PHYS206A - Problem Solving for PHYS 205A Students will learn tips and techniques for solving problems in 205A. This will be done in a problem-based learning environment by solving problems in groups with leadership from the instructor. Prerequisite: MATH 150 with a grade of C or better. Co-requisite: concurrent enrollment in PHYS 205A. Credit Hours: 1

PHYS206B - Problem Solving for PHYS 205B Students will learn tips and techniques for solving problems in 205A. This will be done in a problem-based learning environment by solving problems in groups with leadership from the instructor. Co-requisite: Concurrent enrollment in PHYS 205B. Prerequisite: MATH 150 with a grade of C or better. Credit Hours: 1

PHYS253A - College Physics Laboratory (University Core Curriculum course) [IAI Course: P1 900L] One two-hour laboratory per week. Prerequisite: completion of or concurrent enrollment in 203A,B respectively; if the corresponding lecture course is dropped, the laboratory course must also be dropped. With 203A or B, satisfies the University Core Curriculum Science Group I requirement in lieu of PHYS 101 or 103. Lab fee: $25. Credit Hours: 1

PHYS253B - College Physics Laboratory (University Core Curriculum course) [IAI Course: P1 900L] One two-hour laboratory per week. Prerequisite: completion of or concurrent enrollment in 203A,B respectively; if the corresponding lecture course is dropped, the laboratory course must also be dropped. With 203A or B, satisfies the University Core Curriculum Science Group I requirement in lieu of PHYS 101 or 103. Lab fee: $25. Credit Hours: 1

PHYS255A - University Physics Laboratory (University Core Curriculum course) [IAI Course: P2 900L] One two-hour laboratory per week. Prerequisite: completion of or concurrent enrollment in 205A,B respectively; if the corresponding lecture course is dropped, the laboratory course must also be dropped. With 205A or B, satisfies the University Core Curriculum Group I requirement in lieu of PHYS 101, 103. Lab fee: $25. Credit Hours: 1

PHYS255B - University Physics Laboratory (University Core Curriculum course) One two-hour laboratory per week. Prerequisite: completion of or concurrent enrollment in 205A,B respectively; if the

corresponding lecture course is dropped, the laboratory course must also be dropped. With 205A or B, satisfies the University Core Curriculum Group I requirement in lieu of PHYS 101, 103. Lab fee: $25. Credit Hours: 1

PHYS301 - Theoretical Methods in Physics Introduction to theoretical methods of general usefulness in intermediate and advanced undergraduate physics, with particular emphasis on applications of vector algebra and calculus, complex numbers, matrices, ordinary differential equations and Fourier series to selected topics in physics. Required of all physics majors prior to or concurrently taking 310 or 320. Prerequisite: PHYS 205A, MATH 250 with a grade of C or better. Credit Hours: 3

PHYS302 - Observational Astronomy This course is for students who have a desire to become familiar with the nature and motions of celestial objects in the night sky and techniques to observe them. Suitable for both science and non-science majors who want to learn how to use a telescope and enjoy observational and practical astronomy. Lectures are supplemented by outdoor nighttime astronomical observations. Prerequisite: PHYS 103 (or instructor consent). Lab fee: $20. Credit Hours: 3

PHYS305 - Modern Physics (University Core Curriculum course) The physics of the twentieth century: special relativity (experimental basis; time dilation, length contraction, Lorentz transformations; addition of velocities; relativistic momentum, mass and energy). Quantum mechanics (wave-particle duality, early quantum theory, tunneling phenomena, the Schroedinger equation in one and in three dimensions). Applications of quantum theory to: atomic and molecular structure; lasers, condensed matter physics; nuclear and particle physics. Prerequisites: PHYS 205A and PHYS 205B with a grade of C or above, or PHYS 203A and PHYS 203B both with a grade of C or above. Credit Hours: 3

PHYS310 - Classical Mechanics Review of Newtonian mechanics of particles and rigid bodies, and Lagrangian and Hamiltonian dynamics. Prerequisite: PHYS 301 or MATH 305 or concurrent enrollment, PHYS 205A, and PHYS 205B with grade of C or better. Credit Hours: 3

PHYS320 - Electricity and Magnetism I The theory of electric and magnetic fields; electrostatic fields in vacuum and in material media, special methods for the solution of electrostatics problems, energy, and force relations in electrostatic fields; stationary electric fields in conducting media, electric currents, magnetic fields, magnetic properties of matter. Prerequisite: PHYS 301 or MATH 305 or concurrent enrollment, and PHYS 205A,B and MATH 251 with grade of C or better. Credit Hours: 3

PHYS328 - Light Light propagation, reflection, refraction, interference, diffraction, polarization, and optical instruments. Prerequisite: PHYS 203B or 205B with grade of C or better. Credit Hours: 2

PHYS355 - Modern Physics Laboratory A laboratory class which meets for a two hour session once a week. The laboratory experiments include several of the seminal experimental discoveries that helped establish quantum theory (spectral lines, the charge to mass ratio for the electron, the photoelectric effect, the Franck-Hertz experiment, radioactivity, superconductivity, etc.). Prerequisites: PHYS 205A and PHYS 205B or PHYS 203A and PHYS 203B with a grade of C or better. Lab fee: $25. Credit Hours: 1

PHYS390 - Undergraduate Research An introduction to investigations in physics. Individual work under the supervision of a physics faculty member on a special topic in physics. Not for graduate credit. Special approval needed from the instructor. Credit Hours: 1-4

PHYS420 - Electricity and Magnetism II Induced electromotive force, quasisteady currents and fields, Maxwell's equations, electromagnetic waves and radiation, with applications. Prerequisite: PHYS 320 with grade of C or better. Credit Hours: 3

PHYS424 - Electronics for Scientists Coordinated two-hour lecture and four-hour laboratory study of electronics. Emphasis is on overall modern electronics and its applications in the experimental research laboratory setting. Topics include DC and AC circuit theory, measurement techniques, semiconductor active devices, operational amplifiers and feedback, digital circuits, Boolean algebra, microprocessors and large scale integration, digital to analog/analog to digital conversion, and data acquisition. Prerequisite: PHYS 203B or 205B and MATH 111 with a grade of C or better. Credit Hours: 4

PHYS425 - Solid State Physics I Structure of a crystalline solid; lattice vibrations and thermal properties; electrons in metals; band theory; electrons and holes in semiconductors; opto-electronic phenomena in

solids; dielectric and magnetic properties; superconductivity. Prerequisite: PHYS 310, 320, and 430 with grade of C or better. Credit Hours: 3

PHYS428 - Modern Optics and Lasers Properties of electromagnetic waves in space and media, polarization and interference phenomena and devices, electro- and magneto-optic effects, optical gain, and lasers. Prerequisite: PHYS 420 with grade of C or better. Credit Hours: 3

PHYS430 - Quantum Mechanics I An introduction to quantum phenomena, wells, barriers, Hydrogenic atoms, angular momentum and identical particles. Prerequisite: PHYS 305, 310, and 320 with a grade of C or better. Prior or concurrent enrollment in PHYS 420 is desirable. Credit Hours: 3

PHYS431 - Atomic and Molecular Physics I Atomic spectra and structure; molecular spectra and structure. Prerequisite: PHYS 430 with a grade of C or better. Credit Hours: 3

PHYS432 - Nuclear Physics I Basic nuclear properties and structure; radioactivity, nuclear excitation, and reactions, nuclear forces; fission and fusion. Prerequisite: PHYS 430 with grade of C or better. Credit Hours: 3

PHYS440 - Applications of Quantum Mechanics Applications of quantum mechanics to include time-independent and time-dependent perturbation theory, variational methods, introduction to solid-state physics and materials. Prerequisite: PHYS 430 with grade of C or better. Credit Hours: 3

PHYS445 - Thermodynamics and Statistical Mechanics Laws of thermodynamics; Principles and Applications of Classical and Quantum Statistical Mechanics; Introduction to Phase Transitions. Prerequisites: PHYS 305 and PHYS 301 both with a grade of C or better; MATH 251 with a grade of C or better. Credit Hours: 3

PHYS450 - Advanced Laboratory Techniques Introduces students to experimental research and encourages them to develop and carry out experiments. Prerequisite: PHYS 305 and PHYS 355 with a grade of C or better. Lab fee: $50. Credit Hours: 3

PHYS458 - Laser and Optical Physics Laboratory Properties of laser beams and resonators, fluorescence and two photon spectroscopy, diffraction, Fourier transformation and frequency filtering, electro- and magneto-optic modulation, fiber propagation and related experiments. Prerequisite: PHYS 428 with grade of C or better. Credit Hours: 2

PHYS470 - Special Projects Each student chooses or is assigned a definite investigative project or topic. Prerequisite: PHYS 310, 320 or consent of instructor. Credit Hours: 1-3

PHYS475 - Special Topics in Physics These courses are advanced special topics in physics designed to enable undergraduate and graduate students to become well-versed in a particular and current research area of physics with the intention of preparing them for future research and/or industrial applications. They are offered as the need arises and interest and time permit. Students are required to give presentations. Special approval needed from the instructor. Credit Hours: 3-6

PHYS476A - Introduction to Astrophysics This course provides an introduction to the modern scientific study of the universe. The laws of physics will be used to explore a wide range of astrophysical processes, including comparative planetology, orbital dynamics, stellar evolution, and cosmology. Prerequisites: Two semesters of an introductory physics sequence (PHYS 203A, 203B or PHYS 205A, 205B) and Astronomy (PHYS 103). Credit Hours: 3

PHYS476B - Introduction to Biological Physics This course provides an introduction to how physics principles and techniques are applied to study and describe complex and emergent processes found at the biological and biomolecular level. This course combines several topics not usually covered in standard undergraduate science courses to qualify and quantify cell structure, mechanics, dynamics, self-assembly, and biological functionality. Prerequisites: Two semesters of an introductory physics sequence (PHYS 203A,B or PHYS 205A,B) with minimum grades of C, MATH 150 or concurrent enrollment. Credit Hours: 3

PHYS476C - Introduction to Computational Physics This course provides foundational knowledge in the usage of computers for solving natural problems in different types of physical systems. The class will give a thorough understanding of various numerical techniques such as interpolating/extrapolating

data, integrating ordinary and partial differential equations, and solving linear algebra problems. Students will be guided to write programs for solving several applied physics problems in classical and modern physics. A brief survey of High Performance Computing will also be presented giving students a working knowledge of scientific computing. Prerequisites: Two semesters of an introductory physics sequence (PHYS 203A,B or PHYS 205A,B), with minimum grades of C and concurrent enrollment in PHYS 305. PHYS 301, PHYS 310 and PHYS 320 are not required but recommended. Credit Hours: 3

PHYS476M - Introduction to Materials Science and NanoPhysics This course will serve as an introductory course in Materials Science and Nanoscale Physics. Topics to be covered include: The need for studying Materials Science, classification of materials, advanced concepts in materials manufacturing, modern materials, nanoscale materials, electrical, thermal, magnetic and optical properties of materials, tailoring materials for application development, Techniques of Materials characterization, Nanomaterials and Nanotechnology, and Societal Impact. Prerequisites: Two semesters of an introductory physics sequence (PHYS 203A,B or PHYS 205A,B), with minimum grades of C, MATH 150 or concurrent enrollment. Credit Hours: 3

PHYS476Q - Quantum Entanglement This course provides an introduction to the theory of quantum entanglement and its use in quantum information science, especially for the task of communication. Topics include quantum teleportation, entanglement measures, and nonlocality. Prerequisite: MATH 221 with a grade of C or better. Credit Hours: 3

PHYS490 - Advanced Undergraduate Research Advanced undergraduate research under the supervision of a physics faculty member. A presentation of the results will be made at the end of the term. Not for graduate credit. Prerequisite: PHYS 310, 320 or consent of instructor and undergraduate advisor. Credit Hours: 1-4

Physics Faculty

Byrd, Mark, Professor, Physics, Ph.D., University of Texas, Austin, 1999; 2003. Theoretical Quantum Computation and Quantum Error Correction.

Jayasekera, Thushari, Associate Professor and Undergraduate Advisor, Physics, Ph.D., University of Oklahoma, Norman, 2005; 2011. Engineering Electron Structure, Electron Transport, and Heat Transport in Low-Dimensional Nanostructures for Device Applications.

Lee, Bumsu, Assistant Professor, Physics, Ph.D., Rutgers, The State University of New Jersey, 2012; 2019. Quantum Optics and Experimental Condensed Matter Physics for Solid-State Quantum Materials.

Mazumdar, Dipanjan, Associate Professor, Physics, Ph.D., Brown University, 2008; 2014. Condensed Matter Experiment, Materials Physics, Electronic Properties of Novel Materials and Heterostructures, Emphasis on Exploring the Interplay Between Spin, Charge, Lattice and Orbital Degrees of Freedom.

Sivakumar, Poopalasingam, Assistant Professor, Physics, Ph.D., University of Oklahoma, 2009; 2015. Soft Condensed Matter Experiments, Biophysics, Laser Spectroscopy and Optical Physics of Biomolecules.

Talapatra, Saikat, Professor and Chair of Physics, Ph.D., Southern Illinois University, 2002; 2007. Condensed Matter Experiment, Materials Physics, Nanoscale Materials and Structures, Electronics and Photo Electronics, Energy Storage/Conversion in Nanomaterials, Interdisciplinary Nanotechnology.

Emeriti Faculty

Ali, Naushad, Professor, Emeritus, Physics, Ph.D., University of Alberta, 1984.

Cutnell, John D., Professor, Emeritus, Physics, Ph.D., University of Wisconsin, 1967.

Gruber, Bruno J., Professor, Emeritus, Physics, Ph.D., University of Vienna, Austria, 1962.

Henneberger, Walter C., Professor, Emeritus, Physics, Ph.D., Gottingen University, Germany, 1959.

Johnson, Kenneth W., Professor, Emeritus, Physics, Ph.D., Ohio State University, 1967.

Malhotra, Vivak, Professor, Emeritus, Physics, Ph.D., Indian Institute of Technology, Kanpur, 1978.

Masden, J. Thomas, Associate Professor, Emeritus, Physics, Ph.D., Purdue University, 1983.

Migone, Aldo, Professor, Emeritus, Physics, Ph.D., Pennsylvania State University, 1984.

Sanders, Frank C., Associate Professor, Emeritus, Physics, Ph.D., University of Texas, 1968.

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