



**PHYSICS CERTIFICATION (GRADES 8-12)
BACHELORS OF ARTS AND SCIENCE
PROGRAM SUBMISSION
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The content courses in this program are used for transcript reviews for entrance into Alternative Certification Option 6.

Executive Summary

Theme of the Unit

The mission of the College of Education and Human Services is the preparation of leaders for successful careers that positively impact communities as advocates and practitioners, through student-centered, authentic, and engaging academic programs. The college envisions being recognized for producing graduates who foster excellence in their communities. The college's education programs support that mission and vision by ensuring candidates exemplify the knowledge, skills, dispositions, leadership qualities, and decision-making skills necessary to serve as effective educators in their communities. The goal of the college's educator preparation program is to produce candidates who demonstrate the characteristics of a Murray State University graduate, the proficiencies delineated by Kentucky Teacher Standards and the knowledge required by learned societies. "Educator as a reflective decision-maker" is the unit's theme. Undergraduate candidates demonstrate professional dispositions throughout their course work, field experiences, and student teaching. Murray State University candidates will become educators who demonstrate these dispositions: inclusive, responsible, enthusiastic, caring, confident, and ethical. Graduate candidates exhibit the same dispositions while developing their capacities as teacher leaders who foster excellence in their classrooms, schools, districts, and communities.

Unique Features

Murray State University (MSU) has long recognized teacher preparation as a major institutional focus. Established in 1922 by the Kentucky General Assembly as Murray State Normal School, the institution was renamed Murray State College in 1948 and achieved university status in 1966 as Murray State University. This tax-supported residential comprehensive university is composed of the Hutson School of Agriculture, School of Nursing and Health Professions, and four academic colleges: College of Education and Human Services, Arthur J. Bauernfeind College of Business, College of Humanities and Fine Arts, and Jesse D. Jones College of Science, Engineering and Technology. The university fosters an exciting and challenging learning environment by emphasizing student-centered learning and educational experiences; preparing graduates to succeed in a culturally diverse, technologically oriented society; developing collaborative relationships with alumni and community constituents; promoting international education; and encouraging academic outreach.

MSU serves an 18-county region in the heart of the Jackson Purchase area of Western Kentucky. In fall 2015, the university's enrollment was 10,614 students. MSU has the highest graduation rate (53.1%) and the highest retention rate (72.4%) of among public comprehensive universities in the Commonwealth. Murray State University has consistently been ranked among the top Southern regional and liberal arts colleges in the *U.S. News & World Report's* annual publication, *America's Best Colleges* and has been listed in Kiplinger's *100 Best Values in Public Colleges*. Senior Surveys indicate that students are positive about their overall education as well as their chosen major in teacher education at Murray State. The Southern Association of Colleges and Schools (SACS) has continuously accredited Murray State since 1928.

Until July 2014, the College of Education departments were: Adolescent, Career and Special Education; Early Childhood and Elementary Education; and Educational Studies, Leadership and Counseling. During a summer 2014 university-wide academic reconfiguration, the College of Education transformed into the College of Education and Human Services (COEHS). The three existing departments were joined by the Department of Community Leadership and Human Services and the Center for Communication Disorders. Please reference the COEHS organizational flowchart at <http://coekate.murraystate.edu/ncate/st/general.htm>.

COEHS is a member of the American Association of Colleges for Teacher Education (AACTE), Teacher Education Council of State Colleges and Universities (TESCU) and is accredited by the National Council for the Accreditation of Teacher Education (NCATE). Initial accreditation from NCATE was received in 1954. Murray State University has actively pursued and maintained NCATE accreditation for its teacher preparation program. In fall 2016, the unit will seek Council for the Accreditation of Educator Preparation (CAEP) accreditation.

Several unit programs are provided at these Kentucky extended regional campuses: Henderson, Hopkinsville, Madisonville, and Paducah. Candidates can earn undergraduate degrees in elementary education, middle school education, learning and behavior disorders, and interdisciplinary early childhood education. Each semester, the unit hosts an extended campus team session to share unit initiatives, provide professional development, and host course instructional team meetings. All instructors teaching the same course at all sites meet to create a common vision for their course, design common course assignments and assessments, and discuss ways to ensure a consistent, quality course delivery at all site locations.

Rationale for the Program

According to the U.S. Department of Labor, job prospects are best for teachers in high-demand fields, such as mathematics, sciences, languages, and bilingual education. Locations in urban or rural school districts are also considered to be high need areas for content area teachers. Teachers who are geographically mobile and who obtain licensure in more than one subject are likely to have a distinct advantage in finding a job. The Secondary Education program includes University Studies courses, professional education courses and subject-matter content majors or areas. Students can choose from three certification levels: grades 8-12, grades 5-12, and grades P-12. These programs will prepare students in the specified grade ranges in curriculum content areas. The programs range from approximately 120 credit hours to 130 credit hours in content areas as well as professional education coursework. The programs provide access to current best practices and research through practicum experiences and field-based learning activities. The culminating experience is a semester-long teaching experience in the appropriate content area in a public school. Students in these programs are assigned dual advisors: a faculty member in the subject-matter department and one in the Department of Adolescent, Career and Special Education.

Admission and Exit Requirements

Continuous assessment procedures are used to document and systematically monitor candidate progress throughout the education program to ascertain candidates' proficiency in the Kentucky Teacher Standards. Checkpoints provide data to facilitate faculty efforts to make

recommendations for improvement, remediation, or candidates' continuance in the program. To become admitted to the teacher education program, candidates must meet the following requirements:

- Attend an admission to teacher education orientation.
- Pass all portions of the CASE exam.
- Earn an overall undergraduate GPA ≥ 2.75 on a 4.0 point scale.
- Complete a minimum of 24 credit hours with a GPA ≥ 2.75 .
- Earn a "B" or higher in the following courses: ENG 105, MAT 117 (or higher), COM 161, EDU 103 (or equivalent).
- Receive their advisor's recommendation to continue in the program through the interview process.
- Review and declare they will adhere to the Professional Code of Ethics for Kentucky School Personnel.
- Submit an official application to Teacher Education Services.

To be admitted to student teaching, candidates must be admitted to teacher education and meet these requirements:

- Attend an admission to student teaching orientation.
- File a formal application with Teacher Education Services two semesters prior to the student teaching term.
- Demonstrate teaching ability in field and practicum experiences.
- Complete 200 hours of field experiences and legislated components.
- Maintain a GPA ≥ 2.75 in overall coursework, professional education coursework, and major or area(s).

To begin student teaching, candidates must have senior, post-bac, or graduate status and have completed all major courses and specialty areas. In addition, they must meet these requirements:

- Complete all required professional teacher education courses with GPA ≥ 2.75 .
- Provide documentation of a current physical exam and a TB risk assessment.
- Obtain a criminal records check.
- Complete all PBIS modules.
- Supply TES with any required information.

To be recommended for initial certification, candidates must successfully complete student teaching and program requirements. They must earn passing scores on relevant *PRAXIS* specialty area tests and the *Principles of Learning and Teaching* exam. Because teacher certification requirements are subject to change, students who are registering for the tests need to refer to the Education Professional Standards (EPSB) website at www.kyepsb.net for current requirements.

Modes of Delivery

Course work is delivered through multiple venues: traditional (face-to-face), hybrid (part traditional, part online), and online.

Conceptual Framework

All teacher certification programs at Murray State University share the same conceptual framework. This document is available at http://coehsnet.murraystate.edu/program_submissions/.

Continuous Assessment

All teacher certification programs at Murray State University share a continuous assessment plan. This document is available at http://coehsnet.murraystate.edu/program_submissions/.

Program Experiences

A. Courses and Experiences

The Physics Education program supports the unit's theme by nurturing individuals to become reflective decision-makers. Reflection is the focus of course activities and is the primary means by which candidates integrate course experiences with Kentucky performance Standards (KTS), College of Education and Human Services Dispositions, and the candidates' own experiences, values, and beliefs about education. At the program's beginning, candidates are asked to reflect upon their own values and beliefs about education and seek integration of those with the COEHS Dispositions through assignments such as philosophy statements, growth plans, practicum work, and other reflective assignments. This process continues as candidates develop portfolio items to reflect their growth and understanding of educational principles leading to the program's end with the eligibility portfolio as a summative evaluation of their knowledge and demonstration of their skills according to Kentucky performance standards. Throughout, program coursework is designed to require planning and reflecting at increasing levels of expertise. Secondary education program faculty collaborate with content area faculty to teach concepts, principles, theories, standards, and research related to evidence-based practices in secondary curriculum, and assessment. The pedagogy coursework models the use of active instructional methods, real-life applications, and cognitive strategies to stimulate learning and provide motivation for the secondary learner. Along with a strong component of content knowledge in the areas of certification, the program is designed to integrate theory into practice with field experiences scheduled as an integral part of methods courses. As program policy, candidates follow curriculum guidesheets and RACR audits (a university advising program tool), and confer with advisors to help them to monitor their personal progress and prepare them for the continuous self-assessment required of professional educators.

At admission to teacher education, candidates are interviewed by faculty and asked to respond to the COEHS dispositions and the Kentucky Code of Ethics. The *Professional Code of Ethics for Kentucky School Personnel* is presented at three additional times to candidates - during orientations to teacher education and student teaching and during the student teaching interview. The Kentucky teacher performance standards are integrated throughout core courses and secondary methods courses as demonstrated in the table below. Candidates are introduced to the standards in early coursework where they gain knowledge (K) of the role performance standards play in becoming reflective decision-makers. As coursework progresses, the standards are applied (A) in lesson plans and other instructional activities. At the end of the program, during

extended practicum and student teaching, candidates are evaluated (E) for each standard in an eligibility portfolio. The portfolio is independently scored by two faculty members with content and instructional knowledge in the discipline. In addition, the Murray program allows for post-baccalaureate students to return and earn certification in a content area.

Murray State University offers two degree programs as paths to physics education certification. The first is a traditional baccalaureate program in physics. This course of study follows curricular guidelines promoted by the American Institute of Physics and its member societies, the American Physical Society (APS) and the American Association of Physics Teachers (AAPT), for quality of content. The second degree path Engineering Physics is an ABET-accredited engineering program that gives students a solid foundation in physics principles, and couples this with elements of electrical and mechanical engineering. The result is a student equipped to put theory into practice, with a grasp of applications of physics to real-world problems. The two options put Murray State University's physics education program in a unique position to produce teachers with a high level of content knowledge who are able to provide rich educational experiences for their students.

Code of Ethics

Teacher candidates read and examine the *Professional Code of Ethics for Kentucky School Personnel* when they attend an admission to teacher education orientation. They sign the *Declaration of Eligibility* to attest they (1) understand the standard for personal and professional conduct expected of a professional educator; (2) certify they have read, examined, and understand the *Professional Code of Ethics for Kentucky Certified School Personnel* and agree to abide by its terms during the course of preparation and careers as professional educators; and (3) affirm and declare that all information they give is true, correct, and complete to the best of their knowledge. This is one of the requirements for admission to teacher education.

Once the *Declaration of Eligibility* has been completed and signed, if the attestation changes during the time of participation in the teacher education program the Director of Teacher Education Services must be notified immediately and a new declaration must be submitted. Teacher candidates re-examine the *Professional Code of Ethics for Kentucky School Personnel* during the admission to student teaching orientation. They submit an updated *Declaration of Eligibility* at the conclusion of this orientation. Once candidates have completed all program and certification requirements, they submit a CA-1 application for Kentucky Certification. The application includes a section entitled *Character and Fitness*. By signing the form, candidates attest they have abided and will continue to adhere to the *Professional Code of Ethics for Kentucky School Personnel*.

Teaching Reading and Writing Skills

Candidates enhance their personal literacy skills by successfully completing two *Oral and Written Communication* university studies courses, ENG 105 *Critical Reading, Writing, and Inquiry* and COM 161 *Introduction to Public Speaking*. Furthermore, they complete additional hours of Historical, Literary, and Philosophical university studies courses based upon their choice of content. Students further refine their writing skills by completing the unit's writing-

intensive student teaching semester. Methods courses with included field experiences provide students with hands on planning, teaching, and tutoring instruction with secondary level public school students. If the student chooses an English content area, they complete 24 credit hours in literature, English, and writing. Furthermore, candidates demonstrate writing proficiency by passing the writing portion of the *Core Academic Skills for Educators* exam. The Praxis II examination in their content area is required for certification for students completing the degree. With these literacy skills in place, candidates are prepared to develop the reading and writing skills of students in their future classrooms.

Field Experiences

As per 16 KAR 5:040 legislation, Kentucky teacher candidates are required to complete a minimum of 200 clock hours of field experiences prior to student teaching. Candidates participate in varied activities in P12 school settings. Activities include engaging a diverse student population, observing in schools and related agencies (e.g. Family Resource Centers or Youth Service Centers), tutoring, interacting with families of students, attending school board and school-based council meetings, participating in a school-based professional learning community, and assisting teachers or other school professionals. Candidates record field experience hours and activities on the *LiveText Field Experience Module* system and the *Kentucky Field Experience Tracking System*. Course instructors, cooperating teachers, and university supervisors confirm candidates’ participation. The unit provides training, video clips, and step-by-step directions to facilitate candidates’, instructors’ and cooperating teachers’ recording efforts. The *Secondary Education Field Experiences Table* delineates this program’s field experiences.

Secondary Education Field Experiences Table

Course	Field Hours
EDU 103	7 hours
EDP 260	7 hours
EDU 303	6 hours
EDU 403	3 hours
EDU 405	2 hours
SED 300	7 hours
SEC 420	57 hours
SEC 422	118 hours

EPSB Themes

Effective educators need to be equipped with the knowledge, skills, dispositions, and decision-making skills necessary to address the needs of a diverse student population. Therefore, the Kentucky Education Professional Standards Board has identified four important themes (diversity, assessment, literacy, closing the achievement gap) to be integrated throughout candidates' academic course work. Furthermore, the unit's theme of *Educator as a Reflective Decision-Maker* is emphasized throughout candidates' program preparation. The *EPSB Themes for Secondary Education Core Education Courses* table depicts the degree to which these themes are addressed in multiple courses.

EPSB Themes for Secondary Education Core Education Courses

Course	EPSB THEMES				UNIT THEME
	Diversity	Assessment	Literacy	Gap	Reflective Decision-Maker
EDP 260	A				A
EDU 103	A	K		A	E
EDU 303	K	K	K	K	A
EDU 403	A	A		A	A
ELE 421	E	E	E	E	E
SED 300	K	K	K	K	A
K – Knowledge, A – Application, E – Evaluation					

Physics Education Content Course Descriptions

PHY 100T (099) Transitions (1). Only one freshman orientation will count toward graduation. Graded pass/fail. (Same as EGR 100T.)

PHY 235 Mechanics, Heat and Wave Motion (4). Introduction to classical mechanics. Topics include kinematics, dynamics, energy, momentum, rotational motion, wave motion, and the laws of thermodynamics. Calculus and vector notation used. Must be taken concurrently with PHY 236. Three lectures and two recitation meetings per week. Corequisite: MAT 250.

PHY 236 Mechanics, Heat and Wave Motion Laboratory (1). Laboratory course must be taken concurrently with PHY 235. Two hours laboratory per week.

PHY 255 Electricity, Magnetism and Light (4). Electric and magnetic fields, circuits, electromagnetic oscillations, and optics. Calculus and vector notation used. Must be taken concurrently with PHY 256. Three lectures and two recitation meetings per week. Prerequisite: PHY 235. Corequisite: MAT 308.

PHY 256 Electricity, Magnetism and Light Laboratory (1). Laboratory course must be taken concurrently with PHY 255. Two hours laboratory per week.

PHY 460 Electricity and Magnetism (3). Electric fields, potential dielectrics, steady currents, magnetic fields and electromagnetic induction. Three lectures per week. Graduate credit for M.A.T. candidates only. Prerequisites: PHY 255 and MAT 411. (Same as EGR/ETE 460.)

PHY 470 Optics (3). Reflection, refraction, thin lenses, interference, diffraction, polarization and selected optical devices. Prerequisite: PHY 255 or 121 and MAT 250.

PHY 530 Mechanics I (3). Dynamics of particles, coordinate transformation, and non-inertial reference systems. Celestial mechanics. Dynamics of systems of particles. Prerequisites: PHY 255 and MAT 411 (or concurrent registration).

PHY 580 Modern Physics I (3). An investigation of the physical phenomena explained since 1900 by the introduction of the discreteness of nature and the wave-particle duality, leading to the development of wave mechanics. Topics include Planck radiation, photoelectric and Compton effects, pair production and annihilation, the nuclear atom and Bohr theory, the deBroglie hypothesis, the Schroedinger equation and applications to atomic physics. Prerequisite: PHY 460 or 530.

EGR (PHY) 140 Introduction to Computing Applications in Science and Engineering (3). A course to introduce students to computational techniques employed in scientific, engineering, mathematical and statistical applications. C++ language will be used in several related programming projects, including graphics. The course is designed to meet the needs of students in physics, engineering physics and related sciences in the use of the microcomputer as a tool for the solution of problems and in particular where graphics are required.

EGR (PHY) 240 Thermodynamics I (3). Fundamental engineering concepts of power systems, cooling systems and system efficiency. First and second law analysis. Entropy; exergy; reversible and irreversible processes. Ideal gases. Application to simple physical, chemical and engineering problems. Three lectures per week, incorporating laboratory activities for students and demonstrations as appropriate. Prerequisite: PHY 235. Corequisite: MAT 308.

EGR 390 Engineering Measurements (3). General considerations of signals and utilization of instruments to measure physical properties of systems. Review and introduction of useful mathematical concepts such as statistical data analysis. Introduction to digital data acquisition and signal processing. Application to the design of instruments which measure displacement,

motion, count, strain, force, pressure, level, fluid flow and temperature. Prerequisites: EGR 264; Corequisite: MAT 338.

Modes of Delivery

Secondary education courses are delivered on the Murray State University campus using face-to-face and online delivery methods. Many instructors also use a blend of approaches, or hybrid model of delivery. Faculty use web-based learning platforms such as *Canvas* and *LiveText* to supplement and enhance face-to-face instruction.

Modes of Delivery for Program Content Courses

Course Number	Face to Face	Web	On-Campus
EDU 103	X	X	X
EDU 303	X		X
EDU 403	X		X
EDU 405	X		X
SEC 420	X		Practicum Sites
SEC 422	X		Practicum Sites
SEC 421	X		Student Teaching Sites
EDP 260	X	X	X
SED 300	X		X

B. Specialty Professional Association (SPA) Standards

NSTA - National Science Teachers Association

NSTA STANDARD	Courses/Activities/Assessments
<p>1. Content Knowledge. Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure. Preservice teachers will:</p> <p>(a) Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association;</p>	All required PHY, EGR, CHE courses
<p>(b) Understand the central concepts of the supporting disciplines and the supporting role of science specific technology;</p>	All general content delivered through coursework

<p>(c) Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students.</p>	<p>All education courses</p>
<p>2. Content Pedagogy. Effective teachers of science understand how students learn and develop scientific knowledge. Preservice teachers use scientific inquiry to develop this knowledge for all students. Preservice teachers will:</p> <p>(a) Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science;</p>	<p>EDU 303, EDU 420 Addressed through education courses</p>
<p>(b) Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate;</p>	<p>EDU 303, EDU 420 Addressed through education courses</p>
<p>(c) Design instruction and assessment strategies that confront and address naïve concepts/preconceptions.</p>	<p>EDU 303, EDU 420 Addressed through education courses</p>
<p>3. Learning Environments. Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources--including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the learning goals are met. Preservice teachers will:</p> <p>(a) Use a variety of strategies that demonstrate the candidates' knowledge and understanding of how to select the appropriate teaching and learning activities – including laboratory or field settings and applicable instruments and/or technology- to allow access so that all students learn. These strategies are inclusive and motivating for all students;</p>	<p>EDU 303, EDU 420 Addressed through education courses</p>
<p>(b) Develop lesson plans that include active inquiry lessons where students collect and interpret data using applicable science-specific technology in order to develop concepts, understand scientific processes, relationships and natural</p>	<p>EDU 303, EDU 420 Addressed through education courses</p>

patterns from empirical experiences. These plans provide for equitable achievement of science literacy for all students;	
(c) Plan fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated;	EDU 303, EDU 420 Addressed through education courses
(d) Plan a learning environment and learning experiences for all students that demonstrate chemical safety, safety procedures, and the ethical treatment of living organisms within their licensure area.	CHE 201, CHE 202, Chemical Safety
4. Safety. Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure. Preservice teachers will: (a) Design activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction;	PHY 236, PHY 256, EGR 390, CHE 201, CHE 202, Safe Lab/Experiment Practices
(b) Design and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students;	PHY 236, PHY 256, EGR 390, CHE 201, CHE 202, Safe Lab/Experiment Practices
(c) Design and demonstrate activities in a P-12 classroom that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms.	N/A
(b) Provide data to show that P-12 students are able to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science;	EDU 405, SEC 420 (maybe), Addressed through Education courses
(c) Engage students in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner.	EDU 405, SEC 420 (maybe), Addressed through Education courses

<p>6. Professional Knowledge and Skills. Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community. Preservice teachers will:</p> <p>(a) Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community;</p>	<p>PHY 100 T, Membership in the Society of Physics Students (SPS), Employed as Teaching Assistants</p>
<p>(b) Engage in professional development opportunities such as conferences, research opportunities, or projects within their community.</p>	<p>PHY 100 T, Membership in the Society of Physics Students (SPS), Employed as Teaching Assistants</p>

Unifying Concepts

A: Competency (numbers 1-5)	B: Required Courses or advising requirements
Multiple ways we organize our perceptions of the world and how systems organize the studies and knowledge of science.	PHY 235/236, 255/256, 370, 390, 460
Nature of scientific evidence and the use of models for explanation.	PHY 235/236, 255/256
Measurement as a way of knowing and organizing observations of constancy and change.	PHY 236, 256, 390
Evolution of natural systems and factors that result in evolution or equilibrium.	PHY 235
Interrelationships of form, function, and behaviors in living and nonliving systems.	PHY 370

Science Content Requirement Analysis Table A for Physics

A. Core Competencies (numbers 1-11)	B: Required Courses or advising requirements
Energy, work, and power	PHY 235/236; PHY 255/256
Motion, major forces, and momentum	PHY 235/236
Newtonian physics w/engineering applications	PHY 235/236
Conservation mass, momentum, energy, and charge	PHY 235/236; PHY 255/256
Physical properties of matter	CHE 201, PHY 235/6, 255/6
Kinetic-molecular motion and atomic models	PHY 370
Radioactivity, nuclear reactors, fission, and fusion	PHY 370
Wave theory, sound, light, the electromagnetic spectrum and optics	PHY 255/256; PHY 370; PHY 470
Electricity and magnetism	PHY 255/256; PHY 460
Fundamental processes of investigating in physics	PHY 235/6, 255/6, 370, 390
Applications of physics in environmental quality and to personal and community health	PHY 370

Science Content Requirement Analysis Table C for Physics

B. Advanced Competencies (numbers 12-22)	Required Courses
Thermodynamics and energy-matter relationships	PHY 240
Nuclear physics including matter-energy duality and reactivity	PHY 370
Angular rotation and momentum, centripetal forces, and vector analysis	PHY 235/6
Quantum mechanics, space-time relationships, and special relativity	PHY 370
Models of nuclear and subatomic structures and behavior	PHY 370, CHE 201
Light behavior, including wave-particle duality and models	PHY 255/6, 370, 470
Electrical phenomena including electric fields, vector analysis, energy, potential, capacitance, and inductance	PHY 255/6, 460
Issues related to physics such as disposal of nuclear waste, light pollution, shielding communication systems and weapons development	PHY 370, 460
Historical development and cosmological perspectives in physics including contributions of significant figures and underrepresented groups, and evolution of theories in physics	PHY 235, 255, 370
How to design, conduct, and report research in physics	PHY 390
Applications of physics and engineering in society, business, industry, and health fields	PHY 235, 255, 370

Science Content Requirement Analysis Table C for Physics

C. Supporting Competencies (numbers 23-40)	Required Courses
Biology	
Organization of life	
Bioenergetics	
Biomechanics	
Cycles of matter	
Chemistry	
Organization of matter and energy	CHE 201
Electrochemistry	CHE 201
Thermodynamics	CHE 201
Bonding	CHE 201
Earth sciences and/or astronomy	
Structure of the universe	PHY 370
Energy	PHY 235, 255, 370
Interactions of matter	PHY 370
Mathematical and statistical concepts and skills	
Statistics	
Use of differential equations	MAT 411
Calculus	MAT 250, 308, 309

C. Kentucky Teacher Standards

The Kentucky Teacher Performance Standards are integrated throughout core courses and secondary education methods courses as demonstrated in the table below. Candidates are introduced to the standards in early coursework where they gain knowledge (K) of the role performance standards play in becoming reflective decision-makers. As coursework progresses, the standards are applied (A) in lesson plans and other instructional activities. At the end of the program, during student teaching, candidates are evaluated (E) for each standard in an eligibility portfolio. The portfolio is independently scored by two faculty members with content and instructional skill in the appropriate content area. Secondary and content area instructors use web-based learning platforms such as *Canvas* to supplement and enhance face-to-face instruction. The *Kentucky Teacher Standards* matrix demonstrates the integration of Kentucky Teacher Standards throughout secondary education coursework.

Kentucky Teacher Standards

Course	KTS 1	KTS 2	KTS 3	KTS 4	KTS 5	KTS 6	KTS 7	KTS 8	KTS 9	KTS10
CSC 199	K					A				
EDP 260		K	K	A		A	A	A		
EDU 103	A	K	A	K	K	K	A	K	K	K
EDU 303		A*	A	A	A	A	A	A	K	
EDU 403	A	K	A	K	K	K	A	K	K	A

SEC 420	K	A	K	A					K	
SEC 422	E*									
SED 300	A	K	K			K	K	A	K	
K – Knowledge, A – Application, E – Evaluation, * - Signature Assignment										

- KTS 1: Content Knowledge
- KTS 2: Design Instruction
- KTS 3: Learning Climate
- KTS 4: Implements Instruction
- KTS 5: Assessment
- KTS 6: Technology
- KTS 7: Reflection
- KTS 8: Collaboration
- KTS 9: Professional Development
- KTS 10: Leadership

D. Kentucky Core Academic Standards

All teacher certification candidates in the Murray State University education program become familiar with the Kentucky Core Academic Standards (KCAS) in EDU 103 *Issues and Practices of American Education* or the equivalent course specific to their discipline. This course is designed to provide students with an overview of the field of education. The instructor of this course introduces the KCAS to raise candidates' initial awareness of KCAS as a framework for standards-based instruction. In EDU 303 *Strategies of Teaching*, the instructor spends several class sessions acquainting candidates with the KCAS. In this course, candidates develop lesson planning. All lesson plans, instructional, activities, and assessments must be aligned to the KCAS standards in the appropriate content area. Additionally, candidates take EDU 405 *Evaluation and Measurement in Education*. Candidates develop proficiency in designing standards-based assessment instruments and interpreting the results to inform future instruction. This course's key assessment provides an introduction to the Teacher Performance Assessment (TPA) candidates complete during their student teaching experience.

In the Physics Education program, candidates apply what they have learned about designing KCAS standards-based instruction and assessment instruments during the field and practicum experiences associated with these professional education methods courses.

Kentucky Core Academic Standards

Course	KCAS Content Area	Activity
EDU 303	Specific to content area	Lesson plans, micro-teaching activities, mock classroom situations
SEC 420	Specific to content area	Lesson plans, unit plans, field experiences
SEC 422	Specific to content area	Lesson plans, unit plans, field experiences
SEC 421	Specific to content area	Student teaching experience -Designing and implementing instruction

During the student teaching semester, candidates complete TPAs which demonstrate their proficiency in designing, implementing, and reflecting upon KCAS-aligned instructional units, lessons, and assessment instruments. They draft a KCAS standards-based instructional unit. Candidates use the results from a pre-assessment to modify the unit by differentiating instruction to address students' academic needs. They teach and reflect upon a series of lessons before administering the post-assessment. Candidates analyze post-assessment data to discern student growth, continuing academic needs, and achievement gaps to inform future instruction.

E. Physics Program Faculty

Name	Highest Degree, Field, & University	Assignment: Indicate the role(s) of the faculty member (1)	Faculty Rank (2)	Scholarship (3), Leadership in Professional Associations, and Service (4); List up to 3 major contributions in the past 3 years (5)*	Status (FT/PT to institution, unit, and program)
Cobb, Stephen	Ph.D, Physics, Georgia Tech	Dean, JCSET Part-time teaching	Professor	Officer, American Assoc. of Engrg Education Division of Physics (2006)	FT/PT/PT
Baltimore, Carol	M.S, Physics Murray State	Teaching	Lecturer		FT/PT/PT
Claiborne, Daniel	Ph.D, Engr., U of Missouri-Columbia	Dept. Chair, Teaching	Assoc. Professor		FT/PT/PT
Crofton, John	Ph.D, Physics, Auburn	Teaching	Professor	PI: AFOSR grant (2005) Publication: JEM (2005)	FT/PT/PT
Hereford, James	Ph.D, Elect Engr, Georgia Tech	Teaching	Assoc. Prof	Publication: IEEE Journal (2006) Presentation: NASA/DoD conf. (2005) PI, KSGC grant (2005)	FT/PT/PT
Kobraei, Hamid	Ph.D, Physics, American Univ	Teaching	Professor	Collegiate Tenure/Promotion Cmttee (2004-6) Conf. Presentation: AASCUE (2006)	FT/PT/PT
Leedy, Aleck	Ph.D., Engr., Auburn	Teaching	Assoc. Prof.		FT/PT/PT
	Ph.D, Physics,				FT/PT/PT

Ridley, Joshua	West Virginia Ph.D, Mech. Engineering, Illinois	Teaching	Asst. Prof.	PI: KSEF grant (2006)	FT/PT/PT
Rogers, James		Teaching	Assoc. Prof.	NASA Moonbuggy Project (2004-6) Publication: Teaching Professor (2005)	
	Ph.D, Mech Engineering, Iowa State			Robotics Course: TQI (2005) PI: Biodiesel Grant (2005)	FT/PT/PT
Thiede, Ted		Teaching	Assoc. Prof.	DoD/EPSCoR Cmtte (2004-6)	

Education Faculty

NAME	HIGHEST DEGREE, FIELD, & UNIVERSITY	ASSIGNMENT	FACULTY RANK	CERTIFICATIONS, EXPERIENCE, SCHOLARSHIP, LEADERSHIP IN PROFESSIONAL ASSOCIATIONS, AND SERVICE	STATUS
Allen, David	Ph.D, Education- School Improvement, Text State University-San Marcos	Director of Center for Environmental Education Teaches assessment and environmental education courses	Assistant Professor	<ul style="list-style-type: none"> • <i>Educational Testing Services, Assessment Specialist – 10 years, Middle School Science – 6 years, High School Science – 3 years</i> • <i>Allen, D. (August 2015). Project Learning Tree survey of use. Annual conference of the Japanese Society of Environmental Education, Nagoya, Japan.</i> • <i>Allen, D. (October 2014). Perceptions of environmental education from across a university campus. Annual conference of the North American Association for Environmental Education. Ottawa, Ontario, Canada.</i> • <i>Waite, D., & Allen, D. (2003). Corruption and abuse of power in educational administration. Urban Review, 35(4), 281-296</i> 	Full-time to institution Part-time to unit Part-time to program

Brown, Cory	Ph.D, Multicultural and Equity Studies in Education, Ohio State University	Assistant Professor Teaches foundation courses	Assistant Professor	<ul style="list-style-type: none"> • <i>High School English – 2 years, Full-Time Academic Advisor, University of Cincinnati – 5 years, University Appointments, Education – 10 years.</i> • <i>Dixson, A. D., Dodo-Seriki, V. and Brown, C. T. (2014). Culturally relevant pedagogy at the intersections of race, gender, and class. Paper presented at the biennial meeting of the International Conference on Urban Education, Montego Bay, Jamaica.</i> • <i>Dodo-Seriki, V., Brown, C. T., and Fasching-Varner, K. (Accepted and in preparation, 2015). The permanence of racism in teacher education. In J. K. Donnor, R. Reynolds, M. Lynn, and A. D. Dixson (Eds.). Is the post-racial still racial?: Understanding the relationship between race and education. NSSE Yearbook, Teachers College Record.</i> • <i>National Council of Teachers for English Assembly of Research - Program Reviewer and Planning Committee, 2015 (New Orleans, Louisiana)</i> 	Full-time to institution Part-time to unit Part-time to program
Campoy, Renee	Ed.D. Curriculum & Instruction University of Missouri-St. Louis	Assistant Dean (Part-time) Teaches EDU 405 (part-time) NCATE Coordinator	Professor	<ul style="list-style-type: none"> • <i>Book: (2004) Case study analysis in the classroom</i> • <i>Presentation: (2006) AERA</i> • <i>BOE Team member: (2005-present)</i> 	Full-time to Institution, Full-time to Unit, Part-time to Program
Gierhart, Greg	MA, Education, Murray State University	Hart Residential College Head Teaches instructional strategies and math methods courses	Lecturer	<ul style="list-style-type: none"> • <i>Certifications & Experience: KY Teaching Lic., Middle school Spanish, Science, and Math, endorsement for teaching early elementary, DPP, School Administration. 10 years experience – middle school.</i> • <i>Murray Lion's Club,</i> 	Full-time to institution Part-time to unit Part-time to program

				<p><i>National Council of Teachers of Mathematics, National Science Teachers Association, Association of Supervisors and Curriculum Development, International Literacy Association, Association for Middle Level Education, Phi Delta Kappan, Phi Kappa Phi</i></p> <ul style="list-style-type: none"> • <i>KY Department of Education, Math & Science Leadership Networks</i> 	
Matlock, Pam	MA Special Education, Murray State University	Paducah Campus 2+2 Education Coordinator Teaches special education courses	Lecturer	First Book, Chapter Advisor - Monthly distribution of new books to low socioeconomic students in public schools, KEA - SP, Chapter Advisor - Global Education Outreach Committee, Chairperson	Full-time to institution Part-time to unit Part-time to program
Stormer, Kimberly	Ph.D. Instructional Leadership Academic and Curriculum University of Oklahoma	Middle Level Education Program Coordinator, Teaches middle level education courses.	Assistant Professor	Taught for 7.5 years in large urban school district; and Worked as a School Improvement Specialist for the Oklahoma State Department of Education Diversity Chair Kentucky Council Teachers of English Advisor Murray State Middle Level Association	Full-time to institution Part-time to unit Part-time to program
Jacobs, Martin	Ed.D. Curriculum and Instruction, Florida International University	Part-time to Program: Middle School Reading	Professor	Scholarship focused upon Teacher Leadership, with presentation and publication outcomes Faculty Representative: Murray State Board of Regents 11 years P12 teacher; 5 years elementary assistant principal	Full-time to institution Part-time to unit Part-time to program
Musselman, Meagan	Ph.D. Curriculum & Instruction Southern Illinois University	Teacher Leader Program Coordinator, Teaches middle level undergraduate education courses and graduate courses across multiple levels	Associate Professor	Taught math and science in public middle schools; and Education consultant to area schools President of Kentucky Association of Teacher Educators	Full-time to institution Part-time to unit Part-time to program
Gierhart, Greg	MA-Murray State University	Early Childhood and Elementary	Lecturer	Taught 10 years in a rural school district	Part-time to institution

	Pursuing PhD Southern Illinois University-Carbondale	Education Teach mathematics to IECE and elementary education majors.		Provisional Certificate For Teaching In The Middle Grades 5-8 Mathematics Field: Science Professional Certificate for Middle School Teaching	Part-time to unit Part-time to program
Hyde ,Lori	MA- Murray State University in Reading and Writing	REA 407 at the Paducah Campus	Adjunct Instructor	6 th grade Reading and Writing at Lone Oak Middle School Certified Elementary Education Certified Reading and Writing Literacy Specialist K-12 Super Saturdays Instructor	Part-time to institution Part-time to unit Part-time to program
Myers, Hannah	MA- Murray State University in Education and Education Administration	MID 307	Adjunct Instructor	Magistrate for Hopkins County- Co-Chair of Build Smart Murray Campaign Chairman of the City Council	Part-time to institution Part-time to unit Part-time to program

F. Curriculum Contract/ Guidesheet

Program coordinators ensure current guidesheets are available for advisors and students (<http://coekate.murraystate.edu/coecms/ncate/manager/advsheet>).

Guidesheets are used by academic advisors, students, and faculty to ensure consistency and clarity of program requirements.

Murray State University

Revised Fall 2015

Bachelor of Arts/Physics Certification – Grades 8-12

Program Guidesheet/Advising Form

2015-2016 Bulletin

Student's Name: _____

UNIVERSITY STUDIES FOR B.S. DEGREE (46 HOURS)

Oral and Written Communication (7 Hours)

Hours Semester

Grade

ENG 105 Critical Reading, Writing, and Inquiry

4 _____

COM 161 Introduction to Public Speaking

3 _____

Scientific Inquiry, Methodologies, and Quantitative Skills (15 Hours)

Approved University Studies _____

5 _____

Approved University Studies _____

5 _____

Approved University Studies _____

5 _____

World's Historical, Literary, and Philosophical Traditions (6 Hours)

Approved University Studies	_____	3	_____
Approved University Studies	_____	3	_____
Global Awareness, Cultural Diversity, and the World's Artistic Traditions (3 Hours)			
Approved University Studies	_____	3	_____
Social and Self-Awareness and Responsible Citizenship (6 Hours)			
Approved University Studies	_____	3	_____
EDP 260	Psychology of Human Development	3	_____
University Studies Approved Electives (9 Hours)			
EDU 103	Issues and Practices of American Education	3	_____
Approved University Studies Elective	_____	3	_____
Secondary Certification Courses (32 hours)			
EDU 303	Strategies of Teaching	3	_____
EDU 403	Structures and Foundations of Education	2	_____
EDU 405	Evaluation and Measurement in Education ¹	3	_____
SEC 420	Practicum in Secondary Schools ¹	3	_____
SEC 422	Extended Practicum ²	4	_____
SEC 421	Student Teaching in the Secondary School	14	_____
	*Writing-Intensive Course		
SED 300	Educating Students with Disabilities	3	_____
Required Major Courses (32 hours)			
EGR 140	Introduction to Computer Applications	3	_____
EGR 240	Thermodynamics I	3	_____
EGR 390	Engineering Measurements	3	_____
PHY 100T	Transitions	1	_____
PHY 235	Mechanics, Heat and Wave Motion	4	_____
PHY 236	Mechanics, Heat and Wave Motion Lab	1	_____
PHY 255	Electricity, Magnetism and Light	4	_____
PHY 256	Electricity, Magnetism and Light Lab	1	_____
PHY 460	Electricity and Magnetism I	3	_____

PHY 470	Optics	3	_____
PHY 530	Mechanics I	3	_____
PHY 580	Modern Physics I	3	_____
Co-Requirements for Major (6 hours)			
CHE 201	General College Chemistry	5	_____
CHE 202	General Chemistry and Qualitative Analysis	3	_____
CSC 420	Numerical Analysis I		
Or			
MAT 442	Introduction to Numerical Analysis	3	_____
MAT 250	Calculus and Analytical Geometry I	5	_____
MAT 308	Calculus and Analytical Geometry II	5	_____
MAT 309	Calculus and Analytical Geometry III	4	_____
MAT 338	Ordinary Differential Equations		
Required Limited Elective		3	
	PHY/EGR course 300-level or above		_____
Required Minor (3-21 hours)			
_____	_____	3	_____
_____	_____	3	_____
_____	_____	3	_____
_____	_____	3	_____
_____	_____	3	_____
_____	_____	3	_____
_____	_____	3	_____
_____	_____	3	_____
_____	_____	3	_____

Total Curriculum Requirements – 122-149

hours

¹SEC 420 and EDU 405 must be taken together and two semesters before student teaching.

²SEC 422 must be taken one semester before student teaching.

PRAXIS TEST:

The following scores on the Specialty Exams are required to be eligible for a teaching certificate:

Physics (5265)– Passing Score of 133

Principles of Learning and Teaching (5624) – Passing Score of 160

Teacher certification requirements are subject to change. Before registering for the test(s), please refer to the Education Professional Standards Board (EPSB) website at www.epsb.ky.gov for current requirements or contact the Division of Professional Learning and Assessment at 502-564-4606 or 888-598-7667.

REQUIREMENTS FOR ADMISSION TO TEACHER EDUCATION AND STUDENT TEACHING AT MURRAY STATE UNIVERSITY Rev. (9/2015)

Teacher Education

To be admitted to teacher education, students must:

1. Attend an admission to teacher education orientation.
2. Earn passing scores on the Core Academic Skills for Educators (CASE) test with these subject scores – Reading 156, Writing 162, and Mathematics 150. Request ETS to send scores to Teacher Education Services electronically by using this code, R1494. If any of the PPST subject areas were passed prior to September 1, 2014, use these PPST scores - Reading 176, Writing 174, and Math 174. GRE (Graduate Records Exam) scores may be used for Graduate Students only with a minimum passing score of 150 in verbal, 143 in quantitative, and 4.0 in analytical writing.
3. Earn an overall undergraduate GPA of > 2.75 on a 4.0 scale at the point of admission. This 2.75 minimum GPA remains a requirement throughout the teacher certification program.
4. Complete a minimum of 24 credit hours with a GPA > 2.75 to include the following coursework:
 - a. ENG 101, 102, 104 or 105 with a “B” or higher
 - b. MAT 117 (or higher level math) with a “B” or higher
 - c. COM 161 or HON 165 with a “B” or higher
 - d. EDU 103 with a “B” or higher (or AED 380 or EDU 104 or CTE 200 or MSU 123 or ELE 605 [graduate students])
5. Participate in the admission to teacher education interview and receive their academic advisor’s recommendation to continue the program.
6. Review the Professional Code of Ethics for Kentucky School Personnel. Sign the
 - a. Declaration of Eligibility (pink sheet) affirming a commitment to uphold the code and
 - b. acknowledging awareness of information required for state certification. If answers given on the Declaration of Eligibility change during the time of participation in the teacher education program, the Director of Teacher Education Services must be notified immediately.

These requirements must be documented in *Recruiter*. CASE or GRE scores must be sent to MSU (R1494) via ETS. Admission will only be granted following a successful review by Teacher Education Services.

NOTE: Students who have not been admitted to Teacher Education will not be eligible to enroll in upper level courses that specify admission to teacher education as a prerequisite.

Student Teaching

To be admitted to student teaching, students must have

- 1) been granted admission to Teacher Education;
- 2) filed a formal application in Teacher Education Services two semesters prior to the term in which student teaching is desired (Applications are distributed at scheduled student teaching orientations only.);

- 3) earned and maintained GPA ≥ 2.75 in major/areas, professional education, and overall;
- 4) demonstrated teaching ability in field and clinical situations;
- 5) documented completion of 200 or more field hours and components (beginning 9/1/2013);
- 6) senior, post-bac, or graduate status and have completed all major courses and specialty areas;
- 7) been admitted to Teacher Education;
- 8) completed all required professional teacher education courses (EDU 103, EDP 260,
- 9) EDU 303, SED 300 and EDU 403, etc. – see specific requirements by major or area) with a GPA > 2.75 GPA;
- 10) filed a valid and current medical examination, which includes a TB risk assessment (to begin student teaching within six months of exam);
- 11) obtained a criminal records background check; and
- 12) supplied TES with any other required information (transcripts, course substitution forms, etc.).

General Requirements for Kentucky Certification

Graduates who wish to be recommended by MSU for an initial Kentucky teaching certificate must have

- 1) successfully completed an approved teacher education program including student teaching;
- 2) filed an application for certification (CA-1) with Teacher Education Services at MSU;
- 3) obtained at least minimal scores required on PRAXIS specialty area tests and the appropriate Principles of Learning and Teaching Test (PLT);
- 4) completed all applicable **computer literacy and applications** requirements;
- 5) earned a bachelor’s degree;
- 6) mailed a copy of criminal record check to EPSB; and
- 7) sent official transcript to EPSB.

In addition, in Kentucky, full certification requires the completion of the Kentucky Teacher Internship Program. To be recommended for certification in other states, all Kentucky requirements must be met.

NOTE: Requirements for teacher certification are established by the Kentucky Education Professional Standards Board (KEPSB). Students are cautioned that changes in these requirements may occur after publication of the current Murray State University *Bulletin*. For the most current information, students should check with an advisor in one of the departments in the College of Education.

Student’s Signature: _____

Date: _____

Advisor’s Signature: _____

Date: _____

G. Syllabi

Common course syllabi, posted on the unit's intranet site, ensure all course instructors provide a consistent, quality delivery of each education course. Furthermore, these guidesheets also contain important Admission to Teacher Education information. Guidesheets are shared during advising sessions, aligned with candidates' MSU RACR audits, and posted on <http://coekate.murraystate.edu/coecms/ncate/manager/advsheet/>.

EDUCATION CORE AND METHODS COURSES**EDU 103****EDU 303****EDP 260****SED 300****EDU 403****EDU 405****SEC 420****PHYSICS CONTENT COURSES****PHY 235 & 236 (LAB)**