Revised Program X

Name of Institution: Peru State College
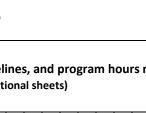**Date Submitted: May 1, 2021**

Endorsement: **MATHEMATICS**
Total Hours Required by Rule 24: **36**

Program Hours Required by Institution: 38

Grade Levels: **6-12**
Endorsement Type: **FIELD**

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S1. Content Knowledge. Effective teachers of secondary mathematics demonstrate and apply knowledge of major mathematics concepts, algorithms, procedures, connections, and applications within and among mathematical domains. They understand the influence of curriculum standards on the mathematical content knowledge needed for teaching secondary (6-12) students.		X	X	X	X	X	X	X	X	X	X																									

Preservice teacher candidates:
  A. Demonstrate and apply knowledge of major mathematics concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains (Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics as outlined in the *NCTM NCATE Mathematics Content for Secondary*; and
  B. Demonstrate an understanding of curriculum standards for mathematics and their impact on the mathematical content knowledge necessary for teaching secondary students.

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All secondary mathematics teachers are prepared with depth and breadth in the following mathematical domains: Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics. All teachers certified in secondary mathematics will know, understand, and teach with the breadth of understanding reflecting the following competencies for each of these domains:

	Ex	114	225	226	230	304	306	327	404	418	430	490	St440	E300	E309	E310	E315	E317	E411	E420	E434
E1. **Number and Quantity**. All secondary mathematics teachers are prepared to develop student proficiency with the following topics related to number and quantity:		X		X			X	X	X	X	X		X			X					

A. Structure, properties, relationships, and operations including standard and non-standard algorithms on various types of numbers and number systems, including integer, rational, irrational, real, and complex numbers;
B. Fundamental ideas of number theory (divisors, factors and factorization, primes, composite numbers, greatest common factor, least common multiple, and modular arithmetic)
C. Quantitative reasoning and relationships that include ratio, rate, and proportion and the use of units in problem situations;
D. Vector and matrix operations, modeling, and applications;
E. Utilization of technological tools to explore number and quantity; and
F. Historical development and perspectives of number, number systems, and quantity including contributions of significant figures and diverse cultures.

	Ex	114	225	226	230	304	306	327	404	418	430	490	St440	E300	E309	E310	E315	E317	E411	E420	E434
E2. **Algebra**. All secondary mathematics teachers are prepared to develop student proficiency with the following topics related to algebra:		X	X	X			X	X	X	X	X										

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A. Algebraic notation, symbols, expressions, equations, inequalities, and proportional relationships, and their use in describing, interpreting, and modeling relationships;

B. Function classes including polynomial, exponential and logarithmic, absolute value, rational, periodic, and discrete and how the choices of parameters determine particular cases and model specific situations;

C. Functional representations (tables, graphs, equations, descriptions, recursive definitions, and finite differences) and notations as a means to describe, interpret, and analyze relationships and to build new functions;

D. Patterns of change in linear, quadratic, polynomial, and exponential functions and in proportional and inversely proportional relationships and types of real-world relationships these functions can model;

E. Linear algebra including vectors, matrices, and transformations;

F. Abstract algebra including groups, rings, and fields and the relationship between these structures and formal structures for number systems and numerical and symbolic calculations;

G. Utilization of technological tools to explore algebraic ideas, individual functions, and classes of related functions and to solve problems; and

H. Historical development and perspectives of algebra including contributions of significant figures and diverse cultures.

		Math 114 Trigonometry (3)	Math 225 Calculus I (5)	Math 226 Calculus II (5)	Math 230 Found of Math Thought (3)	Math 304 Modern Geometry (3)	Math 306 Modern Algebra (3)	Math 327 Calculus III (3)	Math 404 Mathematical Modeling (3)	Math 418 Linear Algebra (3)	
E3. Geometry and Trigonometry. All secondary mathematics teachers are prepared to develop student proficiency with the following topics related to geometry and trigonometry:		X		X	X					X	

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A. Core concepts and principles of Euclidean geometry in two and three dimensions and examples of non-Euclidean geometry;

B. Transformations including dilations, translations, rotations, reflections, glide reflections, and the expression of symmetry in terms of transformations;

C. Congruence, similarity and scaling, and their development and expression in terms of transformations;

D. Right triangles and trigonometry;

E. Application of periodic phenomena and trigonometric identities;

F. Identification, classification into categories, visualization, and representation of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, prisms, pyramids, cones, cylinders, and spheres);

G. Formula rationale and derivation (perimeter, area, and volume) of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, rectangular prisms, pyramids, cones, cylinders, and spheres), with attention to units, unit comparison, and the iteration, additivity, and invariance related to measurements;

H. Geometric constructions, axiomatic reasoning, and proof;

I. Analytic and coordinate geometry including algebraic proofs (e.g., the Pythagorean Theorem and its converse) and equations of lines and planes, and expressing geometric properties of conic sections with equations;

J. Utilization of concrete models and dynamic technological tools to conduct geometric and trigonometric investigations that emphasize visualization, recognizing patterns, conjecturing, and proof and to model and solve problems; and

K. Historical development and perspectives of geometry and trigonometry including contributions of significant figures and diverse cultures.

| E4. **Statistics and Probability.** All secondary mathematics teachers are prepared to develop student proficiency with the following topics related to statistics and probability: | | | | | | | | | X | | X | | X | | | | | | | | |

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List the courses the institution requires to meet Rule 24 requirements, associated Guidelines, and program hours required by the institution for this endorsement in the first row: (If more than 35 courses please fill out additional sheets)

D Certification Endorsement Requirements: This endorsement requires a minimum of **36 semester hours** of mathematics.

A. Statistical variability and its sources and the role of randomness in statistical inference;
B. Creation and implementation of surveys and investigations using sampling methods and statistical designs, statistical inference (estimation of population parameters and hypotheses testing), justification of conclusions, and generalization of results;
C. Construction and interpretation of graphical displays of univariate data distributions, summary measures and comparison of distributions of univariate data, and exploration of bivariate and categorical data;
D. Continuous and discrete probability, conditional probability, and combinatorial techniques;
E. Random (chance) phenomena, simulations, and probability distributions and their application as models of real phenomena and decision making;
F. Utilization of technological tools to explore statistical ideas, represent information, create simulations, and solve problems; and
G. Historical development and perspectives of statistics and probability including contributions of significant figures and diverse cultures.

E5. Calculus. All secondary mathematics teachers are prepared to develop student proficiency with the following topics related to calculus:

Marked: Math 114 Trigonometry, Math 225 Calculus I, Math 327 Calculus III

A. Limit, continuity, and the techniques and applications of differentiation and integration;
B. Parametric, polar, and vector functions;
C. Sequences and series;
D. Applications of function, geometry, and trigonometry concepts to solve problems involving calculus;
E. Utilization of technological tools to explore and represent fundamental concepts of calculus and to solve problems taken from real-world contexts; and
F. Historical development and perspectives of calculus including contributions of significant figures and diverse cultures.

E6. Discrete Mathematics. All secondary mathematics teachers are prepared to develop student proficiency with the following topics related to discrete mathematics:

Marked: Math 114 Trigonometry, Math 226 Calculus II, Math 327 Calculus III, Math 430 Combinatorics

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D Certification Endorsement Requirements: This endorsement requires a minimum of **36 semester hours** of mathematics.

A. Discrete structures including sets, relations, functions, graphs, trees, and networks;
B. Enumeration including permutations, combinations, iteration, recursion, and finite differences;
C. Propositional and predicate logic;
D. Applications of discrete structures such as modeling and solving linear programming problems and designing data structures;
E. Utilization of technological tools to solve problems involving discrete structures, the application of algorithms, and programming; and
F. Historical development and perspectives of discrete mathematics including contributions of significant figures and diverse cultures.

Requirement	Example	114	225	226	230	304	306	327	404	418	430	490	Stat 440	E300	E309	E310	E315	E317	E411	E420	E434
S2. Mathematical Practices. Effective teachers of secondary mathematics know the importance of problem solving, reasoning and proof, modeling, attending to precision, identifying elements of structure, generalizing, engaging in mathematical communication, and making connections as essential mathematical practices. They understand that these practices intersect with mathematical content and that understanding of mathematical content relies on the ability to demonstrate these practices within and among mathematical domains and in their teaching.					X		X		X												

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Preservice teacher candidates:
- A. Use problem solving to develop conceptual understanding, make sense of a wide variety of problems and persevere in solving them, apply and adapt a variety of strategies in solving problems confronted within the field of mathematics and other contests, and formulate and test generalizations.
- B. Reason abstractly, reflectively, and quantitatively with attention to units, constructing viable arguments and proofs, and critiquing the reasoning of others; represent and model generalizations using mathematics; recognize structure and express regularity in patterns of mathematical reasoning; and use multiple representations to model and describe mathematics; and utilize appropriate mathematic vocabulary and symbols to communicate mathematical ideas to others;
- C. Formulate, represent, analyze, and interpret mathematical models derived from real-world contexts or mathematical problems.
- D. Organize mathematical thinking and utilize appropriate mathematical vocabulary and symbols to precisely express ideas orally, pictorially, and in writing to diverse audiences; and
- E. Demonstrate the interconnectedness of mathematical ideas and how they build on one another and recognize and apply mathematical connections among mathematical ideas and across various content areas and real-world contexts.

Requirement													EDUC 300	EDUC 309	EDUC 310	EDUC 315	EDUC 317	EDUC 411	EDUC 420	EDUC 434
S3. Content Pedagogy. Effective teachers of secondary mathematics apply knowledge of curriculum standards for mathematics and their relationship to student learning within and across mathematical domains. They incorporate research-based mathematical experiences and include multiple instructional strategies and mathematics-specific technological tools in their teaching to develop all students' mathematical understanding and proficiency. They provide students with opportunities to do mathematics – talking about it and connecting it to both theoretical and													X	X	X	X	X	X	X	X

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real-world contexts. They plan, select, and implement formative and summative assessments for monitoring student learning, measuring student mathematical understanding, and informing practice.																											

Preservice teacher candidates:
  A. Apply knowledge of curriculum standards for secondary mathematics and their relationship to student learning within and across mathematical domains;
  B. Analyze and consider research in planning for and leading students in rich mathematical learning experiences;
  C. Plan lessons and units that incorporate a variety of strategies, differentiated instruction for diverse populations, and mathematics-specific and instructional technologies in building all students' conceptual understanding and procedural fluency;
  D. Provide all students with opportunities to communicate about mathematics and make connections among mathematics, other content areas, everyday life, and the workplace;
  E. Implement techniques related to student engagement and communication including selecting high quality tasks, identifying student misconceptions, and employing a range of questioning strategies;
  F. Plan, select, and implement formative and summative assessments reflecting mathematical knowledge, skills, understanding, and performance that are essential for all students; and
  G. Monitor all students' progress, make instructional decisions, and measure all students' mathematical understanding and ability using formative and summative assessments.

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S4. Mathematical Learning Environment. Effective teachers of secondary mathematics exhibit in-depth knowledge of adolescent development and behavior and use this knowledge to plan and create sequential learning opportunities grounded in mathematics education research where students are actively engaged in the mathematics they are learning and building from prior knowledge and skills. They demonstrate a positive disposition toward mathematical practices and learning, including culturally relevant perspectives in teaching, and demonstrate equitable and ethical treatment of and have high expectations for all students. They use instructional tools such as manipulatives, digital tools, and virtual resources to enhance learning while recognizing the possible limitations of such tools.														X	X	X	X		X	X	

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Preservice teacher candidates:

A. Exhibit in-depth knowledge of adolescent development and behavior and demonstrate a positive disposition toward mathematical processes and learning;

B. Plan and create developmentally appropriate, sequential, and challenging learning opportunities grounded in mathematics education research in which all students are actively engaged in building new knowledge from prior knowledge and experiences;

C. Incorporate knowledge of individual differences and the cultural diversity that exists within classrooms and include culturally relevant perspectives as a means to motivate and engage students;

D. Demonstrate equitable and ethical treatment of and high expectations for all students;

E. Apply mathematical content and pedagogical knowledge to select and use instructional tools such as manipulatives and physical models, drawings, virtual environments, spreadsheets, presentation tools, and technology; and make sound decisions about when such tools enhance teaching and learning, recognizing both the insights to be gained and possible limitations.

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S5. Impact on Student Learning. Effective teachers of secondary mathematics provide evidence demonstrating that as a result of their instruction, which supports the continual development of a productive disposition toward mathematics, secondary students' conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and application of major mathematics concepts in varied contexts have increased. These teachers show that new student mathematical knowledge has been created as a consequence of their ability to engage students in mathematical experiences that are																		X	X			

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developmentally appropriate, require active engagement, and include mathematics-specific technology in building new knowledge.																					

Preservice teacher candidates:
  A. Engage students in developmentally appropriate mathematical activities and investigations that require active engagement and include technology in building new knowledge; and
  B. Analyze, reflect, and provide data that students have built new knowledge by their engagement in developmentally appropriate mathematical activities and investigations that include technology.

S6. Professional Knowledge and Skills. Effective teachers of secondary mathematics are lifelong learners and recognize that learning is often collaborative. They participate in professional development experiences specific to mathematics and mathematics education, draw upon mathematics education research to inform practice, continuously reflect on their practice, and utilize resources from professional mathematics organizations.																X			X	X	

Preservice teacher candidates:
  A. Take an active role in their professional growth by participating in professional development experiences that directly relate to the learning and teaching of mathematics;
  B. Engage in continuous and collaborative learning that draws upon research in mathematics education to inform practice; enhance all students' knowledge of mathematics; involve colleagues, other school professionals, families, and various stakeholders; and advance their development as a reflective practitioner; and

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C. Utilize resources from professional mathematics education organizations such as print, digital, and virtual resources/collections.																							
S7. Secondary Mathematics Field Experiences and Clinical Practice. Effective teachers of secondary mathematics engage in a planned sequence of field experiences and clinical practice under the supervision of experienced and highly qualified mathematics teachers. They develop a broad experiential base of knowledge, skills, effective approaches to mathematics teaching and learning, and professional behaviors across both middle and high school settings that involve a diverse range and varied groupings of students. Candidates experience a full-time student teaching experience in secondary mathematics directed by university or college faculty with secondary mathematics teaching experience or equivalent knowledge base.															X	X				X	X	

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Preservice teacher candidates:

   A. Engage in a sequence of planned field experiences and clinical practice prior to full-time student teaching experience that include observing and participating in both middle and high school mathematics classrooms under the supervision of experienced and highly qualified mathematics teachers and in varied settings that reflect cultural, ethnic, gender, and learning differences.

   B. Experience full-time student teaching in secondary mathematics that is supervised by a highly qualified mathematics teacher and a university or college supervisor with secondary mathematics teaching experience or equivalent knowledge base.

   C. Develop knowledge, skills, and professional behavior across both middle and high school settings; examine the nature of mathematics, how mathematics should be taught, and how students learn mathematics; observe and analyze a range of approaches to mathematics teaching and learning, focusing on tasks, discourse, environment, and assessment; and work with a diverse range of students individually, in small groups, and in large class settings.