ALGEBRAIC THINKING

The course provides student teachers with pedagogical content knowledge needed in the teaching and learning of mathematics. In addition, it exposes student teachers to the content knowledge needed in preparing them sufficiently to teach mathematics beyond what they will be expected to teach at the basic education level. The demands of rapid change in information- based society today have influenced mathematics programs in various ways. The skills needed for jobs require thoughtful workers who are oriented to problem solving, irrespective of their gender, cultural and socio- economic backgrounds. By studying mathematics, students are taught to reason, to analyse, to think for themselves, while it imparts confidence in their own reasoning powers, and strengthens their mental faculties. Students need to use rules and thought processes of mathematics along with facts, to develop a reasoning pattern that will translate to their everyday lives, making them better thinkers and problem solvers. It is important for students to view mathematics as a significant part of our culture, not only for its valuable scientific applications but also for its enrichment of our cultural life. This mathematics curriculum is, therefore, intended to equip student teachers with the knowledge, skills and values needed to teach mathematics to basic school pupils in everyday life context. Besides, it provides the requisite resource material for preparing student teachers to teach mathematics sufficiently and effectively in our basic schools.

Course Title	ALGEBRAIC THINKING						
Course Code	EBS 210		Level: 200		Credit value: 3		Semester: 1
Pre-requisite	Study of Elective Mathematics at Senior High School						
Course Delivery Modes	Face-to-face ⊠	Practical Activity ☐	Work-Based Learning ☐	Seminars ⊠	Independent Study ⊠	e-Learning opportunities ⊠	Practicum ☐
Course Description (indicate NTS,	This course is designed to expose students to the various elements of algebraic thinking necessary for the prospective teacher to be able to promote meaningful teaching and learning of algebra in schools. The course will generally expose						

NTECF, BSC GLE to be addressed)	students to the three main components of algebraic thinking namely; generalization, equality and unknown quantities. Students will also be introduced to the moves/strategies for teaching each of the following algebraic concepts for conceptual understanding: Algebra of sets, relation, mapping and functions, equivalence relation, properties of integers linear and exponential series, intuitive treatment of convergence and divergence of series: - the comparison of ratio and root test; partial fractions and mathematical Induction. The approaches that would be used in the delivery of this course would prepare trainees to ensure the learning progress of all students by projecting gender roles and issues relating to equity and inclusivity. (*NTS: 2c, 2e, 3a, 3b, 3c, 3d, 3e, 3h, 3i, 3k, 3n, 3p/ NTECF: Pillar 1, & 3.*

	Outcomes	Indicators
Course Learning Outcomes	On successful completion of the course, Student Teachers will be able to:	
	CLO 1. demonstrate understanding of generalization in algebraic function *NTS:, 2e/NTECF: Pillar 1*	1.1. Explain the elements of generalization in algebraic thinking
	CLO 2. demonstrate understanding of the purpose and use of equality in algebraic thinking *NTS: 2a&3j/NTECF: Pillar 1&3*	2.1. Explain the purpose and use of equality in algebraic thinking
	CCLO 3. demonstrate understanding of the purpose and use of unknown in algebraic expressions and equations. *NTS: 2c, 2e/NTECF: Pillar 1&3*	3.1.Explain the purpose and use of the unknown in algebraic expressions and equations

	CLO 4. demonstrate the use of algebraic thinking in analysing the conceptual structures of selected topics in algebra *NTS: 2c, 2e/NTECF: Pillar 1-3*	4.1.Analyse the conceptual structure of algebra of surds, relations and functions and other topics covered in the course	
	CLO 5. demonstrate the understanding of the moves in teaching each of the topics in algebra covered in the course. *NTS: 2c, 2e/NTECF: Pillar 1& 3*	5.1. Outline and explain the moves involved in teaching the algebra topics covered in the course.	

Course Content	**Units**	**Topics:**	**Sub-topics (if any):**	**Teaching Learning Activities**
	1	Components of algebraic thinking	• Elements of generalization, equality and unknown quantities.	• Discussion on the distinction between generalization, equality and unknown qualities
	2	Algebra of sets	• Moves for teaching union and intersection of sets, subset and power set, properties of operation on sets.	• Engage students in real life situations to have a direct purposeful experience of union and intersection of sets, subset and power set, properties of operation on sets and apply the knowledge to solve real life problems
	3	Relations, mappings functions and Equivalence relations	Moves for teaching • Relations • Mapping • Function • Equivalence relations	• Engage students in real life situations to have a direct purposeful experience to distinguish between relations, mapping, function, and equivalence relations and apply the knowledge to solve real life problems
	4	Properties of integers	Moves for teaching properties of integers	• Engage students in real life situations to identify the properties of integers and apply the knowledge to solve real life problems

	5	Linear and exponential series	Moves for teaching • Arithmetic and geometric sequences and series • Infinite geometric sequences • Recursively defined sequences • Finding the Nth term of linear and exponential sequences • Sum of linear and exponential sequences	• Make presentations on arithmetic and geometric sequences and series, infinite geometric sequences, recursively defined sequences, finding the Nth term of linear and exponential sequences and sum of linear and exponential sequences
	6	Convergence and divergence series	Moves for teaching • Convergence and divergence of series (Intuitive treatment-ratio and the root test)	• Use the "learn together" method to present Convergence and divergence of series (Intuitive treatment-ratio and the root test)
	7	Partial fractions	Moves for teaching • Separating algebraic fractions into its partial fractions	• Use the "learn together" method to present partial fractions
	8	Mathematical induction	Moves for teaching • Proof by Mathematical Induction	• Students to research on Peano's Postulates and proof by Mathematical Induction • Students record finding on the Peano's Postulates and proof by Mathematical Induction in their journals • Students present findings on Peano's Postulates and proof by Mathematical Induction • Students solve problems on Proof by Mathematical Induction.
Course Assessment	**Component 1:** Written **Summary of Assessment Method:** A combination of any of these assessment modes;			

	i. Tests/quizzes and class exercises to examine student-teachers' knowledge on algebraic thinking ii. Assignments, group work on algebraic thinking **Weighting: 20 %** **Assesses Learning Outcomes: CLO1, CLO2, CLO3**
	Component 2: Portfolio Assessment **Summary of Assessment Method:** i. Create e-portfolios to contain reports of their research **Weighting: 20%** **Assesses Learning Outcomes: CLO 4**
	Component 3: Summative assessment **Summary of Assessment Method:** Final Examination **Weighting: 60%** **Assesses Learning Outcomes: CLO 1 - CLO 5**
Instructional resources	i. Smartphones ii. PC iii. Open Educational Resources (Including: YouTube, MOOCS-Udemy/coursera, khan academy, TESSA)
Required reading list (Core)	1. Backhouse, J.K., & Houldsworth, S. P. T. (1985). Pure mathematics I. London: Pearson. 2. Larson, R. E., Kanold D. T., & Stiff L. (1993). Intermediate algebra. Canada: D. C. Heath and Company 3. Ofosu, J. B. (2001). A comprehensive SSS course in elective Mathematics. Accra, Afram Publication. 4. Stroud K. A. & Dexter J.B. (2007). Engineering Mathematics. 6 Macmillan, New York.