PEDAGOGICAL CONTENT KNOWLEDGE IN MATHEMATICS

The course provides student teachers with pedagogical content knowledge needed to in the teaching and learning 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	PEDAGOGICAL CONTENT KNOWLEDGE IN MATHEMATICS	Course Code	EBS 371	Level: 300	Credit value: 3	Semester: 1
Pre-requisite Knowledge of the subject matter	**Course Delivery Modes**	Face-to-face	Practical	Work-Based	Seminars	
Independent	e-Learning	Practicum ☒	Activity	Learning	Study	opportunities	
		☒	☐	☐	☒	☒	☐

Course Description The course, *Pedagogical Content Knowledge in Mathematics* is a required course in the Bachelor of Education (Mathematics) **(indicate NTS, NTECF,** programme. The goal is to help prospective high school mathematics teachers acquire the knowledge, skill and reflective **BSC GLE to be** practices necessary for successful teaching of mathematics. In other words, the course is intended to help students to develop **addressed)** competencies in designing best practices and strategies in teaching and learning of mathematics at the Junior High Schools.

It will require student-teachers to scaffold learning; practise how to promote active engagement of the learner; expose and discuss common misconceptions; develop effective and interactive teaching techniques and styles; and use collaborative rich tasks to engage students in co-operative small group work. 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
	On successful completion of the course, Student Teachers will be able to:	
	CLO 1. Demonstrate in-depth knowledge of the concept learnt in the course; **NTS: 2b, 2c, 2e, 3a, 3b, 3c, 3d, 3e, 3h, 3i, 3k, 3n, 3p; NTECF: Pillar 1&3.**	1.1. explain PCK and relationship between teacher content knowledge and pedagogical content knowledge; 1.2. explain mathematical anxiety and ways of minimizing anxiety.
Course Learning **Outcomes**	CLO 2. Demonstrate in-depth knowledge of conceptual and procedural mathematical knowledge **NTS: 2c&3j/NTECF: Pillar 1&3**	2.1. distinguish between conceptual and procedural mathematical knowledge.
	CCLO 3. demonstrate the understanding of teaching mathematics through problem solving **NTS: 2c, 2e, 3a, 3b, 3c, 3d, 3e, 3h, 3i, 3k, 3n, 3p /NTECF: Pillar 1&3**	3.1. plan and demonstrate teaching mathematics through problem solving. 3.2. identify the guidelines for effective teaching of mathematics. 3.3. identify characteristics of effective mathematics instruction and apply this in planning a lesson in mathematics 3.4. identify ways of setting up a safe and friendly environment in the classroom for effective teaching and learning of mathematics.
	CLO 4. Demonstrate understanding of the teaching of mathematics through mathematical investigations. **NTS: 2c, 2e 3a, 3b, 3c, 3d, 3e, 3h, 3i, 3k, 3n, 3p /NTECF:** **Pillar 1, 3, & 4**	4.1. plan and demonstrate teaching mathematics through investigation. 4.2. plan and carry out strategies for teaching selected JHS topics, e.g. Geometry, Algebra, Sets, Statistics, Investigation activities, etc

Course Content	Units	Topics:	Sub-topics (if any):	Teaching Learning Activities

	1	Definition of PCK, Mathematics Anxiety	• PCK in Mathematics • Guidelines for effective teaching of Mathematics • Mathematics myths and anxiety.	• Students to research of the topic for presentation • Students to make group presentations on the subtopics
	2	Mathematical Knowledge – Conceptual And Procedural Knowledge	• Conceptual knowledge • Procedural knowledge	• Discuss the distinction between conceptual an procedural mathematical knowledge • Take notes and keep in students' portfolios

	3	Planning for Effective Instruction	• The use of cooperative learning	• Use the Learning Together method to present cooperative learning
	4	Teaching Through Problem Solving and Teaching Through Mathematical Investigations	• The use of problem solving to teach • The use of problem solving to teach	• Use the Learning Together method to present teaching through problem solving and investigations to students.
	5	Strategies for teaching selected topics of the JHS syllabus	• Strategies for teaching set problems (Venn diagram), algebra, geometry, and Statistics	• Discuss the distinctions between the strategies of teaching set problems (Venn diagram), algebra, geometry, and Statistics

			• Take notes of all possible strategies and keep in students' portfolios
	6	Classroom management and motivation in mathematics instruction.		• Discuss strategies of classroom management and motivation
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 and understanding of the various topics in the course **ii.** Assignments, group work on selected topics **iii.** Test students understanding the various topics **Weighting: 20 %** **Assesses Learning Outcomes: CLO1 - CLO 4**		
	Component 2: Portfolio assessment **Summary of Assessment Method:** a. Inspection of portfolios. b. Learn Together methods of teaching **Weighting: 20%**		

	Assesses Learning Outcomes: CLO1 - CLO4.
	Component 3: Summative assessment **Summary of Assessment Method:** c. Final Examination **Weighting: 60%** **Assesses Learning Outcomes: CLO 1 - CLO4**.
Instructional resources	i. Smartphones ii. PC iii. Open Educational Resources (Including: YouTube, MOOCS-Udemy/coursera, khan academy, TESSA)
Required reading list **(Core)**	Brumbaugh, D. K. & Rock, D. (2006). *Teaching secondary school mathematics 3rd ed*. Mahwah, N. J.: Lawrence Elbaum Associates, Publishers. CRDD (2011). *Junior high school mathematics syllabus.* Accra: CRDD CRDD (2010). *Senior high school mathematics syllabus.* Accra: CRDD Sokpe, B. Y., Yarkwah, C., & Osiakwan, J. (2017). *Pedagogical content knowledge for high school mathematics teachers.* Cape Coast: University Press Sokpe, B. Y., & Osiakwan, J. (2015). *Mathematical investigations*. Cape Coast: University Press Sokpe, B. Y. (2011). *Mathematics and investigations*. Presentations at TIMSS 2011 Workshops for JHS Science and Mathematics teachers.

Additional Reading List	Cooney, T. J.; Davis, E. J. & Henderson, K. B. (1975). *Dynamics of teaching secondary school mathematics* Illinois: Waveland Press.
	Sheffield, L. J. & Cruikshank, D. E. (2000). *Teaching and learning elementary and middle School mathematics 4th ed*. New York: John Wiley & Sons.
	Sokpe, B. Y, Wilmot, E. M. & Cofie P.O. (2010). DSSEP TOT Workshop
	Stronge, J. A. (2007). *Qualities of effective teachers 2nd ed*. Alexandria: Association for Supervision and Curriculum development.
	Trowbridge, L. W. et al (2004), *Teaching secondary school science – Strategies for developing scientific literacy 8th Ed*. Columbus, Ohio, PEARSON Merrill Prentice Hall.
	Van de Walle, J. A. (2016). *Elementary and middle school mathematics. Teaching developmentally* 4th ed. New York: Pearson Longman.