

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): MATH 3760 ABSTRACT ALGEBRA (3,3,0)

Course Aims: This course covers some properties of groups, rings and fields. Permutation groups and polynomial rings are included. Application of permutation group on counting and application of finite field on error correcting code are included.

Prerequisite: MATH 1120 Linear Algebra

Prepared by: W.H. Chan

Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to develop the concepts equivalence relations and congruence
2	Able to describe the elementary properties of abstract groups
3	Able to define rings and fields
4	Able to develop the concepts of homomorphisms, ideals, quotient rings and factorization
5	Able to know the fundamental methods of algebraic coding
	Skills
6	Able to classify groups, rings, integral domains, and fields
7	Able to apply Lagrange's Theorem to analyze the structure of groups
8	Able to apply groups and fields on counting and error correcting codes
	Attitude
9	Able to appreciate the classic Mathematical theories and their applications

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment (assignments and test)	30%	Continuous assessment are designed to measure how well the students have learned the basic concepts and fundamental theory of abstract algebra.
2	Final Examination	70%	Final Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be understanding and skills based to assess the student's versatility in abstract algebra.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Congruence	1,9	3
II. Groups	2, 6,9	6
III. Rings	3, 6, 9	6
IV. Group Homomorphisms	4, 7, 9	8
V. Polynomial Rings	4, 9	8
VI. Algebraic Coding	5, 8, 9	9

Textbook: D.S. Malik, J.N. Mordeson and M.K. Sen, Fundamentals of Abstract Algebra, McGraw-Hill, 1997.

References: P.B. Bhattacharya, Basic Abstract Algebra, Cambridge University Press; 2nd edition, 1994.
 D.S. Dummit and R.M. Foote, Abstract Algebra, Prentice-Hall, 1991.
 J.R. Durbin, Modern Algebra, An Introduction, 3rd Ed., John Wiley & Sons, 1992.
 F.M. Goodman, Algebra, abstract and concrete, Prentice Hall, 1998.
 J.B. Fraleigh, A First course in Abstract Algebra, 7th Ed., Addison-Wesley, 2003.
 N. Jacobson, Basic Algebra I, 2nd Ed., W.H. Freeman, New York, 1985.

Course Content in Outline:

	<u>Topic</u>	<u>Hours</u>
I.	Congruence	3
	A. Equivalence relations	
	B. Congruence	
	C. Integers modulo n	
II.	Groups	6
	A. Elementary properties	
	B. Generators and direct products	
	C. Subgroups, cosets and Lagrange's theorem	
III.	Rings	6
	A. Definition and examples	
	B. Integral domains	
	C. Fields	
	D. Field of quotients	
IV.	Group Homomorphisms	8
	A. Homomorphisms of groups	
	B. Quotient groups and fundamental homomorphism theorem	
	C. Permutation groups and their applications	
V.	Polynomial Rings	8
	A. Elementary properties	
	B. Unique factorization	
	C. Ideal and quotient rings of $F[x]$	
VI.	Algebraic Coding	9
	A. Adjoining roots	
	B. Finite fields	
	C. Linear codes	
	D. Standard decoding	
	E. Hamming codes	
	F. Double error correcting B.C.H. code	