Module: Ring Theory *by Dr. Michael Butler*

Code: MAS3016

20 credits at level HE6

Description and Purpose of Module

This module builds on the material from Algebra. The central notion in the module is that of a ring. After a brief resumé of the key ideas from Algebra, the theory of rings is explored in some depth. Subrings and ring homomorphisms are discussed, and a special type of subring known as an ideal is introduced. It is shown how an ideal ring may be used to partition a ring into equivalence classes, or cosets, and how a ring structure may then be defined on this set of equivalence classes. The quotient rings constructed in this way are a substantial generalisation of the modular arithmetic explored in Algebra.

Indicative Syllabus Content

1. Sets, Relations and Partitions A revision of the key ideas from Algebra.
2. Rings and their Properties The ring axioms, polynomial rings, proofs of basic properties of rings.
3. Subrings, Ring Homomorphisms and Ideals Subrings, ring homomorphisms and their properties, image and kernel and their relationship to mono- and epimorphisms, ideals and associated equivalence relations.
4. Quotient Rings Revision of modular arithmetic, construction of quotient rings, the Isomorphism Theorem for Rings.
5. Integral Domains and Fields divisors of zero, fields, prime and maximal ideals, proof that R/P is an integral domain iff P is prime, and that R/M is a field iff M is maximal, the quaternionic numbers,
6. divisibility, primes and irreducibles, unique factorisation domains.

Learning, Teaching and Assessment

Approximately two-thirds of the available time will be devoted to lectures based on printed notes. Class discussion and participation will be encouraged. The remainder of the time will be devoted to attempting and discussing the structured exercises which appear at the end of each chapter of the notes.

Two pieces of coursework will be set, each to be completed by a prescribed date outside class contact time. There will be a formal closed-book examination of 2¼ hours duration at the end of the module. The weighting of the two components of assessment is as follows:

Coursework: 30% Examination: 70%

Learning Outcomes and Assessment Criteria

	Learning Outcomes when you have successfully completed this module you will:	Assessment Criteria to demonstrate that you have achieved the learning outcome you will:
1.	have an understanding of the concepts of ring, subring, and ring homomorhism.	verify the ring axioms for specific examples; check whether or not a given subset of a ring is a subring; check whether or not a given mapping is a ring homomorphism.
2.	have an understanding of the construction of quotient rings, and the application of the first isomorphism theorem.	apply the first isomorphism theorem to specific examples.
3.	have an understanding of the concepts of integral domain and field.	verify whether or not given ring is an integral domain or a field.
4.	have an understanding of the concepts of divisibility, ireduducible and prime elements, and unique factoriastion.	verify whether or not a given element is irreducible or prime; demonstrate whether or not various integral domains have unique factorisation.

Assessment

Your achievement of the learning outcomes for this module will be tested as follows:

Type	CW	EX
Description	Two pieces of coursework to be completed outside of class time.	Unseen written examination.
%age	30	70
Final Assessment	N	Y
Learning Outcomes	1,2,3,4	1,2,3,4

Prerequisite Module(s)

Before taking this module you must have successfully completed the following:

- MAS1007

Barred Combinations

You cannot take this module if you are taking or have taken:

- MAS3011

Indicative Reading

Allenby, R.B.J.T. Rings, Fields and Groups: an Introduction to Abstract Algebra, 2nd ed., Edward Arnold (1991).
Anderson, M. & Feil, T. A First Course in Abstract Algebra: Rings, Groups and Fields, PWS (1995).
Calugareanu, G. & Hamburg, P. Exercises in Basic Ring Theory,
Kluwer (1998).
Cameron, P. J Introduction to Algebra, OUP (1998).
Cohn, P. M. Classic Algebra, Wiley (2000).
Dummit, D. S. & Foote, R. M. Abstract Algebra (1999).
Durbin, J. R. Modern Algebra: An Introduction, Wiley (1992).
Fraleigh, J. B. A First Course in Abstract Algebra, Addison-Wesley (1999).
Hungerford, Thomas W. Algebra, Springer (1974).
Judson, T. W. Abstract Algebra: Theory and Applications, PWS (1994).
Rotman, Joseph J. A First Course in Abstract Algebra, Prentice-Hall (2000).
Shapiro, Louis. Introduction to Abstract Algebra, McGraw Hill (1975).

Module Type:	STAN
Module Length:	1
Host Subject Group:	Mathematics
Version Number::	0.1

Activity Log

User Name	Date Accessed	Action
mkb1	04/03/2009 16:24:53	added
mkb1	04/03/2009 16:36:48	amended
mkb1	04/03/2009 16:38:48	amended
mkb1	12/08/2010 18:54:24	Ammended
Admin	22/09/2010 11:22:49	Validated
Admin	16/11/2010 16:40:39	Ammended
Admin	16/11/2010 16:40:45	Revalidated
mkb1	07/07/2011 18:58:06	Ammended
mkb1	18/07/2011 16:45:13	Ammended
mkb1	01/09/2011 15:39:21	Ammended
mkb1	06/09/2011 16:38:03	Ammended
mkb1	07/09/2011 18:50:10	Ammended

©2006, The University of Bolton. Copying, reproduction or other use of the material contained herein, in whole or in part, is only permissable by prior agreement