Groups, Rings and Modules

Groups

PartIA prequsites. Normal subgroups, quotient groups and isomorphism theorems. Permutation groups. Groups acting on sets, permutation representations. Conjugacy classes. Centralizers and normalizers. The centre of a group. Elementary proptecies of finite p-groups. Examples of finite linear groups and groups arising from geometry. Simplicity of A_n. Sylow subgroups and Sylow theorems. Applications, groups of small order.

Rings

Definition and examples of rings (communtative, with 1). Ideals, homorphisms, quotient rings, isomorphism theorems. Prime and maximal ideals. Fields. The characteristic of a field. Field of fractions of an integral domain.

Factorization in rings, units, primes and irreducibles. Unique factorization in principal ideal domains and in polynomial rings. Gauss Lemma and Eisenstein irreducibility ~~cir cite cir~~ criterion.

Rings in $\mathbb{Z}[\alpha]$ of algerbric integers as subsets of $\mathbb{C}$ and quotients of $\mathbb{Z}[x]$. Examples of Euclidean domains and uniqueness and non-uniqueness of factorization. Factorization in the ring of Gaussian integers, representation of integers as sum of two squares.

Ideals in polynomial rings. Hilbert basis theorem

Modules

Definitons, examples of vector spaces, abelian group and vector spaces with an endomorphism. Submodules, homomorphisms, quotient modules over Euclidean domains, applications, applications to abelian groups and Jordan normal form.

Appropriate Books

P. M Cohn Classic Algebra Wiley 2000

P. J Cameron Introduction to Algebra OUP

J. B Fraleigh A First Course in Abstract Algebra Addison Wesley (Pearson) 2003

B Hartley and T. O Hawkes Rings, modules and Linear Algebra: a further course in Algebra. CRC 1970

I Herstein Topics in Algebra. John Wiley and Sons, 1975

P. M Neumann, G. A Stoy and E C Thomson Groups and Geometry. OUP 1994

M Artin Algebra (Pearson 1991)