Faculty	Natural Sciences
Home Department	Mathematics and Applied Mathematics
Module Topic	Modern Algebra
Generic Module Name	Mathematics 321
Alpha-numeric Code	**MAT321**
NQF Level	7
NQF Credit Value	30
Duration	Year
Proposed semester to be offered	Both Semesters
Programmes in which the module will be offered	BSc (Mathematical and Statistical Sciences) (3227, 3031) BSc (Physical Science) (3233, 3120) BSc (Computer Science) (3221, 3023)
Year Level	3
Main Outcomes	On completion of this module students should be able to: • Use their knowledge of the basic theory of groups to provide examples and counter- examples of various concepts. • Carry out proofs of mathematical statements • Use new knowledge in unfamiliar but similar situations • Generalize concepts from Groups to Rings • Use different methods to test for irreducibility of polynomials. • Use the theory to construct finite fields • Use their knowledge of field extensions to prove the impossibility of certain geometric constructions using ruler and compass.
Main Content	**Part One** • Mappings and operations • Introduction to group, inverse, identity, permutation, symmetry group, subgroup, dihedral group, groups of finite order, groups of infinite order, Abelian group, non-Abelian groups, Cayley tables • Relation, equivalence relation, congruence, division algorithm, integer modulo n, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, Fermat's Little Theorem • Group properties, generator, order of an element, direct product, cosets, Lagrange's theorem, properties of group order • Homomorphism, isomorphism, finite and infinite cyclic group, isomorphism of cyclic group, subgroup of cyclic group, Cayley's theorem, normal subgroup, kernel, range • Quotient group, fundamental homomorphism theorem, consequences. **Part Two** • Rings, integral domains, subrings, fields, isomorphisms, characteristic • Ordered integral domains, the integers, field of quotients, field of rational numbers • Ordered fields, field of real numbers, field of complex numbers, complex roots of unity • Polynomial, division algorithm, polynomial factorisation,

<table>
<tr><td></td><td colspan="4">unique factorisation domain
• Ring homomorphism, ideal, quotient ring, quotient ring of F[X]. factorisation and ideal
• Field extension: adjoining root, finite field; polynomial equation: polynomial root, rational root, conjugate, introduction to Galois theory Impossible geometric constructions.</td></tr>
<tr><td>Pre-requisite modules</td><td colspan="4">MAT221</td></tr>
<tr><td>Co-requisite modules</td><td colspan="4">None</td></tr>
<tr><td>Prohibited module Combination</td><td colspan="4">None</td></tr>
<tr><td>Breakdown of Learning Time</td><td>Hours</td><td colspan="2">Time-table Requirement per week</td><td>Other teaching modes that does not require time-table</td></tr>
<tr><td>Contact with lecturer / tutor:</td><td>39</td><td>Lectures p.w.</td><td>2</td><td rowspan="6">Practicals – every alternate week</td></tr>
<tr><td>Assignments & tasks:</td><td>60</td><td>Practicals p.w.</td><td>1</td></tr>
<tr><td>Practicals:</td><td>27</td><td>Tutorials p.w.</td><td>0</td></tr>
<tr><td>Assessments:</td><td>12</td><td></td><td></td></tr>
<tr><td>Self-study:</td><td>162</td><td></td><td></td></tr>
<tr><td>Total learning time:</td><td>300</td><td></td><td></td></tr>
<tr><td>Method of Student Assessment</td><td colspan="4">Continuous Assessment (CA): 70%
Final Assessment (FA): 30%</td></tr>
<tr><td>Assessment Module Type</td><td colspan="4">Continuous and Final Assessment (CFA)</td></tr>
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