King Fahd University of Petroleum & Minerals

Department of Mathematics

Syllabus of the Comprehensive Exam

MATH 550 Linear Algebra

Topics

- **Vector Spaces:** Fields; Vector spaces; Subspaces; Bases and dimension; Coordinates.
- **Linear Transformations:** Linear transformations; The algebra of linear transformations; Isomorphisms; Representation of transformations by matrices; Linear functionals; The double dual; The transpose of a linear transformation.
- **Elementary Canonical Forms:** Introduction; Characteristic values; Annihilating polynomials; Invariant subspaces; Simultaneous triangulation; Simultaneous diagonalization; Direct-sum decompositions; Invariant direct sums; The primary decomposition theorem.
- **The Rational and Jordan Forms:** Cyclic subspaces and annihilators; Cyclic decompositions and the rational form; The Jordan form; Computation of invariant factors; Summary; Semi-simple operators.
- **Inner Product Spaces:** Inner products; Inner product spaces; Linear functionals and adjoints; Unitary operators; Normal operators.
- **Spectral Theory**
- **Bilinear Forms:** Bilinear forms; Symmetric bilinear forms; Skew-symmetric bilinear forms.

Reference

- K. Hoffman and R. Kunze, *Linear Algebra*, Second Edition, Prentice-Hall, Inc. (1971).