COURSE SYLLABUS

Course Title: Math 748 Selected Topics in Algebra:
                      Cohomology of vector bundles and syzygies

Semester: Spring 2018

Time: The class will meet twice a week, 75 minutes for each lecture.

Instructor: Andy Kustin

Textbook: Cohomology of vector bundles and syzygies,
                      by Jerzy Weyman
                      Cambridge Tracts in Mathematics, **149**
                      Cambridge University Press.

Potential audience: Some knowledge of commutative algebra
                         and/or algebraic geometry would be useful.

Synopsis: One uses resolution of singularity and the Bott isomorphism
                      theorem to obtain the finite free resolution of the homogeneous
                      coordinate ring of a singularity in projective space. The
                      technique works especially well for determinantal varieties.

Learning Outcomes: The students will learn about Schur modules and Weyl modules
                        and various methods for decomposing methods for decomposing
                        arbitrary modules over the General Linear Group into irreducible
                        modules. The students will learn Lascoux's resolution
                        of determinantal ideals.

Course Grade: The course grade will be based entirely on weekly homework.
                      The usual cutoffs apply, namely more than 90% guarantees an A,
                      more than 80% guarantees a B, more than 70% guarantees a C,
                      and more than 60% guarantees a D.
                      Attendance of all lectures is required.

Course outline:
1. Review of multilinear algebra and combinatorics.
2. Review of homological and commutative algebra.
3. Schur functors and Weyl functors.
4. Schur functors and highest weight theory.
5. Cauchy formulas, Littlewood-Richardson rule, and plethysm.
6. Bott's Theorem.
7. The geometric technique.
8. The Lascoux resolution of determiantal ideals.
9. The determiantal ideals for symmetric matrices.
10. The determiantal ideals for alternating matrices.