

**VILLANOVA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**GROUP THEORY**  
**PHYSICS 6600-01**                      **SYLLABUS**  
Dr. Francis J. Wunderlich, presiding

Course Description: Discrete groups: symmetry point groups and their applications in Molecular Spectroscopy. Character Tables, active transitions in Infrared and Raman spectroscopy will comprise their applications. Continuous groups: orthogonal group, special unitary groups; SU(2) and SU(3) with applications in atomic and nuclear physics; the homogeneous Lorentz and Poincare Groups.

Text: Due to the nature of the course, no single text was deemed appropriate. The following texts will be used where indicated: (extensive hand-outs will supplement class notes)

Discrete Groups: Cotton, F. - "*Chemical Applications of Group Theory*" -Wiley- interscience  
Summary of Techniques found in Margeneau, H. & Murphy, G. - "*The Mathematics of Physics and Chemistry*", D. van Nostrand; and Arfken, G. - "*Mathematical Methods for Physicists*", Academic Press. References: Hammermesh, M. "*Group Theory and its Application to Physical Problems*", Addison-Wesley; Wigner, E. - "*Group Theory and its Application to the Quantum Mechanics of Atomic Spectra*", Academic Press.

Tests: There will be three one-hour tests and a final exam (which will be two and a half hours long and counts twice as much as one test -200 pts.). All tests and the final exam will be **OPEN BOOK** and **OPEN NOTES**. Tests will be graded on the basis of 100 points for a total of 500 points. If for good reasons a student misses a test (there will be **NO** make-up tests administered), the calculation of that student's final grade will be based on 100 less total possible points. University regulations demand a final exam, so should one miss the final, a grade of incomplete will be given (assuming the professor is notified within 24 hours of the exam as per regulations). Dishonesty, cheating, etc. will result in a failing grade. Note: concerning the oft asked question: "Are you going to curve the grades?" -Recall: a straight line is a mathematical curve. Therefore the answer cannot be "no".

Grading and Type of Tests: The tests and final exam will consist of problems based on applications of the concepts and mathematical topics covered in class. They will be numerical or algebraic in nature and it is assumed the student has a calculator and integral tables available. Partial credit will be awarded at the discretion of the instructor. **Remember, the purpose of the tests to give the student the opportunity to illustrate to the instructor the student's grasp of the material and her/his ability to apply it.**

Answers, if incorrect are worthless, **so show** all work. Individual problems will normally be graded on a basis of 10 points, -the correct answer is normally worth 2 points and 8 points for the work. Thus, it is possible (not probable) to get a respectable grade on a problem with the wrong answer, if it was done correctly up to the point of numerical substitution.

Class Attendance: See the Student Handbook for regulations. The student is responsible for **ALL** topics covered in class - whether or not she/he is physically and/or mentally present. Students are expected to attend the weekly Society of Physics Students meetings for their own cultural and scientific edification and are also encouraged to attend the Faculty Research Colloquia.

Tentative Test Dates:

Date	Quiz	Material
Feb. 8	1	Symmetry Point Groups
Mar. 8	2	Character Table Applications
Apr. 19	3	Continuous Groups
	Finals	All of above.

Homework: Homework is an assignment - see attached letter from the Vice President of Academic Affairs defining grades.

Office hours: Hours will be posted. Unlike physicians, you will need no appointment. Including office hours, I am usually available in \_\_\_\_\_ where you are always welcome to come for help, coffee, commiseration, discussion of problems, etc. at any time except when I am in class or late Friday afternoon. You are expected to contact me before you experience insurmountable difficulties - **DO NOT BE BASHFUL!!!!**

**SYLLABI CHECKLIST**

- 1) Description of Course - see above .class notes are available to Administrators on request.
- 2) Objectives of the Course:
  - a) Student ingoes (if successful) - sufficient knowledge and skill to use the mathematical tools necessary to understand the advanced physics which uses these techniques.
  - b) Expectations for student performance -see (a) above, as evidenced by performance on tests and the final examination.
- 3) Writing Assignments .see above sections describing tests and homework.
- 4) Examinations: see above description on page 1 of this document.
- 5) Required Textbooks: see page 1, plus each and every hand-out distributed during class.
- 6) Secondary Sources: see (5) above, as well as Faivey library.
- 7) Modes of Teaching: (Elementary and High Schools place their emphasis on teaching; a university should place its emphasis on learning) .lecture, discussion, problem solving, cajoling, and commiseration, where and when appropriate.
- 8) Other areas of emphasis: attendance, calculation of final grades, office hours, and academic honesty have been covered above. Since the class hours are TBA, these have not been discussed. Class projects and presentations are encouraged with a standing offer of "A" for publication in a recognized refereed physics journal. Outside activities are strongly encouraged, in particular, attendance at the weekly Physics Club seminars and the Faculty Colloquia.

Dover books:

"Group Theory and Chemistry" by David M. Bishop  
Dover 0-486-67355-3  
ISBN  $\rightarrow$  \$ 8.95

"Symmetry and Spectroscopy" by Daniel C. Harris  
and Michael D. Bertolucci  
Subtitle: "An Introduction to Vibrational and  
Electronic Spectroscopy"  
Dover 0-486-66144-X \$13.95

"Group Theory and its Application To Physical  
Problems" by Mosta Hameed  
Dover 0-486-66181-4 \$10.95