

Virginia State  
School of Agriculture, Science, and Technology  
Department of Physics  
Course Syllabus  
SPRING 2004

Physics 319 and 320, Advanced Laboratory - 2 Sem. Hrs. Each

OFFICE HOURS: MONDAY 9-12 TUESDAY 2-3 WEDNESDAY 10-12 FRI-10-12

OFFICE LOCATION 102SE

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WEBSITE: [gwhenderson.com](http://gwhenderson.com)

### Course Description

A study of thermionic emission, vacuum and solid state diodes and triodes in the linear approximation, simple oscillator and amplifiers including frequency response, gain and stability considerations, basic oscilloscopes, devices for detecting and measuring radiation and particle: fundamental considerations involved in pulse analysis and counting devices, methods of measurement and accurate determination of several fundamental constants.

### COURSE TEXT:

None

## LEARNING OUTCOMES, ACTIVITIES, AND EVALUATION

### KNOWLEDGE

The Student will:

have knowledge necessary to repeat sophisticated experiments and design others has been developed in earlier courses.

Evaluation Strategy: Written reports

### SKILLS

The Student will:

a) use sophisticated measuring devices such as:

1. the computer operated monochromator.
2. the Ellipsometer.

3. the Raman spectrometer.

b) develop empirical relationship from data.

c) solve partial differential equations.

Evaluation Strategies: Written reports and Observation

## **ABILITIES**

**The student will:**

- a) do a literature search for the purpose of determining the experimental techniques that are currently developed.
- b) determine new techniques for measuring physical quantities.
- c) use computers in the development of measuring techniques.
- d) do statistical analysis of data and use sophisticated curve fitting techniques.

Evaluation Strategies: Written and Oral reports

## **ADDITIONAL EVALUATION STRATEGIES:**

Final Examination

## **COURSE REQUIREMENTS:**

Spend six hours a week developing experimental skills, learning theory, and developing data analysis techniques.

**(THIS TIME MUST BE ABSOLUTELY DOCUMENTED, NO EXCEPTIONS)**

ASSIST WITH PHYSICAL SCIENCE LABORATORIES

Perform a number of experiments in the program designed by you and your instructor. This will be done at the onset of semester (it could change during the semester depending on whether you discover an exciting measurement you wish to pursue.)

Pass a comprehensive examination consisting of the following elements.

- a) basic experimental techniques 25%
- b) results from your program 25%
- c) creative experience 25%
- d) statistical analysis of data and error analysis 25%

See the Student Handbook and Catalog for specific academic regulation concerning cheating, plagiarism, absenteeism, etc. Students who are covered under the American Disability Act should privately inform the teacher of this fact so that appropriate instructional arrangements can be made.

## GRADING STANDARDS:

Written reports 80%  
Final Examination 20%

## GRADING SCALE

90 - 100 A  
80 - 89 B  
70 - 79 C  
60 - 69 D  
below 60 F

## BIBLIOGRAPHY/READING LIST:

### Periodical

Journal of Scientific Instruments  
Physical Review  
American Journal of Physics  
Journal of Optical Society of America  
Canadian Journal of Physics  
Journal of Modern Physics  
Review of Scientific Instruments

### Books

Young, Hugh, (1996), University Physics, Addison-Wesly Publishing Company, Inc., Reading, MA

Safford, Jr., Edward L. (1984), The Fiberoptics & Laser Handbook, Tab Books, Inc., Blue Ridge Summit, PA

Strong, John, (1938), Procedures in Experimental Physics, Prentice Hall, Inc. Englewood Cliffs, N. J.

Melissinos, Adrian C., (1967), Experiments in Modern Physics, Academic Press, N.Y.

Doebelin, Ernest O. (1966), Measurement Systems: Application and Design, McGraw-Hill Book Company, N. Y.

Meyer, Stuart L. (1975), Data Analysis for Scientists and Engineers, John Wiley & Sons, Inc. N.Y.

## APPENDIX I

### **EXPERIMENT LIST**

The following list of experiments represents a partial list of the experiments that can be performed in our laboratory. Other experiments are available and many others not even named can also be performed in our facility. You are expected to design a program from this list and/or other sources of experimental measurements that you find exciting. Each program must be approved by the instructor.

Subject of experiments      Maximum time required

- I. The Hall Effect 2 weeks
- II. Spectroscopy experiment 5 hours
- III. Franck-Hertz Experiment 2 weeks
- IV. X-ray Diffraction experiments 3 weeks
- V. Superconductivity experiment 3 weeks
- VI. Gamma Ray Spectroscopy 2 weeks
- VII. Computer Interfacing 3 weeks
- VIII. Laser experiment
- IX. Creative resistance measurements 2 weeks
- X. Raman Spectroscopy 3 weeks
- XI. Fiber Optics 3 weeks
- XIII. Ellipsometry 3 weeks

**APPENDIX II**  
**REPORTING REQUIREMENTS**

**WRITTEN REPORTS:** Reports will be developed and written using the currently accepted form for writing articles for scientific journals. An abstract is essential and a bibliography a must.

Each of you will also be required to develop an oral presentation on one of your experiments. I will assist you in developing transparencies.

The date due for each experiment will be determined at the time the experiment is begun.

Each student will develop a program of experiments at the beginning of the semester and will have his or her program approved by the instructor.

Each student is required to document the time that he or she spends in the development of a knowledge base and the actual performance of the experiment. A form has been developed for this purpose and a copy is attached. Other copies will be available as needed for each week of class. Each of you will have a folder in which to keep documented records. It will be house in room 111 S HMB

APPENDIX III

DAILY REPORT FORM FOR ADVANCED LABORATORY

LABORATORY HOURS \_\_\_\_\_

DAY \_\_\_\_\_ DATE \_\_\_\_\_ TIME \_\_\_\_\_

TITLE OF EXPERIMENT \_\_\_\_\_

OBJECTIVES FOR THIS TIME PERIOD \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

APPARATUS OR REFERENCES \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

SUMMARY OF ACCOMPLISHMENTS OR INSIGHTS GAINED \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

NEW IDEAS GENERATED BY EXPERIENCE \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

NAME \_\_\_\_\_ SIGNATURE \_\_\_\_\_

BEGINNING TIME OF ACTIVITY \_\_\_\_\_ ENDING TIME \_\_\_\_\_

TOTAL NUMBER OF HOURS FOR THE DAY \_\_\_\_\_

INSTRUCTOR SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

APPENDIX IV

WEEKLY EVALUATION REPORT

PHYSICS 319 & 320 ADVANCED LABORATORY

DATE: \_\_\_\_\_ WEEK NUMBER \_\_\_\_\_

NAME OF ADVANCED LABORATORY STUDENT \_\_\_\_\_

DURING THIS WEEK I HAVE MADE THE FOLLOWING OBSERVATIONS:

PROGRESS HAS BEEN EXCELLENT

PROGRESS HAS BEEN GOOD

PROGRESS HAS BEEN FAIR

PROGRESS HAS BEEN POOR  \_

THERE IS NO EVIDENCE THAT ANY WORK HAS BEEN PERFORMED

THE AMOUNT OF TIME SPENT IN LABORATORY AN OTHER ACTIVITIES

\_\_\_\_\_ HOURS OF WORK HAS BEEN WELL DOCUMENTED.

A DEFICIT OF \_\_\_\_\_ HOURS HAVE BEEN INCURRED.

THE TOTAL NUMBER OF DEFICIT HOURS AS OF NOW ARE \_\_\_\_\_.

THE EXCEPTIONAL QUALITY OF YOUR WORK FOR THIS WEEK HAVE EARNED YOU A GOLD STAR AND A CERTIFICATE OF ACHIEVEMENT. YES \_\_\_\_\_ NO \_\_\_\_\_

SPECIFIC COMMENTS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signature \_\_\_\_\_

George W. Henderson, Instructor