**Instructors:**
Dr. David Boucher  
Office: Science Center, SSMB 322  
E-mail: boucherds@cofc.edu

Dr. Brooke Van Horn  
Office: Science Center, SSMB 104  
E-mail: vanhorba@cofc.edu

**Office hours:**  
M 1-2, T 1-2, W 11-12, R 12-2, F 11-12, and by appointment.  
M 11-12, T 12-1:30, R 10-11, F 10:30-11:30, and by appointment

**Schedule:**  
Lecture: W 12:00-12:50 (SSMB 327); Lab: F 1-4 (SSMB 329/103)

**Textbooks:** Although there is not a formal textbook, you are strongly encouraged to consult the textbook *Polymers* by Young and Lovell. Your instructors have arranged to have a copy of this textbook on reserve in Addlestone Library. In addition, handouts and pdfs outlining laboratory procedures will be distributed and made available on OAKS as needed.

**Required Materials for lab:**
- Lab coat
- Safety glasses or goggles
- Nitrile gloves (not latex)
- Ballpoint pen, for all lab notebook recording
- Composition book to serve as laboratory notebook
- Three-ring binder to hold annotated spectra (will be cross-referenced with relevant notebook pages)

**Attendance Policy:** Students are required to attend and complete all laboratory experiments. In case of an unavoidable absence, speak with the instructor promptly. If you do not attend the lab you will receive zero lab conduct and notebook points, and you will not be permitted to turn in a lab report. **Attendance to the first week’s safety presentation is required prior to execution of any experiments this semester.**

**Course Overview:** The course is designed as an introduction to polymer and materials science. The lecture will present many essential topics and concepts encountered in polymer chemistry, polymer physics and materials science, and the lab will introduce the student to research techniques commonly used in these areas. Most of the theoretical background for the labs will be covered in the lecture course notes, textbook, and laboratory handouts, but the specific laboratory procedures and experimental techniques will be presented and demonstrated by the instructors.

Each professor will teach the course, with emphasis on their particular expertise. Dr. Van Horn will focus on polymer chemistry and Dr. Boucher will focus on polymer and materials physics. Students will work in small teams (2-3 students) in order to carry out a semester-long synthesis, characterization, and analysis of several prototype polymer(s). At the end of the semester, each team will turn in a binder of raw, annotated data and give an oral presentation containing worked-up, professional-quality data.

**Student Learning Outcomes:** The core learning outcomes for the course are listed below.

1. Synthesize and prepare high quality samples of several prototype polymers for experimental analysis.
2. Use a multitudes of modern instrumental techniques, e.g., NMR, DSC, DLS/SLS and AFM, to collect data for samples of polymers.
3. Analyze combined datasets in order to characterize various features of polymers including, but not limited to molecular weight, chain conformation and configuration, vibrational modes, enthalpy of fusion, and film morphology.

Available Instrumentation:
- UV/Vis spectrophotometers (Perkin-Elmer, Lambda 35 and Lambda 365) with integrating sphere
- Raman spectrometer for solid and liquid samples (Agiltron, Peakseeker)
- FTIR spectrometer equipped with an attenuated total reflectance (Bruker Alpha, Platinum ATR)
- Differential scanning calorimeter (TA instruments, DSC-25)
- One- and two-dimensional NMR (Bruker Ascend 400 MHz)
- Atomic force microscope (TT-AFM)
- Precision spin coater (Laurell Technologies)
- Dynamic and static light scattering instrument (Malvern, Zetasizer Nano ZS)

Laboratory Preparation: You are expected to arrive in lab on time and prepared to carry out your assigned experiment. Preparation consists of:

1. Reading any assigned materials from the lab handouts and any assigned reserve reading.
2. Performing any required calculations.
3. Preparing a brief outline of the procedure to be followed and answers to any pre-lab questions.

Students who have not completed their preparation before coming to lab will be required to complete the preparation before proceeding. Delays that result in the collection of incomplete data will adversely affect your lab report grade(s). You must have your lab notebook initialed by the instructor before you leave at the end of the lab.

Lab Notebook and Data Binder: One of the most important parts of the laboratory procedure is recording permanently all procedures, observation, and numerical data in a bound notebook. A laboratory notebook should provide a full record of what was performed during the experiment. Loose-leaf or spiral-bound notebooks are not acceptable because pages can easily be removed from these types of notebooks. Under no circumstances should pages be removed from a research or laboratory notebook. Pages should be numbered consecutively, leaving two or three blank pages at the beginning for a table of contents. All entries must be made in permanent ink. The procedures and observations should be recorded in the notebook at the time the experiment is being performed, not recalled from memory at some later time. While this approach may take extra time and appear to be a nuisance, it is the only acceptable way to keep a research notebook. Calculations should be done as soon as possible and examples of each should be entered into your notebook when applicable.

Any error made in recording data, procedures, etc., should be crossed out neatly with a single line. Never erase in a laboratory notebook, since, like tearing out pages, it immediately invalidates the notebook. A good rule to follow is to ask yourself whether you could understand and perform the experiment from just the information given in the laboratory notebook. An experimental setup may be difficult to explain with words, so when appropriate include a figure of your experimental set-up. Most importantly, all data and instrument settings must be recorded in your notebook as soon as it is generated.

All data must be recorded in a clear, legible fashion in your lab notebook during the laboratory period. A key skill for any scientist is learning to record data in a clear, organized and complete enough way that someone reading your lab book can understand what it is you have measured without you standing there to tell them. A person should be able to repeat the experiment using your notebook.
as a guide. As scientists you must present your results in a way which can be understood by others. Otherwise, they are essentially worthless.

Your instructor will check lab notebooks at the end of each lab period to confirm that all information has been entered legibly in a way that can be followed by others. All calculations should be shown in the laboratory notebook such that the instructor may follow your logic and check for calculation errors. Each student is expected to observe the College of Charleston Policy on Scientific Integrity.

All recorded data must be printed and kept in a three-ring binder. Spectra, chromatograms, digital files, etc. will be fully annotated and cross-referenced with the pertinent lab notebook pages.

Grading: Your grade for this course will be derived from your performance in the lab (preparation and hands-on experience), lab notebook, binder of data, weekly assignments or written lab reports, and the final team presentation. The relative weights for these three basic components are indicated below:

- Lab Notebook and Annotated Data (40%)
- Safety and Participation (20%)
- Assignments/Reports (20%)
- Team Presentation (20%)

There is a 10 point per day penalty (including the weekend) for late assignments. Letter grades will be assigned based on straight grading scale shown in the table below.

<table>
<thead>
<tr>
<th>Score/%</th>
<th>Grade</th>
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<tr>
<td>93-100</td>
<td>A</td>
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<tr>
<td>90-92</td>
<td>A-</td>
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<tr>
<td>87-89</td>
<td>B+</td>
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<tr>
<td>83-86</td>
<td>B</td>
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<td>80-82</td>
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<td>78-79</td>
<td>C+</td>
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<td>75-77</td>
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<td>&lt;70</td>
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The instructor reserves the right to increase a student’s grade if the instructor feels that it is warranted. Periodically you will be made aware of your class standing so that you can assess your progress and to help you avoid any surprises at the end of the semester.

Important Dates:

<table>
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<tr>
<th>DATE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>Tuesday, August 27</td>
<td>Last Day to Drop/Add Courses</td>
</tr>
<tr>
<td>Mon-Tues October 14-15</td>
<td>No class: Fall Break</td>
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<tr>
<td>Wednesday, October 16</td>
<td>Midterm Grades Available</td>
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<tr>
<td>Friday, October 25</td>
<td>Last Day to Withdraw with a Grade of “W”</td>
</tr>
<tr>
<td>November 27-29</td>
<td>No class: Thanksgiving Break</td>
</tr>
<tr>
<td>Monday, December 2</td>
<td>Last Day of Classes</td>
</tr>
<tr>
<td>Friday, December 13</td>
<td>Final Grades Available Online</td>
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</tbody>
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Electronic devices: Please be respectful and avoid the use of cell phones, text messaging, and social media while in prelab and of course while in the laboratory. The latter is an obvious safety concern. While computers will be required for data processing and analysis, it is expected that they will be used for course-related purposes only.

Student Code of Conduct: The Honor Code of the College of Charleston forbids lying, cheating, stealing, plagiarism, and failing to report an Honor Code violation. Students can find the complete Honor Code and all related processes in the Student Handbook at: http://studentaffairs.cofc.edu/honorsystem/studenthandbook/index.php. Students should also refer to the College of Charleston Department of Chemistry and Biochemistry policy regarding scientific integrity, which can be found at: http://chemistry.cofc.edu/about/policies/index.php.

Science is inherently collaborative. If you go on to work in industrial or academic laboratories you will work with other scientists as a collaborator, as a mentor, and as a student throughout your career. Learning to work effectively with other people is therefore an important part of your undergraduate training. You may choose to work together on the data reduction and analysis with your lab partners, but you should not merely copy out their answers to homework questions. Working together means working together. There are two reasons for this. The first is that you will not really understand how to do the problem simply by copying it out, and understanding the problems should be your chief goal. Secondly, your colleagues will get tired of your mooching. If you do work with people on your assignments, please include the name(s) of your partner(s) on your work.

Although you may work together during your data analysis, the Abstract, Introduction, and Results and Conclusions sections of any reports must be in your own words, thereby reflecting your own knowledge and understanding of the experimental theory and purpose, procedures, observations, and results.

Plagiarism involves using another's work without attribution, as if it were one's own original work. The College of Charleston Honor Code forbids plagiarism and the Student Handbook defines plagiarism as follows:

1. The verbatim repetition, without acknowledgement, of the writings of another author. All significant phrases, clauses, or passages, taken directly from source material must be enclosed in quotation marks and acknowledged either in the text itself and/or in footnotes/endnotes.
2. Borrowing without acknowledging the source.
3. Paraphrasing the thoughts of another writer without acknowledgement.
4. Allowing any other person or organization to prepare work which one then submits as his/her own.

Beyond being an Honor Code violation at the College of Charleston, plagiarism is considered a serious ethical offense and can be detrimental to one's academic reputation and integrity. You should begin now, during your undergraduate education, to develop good practices for avoiding plagiarism and to learn how to properly cite and reference resources from which you draw your facts, ideas, and inspiration. If you are in doubt as to whether or not you may be engaging in plagiarism do not hesitate to ask your instructor. Plagiarism on laboratory reports will not be tolerated.

Violations of the Honor Code, when identified, will be investigated. Each instance will be examined to determine the degree of deception involved. Incidents where your instructor believes the student’s actions are clearly related more to ignorance, miscommunication, or uncertainty can be addressed by consultation with the student. Cases of intentional and willful academic dishonesty will be reported directly to the Dean of Students for further consideration and, if necessary, disciplinary action.
**Student Disability/Access Statement:** This College abides by Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act and will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104, (843) 953-1431. If you have a documented disability that may have some impact on your work in this class and for which you may require accommodations, you are responsible for notifying me as soon as possible and for contacting me one week before accommodation is needed.

**Laboratory Safety Guidelines:** Safety is an important issue in the Department of Chemistry and Biochemistry, and the department considers safe practice as essential to all activities in the building. The safe use of all equipment, devices, and procedures in this laboratory, as well as your future career, is of the utmost importance. It is the responsibility of ALL of the people in the lab to observe safe practices and to know what to do in the event of an accident. *Failure to conduct yourself in a safe manner may result in your forced departure from a particular laboratory period. You will receive no points for lab, nor will you be allowed to hand in a report for that experiment.*

**Attendance to the first week’s safety presentation is required prior to execution of any experiments this semester.**

Official departmental policies can be found at: [http://chemistry.cofc.edu/about/policies/index.php](http://chemistry.cofc.edu/about/policies/index.php).

Listed below are some general safety guidelines:

1. Follow all instructions given by your instructor. Special precautions will be noted by your instructor when necessary.
2. **Always wear approved eye protection, lab coats, pants, and long sleeve shirts. Do not wear open toed shoes. If you do not comply, you will not be allowed in the lab.**
3. “Horseplay” is strictly forbidden. Enjoy the lab period, but be mature.
4. No smoking, eating, or drinking in the lab.
5. Always wash your hands before leaving the lab.
6. Use good housekeeping practices in the lab, cleaning your individual work station, as well as general work areas.
7. Tightly cap all reagent bottles immediately after use. Do not place tops on benchtop in a manner that they can become contaminated.
8. Never return reagents to stock bottles.
9. Always add acids to water, never water to acids.
10. Dispose of unused or contaminated reagents properly. Consult your instructor before cleaning up a chemical spill.
11. Perform all reactions in a functional hood.
12. Report all mercury spills immediately to your instructor.
13. All broken glassware should be carefully and immediately cleaned up and disposed of in the proper “broken glassware” receptacle.
14. Report all broken or defective laboratory equipment to the instructor.
15. Never leave an experiment unattended.
16. Unauthorized or unsupervised experiments are not permitted.
17. Never take chemicals or other substances out of the lab, unless required to complete an experiment, e.g., performing a NMR scan.
18. Never wear gloves on both hands outside of the lab.
19. Bare feet, open toed shoes, and crocs are not acceptable in the laboratory. Clothes must come at least to the knee, and pants are strongly recommended.
20. Contact lenses are permitted in the lab, but they are not considered to be approved eye protection and, therefore, they do not replace safety goggles.
21. If you have long hair, tie it back.
22. Keep all experimental apparatus as far away from the edge of the benchtop as possible.
23. Report any accident, however minor, to your lab instructor at once.
24. Know how to get help in an emergency. Dial 3-5611 from a campus phone to contact emergency personnel.
25. When in doubt “ask.”
26. AT ALL TIMES, THINK ABOUT WHAT YOU ARE DOING!

You should familiarize yourself with the location of the safety equipment in the lab. If there is an accident, knowing the location of the fire extinguisher, fire blanket, shower, and eye wash, and, most importantly, where the exits are, can save lives.

Safety information about the chemicals used in this laboratory course is available in the yellow MSDS binders in the lab room and can also be found online on a number of sites, like http://www.msds.com/. Other sites for MSDS sheets can be found by searching "MSDS" on Google™.