

Glassboro State College Senate Curriculum Committee

Approval Form

Proposal Title: Characterization of Polymers 1907.582

Sponsor(s) Newland Dept.: Physical Sciences Ext. 6337
Dinsmore, Schultz 7348

Check one: Course Specialization Concentration Minor Achievement Certificate
 Certification Program Major Program Minor Change (please name deletion or credit/title/catalog change)

Undergraduate Graduate 4 Credit Hours

<p>Step 1 (Department)</p> <p><input checked="" type="checkbox"/> Approved <u> </u> Date</p> <p><input type="checkbox"/> Not Approved</p> <p><u> </u> Dept. CC Chairperson</p> <p><input type="checkbox"/> Reviewed <u> </u> Date</p> <p><u> </u> Dept. Chairperson</p>	<p>Step 2 (Receipt)</p> <p><input checked="" type="checkbox"/> SCC# <u>90-91-8</u></p> <p>Proposal Received <u> </u> Date</p> <p>RECEIVED</p> <p>OCT 18 1990</p> <p>CLASSIFIED BY: 1000000 REPRODUCTION OFF</p> <p><u> </u> SCC Chairperson</p>	<p>Step 3 (School CC)</p> <p>Reviewed <u> </u></p> <p><input checked="" type="checkbox"/> Approved <input type="checkbox"/> Not Approved</p> <p>Comments:</p> <p><u> </u> School Curr. Comm. Chairperson</p>
--	--	---

Step 4 (Academic Dean) **Comments:**

Recommend
 Not Recommend
 Conditionally Recommend (see comments)

Reviewed
Date Signature, Dean of School

Step 5 (SCC)

Open Hearing Approved by Senate Curriculum Committee
Date Date

Returned to sponsor(s) for the following reasons:

Step 6 (Senate)

Presented to Senate Approved Not Approved
Date

Notification to Executive Vice-President/Provost
Date Signature, SCC Chairperson

Step 7 (Executive V.P./Provost)

Received 3/28/91
Date

Approved Yes No

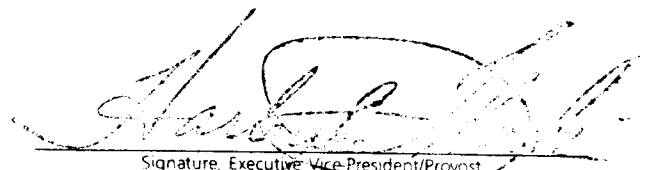
If no, reasons are as follows:

Student credit hours 4

Faculty load hours 5

Equalized credit hours 4 1/3

Official copy and approval sheet filed APR. 26 1991
Date


Signature, Executive Vice-President/Provost

Registrar

Approved course description received 22 Apr. 91
Date

Hegis Taxonomy and Course Number assigned 1907.582

B F Kelsey
Signature, Registrar

22 Apr. 91
Date

Notification forwarded:

- Senate Curriculum Committee Chairperson
- Department Chairperson(s)
- Academic Dean(s)
- Registrar
- Sponsor(s)

COURSE PROPOSAL

DETAILS

COURSE TITLE: Characterization of Polymers

SPONSORS: Drs. Robert Newland, Lee Dinsmore and Charles Schultz

CREDIT HOURS: 4 (includes laboratory)

COURSE LEVEL: Graduate

CURRICULAR EFFECT: Elective

PREREQUISITES: Organic Chemistry II, Physical Chemistry I, Synthesis of Polymers (New course), Permission of the Instructor

SUGGESTED TIME AND SCALE OF IMPLEMENTATION: First offering in the Fall term of 1991

ADEQUACY OF PRESENT STAFF, RESOURCES, LIBRARY HOLDINGS, SPACE AND EQUIPMENT: Faculty, resources and space are adequate. Library holdings are improving in this subfield of chemistry. Equipment is adequate although additional instrumentation is being sought.

The course topics are primarily in the area of organic chemistry. Supporting topics are in the subfield of physical or analytical chemistry. These are the areas of specialization of the sponsors and proposed instructors.

Resources needed include readily available chemicals and glassware. Other general equipment is on hand. Special instrumentation has been purchased for this course over the last four years.

The laboratory component will be housed in the recently renovated lab space available on the third floor of Bosshart. This space can safely house twelve students. Additional lab space is available if needed.

Many of the books purchased in the past three years by the library for the department have been in the field of polymer chemistry.

SHORT TERM EVALUATIONS

This course has not been offered under the short-term process but we have offered another similar course entitled "Introduction to Polymer Chemistry." Last year this course was offered with a laboratory section for the first time by offering a special section of our Seminar II course. Ten students enrolled. In the Fall term of 1987 we offered the "Introduction to Polymer Chemistry" without the lab and thirteen were enrolled. The students in each were laudatory of the course. They performed above the national average on the American Chemical Society Standardized Test for Polymer Chemistry.

RATIONALE

The BS in Chemistry offered by the Department of Physical Sciences is accredited by the American Chemical Society (ACS). Polymer chemistry is one of the three advanced topics recommended by the ACS. It has been estimated by several organizations including the ACS that one-third to one-half of all chemists eventually work in polymer chemistry. Recently the Polymer Chemistry Division Curriculum Task Force and the ACS Education Committee recommended a preliminary topics list for offerings in this field to receive a concentration designation within the regular BS Degree program. We are interested in following these guidelines closely in our own offerings.

We view this course as part of our total offerings in the polymer chemistry area. A second, companion course entitled "Synthesis of Polymers" is being simultaneously proposed and it is a prerequisite to this course.

ESSENCE OF THE COURSE

a. Objectives

Students taking this course will be able to:

- 1) discuss the generalized methods for the characterization of common polymers.
- 2) discuss the theoretical considerations of common characterization techniques.
- 3) read past and current polymer chemistry articles and monographs with understanding and correct analysis of the data contained therein.
- 4) perform common characterization procedures for polymers.
- 5) make a positive contribution when employed as a polymer chemist.
- 6) carry out independent research.

b. Topical outline

The following outline summarizes the course contents in the discussion portion of the course.

- I. Introduction: Physical aspects of chains and averages of polymers
 - A. Molecular size and shape
 - B. Fractionation
 - C. Molecular weight and characterization methods
 - D. Major polymer characterization techniques
- II. Polymer solutions
 - A. Solubility and solubility parameters
 - B. Thermodynamics
 - C. Diffusion

- D. Polymer-polymer miscibility
- III. Bulk properties
 - A. Amorphous/crystalline phases
 - B. Destructive and nondestructive characterization methods
 - C. Fracture behavior
 - D. Thermal transition
 - E. Surface and frictional properties
- IV. The glass-rubber transition
 - A. five regions of viscoelasticity
 - B. Theories of glass transition
 - C. Measurement of glass transition temperature
 - D. Dynamic mechanical behavior
- V. Rubber elasticity
 - A. Thermodynamic equation of state
 - B. Statistical thermodynamics of rubber elasticity
 - C. Internal energy effects
- VI. Rheology
 - A. Chain diffusion
 - B. Viscoelastic behavior
 - C. Deformation and stress-strain properties of solids
 - D. Melt-rheology
 - E. Creep and stress relaxation
- VII. Polymer processing
 - A. Major conversion techniques
 - B. Effect of processing variables
- VIII. Measurable properties of polymeric articles

The laboratory portion of this course will vary some from year to year as we try out new experiments. There is no lack of lab texts nor experiments to select from. Typical examples of the possible experiments are as follows.

- 1) Identification of polymers by infrared spectroscopy
- 2) Dilute solution viscometry
- 3) Molecular weight determination by gel permeation chromatography
- 4) Thermal analysis
- 5) Polymer fractionation
- 6) Polymer tacticity by NMR analysis
- 7) X-ray diffraction by polymers
- 8) Swelling of network polymers

c. Evaluation and grading procedures

Three major exams will be administered during the semester. The third test, the final exam, will be the ACS Standardized Test for Polymer Chemistry. Weekly problem sets will be required. Each student will be required to read, summarize and analyze two articles from the polymer literature. The summaries and analyses will be

distributed to the entire class. Each student will prepare a term paper on a topic of mutual interest to the instructor and student and present the topic to the class. The exams will be worth 40% of the total grade. The problem sets will constitute 15%, the summaries and analyses will be worth 10% and the term paper/presentation will be worth 10%. The lab will be worth 25% of the total.

d. Course evaluation

Student evaluations will be performed at each offering of this course. The content of the course will automatically undergo scrutiny by the American Chemical Society when our program undergoes its annual review. An extensive review of the program's content undergoes an in-depth review by the ACS every five years as well.

In addition, we have in place a Learning Outcomes Assessment Plan approved by the College. This course will be part of that review process. Objective five above will be evaluated by this Assessment Plan.

RESULTS OF CONSULTATION

This course is an upper level course with four semesters of chemistry prerequisites. It is expected that only physical science and chemistry majors will enroll. Therefore no other department has been consulted.

ADDITIONAL INFORMATION

Because of the importance of this topic in industry there are numerous texts that might be used for the discussion and for the lab portion of this course. The following is a partial list of such texts.

Discussion texts

1) Allcock, Harry R., and Lampe, Frederick W., "Contemporary Polymer Chemistry," 2nd edition, Prentice Hall, Englewood Cliffs, NJ, 1990.

2) Billmeyer, Fred W., Jr., "Textbook of Polymer Chemistry," 3rd edition, New York, NY, 1984.

Laboratory texts

1) Pierce, Eli M., Wright, Carl E. and Bordoloi, Binoy K., "Laboratory Experiments in Polymer Synthesis and Characterization," Educational Module for Materials Science and Engineering Project, University Park, PA, 1982.

2) Collins, Edward A., Bares, Jan, and Billmeyer, Fred W. Jr., "Experiments in Polymer Science," Wiley-Interscience, New York, 1973.

CATALOG DESCRIPTION FOR CHARACTERIZATION OF POLYMERS

(Prerequisites: Organic Chemistry II, Physical Chemistry I, Polymer Synthesis, Permission of the Instructor)

This course provides an in-depth study of the procedures, techniques and theoretical aspects of polymer characterization. Major topics include molecular weight determinations, polymer solutions, viscoelasticity and bulk properties. The laboratory experiments will provide exposure to representative procedures and techniques with emphasis on molecular weight determination and thermal methods.