



**RUTGERS**  
UNIVERSITY

Professor Richard Lehman  
Department of Materials Science and Engineering  
rlehman@rutgers.edu

# Glass Engineering

## 14:635:312

---

<b>Class Location &amp; Time</b>	SEC-203, M2, TH2 10:20 – 11:40
<b>Office hours:</b>	Thursday 8:30–9:30 am and by appointment.
<b>Required text:</b>	Notebook, available in class.
<b>Grade Basis</b>	Each hourly exam = 25% Final exam = 35 Homework, class, quizzes, other = 15
<b>Final Examination Date</b>	Friday May 8, 8:00 am, SEC-203
<b>Course Website</b>	<a href="http://www.rci.rutgers.edu/~glasseng">http://www.rci.rutgers.edu/~glasseng</a>

---

### Bibliography

*Properties of Glass-Forming Melts*, by David Pye (Editor), Innocent Joseph (Editor), Angelo Montenero (Editor), CRC Press (2005).

*Fundamentals of Inorganic Glasses*, Varshneya, Academic Press, 1994 (NY)

*Glass: Nature, Structure and Properties*, Scholze, Springer, 1991 (New York)

*Commercial Glasses*, ed Boyd and MacDowell, Am Ceramic Society, 1986 (Columbus)

*Glass Engineering Handbook*, 3rd ed, McLellan and Shand, McGraw-Hill, 1984 (NY)

*Handbook of Glass Manufacture*, 3rd Ed, Vol I and Vol II, Tooley, Ashlee Publishing Co, 1984 (New York)

*Properties and Applications of Glass*, Rawson, Elsevier, 1980 (New York)

*Glass Making Today*, ed Doyle, Portcullis Press, 1979 (Redhill, UK)

*Introduction To Ceramics (IC)*, 2nd ed, Kingery, Bowen, and Uhlmann, Wiley, 1976 (New York)

*Properties Of Glass*, Morey, Reinhold, 1954 (New York)

# Course Outline

---

Title	Description
Overview	What Is Glass, The Glass Transition, Range of Compositions, Products and Processes, Applications and Markets.
Viscosity and Crystallization	The Viscous Flow Process, Viscosity Temperature Relationships, Viscosity Benchmarks, Crystallization Rates, Liquidus Behavior
Compositions and Raw Materials	Silica and Silicate Glasses, Borate and Borosilicates, Compositions For Flat, Container, Fiber, and Specialty Glasses.
Batch Mixing and Melting	Raw Materials and Mixing Methods, Batch Wetting and Compaction Techniques, Batch, Segregation Issues, Furnaces and Furnace Charging.
Glass Furnaces and Melting I	Glass Furnace geometry, batch charging and convective flows in melters, controlling glass flow, refining processes, oxy-fuel technology.
Glass Furnaces and Melting II	Glass Batch Melting Reactions and Principles. Sulfate Refining Systems, Other Refining Agents. Specialized Melting Processes
Glass Furnaces and Melting III	General Glass Furnace Operation, Refractories, forehearth design and operation, environmental issues.
Glass Containers	Forming Processes: Press and Blow, IS Machines, Molds, and Container Design. Surface Treatments and Chemical Durability
Flat Glass Forming Processes	Manufacturing Methods: Past and Present, Sheet, Plate, Rolled, with an emphasis on Float.
Flat Glass Fabrication	Fabrication Processes: Chemical and Heat Strengthening, Tempering, Laminating, Insulating. Architectural and Automotive Products.
Annealing Processes	Thermal processes to relieve strain in glass; the effect of annealing on properties; glass relaxation processes.
Tempering of Glass, Stress Measurement	Imparting strain in glass to strengthen. Heat-treated glass, tempered glass, principles and practice. Strain measuring techniques.
Fiber Glass Manufacture	Insulation Process, Textile Fibers, Micro Fibers, Secondary Forming, Products and Applications
Chemical Durability	The chemical durability of glass in various environments, weathering.

---