1. Introduction to Machining Processes
   History of Casting
   Development of Foundry Technology in the United States
   Casting Advantages, Applications, and Market Size

2. Principles of Liquid Metal Processing
   Introduction to Principles of Liquid Metal Processing
   Principles of Physical Chemistry
   Thermodynamic Properties of Aluminum-Base and Copper-Base Alloys
   Thermodynamic Properties of Iron-Base Alloys
   Composition Control
   Gases in Metals
   Inclusion-Forming Reactions

3. Principles of Solidification
   Nucleation Kinetics
   Basic Concepts in Crystal Growth and Solidification
   Solidification of Single-Phase Alloys
   Solidification of Eutectics
   Solidification of Peritectics
   Columnar to Equiaxed Transition
   Microsegregation and Macrosegregation
   Behavior of Insoluble Particles at the Solid/Liquid Interface
   Low-Gravity Effects During Solidification
   Solidification of Eutectic Alloys: Aluminum-Silicon Alloys
   Solidification of Eutectic Alloys: Cast Iron
   Interpretation and Use of Cooling Curves (Thermal Analysis)

4. Patterns
   Patterns and Patternmaking

5. Molding and Casting Processes
   Classification of Processes and Flow Chart of Foundry Operations
   Aggregate Molding Materials
   Bonds Formed in Molding Aggregates
Resin Binder Processes
Sand Molding
Coremaking
Plaster Molding
Ceramic Molding
Investment Casting
Replicast Process
Rammed Graphite Molds
Permanent Mold Casting
Die Casting
Centrifugal Casting
Continuous Casting
Counter-Gravity Low-Pressure Casting
Directional and Monocrystal Solidification
Squeeze Casting
Semisolid Metal Casting and Forging

6. Foundry Equipment and Processing
   Sand Processing
   Melting Furnaces: Electric Arc Furnaces
   Melting Furnaces: Induction Furnaces
   Melting Furnaces: Reverberatory Furnaces and Crucible Furnaces
   Melting Furnaces: Cupolas
   Vacuum Melting and Remelting Processes
   Degassing Processes (Converter Metallurgy)
   Degassing Processes (Ladle Metallurgy)
   Nonferrous Molten Metal Processes
   Automatic Pouring Systems
   Shakeout and Core Knockout
   Blast Cleaning of Castings
   Welding of Cast Irons and Steels
   Hot Isostatic Pressing of Castings

   Testing and Inspection of Casting Defects
   Coating of Castings
   Foundry Automation

7. Design Considerations
   Riser Design
   Gating Design
Casting Design
Dimensional Tolerances and Allowances

8. **Ferrous Casting Alloys**
   - Classification of Ferrous Casting Alloys
     - Gray Iron
     - Ductile Iron
     - Compacted Graphite Irons
     - High-Alloy White Irons
     - Malleable Iron
     - High-Alloy Graphitic Irons
     - Plain Carbon Steels
     - Low-Alloy Steels
     - High-Alloy Steels
     - Cast Alnico Alloys

9. **Nonferrous Casting Alloys**
   - Aluminum and Aluminum Alloys
   - Copper and Copper Alloys
   - Zinc and Zinc Alloys
   - Magnesium and Magnesium Alloys
   - Cobalt-Base Alloys
   - Nickel and Nickel Alloys
   - Titanium and Titanium Alloys
   - Zirconium and Zirconium Alloys
   - Cast Metal-Matrix Composites

10. **Computer Applications in Metal Casting**
    - Introduction to Computer Applications in Metal Casting
    - Modeling of Solidification Heat Transfer
    - Modeling of Fluid Flow
    - Modeling of Combined Fluid Flow and Heat/Mass Transfer
    - Modeling of Microstructural Evolution