# Processing of non metals - Web course

## COURSE OUTLINE

The main objective of the course is to impart an understanding of the manufacturing science and engineering of non-metals which is usually not covered at theUG level. The course deals with the study of the basic nature of different non-metals and the manufacturing processes associated thereof. The various non-metals covered in the course include glasses, ceramics, plastics and different types of composite materials.

**Contents:** Introduction; classification of engineering materials and processing techniques, various types of non-metals, basic nature of non-metals, properties of various non-metals, challenges in processing of non-metals, glass forming, heat treating glass; classification of ceramics, structure and properties, synthesis of ceramic powders, processing of ceramic products, ceramic coatings.

Classification of plastics, processing – injection/rotational/blow molding, extrusion, thermoforming, rapid prototyping; classification of composite materials, polymer matrix composites, processing – hand layup, filament winding, pultrusion etc., processing of ceramic matrix composites, Secondary processing of composite materials.

## COURSE DETAIL

| Sl. No | Topic | Hours |
|---|---|---|
| 1. | Introduction: Classification of engineering materials and processing techniques, structure and properties of non-metals. | 2 |
| 2. | Glass structure and properties, glass melting and forming, glass annealing. | 3 |
| 3. | Classification of ceramics: crystal structures and properties, ceramic | 7 |

NP-TEL

NPTEL

**http://nptel.ac.in**

Mechanical Engineering

**Pre-requisites:**

- Understanding of the basic concepts of science and engineering of materials and basic manufacturing techniques
- UG course on Basic Manufacturing Processes

**Additional Reading:**

- Handbook of Composites: S.T. Peters

**Coordinators:**

**Dr. Inderdeep Singh**
Department of Mechanical and Industrial EngineeringIIT Roorkee

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| | powder preparation, Synthesis of ceramic powders, fabrication of ceramic products from powders: pressing, casting, vapour phase techniques, sintering, finishing, machining. ceramic coatings. | |
| 4. | Structure and mechanical properties of plastics, thermoplastics and thermosets, Processing of Plastics: Extrusion. Injection moulding. Thermoforming. Compression moulding. Transfer moulding. General behavior of polymer melts, Machining of plastics. | 7 |
| 5. | Classification of composite materials, properties of composites, processing methods of polymeric matrix composites: hand lay-up, autoclaving, filament winding, pultrusion, compression molding, pre-pegging, sheet molding compounds etc., process capability and application areas of various techniques. | 10 |
| 6. | Ceramic matrix composites, mechanical properties of ceramic matrix composites, different processing techniques for ceramic matrix composites, process capability and applications of various techniques. | 6 |
| 7. | Secondary processing of composite materials, Need of secondary operations, different type of secondary operations, machining and drilling of non-metals, machining induced damage, different methods of reducing the damage on account of secondary processing. | 5 |

**References:**


1. Manufacturing Processes for Engineering Materials : S. Kalpakjian, 3rd edition Addison - Wesley, 1997
2. Plastic Materials and Processing : A. Brent Strong, Prentice Hall, ISBN 0-13-021626-7
3. Composite Materials: Engineering and Science: F.L. Mathews and R.D. Rawlings, CRC press, 084930251X