

**OBJECTIVE**

To enable the students to have a complete knowledge on the steps involved in the processing of ceramic raw materials and the equipments used for those processes.

**OUTCOME**

On completion of the course the students are expected to

- Have a thorough knowledge on the quarrying of different plastic and non-plastic raw materials.
- Have a better understanding on the different equipments used for size reduction of raw materials and the laws involved in size reduction.
- Have a clear understanding on the mechanical separation operations like screening, filtration, sedimentary separation and magnetic separation.
- Have studied the principle and working of various equipments used for mixing, conveying and storage of ceramic raw materials.
- Have a clear knowledge on methods for characterizing the ceramic powder for its shape and size.

**UNIT I QUARRYING**

Winning of clays, quarrying of non plastic materials, transportation. Clay purification methods – wet and dry methods. Weathering of clay. Beneficiation of non plastic materials.

**UNIT II SIZE REDUCTION**

Laws of size reduction, mechanism of size reduction. Different crushers and grinders – jaw crusher, gyratory crusher, hammer mill, different types of tumbling mill, jet mill, attrition mill, vibro energy mill – principle of working. Closed circuit and open circuit grinding.

**UNIT III MECHANICAL SEPARATION**

Introduction, types. Screening – dry and wet screening, equipments, effectiveness of screen, test sieves-ASTM, BSS, BIS, IS. Filtration – theory of filtration, batch and continuous filters, principles of cake filtration. Separation based on movement through a fluid – sedimentation, cyclone separation, air classification. Magnetic separation.

**UNIT IV MIXING**

Mixing – mechanism of mixing, types of mixers – batch and continuous mixers – pan mixer, shaft mixer, U mixer, muller mixer and other mixers, liquid mixers – mechanism, blungers, agitators.

## **UNIT V CONVEYING AND STORAGE OF MATERIALS**

Conveying – solid conveying-types of conveyors, criteria for selecting a conveyor; liquid conveying-condition for liquid conveying, different types of pumps. Storage methods of different ceramic powders. Problems in bin storage

### **TEXT BOOKS**

1. Warren L.McCabe, Julian C.Smith and Peter Harriott, Unit Operations of Chemical Engineering, 7<sup>th</sup> Edn., McGraw Hill International Edition, 2005.
2. Charles Burroughs Gill, Materials Beneficiation, Springer Verlag, 1991.

### **REFERENCES**

1. Ryan W and Redford C, Whitewares: Production, Testing and Quality Control, Pergamon Press, NY, 1987.
2. Vincenzini P, Fundamentals of Ceramic Engineering, Elsevier Applied Science, London,1991.
3. Paul De Garmo E, Black J.J and Ronald A.Kohser, Materials and Processes in Keishi Gotoh, Powder Technology Handbook, Marcel Dekker Inc., 1997.
4. F. Singer and S. Singer, Industrial Ceramics, Oxford and IBH Publishing Co., 1991.
5. Mohamed N.Rahaman, Ceramic Processing, Taylor & Francis, 2007.Manufacturing, 8<sup>th</sup> Edn., Prentice-Hall India Pvt. Ltd., New Delhi, 1997.
6. Tooley F.V, Handbook of Glass Manufacture, Vol I&II, Ogden Publishing Co., NY, 1960.