

4.1 CERAMIC MACHINERIES

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3 - 2

RATIONALE

A thorough knowledge of the important machineries used in the ceramic industries enable the students to carry out various processes efficiently, hence this subject is very essential.

DETAILED CONTENTS

THEORY

1. Crushing & Grinding: (10 hrs.)
Introduction, Double and single toggle jaw crushers, Gyratory crushers, Crushing rolls and hammer mills, edge runner etc. pan grinding, ring roll mills, ball mills, pot mills, pebble mill, rod and tube mills, cylindrical ball mill, conical mills, ball tube mills and their parts, quantity of balls, size of balls.
2. Blunging, Sieve & Screening Machines: (11 hrs.)
Blunger, wet classifiers, Air separators, magnet separators, vibrating sieve, Electromagnetic separator, slip lifting pumps, Mixing Agitators, Diaphragm pump, Filter press, Vacuum filter, Centrifugal De-watering. Heated Drums, dryers, De-airing single and double arc plug mills and plugging equipments.
2. Shaping Machine: (11 hrs.)
Potters wheel, shell wheel, jigger & jolly, Batting machine, Semi and fully automatic jiggers, Roller machines, Extrusion wire cutting machines, Pressing machines, Hydraulically operated sanitary pipe machines. Turning machine, Scalloping machines, Dry and Dust pressing machines, Tempering machines, Hot pressing and sintering machines, Toggle Brick making press and their parts. Tiles press machines and work schedules.
4. Dryers: (8 hrs.)
Unheated Dryers, Heated Dryers, Batch Dryers, Chamber and Corridor dryers. Humidity dryers, Continuous dryers, Dobbins or potters stove, Tunnel dryers.
3. Handling Of Solids: (8 hrs.)
Portable power driven machines, permanent installations, flight conveyors, belt conveyors, screw conveyors, conveying through pipes, slurry pumps.

LIST OF PRACTICALS

1. To grind a given sample by a ball mill process.
2. To study the operation of crusher
3. To study the operation of magnetic separator
4. To filter the slip through filter press.
5. To study the operation of jiggering and jollying machine.
6. To study the operation of pressing machine (Hydraulic or Toggle press)

RECOMMENDED BOOKS

1. Industrial Ceramic by Singer & Singer, IBH Publisher.
2. A Concise Introduction to Ceramics by George C. Phillips, Amazon Publication
3. Ceramics, Mastering the Craft by Richard Zakin, American Ceramic Society Publication, 1990

4.2 COMPUTER APPLICATION IN CERAMIC INDUSTRY

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RATIONALE

In today's environment almost all the processes in ceramic industry are computerized. In order to prepare diploma holders to work in this environment, this subject has been kept as a care subject. This subject will ensure the students to have proficiency in handling different types of software used in ceramic industries.

DETAILED CONTENTS

1. Introduction:

Introduction to computers and its various parts, CPU, peripheral devices (Input devices: mouse, key board, joystick, touchpad, trackball, light pen etc. Out put devices: printers, monitors, speakers).

2. Hardware and software: "Application software" and "System software".

3. Introduction to various computer generations (I & V generations) and their developments: languages: machine language, Assembly language, high level languages.

Types of computers: Personal Computers, Mini Computers, Micro Computer, Mainframe and Super Computers, Based on the data handled: Digital, Analog and Mixed Computers.

4. Application Software like: MS-Word, MS-Excel and MS-Power point.

4. Auto CAD:

Starting up, practice on-how to create a new drawing file, setting drawing limits and saving a file, drawing lines in different ways using absolute co-ordinates, user co-ordinates, WCS, UCS, drawing lines, circles, arcs, ellipses, polygons, sp lines, polylines, zoom commands.

Practice on Edit commands such as erase, copy, mirror, array, offset, rotate, loops, undo, redo, scale, stretch, trim, break, extend, chamfer, fillet.

Practice on text commands single line text, paragraph text, editing text, text size, text styles, changing properties commands.

Practice on making complete drawings of components by doing exercise. Practice on print/plot commands, Export/Import commands.

REFERENCE BOOKS:-

1. Introduction to computers by A.Leon and Leon
2. Alogrithru and Data structure programme by wirth, PHI Publication
3. The art of computer Programming by Kruth, Addison Wesley Publication.
4. AutoCAD by R.W. Kigh, Galcotia, New Delhi Publication
5. Engineering Drawing with AUTOCAD 2000 by T. Jaypooran, Vikas Publishing House.

4.3 CERAMIC WHITEWARE TECHNOLOGY-I

L T P
3 - 6

RATIONALE

In this specialized subject an whiteware technology inputs are provided to the students about raw materials, processes, fabrication, drying and firing techniques.

DETAILED CONTENTS

1. Introduction to raw materials: (12 hrs.)
Naturally occurring raw materials-Clay, Quartz, Napthelene cyanide, Talc, Sillimanite, Kyanite, Andalusite, Zircon, Bone-ash, Gypsum, Plaster of Paris, Synthetically prepared materials-Alumina, Zirconia, Beryllia.
2. Processes:- (8 hrs.)
Crushing and grinding, mixing, agitating, magnetising, sieving, pumping, filtrating, plugging and batting
3. Fabrication or Shaping Methods: (12 hrs.)
Detailed study of slip casting, pressure fabrication, hot pressing, plastic forming, dry pressing, isostatic pressing, jiggering & jollying, extrusion, injection moulding, throwing, finishing operation; sponging, smoothing, fitting, jointing or stickup.
Theoretical concept about slip casting, zeta potential, double layer formation, role of electrolytes, deflocculants.
4. Drying: (8 hrs.)
Removal of water, factors affecting drying, types of driers-batch & continuous driers, hot flow, steams pipes, chamber driers & tunnel driers etc., defects in drying.
5. Firing:- (8 hrs.)
Effect of heat on clay & other materials, effect of heat on ceramic bodies, firing of bone-china bodies, different types of firing kilns.

LIST OF PRACTICALS

1. Study of effect of electrolytes on different clays.

2. Determination of dry content by pint weight method.
3. Preparation of good casting slip with a body suitable for making (a) Majolica (b) Earthenware (c) Stoneware
4. Study of heating & cooling schedule.
5. Determination of drying shrinkage of clay body.
6. Determination of firing shrinkage of clay body.
7. Determination of Water of Plasticity of clay.
8. Determination of loss on Ignition.
9. Determination of fineness of various raw materials used for whiteware bodies.
10. Determination of water absorption.
11. Determination of Specific gravity of suitable solution.
12. Making of a cup by casting method.
13. Making of plate by Jiggering method.
14. Study of defects in drying process in dry oven.

RECOMMENDED BOOKS

1. Ceramic white wares by Sudhir Sen
2. Industrial Ceramics by Singer & Singer, Khanna Publishers, New Delhi
3. Handbook of Ceramics, Prentice Hall of India Publication

4.4 CERAMIC REFRACTORY TECHNOLOGY-I

L T P
3 - 6

RATIONALE

In this specialised subject on refractory technology, a thorough knowledge of classification and testing of refractories is provided along with manufacturing techniques of important refractories. Phase diagrams are also dealt in this subject.

DETAILED CONTENTS

THEORY

1. Definition and classification of refractories, (8 hrs.)
(Acid, basic and Neutral) with examples. Properties of materials factors affecting the selection of raw material occurrence of raw material and manufacturing units in India.
2. Testing of refractories (16 hrs.)
 - Refractoriness
 - Refractoriness under load
 - Expansion characteristics
 - Spalling/thremal chock resistance
 - Permeability
 - Porosity
 - Density
 - Compressive and tensile strength
 - Thermal conductivity
 - Cold crushing strength
 - Slag resistance
 - Permanent linear change
3. Manufacture of Alumina , refractory, Silica, refractory, Magnesite, semi-silica refractory, Fire Clay refractory, Carbon refractory and Graphite refractory, Chromite refractory, Chrome-Magnesium refractory, Magnesium-Chrome refractory, Dolomite refractories, Fusion-cast refractories. Their properties and uses, mullite, sillimanite refracotry (20 hrs.)
3. Phase diagrams with respect to the raw materials, Controlling and Firing temp. and schedule ($Al_2O_3-SiO_2, MgO-SiO_2$). (4 hrs.)

LIST OF PRACTICALS

1. Specific gravity determination of refractory materials.
2. Porosity determination of moulded materials.
3. Compaction of the refractory materials.
4. Refractoriness determination (pyrometric cone equivalent) of different bricks
5. Size distribution studies of given materials obtained after filtration
6. Green & sinter density determination of ceramic sample.
7. Study of density variance with pressure.
8. Determination of Permanent linear change of different bricks.
9. Determination of Modules of rupture of different bricks.
10. Determination of Cold crushing strength of different bricks.
11. Determination of Hydraulic strength of different bricks.
12. Determination of Effects of coarse medium & fine grog on clay.

RECOMMENDED BOOKS

1. Refractory by Nandi, New Age Publication
2. Refractory by Mishra, Tata McGraw Hill Publishers, New Delhi
3. Introduction to Ceramics by W.D. Kingery, Prentice Hall of India Publication

4.5 GLASS TECHNOLOGY-I

L T P
3 - 6

RATIONALE

In this specialized subject on glass technology, starting from fundamental concepts, characteristics, composition and properties, furnaces for glass making are also discussed in detail for making the students competent in this technology area.

THEORY

1. Origin of glass, Fundamental concept of glassy state, Definition of glass, Raw materials, Component of glass, glass making oxides like acidic oxide, basic oxide, intermediate oxide, properties and its function. (8 hrs.)
2. Chemical and physical characteristics of glass, Principle of glass making, Batch material, Their storage, Mixing and conveying, Factors influencing choice of batch materials, Cullets. (8 hrs.)
4. Chemical composition of different types of glass, Calculation of batch from glass composition and vice-versa. Empirical formulae, phase equilibrium studies. (8 hrs.)
5. Furnaces for glass making-Batch and continuous type, Glass tank furnace, Tank and pot type furnace, Regenerators and recuperators, flue system, chimney draft, melting batch charging, tank temperature, control of furnace temperature floaters. (14 hrs.)
5. Properties of glass- Density, Thermal expansion, Viscosity, Surface tension, Optical properties, moisture content, Elastic module, poisson's ratio, impact strength, Hardness Brittleness, Bending test. (10 hrs.)

LIST OF PRACTICALS

1. Processing of raw materials: Preparation of sand from quartz, calculation of quartz.
2. Purification of sand, its sieve analysis, its moisture estimation & removal of iron from sand.
3. Batch formulation.

4. Mixing & melting of batch ingredients.
5. Drawing rods from molten glass.
6. Production of various colored glasses by melting such as cobalt blue, copper blue, purple with Manganese.
7. Determination of density of glasses.
8. Determination of specific gravity of glasses
9. Determination of chemical durability of glasses.
10. Preparation of soda lime, silica glass & water glass.

RECOMMENDED BOOKS

1. Modern glass practice by S.G. Scholse, McGraw Hill Publishing.
2. Handbook of glass manufacturing by F.V. Tooley, Prentice Hall of India Publication