

**Scheme of Teaching and Examination for IV Semester DIPLOMA in CHEMICAL  
ENGINEERING(CERAMICS) ENGINEERING  
THEORY**

Sl. No.	SUBJECTS	SUBJECT CODE	TEACHING SCHEME		EXAMINATION SCHEME					
			Periods per Week	Periods in one Session	Hours of Exam.	Terminal Exam. (A) Marks	Final Exam. (B) Marks	Total Marks (A+B)	Pass Marks Final Exam.	Pass Marks in the Subject
1	Geology for Ceramic Engineering	30401	5	60	3	20	80	100	26	36
2	Chemistry for Ceramic Engineering	30402	4	50	3	20	80	100	26	36
3	Chemical Engineering	30403	4	50	3	20	80	100	26	36
4	Pottery & Porcelain Technology-I	30404	4	50	3	20	80	100	26	36
5	Refractory Technology-I	30405	4	50	3	20	80	100	26	36
Total :-			21					500		

**PRACTICAL**

Sl. No.	SUBJECTS	SUBJECT CODE	TEACHING SCHEME		EXAMINATION SCHEME					
			Periods per Week	Periods in one Session	Hours of Exam.	Marks Internal Exam. (A)	Marks External Exam. (B)	Total Marks (A+B)	Pass Marks Final Exam.	Pass Marks in the Subject
6	Workshop Practice	25406	9	120	6	10	40	50	16	21
7	Workshop Practice-II (Pottery & Refractory)	30407	6	60	6	10	40	50	16	21
8	Geology	30408	6	60	3	10	40	50	16	21
Total :-			21					150		

**SESSIONAL**

Sl. No.	SUBJECTS	SUBJECT CODE	TEACHING SCHEME		EXAMINATION SCHEME			
			Periods per Week	Periods in One Session	Marks of Internal Examiner (X)	Marks of External Examiner (Y)	Total Marks (X+Y)	Pass Marks in the Subject
9	Workshop Practice	25408	-	-	20	30	50	25
10	Ceramic Engineering Workshop Practice-II (Pottery & Refractory)	30410	-	-	20	30	50	25
Total :-							100	

<b>Total Periods per Week</b>	<b>42</b>	<b>Total Marks</b>	<b>750</b>
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## GEOLOGY FOR CERAMICS ENGINEERING

<b>Subject Code</b> <b>30401</b>	<b>Theory</b>			<b>No of Period in one session : 60</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>80</b>
	<b>05</b>	<b>-</b>	<b>-</b>	<b>Internal Exam.</b>	<b>:</b>	<b>20</b>

**S.No. Topics**

- 01 Introduction
- 02 General Idea of Rocks and Minerals
- 03 Physical Properties
- 04 Economic Geology with reference to Ceramic
- 05 Optical Mineralogy

**CONTENTS:**

**TOPIC: 01 – INTRODUCTION:**

Introduction of Geology, Utility of geology in Ceramic Industries, Branches of Geology, Brief knowledge of origin and age of earth.

**TOPIC: 02 – GENERAL IDEA OF ROCKS AND MATERIALS:**

Rocks - Definition, Classification of rocks, Characteristics of rocks.  
Minerals – Definition, Classification of Minerals, Crystal systems.

**TOPIC: 03 – PHYSICAL PROPERTIES:**

Physical properties of minerals used in ceramic industries such as Kaolin, Fireclay, Ball clay, Felspar, Talc, Sillimanite, Kyanite, Andalusite, Bauxite, Topaz, Garnet, Calcium Carbonate, Magnesite, Dolomite, Olivine, Zircon, Mica, Silica, Steatite.

**TOPIC: 04 – ECONOMIC GEOLOGY WITH REFERENCE TO CERAMIC:**

Economic use of ceramic raw materials such as Clay, Silica, Felspar, Talc, Limestone, Dolomite, Gypsum, Magnesite, Chromite, Bauxite, Sillimanite, Kyanite and Andalusite, Zircon, Mica, Calcite, Pyrophyllite.

**TOPIC: 05 – OPTICAL MINERALOGY:**

Introduction, Petrological Microscope, Properties of Light, Refraction, Double Refraction, Polarised light, Observation of minerals, Procedure for the identification of minerals in section.

**Books Recommended:**

- |                                     |                             |
|-------------------------------------|-----------------------------|
| 1. Introduction of Physical Geology | - A.K. Datta                |
| 2. Optical Mineralogy               | - A.F. Rogers and P.F. Kerr |

# CHEMISTRY FOR CERAMICS ENGINEERING

<b>Subject Code</b> <b>30402</b>	<b>Theory</b>			<b>No of Period in one session : 50</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>80</b>
	<b>04</b>	<b>-</b>	<b>-</b>	<b>Internal Exam.</b>	<b>:</b>	<b>20</b>

## S.No. Topics

- 01 Physical Chemistry
- 02 Preparation, Properties and uses of the compounds used in Ceramic Industry

## CONTENTS:

### TOPIC: 01 – PHYSICAL CHEMISTRY:

Elementary knowledge of phase rule – phase, component, degree of freedom, one component system, two component system,  $\text{SO}_2\text{-Al}_2\text{O}_3$  system, elementary knowledge of pH Value  
Preliminary idea of law of mass action, viscosity and surface tension

### TOPIC: 02 – PREPARATION, PROPERTIES AND USES OF THE COMPOUNDS USED IN CERAMICS INDUSTRY:

Preparation, Properties and uses of the following compounds used in ceramic industry:-

Sodium Carbonate, Sodium Silicate, Sodium Sulphate, Barium Carbonate, Calcium Carbonate, Calcium Sulphate, Plaster of Paris and Gypsum Magnese Oxide, Zinc Oxide, Lead Oxides, Antimony Oxide, Chromic Oxide, Tin Oxide, Potassium Chromate and Dichromate, Magnesium Oxide, Selenium Metal, Borax, Copper Sulphate, Cuprous and Cupric Oxide, Alumina, Ferrous and Ferric Oxides, Cobalt Oxide.

## Books Recommended:

- 1. Physical Chemistry - Puri and Sharma
- 2. Physical Chemistry - Bahl and Tuli
- 3. Inorganics Chemistry - Puri and Sharma
- 4. Engineering Chemistry - O.P. Agrawal

# CHEMICAL ENGINEERING

<b>Subject Code</b> <b>30403</b>	<b>Theory</b>			<b>No of Period in one session : 50</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>80</b>
	<b>04</b>	<b>-</b>	<b>-</b>	<b>Internal Exam.</b>	<b>:</b>	<b>20</b>

S.No.	Topics	-
01	Crushing and Grinding	
02	Size Separation	
03	Conveying	
04	Mixing	
05	Filtration	
06	Drying	
07	Heat Transfer	

## CONTENTS:

### TOPIC: 01 – CRUSHING AND GRINDING:

Rettinger's Law of Crushing, Jaw Crusher, Gyratory Crusher, Crushing rolls, Hammer mill, Ball mill, Tube mill.

### TOPIC: 02 – SIZE SEPERATION:

Screens, Grizzlies, Trommels, Shaking Screens, Vibrating Screens.

### TOPIC: 03 – CONVEYING:

Belt conveyors, Screw Conveyor, Elevator, Chain Conveyors.

### TOPIC: 04 – MIXING:

Paddle strirrer, Propeller, Kneader, Dry mixers, Muller mixer.

### TOPIC: 05 – FILTRATION:

Plate and Frame Filter Press, Screen and Leaf Filter Press.

### TOPIC: 06 – DRYING:

Compartmental Dryer, Tunnel Dryer, Rotary Dryer, Drum Dryer.

### TOPIC: 07 – HEAT TRANSFER:

Conduction, Heat flow through composite wall, convection, radiation, double pipe heat exchanger.

## Books Recommended:

- |   |                       |
|---|-----------------------|
| 3. Introduction to Chemical Engineering | - Bedger and Banchemo |
| 4. Unit Operation                       | - Mc Cabe and Smith   |

# POTTERY AND PORCELAIN TECHNOLOGY - I

<b>Subject Code</b> <b>30404</b>	<b>Theory</b>			<b>No of Period in one session : 50</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>80</b>
	<b>04</b>	<b>-</b>	<b>-</b>	<b>Internal Exam.</b>	<b>:</b>	<b>20</b>

S.No.	Topics
01	Introduction and Classification
02	Raw Materials
03	Batch Calculation
04	Plaster of Paris
05	Glazes
06	Manufacturing Process

## CONTENTS:

### TOPIC: 01 – INTRODUCTION AND CLASSIFICATIONS:

Division and brief history, scope and division of: Pottery, Terra Cotta, Earthenware, Stoneware and Porcelainware.

### TOPIC: 02 – RAW MATERIALS:

Geological Formation, occurrence and properties of raw materials such as Clays, Quartz, Felspar, Whittings, Talc, Pyrophyllite, Nepheline, Syenite, Bone Ash, Kyanite and Sillimanite.

### TOPIC: 03 – BATCH CALCULATION:

Batch calculation, batching.

### TOPIC: 04 – PLASTER OF PARIS:

Use of Plaster of Paris in Pottery Industries, Manufacture of Plaster of Paris and Properties.

### TOPIC: 05 – GLAZES:

General idea of glazes, role of glaze on pottery body. Colouring ingredient, application of glaze, firing and defects of glazes.

### TOPIC: 06 – MANUFACTURING PROCESS:

Body preparation such as clay preparation, blunging, ball milling, screening, dewatering of clay slip, casting slip, plastic forming, dry pressing, slip casting, mould making, drying, firing, inspection, packing and despatch.

## Books Recommended:

1 Elements of Ceramics	- F.H. Norton
2 Ceramic Fabrication Process	- W.D. Kingrey
3 Modern Pottery Manufacture	- H.N. Bose

## REFRACTORY TECHNOLOGY - I

<b>Subject Code</b>  <b>30405</b>	<b>Theory</b>			<b>No of Period in one session : 50</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>80</b>
	<b>04</b>	<b>-</b>	<b>-</b>	<b>Internal Exam.</b>	<b>:</b>	<b>20</b>

S.No.	Topics
01	Introduction and Classification
02	Raw Materials
03	Machinery and Equipments used for manufacturing of refractories
04	Kilns and Kilns Furniture
05	Dryer
06	Manufacturing Processes
07	Manufacture
08	Concept of Quality Control

### CONTENTS:

#### TOPIC: 01 – INTRODUCTION AND CLASSIFICATIONS:

Introduction of refractories, classification of refractories such as acid, basic, neutral and special refractories.

#### TOPIC: 02 – RAW MATERIALS:

Refractories raw material such as Fire Clay, Sillimanite, Kyanite, Andalusite, Bauxite, Quartzite, Magnesite, Chronite, Dolomite, Forsterite, Zircon – their properties, uses and occurrences.

#### TOPIC: 03 – MACHINERIES AND EQUIPMENTS USED FOR MANUFACTURING OF REFRACTORIES:

Jaw Crusher, Cone Crusher, Impact Mill, Tube Mill, Jet Mill, Vibrating screen, Magnetic separator, Pug Mill, Counter Current Mixer, Ball Mill, De-airing Pug Mill, Friction – screw press, hydraulic oil press.

#### TOPIC: 04 – KILNS AND KILNS FURNITURE:

Various types of kilns used in Refractory Industries such as Down-draft kiln, Tunnel kiln, Rotary kiln, Shaft kiln.

#### TOPIC: 05 – DRYER:

Tunnel Dryer.

#### TOPIC: 06 – MANUFACTURING PROCESS:

Raw material treatment, moulding, drying, firing.

#### TOPIC: 07 – MANUFACTURE:

Crucible, Glass Pots, Saggars, Furnace blocks, Muffles, Saggar cones.

#### TOPIC: 08 – CONCEPT OF QUALITY CONTROL:

Concept of Quality Control, Introduction of I.S. Codes.

#### Books Recommended:

1 Refractories and Their Manufacture, Properties and Uses	- M.L. Mishra
2 Handbook on Refractories	- D.N. Nandi
3 Refractories	- F.H. Norton
4 Technology of Ceramic and Refractories	- P.P. Budnikov

## WORKSHOP PRACTICE

<b>Subject Code</b> <b>25406</b>	<b>Practical</b>			<b>No of Period in one session : 120</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>40</b>
	-	-	<b>09</b>	<b>Internal Exam.</b>	<b>:</b>	<b>10</b>

### Rationale & Objective:

A Diploma holder technician should get more opportunity to know about machines, equipments & its operations which will help to be more confident & practical.

### S. No. Topics

- A Machine Shop
- B Welding Shop
- C Foundry Shop
- D Fitting Shop

### CONTENTS:

#### TOPIC: A – MACHINE SHOP:

- A.01 Safety precautions, Machine cleaning, checking, making ready for operation. Selection of tools, preparing it in ready condition (tool sharpening)
- A.02 Lathe:
  - Setting of job on three jaw, four jaw check, centering, tool/tools fitting, adjustment of tail stocks (if required).
  - Practice of operations: Turning, facing, taper turning on sample jobs. Job configuration checking.
  - Preparing a job by above processes (Sessional Preparation)
- A.03 Shaper:
  - Study of quick return mechanism.
  - Repair of faults (minor) in machines.
  - Tool setting on Ram.
  - Practice of feed depth of cut, no. of pass on sample job.
  - Preparation of V block on a sample job.
- A.04 Drilling:
  - Checking of drill bit.
  - Making of sample blind hole.
  - Making hole in a tapered job/V block.

#### TOPIC: B – WELDING SHOP:

- B.01 Safety precautions, handling of tools & equipment.
- B.02 Gas welding: Flame adjustment, practical on welding, soldering & brazing on two parts (sample job).
- B.03 Electric welding:
  - (i) Flame adjustment, use of electrodes on jobs (T- shape, L-shape), Coarse & fire welding.
  - (ii) Preparation of chair & grill.

#### TOPIC: C – FOUNDRY SHOP:

(Pattern, Molding & Cutting)

- C.01 Tools, cope, drag. Different types of pattern – introduction & use.
- C.02 Preparation of foundry sand
- C.03 Demonstration & handling of mould (A sample mould should be prepared by teacher/Institute)
- C.04 Preparation of different types of moulds using single piece, spit or any available pattern – at least 3 moulds should be prepared by each student.
- C.05 Taking photographs of different moulds prepared by students
- C.06 Non-Fe Casting of one of the above.

#### TOPIC: D – FITTING SHOP:

- D.01 Tools – Introduction & its use
- D.02 Different processes (Sawing, filing, drilling, tapping, dieing, scraping, reaming etc.)
- D.03 Different types of fitting – Round fitting, Square fitting, Triangular fitting etc.
- D.04 Use of above D. 02 & D.03 on sample jobs, L-shape, T-shape etc.
- D.05 Practical Use of fitting
- D.06 Preparation of threads in pipes using tap & die – sessional preparation.

## WORKSHOP PRACTICE – II (POTTERY AND REFRACTORY)

<b>Subject Code</b> <b>30407</b>	<b>Practical</b>			<b>No of Period in one session : 60</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>40</b>
	<b>-</b>	<b>-</b>	<b>06</b>	<b>Internal Exam.</b>	<b>:</b>	<b>10</b>

### CONTENTS:

#### POTTERY

##### TOPIC: 01

Raw materials preparation

##### TOPIC: 02

Making of slip

##### TOPIC: 03

Making of Plaster of Paris

##### TOPIC: 04

Making of mould

##### TOPIC: 05

- Shaping of Articles:
- Hand Moulding
- Slip Casting

##### TOPIC: 06

Preparation of Frit and Glaze

#### REFRACTORY

##### TOPIC: 01

Processing of Refractory Raw materials

##### TOPIC: 02

- Shaping of Refractory bricks:
- Hand moulding
- Slip casting
- Pressing

##### TOPIC: 03

Making of saggars by hand moulding

##### TOPIC: 04

Making of muffles by hand moulding

##### TOPIC: 05

Drying of Refractory Wares

##### TOPIC: 06

Firing of Refractory wares

# GEOLOGY

<b>Subject Code</b> <b>30408</b>	<b>Practical</b>			<b>No of Period in one session : 60</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>40</b>
	<b>-</b>	<b>-</b>	<b>06</b>	<b>Internal Exam.</b>	<b>:</b>	<b>10</b>

## CONTENTS:

1. Identification of hand specimens such as graphite, Basalt, Sand Stone, Kaoline, Quartz, Felsapar, Calcite, Beryl, Bauxite, Lime Stone, Hematite & Magnesite.
2. Determination of specific gravity of mineral by Steel yard balance of Feldspar, Calcite, Bauxite, Quartz, Lime Stone, Magnesite, Hematite.
3. Study of the Petrological Microscope with respect to:-  
Parts component & their function,  
Working Principle
4. Blow pipe analysis of common minerals such as: - Hematite, Magnesite, Gypsum, Calcite, Beryl etc.

## Books Recommended:

- Introduction of Physical Geology - A. K. Datta  
Optical Mineralogy - A. F. Rogers & P. F. Kerr

## WORKSHOP PRACTICE

<b>Subject Code</b> <b>25408</b>	<b>Sessional</b>			<b>No of Period in one session :</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>30</b>
	-	-	-	<b>Internal Exam.</b>	<b>:</b>	<b>20</b>

### Rationale & Objective:

A Diploma holder technician should get more opportunity to know about machines, equipments & its operations which will help to be more confident & practical.

### S. No. Topics

- A Machine Shop
- B Welding Shop
- C Foundry Shop
- D Fitting Shop

### CONTENTS:

#### TOPIC: A – MACHINE SHOP:

- A.01 Safety precautions, Machine cleaning, checking, making ready for operation. Selection of tools, preparing it in ready condition (tool sharpening)
- A.02 Lathe:  
Setting of job on three jaw, four jaw check, centering, tool/tools fitting, adjustment of tail stocks (if required).  
Practice of operations: Turning, facing, taper turning on sample jobs. Job configuration checking.  
Preparing a job by above processes (Sessional Preparation)
- A.03 Shaper:  
Study of quick return mechanism.  
Repair of faults (minor) in machines.  
Tool setting on Ram.  
Practice of feed depth of cut, no. of pass on sample job.  
Preparation of V block on a sample job.
- A.04 Drilling:  
Checking of drill bit.  
Making of sample blind hole.  
Making hole in a tapered job/V block.

#### TOPIC: B – WELDING SHOP:

- B.01 Safety precautions, handling of tools & equipment.
- B.02 Gas welding: Flame adjustment, practical on welding, soldering & brazing on two parts (sample job).
- B.03 Electric welding:  
(i) Flame adjustment, use of electrodes on jobs (T- shape, L-shape), Coarse & fire welding.  
(ii) Preparation of chair & grill.

#### TOPIC: C – FOUNDRY SHOP:

(Pattern, Molding & Cutting)

- C.01 Tools, cope, drag. Different types of pattern – introduction & use.
- C.02 Preparation of foundry sand
- C.03 Demonstration & handling of mould (A sample mould should be prepared by teacher/Institute)
- C.04 Preparation of different types of moulds using single piece, spit or any available pattern – at least 3 moulds should be prepared by each student.
- C.05 Taking photographs of different moulds prepared by students
- C.06 Non-Fe Casting of one of the above.

#### TOPIC: D – FITTING SHOP:

- D.01 Tools – Introduction & its use
- D.02 Different processes (Sawing, filing, drilling, tapping, dieing, scraping, reaming etc.)
- D.03 Different types of fitting – Round fitting, Square fitting, Triangular fitting etc.
- D.04 Use of above D. 02 & D.03 on sample jobs, L-shape, T-shape etc.
- D.05 Practical Use of fitting
- D.06 Preparation of threads in pipes using tap & die – sessional preparation.

## WORKSHOP PRACTICE – II (POTTERY AND REFRACTORY)

<b>Subject Code</b> <b>30410</b>	<b>Sessional</b>			<b>No of Period in one session :</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Annual Exam.</b>	<b>:</b>	<b>30</b>
	<b>-</b>	<b>-</b>	<b>-</b>	<b>Internal Exam.</b>	<b>:</b>	<b>20</b>

### CONTENTS:

#### **POTTERY**

##### **TOPIC: 01**

Raw materials preparation

##### **TOPIC: 02**

Making of slip

##### **TOPIC: 03**

Making of Plaster of Paris

##### **TOPIC: 04**

Making of mould

##### **TOPIC: 05**

- Shaping of Articles:
- Hand Moulding
- Slip Casting

##### **TOPIC: 06**

Preparation of Frit and Glaze

#### **REFRACTORY**

##### **TOPIC: 01**

Processing of Refractory Raw materials

##### **TOPIC: 02**

- Shaping of Refractory bricks:
- Hand moulding
- Slip casting
- Pressing

##### **TOPIC: 03**

Making of saggars by hand moulding

##### **TOPIC: 04**

Making of muffles by hand moulding

##### **TOPIC: 05**

Drying of Refractory Wares

##### **TOPIC: 06**

Firing of Refractory wares