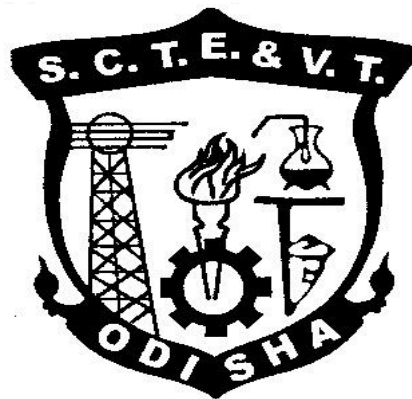


STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 5th SEMESTER (BRANCH NAME- CERAMIC technology) (Wef 2020-21)

Subject Number	Subject Code	Subject	Periods/ week		Evaluation Scheme				
			L	T	P	Internal Assessment/Seasonal	End Sem Exams	Exams (Hours)	Total
Theory									
Th1		Entrepreneurship and Management & Smart Technology	4	-	-	20	80	3	100
Th2		Glass technology	4	-	-	20	80	3	100
Th3		Ceramic WhiteWare	4	-	-	20	80	3	100
Th4		Refractory application in metallurgical industry	4	-	-	20	80	3	100
Th5		Testing of ceramic	4	-	-	20	80	3	100
		Total	20	-	-	100	400	-	500
Practical									
Pr.1		Work Shop-III	-	-	6	50	50	3	100
Pr.2		Ceramic Testing-III	-	-	6	50	50	3	100
Pr.3		Project Phase-I	-	-	4	50	-	-	50
		Student Centred Activities (SCA)	-	-	3	-	-	-	-
		Total	20	-	19	150	100	-	250
		Grand Total	20	-	19	250	500	-	750
Abbreviations: L- Lecturer, T- Tutorial P-Practical. Each class is of minimum 55 minutes duration									
Minimum Pass Mark in each Theory subject is 35% & in each Practical subject is 50 % & in Aggregate Is 40%									
SCA Shall Comprise of Extension Lectures/ Personality Development / Environmental issues/ Quiz /Hobbies/Field visits / Cultural activities /Lil studies / Classes on MOOCS/SWAYAM etc. Seminar and SCA Shall be conducted in asection									
There shall be 1 Internal Assessment done for each of Theory subject. Seasonal Marks shall be total of the performance of individual difference job / experiments in a subject throughout the semester									

CURRICULLUM OF 5TH SEMESTER
For
DIPLOMA IN CERAMIC TECHNOLOGY
(Effective FROM 2020-21 Sessions)



**STATE COUNCIL FOR TECHNICAL
EDUCATION & VOCATIONAL TRAINING,
ODISHA, BHUBANESWAR**

Th1. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY

(Common to All Branches)

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	TOTAL	60

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0

In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.

OBJECTIVES

After undergoing this course, the students will be able to :

- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

DETAILED CONTENTS

1. Entrepreneurship

- Concept /Meaning of Entrepreneurship
- Need of Entrepreneurship
- Characteristics, Qualities and Types of entrepreneur, Functions
- Barriers in entrepreneurship
- Entrepreneurs vrs. Manager

- Forms of Business Ownership: Sole proprietorship, partnership forms and others
- Types of Industries, Concept of Start-ups
- Entrepreneurial support agencies at National, State, District Level(Sources): DIC, NSIC,OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
- Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. **Market Survey and Opportunity Identification (Business Planning)**

- Business Planning
- SSI, Ancillary Units, Tiny Units, Service sector Units
- Time schedule Plan, Agencies to be contacted for Project Implementation
- Assessment of Demand and supply and Potential areas of Growth
- Identifying Business Opportunity
- Final Product selection

3. **Project report Preparation**

- Preliminary project report
- Detailed project report, Techno economic Feasibility
- Project Viability

4. **Management Principles**

- Definitions of management
- Principles of management
- Functions of management (planning, organising, staffing, directing and controlling etc.)
- Level of Management in an Organisation

5. **Functional Areas of Management**

a) Production management

- Functions, Activities
- Productivity
- Quality control
- Production Planning and control

b) Inventory Management

- Need for Inventory management
- Models/Techniques of Inventory management

c) Financial Management

- Functions of Financial management
- Management of Working capital
- Costing (only concept)
- Break even Analysis
- Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)

d) Marketing Management

- Concept of Marketing and Marketing Management
- Marketing Techniques (only concepts)
- Concept of 4P s (Price, Place, Product, Promotion)

e) Human Resource Management

- Functions of Personnel Management
- Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages

6. **Leadership and Motivation**

a) Leadership

- Definition and Need/Importance
 - Qualities and functions of a leader
 - Manager Vs Leader
 - Style of Leadership (Autocratic, Democratic, Participative)
- b) Motivation
- Definition and characteristics
 - Importance of motivation
 - Factors affecting motivation
 - Theories of motivation (Maslow)
 - Methods of Improving Motivation
 - Importance of Communication in Business
 - Types and Barriers of Communication
7. **Work Culture, TQM & Safety**
- Human relationship and Performance in Organization
 - Relations with Peers, Superiors and Subordinates
 - TQM concepts: Quality Policy, Quality Management, Quality system
 - Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)
8. **Legislation**
- a) Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
 - b) Features of Factories Act 1948 with Amendment (only salient points)
 - c) Features of Payment of Wages Act 1936 (only salient points)
9. **Smart Technology**
- Concept of IOT, How IOT works
 - Components of IOT, Characteristics of IOT, Categories of IOT
 - Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

Syllabus to be covered before IA: Chapter 1,2,3,4

RECOMMENDED BOOKS

1. Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
2. Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
3. Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
4. Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
5. Industrial Engineering and Management by Banga and Sharma, Khanna Publications
6. Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
7. Online Resource on Startups and other concepts
8. <https://www.fundable.com/learn/resources/guides/startup>

Th2: GLASS TECHNOLOGY

Name of the course: Diploma in CERAMIC TECHNOLOGY			
Course code:		Semester	5th
Total Period	60	Examination :	3 hrs
Theory periods :	4p / week	Internal assessment	20
Tutorial	1		
Maximum marks	100	End Semester Examination ::	80

A. Rationale:

Glass is one of the important branches of Ceramic as per the modern classification of Ceramic Technology. without the use of glass products modern life style, industrial and commercial activities are not possible. So, the student of Diploma Ceramic must be aware of the manufacturing of glass and special glass and their wide application in various field.

B. Objectives :

After completion of the course, students will be able to :

1. Know various types of raw materials for glass making and formulating batch composition.
2. Understand general ideas about glass melting furnace and glass melting process.
3. Understand about various process of glass forming methods.
4. Know about strain in glass and its elimination.
5. Understand general idea about the quality of glass.
6. Understand different glass defects and their remedies.
7. Know decoration of glass and special glass making.
8. Understand the layout of modern glass plant.

SI NO.	Major Topics	Periods
1.	Raw Material and Batch Composition	10
2.	Glass Melting Process	05
3.	Forming of Glass Wares	05
4.	Annealing and Toughening of Glass	05
5.	Manufacturing of Glass products	10
6.	Properties of Glass	10
7.	Testing of Glass	05
8.	Glass Decoration	05
9.	Special Glass	05

COURSE CONTENT

1.0. RAW MATERIAL AND BATCH COMPOSITION

- 1.1 Define Glass & Glassy state
- 1.2 Historical background of Glass
- 1.3 Glass Industries in India and the present status.
- 1.4 Describe the major ingredients for glass making
- 1.5 Describe the minor ingredients used for glass making
- 1.6 Define Cullet and its use in glass making.
- 1.7 Describe selection of glass composition for various types of glasses.
- 1.8 Properties of glass sand for glass making.

1.9 Impurities in glass raw materials and their influence in glass making.

2.0 GLASS MELTING PROCESS: EXPLAIN THE FOLLOWING IN BRIEF

2.1 Calculation of batch of raw materials for making glass.

2.2 Process of glass formation

2.3 Refining of glass

2.4 De-colorization of glass

2.5 Role of viscosity in glass melting.

2.6 Glass melting furnaces.

2.7 Glass Tank Furnace & Glass pot furnace.

2.8 De-vitrification of Glass

3.0 MANUFACTURING & FORMATION OF GLASS WARE

3.1 Various methods used for making glass products.

3.2 Manufacture of glass by blowing process .

3.3 Float process

3.4 Various moulds for glass making.

3.5 Manufacturing of glass bottle, sheet glass, thermo flask, electric bulb.

3.6 Manufacturing of fiber glass, glass wool.

3.7 Layout of modern glass plant.

4.0 ANNEALING & TOUGHENING OF GLASS

4.1 Define Annealing and Toughening of Glass & Aim of annealing.

4.2 Describe the process of annealing in details.

4.3 Explain tempering of glass by various methods.

4.4 State and explain Chemical & mechanical toughening of glass.

5.0 PROPERTIES OF GLASS

5.1 Describe the following properties of glass in detail.

a) Viscosity.

b) Thermal expansion.

c) Density.

d) Optical properties.

e) Chemical durability.

6.0 TESTING OF GLASS : Describe in brief

6.1 Testing of defects of glass by visual observation.

6.2 Blistering, cords, stones in glass.

6.3 Determination and observation of strain in glass.

6.4 Measurement of thermal shock resistance of glass.

6.5 Testing of viscosity of glass.

6.6 Testing of density of glass.

6.7 Testing of strength of glass.

6.8 Durability of glass

7.0 GLASS DECORATION

Describe the following methods of glass decoration in brief.

a) Polishing

b) Grinding

c) Etching

d) Sand Blasting

e) Engraving

f) Cutting

- g) Staining h) Enameling

8.0 SPECIAL GLASSES

8.1 Define special glass.

8.2 Describe the characteristics and application of the following glasses:-

- a) Borosilicate glass
- b) Pyrex glass
- c) Heat resisting glass
- d) Coloured glass
- e) Ruby glass
- f) Laminated glass

Syllabus Coverage up to Internal Assessments:

Topics: - 1, 2&3

Learning Resources :			
Sl.NO	Title of the book	Name of the Authors	Name of the publishers
1	Hand book of glass manufacturers Vol I & II	F.V Tooley	Ogden Publishing co. New York
2	Modern Glass Practice	Samuel R. Scholes	CBI Publishing Co. INC
3	Hand book of Glass	R. Charan	B H U, Banaras
4	Glass	Shand	Mc Grawhill
5	CHEMISTRY OF GLASS	A . PAUL	Ashlee Pub. Co

Th3: CERAMIC WHITE WARE

Name of the course: Diploma in CERAMIC TECHNOLOGY			
Course code:		Semester	5th
Total Period	60	Examination :	3 hrs
Theory periods :	4p / week	Internal assessment	20
Tutorial			
Maximum marks	100	End Semester Examination ::	80

A. Rationale :

Ceramic White wares are very much essential in everyday life. So, the students of Ceramic Technology must know about various white ware products, their manufacturing process, properties and application in details.

B. Objectives :

After completion of the course, students will be able to:

1. Know various raw materials used in whiteware and heavy clay wares making.
2. Know the process of manufacturing of various white ware and heavy claywares.
3. Understand various composition and body formulation of various types of white wares, and heavy clay wares, their manufacturing process and the characteristics.
4. Understand various qualities and process of testing of various ceramic products.
5. Know about the specification as per the B.I.S. for white wares and heavy clay ware.

Sl.No.	Major Topic	Periods
1	Introduction to whiteware	10
2	Process of manufacturing	10
3	Body Formulation & characteristics	20
4	Ceramic Glazes	10
5	Plaster of Paris & plaster products	10

COURSE CONTENT

1.0 INTRODUCTION TO WHITE WARE

- 1.1 Explain the term whiteware and its classification.
- 1.2 White ware industries in India.
- 1.3 International scenario in manufacturing of white ware
- 1.4 Selection of principal raw materials for use in whiteware and heavy clay ware industries.
- 1.5 Explain the qualities and Characteristics of the raw material used for white ware making.
- 1.6 Describe the influence of raw materials on white ware and heavy clay ware products making.

2.0 PROCESS OF MANUFACTURING FOR WHITEWARE & HEAVY CLAY WARES: (Describe in details of the following).

- 2.1 Materials processing.
- 2.2 Fabrication: Slip casting, plastic shaping, semidry & dry press.
- 2.3 Drying operation
- 2.4 Glazing operation
- 2.5 Firing operation
- 2.6 Explain the remedies for green rejection.
- 2.7 Describe the causes of drying & firing defects and their remedies.

3.0 BODY & GLAZE FORMATION, CHARACTERISTICS AND MANUFACTURING OF THE FOLLOWING WHITE WARES IN DETAIL

3.1 EARTHEN WARE

- a) Fine earthen ware
- b) Common earthen ware glaze tile (floor & wall)
- c) Earthenware sanitary ware

3.2 STONE WARE

- a) Fine stoneware.
- b) Coarse stoneware
- c) Sanitary wares
- d) Vitreous china sanitary wares
- e) Chemical stone ware for chemical Engineering.
- f) Acid-resistant bricks and tiles

3.3 PORCELAIN WARE:

- a) Hard Porcelain
- b) Soft Porcelain
- c) Chemical Porcelain
- d) Electrical Porcelain
- e) Bone China and fritted China.

3.4 HEAVY CLAY WARES :

- a) Common Building bricks.
- b) Paving brick.
- c) Face brick
- d) Common Building tiles
- e) Salt glaze stone ware pipes

4.0 CERAMICS GLAZE

- 4.1 Define glaze & classification of glaze.
- 4.2 Various types of glaze.
- 4.3 Raw materials and their influence on glaze.
- 4.4 Preparation of glaze.
- 4.5 Glaze frit & its preparation.
- 4.6 Glaze application & decoration.
- 4.7 Glaze defects & their elimination.
- 4.8 Glaze calculation.
- 4.9 Testing of glaze.

5.0 PLASTER OF PARIS

- 5.1 Various types of plaster of Paris & their preparation.
- 5.2 Various types of plaster of Paris products.
- 5.3 Quality of plaster of Paris for ceramic use.
- 5.4 Plaster of Paris mould for ceramic shaping.

Syllabus Coverage up to Internal Assessments:

Topics 1,2&3

Learning Resources :			
Sl.NO	Title of the book	Name of the Authors	Name of the publishers
1	Industrial ceramics	Singer and Singer	Oxford & IBH
2	Whiteware	W. Ryan & Redford	Pergamon Press
3	Modern Pottery	H.N. Bose	Ceramic Publishing House ,Bhagalpur
4	White ware	S. Sen	Oxford & IBH
5	Fine Ceramics	F.H. Norton	Mc Grawhill
6	Elements of ceramics	F.H. Norton	Longman Higher Education
7	Ceramic WhiteWare	New comb R.Junior	Pitman Publishing House
8	Ceramic drying	R. W Ford	Pergamon Press

Th4: REFRACTORY APPLICATIONS IN METALLURGICAL INDUSTRY

Name of the course: Diploma in CERAMIC TECHNOLOGY			
Course code:		Semester	5th
Total Period	60	Examination :	3 hrs
Theory periods :	4p / week	Internal assessment	20
Tutorial			
Maximum marks	100	End Semester Examination ::	80

A. Rationale:

Metal cannot be extracted without refractory. Refractory is the backbone of ferrous metal extraction industries. So, the students of Ceramic Technology should know various application of refractories in ferrous metal extraction furnaces. This will help the students for refractory management in ferrous metal industries.

B. Objectives : After completion of the course student will be able to .

- 1 . Understand the furnace used and the process for iron & steel making.
- 2 . Know about non ferrous refractories.
- 3 . Understand the uses of refractories in ferrous metal extraction process.
- 4 . Know the refractories use in sponge iron, coke oven & in alloy steel making.
- 5 . Know about refractory lining in furnaces.

Sl.No	Major Topics	Periods
1	Introduction to ferrous metal extraction.	20
2	Refractories for iron & steel making	20
3	Refractories for Non ferrous metal extraction	10
4	Refractory lining	10

1.0 SCOPE AND RELEVANCE OF METALLURGY TO CERAMIC:

- 1.1 Introduction to metallurgy and its importance to refractory.
- 1.2 Extraction of pig iron from blast furnace, modern development in B.F
- 1.3 Preparation of cast iron and alternative route for iron making.
- 1.4 Corex and midrex process.
- 1.5 Steel making by L.D process and by Electric arc furnace.
- 1.6 Classification of steel and application of steel.
- 1.7 Alloys of steel.
- 1.8 Recent process of steel making, continuous casting process of steel.
- 1.9 Introduction to powder metallurgy process.
- 1.10 Secondary steel making process.
- 1.11 Sponge iron making.

2.0 REFRACTORIES FOR IRON AND STEEL MAKING:

- 2.1 Describe various types of refractories used in iron & steel making and their important properties.
- 2.2 Blast furnace, Electric arc furnace & cupola furnace and hot stove.
- 2.3 BOF , LRF, Ladle , Torpedo ladle car .
- 2.4 Continuous casting tundish refractory
- 2.5 Slide gate refractory .
- 2.6 Explain mono block shroud, sub entry Nozzle, Stopper, well block and purging plug refractory along with their application .
- 2.7 Refractory for secondary steel making, Ladle furnaces.

- 2.8 Factors related to choice of refractory .
- 2.9 Refractory for sponge iron making & foundries.
- 2.10 Refractories for Ferro Alloy Industries.
- 2.11 Refractories for coke oven plant .
- 2.12 Refractories for reheating furnaces .
- 2.13 Refractories for soaking peats.
- 2.14 Refractories used in heat treatment furnace.

3.0 REFRACTORIES FOR NON FERROUS METAL INDUSTRIES :

- 3.1 Refractory used for the extraction of the following non ferrous metals.
 - a) Aluminum
 - b) Copper
 - c) Zinc
 - d) Lead

4.0 REFRACTORY LINING

- 4.1 Various types of refractory shapes used in furnace construction.
- 4.2 Various types of tools used in refractory lining.
- 4.3 Designing of refractory lining.
- 4.4 Preliminary ideas on brick bonding for kiln construction.
- 4.5 Monolithic Lining
- 4.6 Important factors in lining operation
- 4.7 Preliminary ideas on lining of ladle, tundish, BOF and other steel making furnaces

Syllabus Coverage up to Internal Assessments:

Topics 1&2

Learning Resources :			
Sl.No	Title of the book	Name of the Authors	Name of the publishers
1	Refractories production and properties	J. Chester	Iron and Steel Institute London
2	Refractories	M. L. Mishra	Clear type press Allahabad
3	Refractories	Chesti	Prentice Hall India Learning Pvt. Ltd. New Delhi
4	Refractory	Nandy	Publisher India
5	Refractories	Norton	Mc Grawhill Company INC
6	Industrial ceramics	Singer and Singer	Oxford & IBH
7	Iron making	Tupkary	Khanna Publisher
8	Steel making	Tupkary	Khanna publisher
9	Principles of blast furnace Iron making	A.K Biswas	SBA Publication, Kolkata

TH5: TESTING OF CERAMIC

Name of the course: Diploma in CERAMIC TECHNOLOGY			
Course code:		Semester	5th
Total Period	60	Examination :	3 hrs
Theory periods :	4p / week	Internal assessment	20
Tutorial			
Maximum marks	100	End Semester Examination ::	80

A. Rationale:

Testing of Ceramic products and raw materials are highly essential to know the quality of Ceramic products and also the use of ceramic raw materials. When the students become aware on testing methods it will help them to work confidently in ceramic research and development laboratory. So, the students of Ceramics must know testing of ceramic materials theoretically before making ceramic practicals in the laboratory.

B. Objectives :

After completion of the course, students will be able to :-

1. know the importance of testing for quality product.
2. know important physical and chemical test required for various ceramic raw materials and products.
3. know the important test required and their procedure for refractory products.
4. know the important test for ceramic whiteware products.
5. know the testing Schedule, routine control and quality control required for various ceramic products.

Sl. No.	Main Topics	Periods
1.	Introduction	05
2.	Testing of ceramic raw materials	15
3.	Testing of heavy clay wares & plaster of Paris.	10
4.	Testing of whitewares	10
5.	Testing of Refractory	10
6.	Quality control of ceramic	10

COURSE CONTENT

1.0 INTRODUCTION

- 1.1 Importance of Testing of Ceramic Raw materials & products.
- 1.2 Sampling of raw materials & products for testing.

2.0 TESTING OF CERAMIC RAW- MATERIALS

- 2.1 Measurement of moisture by various methods.
- 2.2 Particle size analysis by sedimentation and centrifuged method.
- 2.3 Particle size determination by modern method.
- 2.4 Testing of clay for ceramic use.

3.0 TESTING OF HEAVY CLAY WARES AND PLASTER OF PARIS:.

- 3.1 Testing of common bricks, dimensional tolerance, water absorption, compressive strength, efflorescence and war page.
- 3.2 Testing of salt glazed sewer pipes.
- 3.3 Testing of tiles.

3.4 Testing of plaster of paris.

4.0 TESTING OF WHITE WARES

4.1 Physical properties of green ware and fired ware.

4.2 Chemical properties of fired products.

4.3 Testing of glaze.

4.4 Testing of electrical insulators.

5.0 TESTING OF REFACTORIES

5.1 Permeability test of refractory.

5.2 Chemical properties and chemical analysis.

5.3 Mechanical properties of refractory product (Abrasion resistance and ccs) .

5.4 Thermal conductivity.

5.5 Slag attack.

5.6 Thermal shock resistance & high temperature deformation.

5.7 Hot modules of rupture & creep.

5.8 Spalling resistance of refractories.

6.0 QUALITY CONTROL OF CERAMIC.

6.1 Describe the testing schedule of various whiteware products.

6.2 Describe the routine control and laboratory tests required at regular intervals in white ware industries.

6.3 Describe the works control on refractory making.

6.4 Describe the testing and Quality control scheme for various whiteware products Tableware, Sanitary wares, glazed wall and floor tiles.

Syllabus Coverage up to Internal Assessments:

Topics 1,2&3

Learning Resources :			
Sl. NO	Title of the book	Name of the Authors	Name of the publishers
1	Industrial ceramic	Singer & Singer	Oxford & IBH
2	White ware	W Ryan	Pergamon Press
3	Refractory	Chesti	Prentice Hall India
4	Refractory	F.H. Nontom	Mc Grawhill
5	Refractory	Nandi	Publisher India
6	Fine Ceramics	F.H .NORTON	Mc Grawhill
7	Ceramic White Ware	S. SEN	Oxford & IBH

PR1: CERAMIC WORKSHOP III

Name of the course: Diploma in CERAMIC TECHNOLOGY			
Course code:		Semester	5th
Total Period	90	Examination :	3 hrs
Theory periods :	6 p / week	Internal assessment	50
Tutorial			
Maximum marks	100	End Semester Examination ::	50

A. Rationale:

To develop the practical skill in the ceramic field student must practice the job of making various ceramic products in ceramic workshop.

B. Objectives:

After completion of the ceramic workshop III jobs properly the students must able to do

- (i) Making of various types of mould.
- (ii) Making of various ceramic products by various methods.
- (iii) Making of proper drying and firing of green articles.
- (iv) Making of decoration on various ways on products.
- (v) Making of glass decoration.

(Minimum 15 numbers of jobs to be practices by the students)

C. CERAMIC SHAPING

- a. Preparation of one piece plaster of Paris moulds.
- b. Two pieces mould and preparation of three pieces mould.
- c. Preparation of
 - i. Earthenware body
 - ii. Stoneware body
 - iii. Porcelain body
- d. Use of potter's wheel (each student must learn how to prepare simple hollow wares by throwing)
- e. Preparation of cups and saucers by Jiggering & Jolleying.
- f. Preparation of articles by dry pressing, Toggle pressing and casting.
- g. Preparation of common bricks and tiles.
- h. Preparation of art pottery products by slip casting process.
- i. Preparation of plaster of paris from Gypsum

D. DRYING, FIRING & DECORATION OF WHITE WARE

- a. Drying of thick and thin wares, determination of drying characteristic curve.
- b. Glost firing of earthenware articles using fritted glazes.
- c. Glost firing of stoneware articles using felespathic glazes.
- d. Glost firing of porcelain ware with white & coloured glaze.
- e. Melting of glaze frit.
- f. Decorate tiles by (a) Hand Painting (b) Transfer printing.
- g. Preparation of glaze frit.

E. GLASS

- a. Process for purification of glass sand
- b. Melting of glass by crucible furnace.
- c. Melting of colored glass.
- d. Drawing of rods from molten glass.
- e. Grinding and polishing of lenses.
- f. Decoration of glass by :
 - a) Etching
 - b) Sand Blasting
 - c) Enameling
 - d) Silvering of glass
7. Grading of sand for glass batch.

PR2: CERAMIC TESTING III

Name of the course: Diploma in CERAMIC TECHNOLOGY			
Course code:		Semester	5th
Total Period	90	Examination :	3 hrs
Theory periods :	6 p / week	Internal assessment	50
Tutorial			
Maximum marks	100	End Semester Examination ::	50

A. Rationale:

To know the properties of ceramic products, testing is required. Testing also help to control the quality in product making at various stages of manufacturing. So, the students must be aware on ceramic testing and practice the process of testing.

B. Objectives:

After completion of the ceramic testing III job, students must be able to

- (i) Make various test of glass products
- (ii) Make the testing of quality of ceramic slip, quality of ceramic glaze and overall quality of ceramic products.
- (iii) Know the function of various modern equipments relating to ceramic testing.

(SECTION – A)

(Minimum 5 nos of test)

C. GLASS

- a. Simple test for iron in sand.
- b. Determination of chemical durability of glass.
- c. Determination of refractive index of glass.
- d. Study of absorption in colored glass by spectro photometer.
- e. Comparison of reflectance of glass and glaze.
- f. Determination of defects in glass article by visual observation and under Microscope.
- g. Observation of strain by strain viewer.
- h. Determination of thermal shock resistance of glass.

(SECTION -B)

(Minimum 6 nos of test)

D. WHITE WARES AND HEAVY CLAY WARES.

1. Determination of particles size by Wet sieve analysis.
2. Determination of moisture content by infra-red moisture balance.
3. Determination of optimum deflocculation by measuring viscosity of slips.
4. Measurement of pH of slip by various methods.
5. Determination of bulk density, apparent porosity and water absorption of white ware products.
6. Determination of crazing resistance of glazed body by autoclave test.
7. Determination of impact resistance of glazed and unglazed bodies.
8. Testing of thickness of glaze.
9. Determination of CCS and MOR of various white ware bodies.

10. Testing of Building bricks.
A - Efflorescence.
B -Compressive strength
C -Water absorption& porosity
D -Dimensional Tolerance
E - Warpage

(SECTION – C)
(Minimum 3 nos of test)

E. STUDY OF FOLLOWING EQUIPMENTS.

- a. DTA
- b. TGA
- c. Spectrophotometer
- d. Mineralogical Microscope
- e. X-RD
- f. X-RF

PR3: PROJECT WORK (Phase-I)

Name of the course: Diploma in CERAMIC TECHNOLOGY			
Course code:		Semester	5th
Total Period	60	Examination :	
Theory periods :	4 p / week	Internal assessment	50
Tutorial			
Maximum marks	50	End Semester Examination ::	-

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course by undertaking a project. The individual students have different aptitudes and strengths. Project work, therefore, should match the individual strengths of students. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of ceramic technology practices in real life situations, so as to participate and manage a large ceramic engineering projects in future.

Entire Project shall spread over 5th and 6th Semester. Part of the Project covered in 5th Semester shall be named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop ceramic engineering or applications and implement these for the actual needs of the community/industry.
- Explain the working of industrial environment and its work ethics.
- Explain what entrepreneurship is and how to become an entrepreneur.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- Field computing and to achieve real life experience in ceramic technologies.

General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester). Students should be allotted a problem of interest to him/her as a project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be

individual assignment or a group assignment. There should not be more than 5 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

Following are the broad suggestive areas of project work

- ✓ Preparation and testing of refractory products.
- ✓ Preparation and testing of white ware products.
- ✓ Designing of ceramic products like earthenware, tiles etc.
- ✓ Decoration of ceramic body.
- ✓ Glaze defect in sanitary ware.
- ✓ Testing and preparation of glassware.
- ✓ Fuel conservation on tunnel kiln.
- ✓ Latest development of material in modern ceramic.
- ✓ Alternative material for silica refractory making
- ✓ Reducing refractory consumption in ladle
- ✓ Utilizing waste ceramic material and product
- ✓ Develop some ceramic material for pollution control.
- ✓ Improving existing systems / equipments.
- ✓ Any other related area found worth.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

Project Phase-I and Phase-II

The Project work duration shall cover 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5th sem under Project Phase-I. The students may be allowed to study literature, any existing system related to project work and then define the Problem/objective of the Project. All Preliminary work for the project work including Design if any is to be complete in Phase-I. In Phase-II Execution of work ,Testing, documentation of the project have to be completed. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-I in 5th semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

EQUIPMENT List

Sl. No.	Equipment
1	Blender
2	Potter's Wheel
3	Painter's Wheel
4	Jigger & Jolley M/C
5	Toggle Press
6	Hand Press
7	Frit Furnace
8	Electric Furnace
9	Ball Mill
10	Pot Mill
11	Enamelling Furnace
12	Air Compressor
13	Sieve Shaker
14	Permanent Magnet
15	Refractometer
16	Reflectance Meter
17	Microscope
18	Strain Viewer
19	Thermal Shock Resistance Apparatus
20	Hydrometer
21	Infrared Moisture Balance
22	pH Meter
23	MOR Apparatus
24	CCS Machine
25	DTA Apparatus
26	TGA Apparatus
27	XRD Machine
28	X-RF Machine
29	Autoclave
30	RUL Furnace
31	Impact Tester
32	Torsion viscometer
33	Particle Size Analyser
34	PCE Furnace
35	Permeability apparatus
36	Driers
37	Impact tester
38	Dilatometer
39	Spectrophotometer
40	Mineralogical microscope
41	Glass melting furnace
42	Air compressor with accessories for sand blasting