

Hemchandracharya North Gujarat University, Patan

Community College

Programme on
Ceramic Technology

Offered at

Pramukh Swami Science and H.D. Patel Arts College

Sarva Vidyalaya Campus, Kadi

Preface

The University Grants Commission (UGC) has launched a scheme on skills development based higher education as part of college/university education, leading to setting up of Community college to serve multiple needs, including (i) career oriented education and skills to students interested in directly entering the workforce; (ii) contracted training and education programmers for local employers; (iii) high-touch remedial education for secondary school graduates not ready to enroll in traditional colleges, giving them a path to transfer to three or four year institutions; and (iv) general interest courses to the community for personal development and interest. Bachelor of Vocation will have with multiple exits such as Diploma/Advanced Diploma under the NSQF(National Skills Qualifications Framework).

The Community College model, by and large, will be accessible to a large number of individuals of the community, offer low cost and high quality education locally, that encompasses both vocational skills development as well as traditional coursework, thereby providing opportunities to the learners to move directly to the employment sector or move into the higher education sector. It offers a flexible and open education system which also caters to community-based life-long learning needs. It has a synergistic relationship between the community, community college and the job market.

About the programme

Ceramic Technology is the science and technology of creating objects from inorganic, non-metallic materials. This is done either by the action of heat, or at lower temperatures using precipitation reactions from high-purity chemical solutions. The term includes the purification of raw materials, the study and production of the chemical compounds concerned, their formation into components and the study of their structure, composition and properties.

Ceramic materials may have a crystalline or partly crystalline structure, with long-range order on atomic scale. Glass ceramics may have an amorphous or glassy structure, with limited or short-range atomic order. They are either formed from a molten mass that solidifies on cooling, formed and matured by the action of heat, or chemically synthesized at low temperatures using, for example, hydrothermal or sol-gel synthesis so this course is useful for students for establish their career in job or self employee.

CTR1: Eligibility Criteria (EC) for Admission

1. The eligibility conditions for admission to the program will be 10+2 or equivalent in any stream
2. If the candidate has attained the specific level 4 of NOS of Ceramic sector (by decision of equivalence committee of the college) can get admitted in Ceramic Technology programme of community college.
3. There is no age bar for admission to Community Programmer
4. The student can take exit from this course at any point of time and can get re-entry in this programme. Such students will get priority in admission than to a fresher student. (Multi entry multi exit scheme).

CTR2: Admission Procedure

1. For admission to the programmes offered, preference should be given to the learners living in the local community. Reservation to SC, ST, OBC and PwD categories will be available as per the extant national / State policy.
2. Admissions may be done on a rolling basis depending on the duration of the programmes to facilitate a steady stream of learners joining the college and moving out as trained work force to the job market, round the year and not just once in a year.
3. The applicants seeking re-entry into the college should get preference in admission over the new applicants.
4. Candidates are selected on the basis of Merit.

CTR3: Fees and Scholarship:

1. Student fee should be decided as per the prevalent practice for fee fixation for aided courses.
2. Attempt should be made to recover part of the operating expenditure from the student fees.

CTR4: Registration / Enrollment:

1. Every student admitted to the college for the programme must get enrolled to university within a month from the date of admission.

CTR5: Semester Examinations

1. Candidates desirous of appearing at any Semester Examination shall have to submit applications in the prescribed form, through the designated authority on or before the prescribed date.
2. No candidate will be admitted to any Semester examination unless the Designated Authority i.e. the Head of the Department or Principal of the College certifies that:
 - (1) The candidate attended the course of study to the satisfaction of the designated authority.
 - (2) The candidate maintained a good conduct and character during the studies.
 - (3) The candidate maintained minimum 80% attendance in each semester.

CTR6: Evaluation

1. Appropriate mechanism for assessment of the learners' progress towards acquisition of knowledge and skill should be developed by the College. Partner industries should also be given a clear and well defined role in the assessment of the learners.
2. Practical or hands on skills should be given comparatively more weightage in the overall assessment plan.
3. The College should adopt and integrate the guidelines and recommendations of the respective Sector Skill Councils (SSCs) for the assessment and evaluation of the vocational component, wherever available. They should also involve the SSCs in the assessment process, wherever required. It applies to colleges, both Autonomous and non-Autonomous, and universities to maintain Occupational Standards and the fitness for the job.
4. Theory of each CORE paper will be evaluated for a maximum of 100 marks out of which, 40 marks shall be for Internal Exam and 60 marks for the end semester examination. An end semester examination shall be of 2 hours duration.
5. Practical will be evaluated on Basis of 75% Continuous evolution as well as 25% End Semester Examination.

CTR7: Rules for grading

1. One Credit would mean equivalent of 14-15 periods of 60 minutes each, for theory, workshops / labs and tutorials per semester.
2. For internship / field work, the credit weightage for equivalent hours shall be 50% of that for lectures / workshops

3. For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study shall be 50% of that for lectures / workshops
4. To pass a subject in any Semester a candidate must obtain a minimum of 40% of marks in each paper.
5. If a candidate fails in any subject, he has to reappear for that particular paper and pass. (That is, for example if candidate fails in midterm exam of a subject, he has to reappear for midterm of that subject.)
6. The performance of each candidate in all the subjects will be evaluated on 7- point scale in term of grades as follow:

Grading Scheme		%age according to Grade	Grade Points	Qualitative Meaning of Grade
1	A +	90-100	10.0	Outstanding
2	A	80-89	9.0	Excellent
3	A-	70-79	8.0	Very Good
4	B +	60 – 69	7.0	Good
5	B	50-59	6.0	Average
6	B-	40-49	5.0	Fair
7	F	Less Than 40	0	Fail
8	I	Incomplete		

CTR8: performance index

1. The performance of a student in a semester is expressed in terms of the **Semester Performance Index (SPI)**.

SEMESTER PERFORMANCE INDEX (SPI)

The Semester Performance Index (SPI) is the weighted average of Course Grade Points obtained by the student in the semester. The Weights assigned to Course Grade Points are the Credits carried by the respective courses.

$$a. \quad g_1 c_1 + g_2 c_2 + \dots$$

$$2. \quad SPI = \frac{\dots}{\dots}$$

$$a. \quad c_1 + c_2 + \dots$$

Where, g_1, g_2, \dots are the Grade points obtained by the student in the Semester, for Courses carrying Credits c_1, c_2, \dots respectively.

- The cumulative performance of a student at the end of the Semester / Course is expressed in terms of the **Cumulative Performance Index (CPI)**.

CUMULATIVE PERFORMANCE INDEX (CPI)

This index is defined as the weighted average of Course Grade Points obtained for all the weights for Theory Papers (Both Mid Term & End Term) and Practicals attempted since his admission to the program, where the weights are defined in the same way as in **Semester Performance Index (SPI)**.

- If a failed student repeats a course, only the Grade Points obtained in the latest attempt shall be counted in the **Cumulative Performance Index**. Whenever the candidate clears the subject in the next semester examination, the total credits for that subject will be added to CPI.
- For any Semester, the maximum marks for the Mid Term and End Term assessments are shown in the teaching and examination scheme. For the purpose of Mid Term assessment, tests, quizzes, assignments or any other suitable methods of assessment may be used by the department.

CTR9: semester passing scheme

- For each semester examination, a candidate will be considered as pass if he/she has secured “B-“ or above grade in all the subject (s) and overall grade point 5.00 or above.
- For each semester examination, a candidate will be considered as fail if he/she has secured “F” grade in any or all the subject (s).
- If the candidate does not fulfill the subject requirements including requisite attendance percentage, he/she will be given I grade and the candidate will have to complete the course requirements before the commencement of the next End Semester examination. If the candidate does not clear I grade in any subject before the commencement of the next End Semester examination, he/she will be considered fail - F grade.
- Candidate has to clear his / her ‘F’ grade or ‘I’ grade, if any, by the next End Semester examination.

CTR10: semester promotion scheme

A candidate will be promoted to the subsequent Semester according to the following scheme:

- A candidate would be granted admission to the Second Semester if and only if he/she has been granted Term for First Semester and has applied for the university examination.

Promotion Criteria	
Semester	Condition(s) For Promotion
II	Grant of Term for Semester – I

CTR11: Award of grading / division

No class/ division will be awarded to the students in the first semesters. Divisions shall be awarded only at the end of Final Examinations on successful completion of all the Semesters. For awarding the degree at the end of the course, Cumulative Performance Index (CPI) of all the Mid Term and Final exams shall be taken in to consideration as per the following pattern of **Cumulative Performance Index (CPI)**:

S.N.	CPI	Division
1	7.50 to 10.00	FIRST Division with Distinction
2	6.50 to 7. 49	FIRST Division
3	6.00 to 6. 49	SECOND Division

CTR12: Award of degree

- 1.Award of Certificate, Advanced certificate, Diploma or Advanced Diploma, as the case may be, would depend on acquisition of requisite credits as prescribed by the certification body and not on the duration of the calendar time spent in pursuing the course.
- 2.The certificate shall mention the credits earned, course duration (in hours), and the curriculum covered. If the course is aligned with NVEQF / NSQF, the corresponding NVEQF / NSQF level should also be mentioned on the certificate.
- 3.Award of degree will be as follows:

NVEOF LEVEL	SKILL COMPONENT	GENERAL EDUCATION CREDITS	NORMAL CALENDER DURATION(POST MEETING THE CENTRAL CRITERIOR)	AWARDS
1	6	9	THREE MONTH	CERTIFICATE
2	12	18	ONE SEMESTER	ADVANCED CERTIFICATE
3	24	36	TWO SEMISTER	DIPLOMA

Ceramic Technology

SEMESTER-I & SEMESTER-II

SYLLABUS

CERAMIC TECHNOLOGY

SEMESTER – I

Course Code	Course Title	Credit		Total	Marks				Total
		Th.	Pra/Field		Th.		Practical		
					I	E	ESE	PA	
CT101	BASICS OF CERAMIC MATERIALS AND PROCESS-I	4	-	4	40	60	--	--	100
CT102	BASICS OF CERAMIC MATERIALS AND PROCESS-II	4		4	40	60	--	--	100
CT103	FUNDAMENTALS OF CHEMISTRY-I	4	-	4	40	60	--	--	100
CT104	CERAMIC PRACTICALS-I	-	12	12	--	--	300	100	400
CT105	CHEMISTRY PRACTICALS-I	-	6	6	--	---	150	50	200
	TOTAL	12	18	30	120	180	450	150	900

SEMESTER-II

Course Code	Course Title	Credit		Total	Marks				Total
		Th.	Pra/Field		Th.		Practical		
					I	E	ESE	PA	
CT 201	BASICS OF CERAMIC MATERIALS AND PROCESS -III	4	-	4	40	60	--	--	100
CT 202	BASICS OF CERAMIC MATERIALS AND PROCESS-IV	4		4	40	60	--	--	100
CT 203	FUNDAMENTALS OF CHEMISTRY-II	4	-	4	40	60	--	--	100
CT 204	CERAMIC PRACTICALS-II	-	12	12	--	--	300	100	400
CT 205	CHEMISTRY PRACTICALS-II	-	6	6	--	---	150	50	200
	TOTAL	12	18	30	120	180	450	150	900

SEMESTER – I

Course Code	Course Title	Credit		Total	Marks				Total
		Th.	Pra/Field		Th.		Practical		
					I	E	ES E	PA	
CT101	BASICS OF CERAMIC MATERIALS AND PROCESS-I	4	-	4	40	60	--	--	100
CT102	BASICS OF CERAMIC MATERIALS AND PROCESS-II	4		4	40	60	--	--	100
CT103	FUNDAMENTALS OF CHEMISTRY-I	4	-	4	40	60	--	--	100
CT104	CERAMIC PRACTICALS-I	-	12	12	--	--	300	100	400
CT105	CHEMISTRY PRACTICALS-I	-	6	6	--	---	150	50	200
	TOTAL	12	18	30	120	180	450	150	900

CT-101 BASICS OF CERAMIC MATERIALS AND PROCESS-I

RATIONALE: This course is designed to enable students to acquire basic understanding of the Ceramics. Its help to understand fundamental and structure of the unexplored and unidentified raw materials of the Ceramic industry.

LEARNING OUTCOMES:

- Understand the concept of origin and Basic concept of ceramic.
- Develop an understanding the process of the ceramic industry.
- Gain knowledge about the structure, function and applications of various ceramics product.

TEACHING AND EVALUATION SCHEME: The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 40 marks and End Term Examination conducted by University examination for 60 marks.

Subject Code	Subject Title	Credits	Theory			Total Marks
			Hrs.	Max Marks		
				Mid Term	End Term	
CT- 101	BASICS OF CERAMIC MATERIALS AND PROCESS-I	4	48	40	60	100

COURSE CONTENT:

Unit 1. Introduction of Ceramic

- What is Ceramic
- Birth of Ceramic
- History of Ceramic
- Developments of Ceramics
- Classification of Ceramic

Number of lectures: 14

Weight age: 30%

Unit 2. Ceramic of Raw Materials

- China clays
- Ball and plastic clays
- Quartz, Quartzite, Silica Sand and Stone
- Potas Felspar
- Soda Felspar
- Raw Materials and chemicals for glaze.
 1. Al_2O_3
 2. ZnO,
 3. $BaCO_3$
 4. Zirconium Silicate

Number of lectures: 14

Weight age: 30%

Unit 3. Testing of raw materials

- Sampling
- Rapid control test
- Suitability test

Number of lectures: 20

Weight age: 40%

- Periodic control test
- Control test for Additives Physical Properties
- Swelling and Dispersion
- Natural Moisture
- Plasticity
- Free Iron
- Shrinkage
- Fired Colors
- L.O.I

REFERENCES:

1. Ceramics Materials Science and Technology, C.Barry Carter
2. A Handbook Of modern Pottery Manufacture, H.N.Bose
3. Industrial Ceramic, Singer & Singer
4. Hand Book for production of vitreous China sanitary ware. Dr. K N Maiti

INSTRUCTION STRATEGIES

1. Interactions with the students to understand the basic level of ceramics.
2. Explaining & Discussing the primary terminologies related to Basic Ceramics.
3. Teaching the topics included in the syllabus with the help of teaching aids like Basic ceramics Notes, Question Banks, References, Models, Diagrams
4. Assistance in solving of questions from our question bank.

TEACHING AND EXAMINATION

UNIT	Examination Scheme %Weight age	Teaching Scheme No. of Lecture
Unit 1	30	14
Unit 2	30	14
Unit 3	40	20
Total	100	48

CT-102 BASICS OF CERAMIC MATERIALS AND PROCESS-II

RATIONALE: This course is designed to enable students to acquire basic understanding of the Ceramics. Its help to understand fundamental and structure of the unexplored and unidentified raw materials of the Ceramic industry.

LEARNING OUTCOMES:

- Understand the concept of origin and Basic concept of ceramic.
- Develop an understanding the process of the ceramic industry.
- Gain knowledge about the structure, function and applications of various ceramics product.

TEACHING AND EVALUATION SCHEME: The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 40 marks and End Term Examination conducted by University examination for 60 marks.

Subject Code	Subject Title	Credits	Theory			Total Marks
			Hrs.	Max Marks		
				Mid Term	End Term	
CT- 102	BASICS OF CERAMIC MATERIALS AND PROCESS-II	4	48	40	60	100

COURSE CONTENT:

Unit 1. Machineries of mining and Winning of Clay	Number of lectures: 14
<ul style="list-style-type: none">• Winning of Ceramic Material from The Earth• Mining of Clay• Washing Of Clay• Jaw Crusher• Cone Crusher• Pulverizer• Blunger• J.C.B	Weight age: 30%
Unit 2. Sleep house	Number of lectures: 14
<ul style="list-style-type: none">• Blunging• Ball mill Grinding• Vibrating & Screening• Storage & Agitating• Magnet Separators	Weight age: 30%
Unit 3. Plaster of paris and Manufacture of Models and Moulds	Number of lectures: 20
<ul style="list-style-type: none">• Introduction• Gypsum Minerals-Occurrence and Availability• Making of Plaster of Paris• Testing and quality Specification of Plaster of Paris• Production of Models and Moulds	Weight age: 40%

REFERENCES:

1. A Handbook for Production of vitrouse chaina sanitary wares,Dr.K.N.Maiti
2. Ceramics Materials Science and Technology, C.Barry Carter
3. A Handbook Of modern Pottery Manufacture, H.N.Bose
4. Industrial Ceramic, Singer & Singer

INSTRUCTION STRATEGIES

1. Interactions with the students to understand the basic level of ceramics.
2. Explaining & Discussing the primary terminologies related to Basic Ceramics.
3. Teaching the topics included in the syllabus with the help of teaching aids like Basic ceramics Notes.
4. Question Banks, References, Models, Diagrams
5. Assistance in solving of questions from our question bank.

TEACHING AND EXAMINATION

UNIT	Examination Scheme %Weight age	Teaching Scheme No. of Lecture
Unit 1	30	14
Unit 2	30	14
Unit 3	40	20
Total	100	48

CT-103 FUNDAMENTALS OF CHEMISTRY-I

RATIONALE: This course is designed to enable students to acquire basic understanding of the Chemical world, its origin and structure to help the potential application of the unexplored and unidentified chemicals in the Ceramic industry.

LEARNING OUTCOMES:

- Understand the concept of origin of chemistry and Basic concept of ceramic
- Develop an understanding of the chemical systems around the ceramic industry.
- Gain knowledge about the structure, function and applications of various chemicals.

TEACHING AND EVALUATION SCHEME: The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 40 marks and End Term Examination conducted by University examination for 60 marks.

Subject Code	Subject Title	Credits	Theory		Total Marks	
			Hrs.	Max Marks		
				Mid Term		End Term
CT-103	FUNDAMENTALS OF CHEMISTRY-I	4	48	40	60	100

COURSE CONTENT:

Unit 1: Basic Concept of Chemistry

Number of lectures: 14

Weight age: 30%

- Importance of chemistry
- Define : Atomic Mass and Molecular Mass
- Definition of Normality, Molarity, molality and Formality
- Define: Solution
- Examples of Normality and Molarity
- Concept of formulae mass, percentage composition and Empirical Formulae

Unit 2: Structure of Atoms and Chemical Bonding

Number of lectures: 14

Weight age: 30%

- Concept of Atom and Atomic Mass
- Define : Chemical Bonding
- Types of Chemical bonds
- Concept of Bond, Bond length and Bond Angle.

Unit -3 Solution

Number of lectures: 20

Weight age: 30%

- Introduction
- Types of solution
- Concept of Boiling Point, Melting Point, Freezing Point
- Calculation and Examples of % Vol./Vol. , % Weight/Vol.
- Concept of Parts per Million (PPM)
- Calculations and examples of PPM from Solution

REFERENCES:

1. 'Concise Inorganic Chemistry' J.D.Lee, 5th edn.
2. Text book of Organic Chemistry, Arun Bahal, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Analytical Chemistry, Garry D.Christain.

INSTRUCTION STRATEGIES

1. Interactions with the students to understand the basic level of chemistry.
2. Explaining & Discussing the primary terminologies related to Basic Chemistry.
3. Teaching the topics included in the syllabus with the help of teaching aids like Basic chemistry Notes.
4. Question Banks, References, Models, Diagrams
5. Assistance in solving of questions from our question bank.

TEACHING AND EXAMINATION

UNIT	Examination Scheme %Weight age	Teaching Scheme No. of Lecture
Unit 1	30	14
Unit 2	30	14
Unit 3	40	20
Total	100	48

CT-104 CERAMIC PRACTICALS-I

RATIONALE: This course is designed to enable students to acquire on hand basic understanding of the ceramics world, its origin and structure to help the potential application of the unexplored and unidentified compounds in the ceramic industry. These practicals make the students capable and competent to work in Ceramic industries.

LEARNING OUTCOMES:

- Understand the concept of origin of ceramics.
- Develop an understanding of the physical properties of raw materials.
- Gain knowledge about the structure, function and applications of the raw materials.

TEACHING AND EVALUATION SCHEME: Practical will be evaluated on the basis of continuous evolution of 300 Marks and End Semester Assessment for 100 Marks

Subject Code	Subject Title	Credits	PRACTALS Hrs.	Marks		
				Continuous Evaluations	End Term Evaluations	Total Marks
CT-104	CERAMIC PRACTICALS-I	12	36	300	100	400

LIST OF EXPERIMENTS:

Practical – I (TESTING)

1. Identification of Raw Materials (Ball Clay and China Clay)
2. Physical Properties of Clay Material
(i) Colour (ii) Plasticity
3. Sampling and natural Moisture Testing
4. Physical Properties of Non Plastic Material Colour
5. Swelling and Dispersion of Raw Materials
6. Residue and Free Iron Testing of given sample
7. Determine the Shrinkage of Ball Clay
8. Use of Vernier Calipers
9. Size and Thickness of Tiles of given sample.
10. Determine Physical properties of Plaster of Paris such as
11. Setting Time
12. Moisture content
13. Temperature Rise
14. Compressive strength
15. Slip making process in ceramic industry
16. Mold making process in ceramic industry

CT-105 CHEMISTRY PRACTICALS-I

RATIONALE: This course is designed to enable students to acquire on hand basic understanding of the chemical world, its origin and structure to help the potential application of the unexplored and unidentified compounds in the ceramic industry. These practicals make the students capable and competent to work in chemistry related Ceramic industries.

LEARNING OUTCOMES:

- Understand the concept of origin of chemistry.
- Develop an understanding of the chemical properties of compounds.
- Gain knowledge about the structure, function and applications of the chemicals compounds.

TEACHING AND EVALUATION SCHEME: Practical will be evaluated on the basis of continuous evolution of 150 Marks and End Semester Assessment for 50 Marks

Subject Code	Subject Title	Credits	Practical			Total Marks
			Hrs.	Continuous Evaluations	End Term Evaluations	
CT-105	Chemistry Practicals- I	6	6	150	50	200

LIST OF EXPERIMENTS:

1. Standardization

- 1 Preparation of standard solution of Succinic acid and standardization of NaOH/KOH solution.
- 2 Preparation of standard solution of $\text{Na}_2\text{S}_2\text{O}_3$ and standardization of I_2 solution.
- 3 Preparation of standard solution of EDTA and estimation of $\text{Ca}^{+2}/\text{Mg}^{+2}$ in $\text{CaCl}_2/\text{MgCl}_2$ solution.
- 4 Preparation of standard solution of Oxalic acid and standardization of KMnO_4 solution.
- 5 Preparation of standard solution of $\text{K}_2\text{Cr}_2\text{O}_7$ and standardization of FeSO_4 solution.

2. Volumetric Exercise:

- 1 To find out the concentration of hydroxide. Solution by titrating it against the N/10 Standard solution of Oxalic Acid.
- 2 To make the Standard solution of sodium carbonate (about N/5) and determine the Concentration of Unknown H_2SO_4 with the above solution by using titration method
- 3 To find out the concentration of hydroxide. Solution by titrating it against the N/10 Standard solution of Succinic Acid.

2. Demonstrations:

- Preparation of standard stock solution by w/v method and their different dilutions.
- Preparation of standard stock solution of HCl by v/v method and their different dilutions.

INSTRUCTION STRATEGIES

1. Explanation of Principles, protocols, expected result trends, handling of instruments and equipments, precautions and safety measures in class and demonstration of important steps.
2. Monitoring of the students performing the experiments.
3. Evaluation of results of each experiment.

CERAMIC TECHNOLOGY

SEMESTER – II

Course Code	Course Title	Credit		Total	Marks				Total
		Th.	Pra/Field		Th.		Practical		
					I	E	ESE	PA	
CT 201	BASICS OF CERAMIC MATERIALS AND PROCESS -III	4	-	4	40	60	--	--	100
CT 202	BASICS OF CERAMIC MATERIALS AND PROCESS-IV	4		4	40	60	--	--	100
CT 203	FUNDAMENTALS OF CHEMISTRY-II	4	-	4	40	60	--	--	100
CT 204	CERAMIC PRACTICALS-II	-	12	12	--	--	300	100	400
CT 205	CHEMISTRY PRACTICALS-II	-	6	6	--	---	150	50	200
	TOTAL	12	18	30	120	180	450	150	900

CT-201 BASICS OF CERAMIC MATERIALS AND PROCESS-III

RATIONALE: This course is designed to enable students to acquire basic understanding of the Ceramics. Its help to understand fundamental and structure of the unexplored and unidentified raw materials of the Ceramic industry.

LEARNING OUTCOMES:

- Understand the concept of origin and Basic concept of ceramic.
- Develop an understanding the process of the ceramic industry.
- Gain knowledge about the structure, function and applications of various ceramics product.

TEACHING AND EVALUATION SCHEME: The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 40 marks and End Term Examination conducted by University examination for 60 marks.

Subject Code	Subject Title	Credits	Theory			Total Marks
			Hrs.	Max Marks		
				Mid Term	End Term	
CT- 201	Basics of ceramic materials and process-III	4	48	40	60	100

COURSE CONTENT:

Unit 1. Casting of ceramic ware

- Introduction
- Types of casting
- Casting process
- Precautions in casting process.

Number of lectures: 14

Weight age: 30%

Unit 2. Draying and finishing in ceramic ware

- Introduction
- Draying process
- Finishing
- Green and dry finishing
- Precaution in draying and finishing

Number of lectures: 14

Weight age: 30%

Unit 3. Glazing in ceramic ware

- Introduction
- Glaze formulation
- Properties of glaze
- Glazing process
- Precaution in glazing

Number of lectures: 20

Weight age: 40%

REFERENCES:

1. Ceramics Materials Science and Technology, C.Barry Carter
2. A Handbook Of modern Pottery Manufacture, H.N.Bose
3. Industrial Ceramic, Singer & Singer
4. Hand Book for production of vitreous China sanitary ware. Dr. K N Maiti

INSTRUCTION STRATEGIES

1. Interactions with the students to understand the basic level of ceramics.
2. Explaining & Discussing the primary terminologies related to Basic Ceramics.
3. Teaching the topics included in the syllabus with the help of teaching aids like Basic ceramics
Notes
4. Question Banks, References, Models, Diagrams
5. Assistance in solving of questions from our question bank.

TEACHING AND EXAMINATION

UNIT	Examination Scheme %Weight age	Teaching Scheme No. of Lecture
Unit 1	30	14
Unit 2	30	14
Unit 3	30	20
Total	100	48

CT-202 BASICS OF CERAMIC MATERIALS AND PROCESS-IV

RATIONALE: This course is designed to enable students to acquire basic understanding of the Ceramics. Its help to understand fundamental and structure of the unexplored and unidentified raw materials of the Ceramic industry.

LEARNING OUTCOMES:

- Understand the concept of origin and Basic concept of ceramic.
- Develop an understanding the process of the ceramic industry.
- Gain knowledge about the structure, function and applications of various ceramics product.

TEACHING AND EVALUATION SCHEME: The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 40 marks and End Term Examination conducted by University examination for 60 marks.

Subject Code	Subject Title	Credits	Theory			Total Marks
			Hrs.	Max Marks		
				Mid Term	End Term	
CT- 202	Basics of ceramic materials and process -IV	4	48	40	60	100

COURSE CONTENT:

Unit 1. Kilns and Firing process

Number of lectures: 14

- Introduction
- Firing process
- Heating period
- Cooling period

Weight age: 30%

Unit 2. Environmental health and safety practices for ceramic industry

Number of lectures: 14

- Introduction
- Shop floor safety practices for ceramic materials and processes
- Occupational health and safety
- Environmental issues

Weight age: 30%

Unit 3. Refractory

Number of lectures: 20

- Introduction
- Classification of refractory
- High refractory
- Super refractory
- Application of refractory

Weight age: 40%

REFERENCES:

1. Ceramics Materials Science and Technology, C.Barry Carter
2. A Handbook Of modern Pottery Manufacture, H.N.Bose
3. Industrial Ceramic, Singer & Singer
4. A hand book for production of vitreous sanitary wares,Dr.K.N.Maiti

INSTRUCTION STRATEGIES

1. Interactions with the students to understand the basic level of ceramics.
2. Explaining & Discussing the primary terminologies related to Basic Ceramics.
3. Teaching the topics included in the syllabus with the help of teaching aids like Basic ceramic
4. Notes, Question Banks, References, Models, Diagrams
5. Assistance in solving of questions from our question bank.

TEACHING AND EXAMINATION

UNIT	Examination Scheme %Weight age	Teaching Scheme No. of Lecture
Unit 1	30	14
Unit 2	30	14
Unit 3	40	20
Total	100	48

CT-203 FUNDAMENTALS OF CHEMISTRY-II

RATIONALE: This course is designed to enable students to acquire basic understanding of the Chemical world, its origin and structure to help the potential application of the unexplored and unidentified chemicals in the Ceramic industry.

LEARNING OUTCOMES:

- Understand the concept of origin of chemistry and Basic concept of ceramic
- Develop an understanding of the chemical systems around the ceramic industry.
- Gain knowledge about the structure, function and applications of various chemicals.

TEACHING AND EVALUATION SCHEME: The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 40 marks and End Term Examination conducted by University examination for 60 marks.

Subject Code	Subject Title	Credits	Theory			Total Marks
			Hrs.	Max Marks		
				Mid Term	End Term	
CT-203	FUNDAMENTALS OF CHEMISTRY-II	4	48	40	60	100

COURSE CONTENT

Unit 1 Solid State

Number of lectures: 14

Weight age: 30

- Introduction
- Types of Solid- Amorphous and Crystalline
- Crystal Structure
- Concept of Cubic Unit Cell
- Crystal Bond Theory

Unit-2 General Principles and Process of Isolation of Metal

Number of lectures: 14

Weight age: 30

- Introduction of Metal, Non-Metal and Semi Metal
- Concept of Metallurgy-Occurrence and Composition
- Concept of Ore and Alloy
- Purification & Extraction of Metals-Al, Cu, Fe, Zn
- Mineral Purification

Unit 3 - Surface chemistry

Number of lectures: 20

Weight age: 40

- Introduction
- Concept of Adsorption and Absorption
- Distinction between Adsorption and Absorption
- Types of Adsorption
- Applications of Adsorption and absorption

REFERENCES:

- 1.'Concise Inorganic Chemistry' J.D.Lee, 5th edn.
- 2.Text book of Organic Chemistry, Arun Bahal, S.Chand.
- 3.Principal of Physical Chemistry by Arun Bahal.
- 4.Analytical Chemistry, Garry D.Christain.

INSTRUCTION STRATEGIES

1. Interactions with the students to understand the basic level of chemistry.
2. Explaining the primary terminologies related to Basic Chemistry.
3. Discuss the terminologies related to Basic Chemistry
4. Teaching the topics included in the syllabus with the help of teaching aids like Basic chemistry Notes, Question Banks, References, Models, Diagrams
5. Assistance in solving of questions from our question bank.

TEACHING AND EXAMINATION

UNIT	Examination Scheme %Weight age	Teaching Scheme No. of Lecture
Unit 1	30	14
Unit 2	30	14
Unit 3	40	20
Total	100	48

CT-204 CERAMIC PRACTICALS

RATIONALE: This course is designed to enable students to acquire on hand basic understanding of the ceramics world, its origin and structure to help the potential application of the unexplored and unidentified compounds in the ceramic industry. These practicals make the students capable and competent to work in Ceramic industries.

LEARNING OUTCOMES:

- Understand the concept of origin of ceramics.
- Develop an understanding of the physical properties of raw materials.
- Gain knowledge about the structure, function and applications of the raw materials.

TEACHING AND EVALUATION SCHEME: Practical will be evaluated on the basis of continuous evolution of 300 Marks and End Semester Assessment for 100 Marks

Subject Code	Subject Title	Credits	PRACTICALS Hrs.	Marks		
				Continuous Evaluations	End Term Evaluations	Total Marks
CT-204	CERAMIC PRACTICALS	12	36	300	100	400

LIST OF EXPERIMENTS:

Practical – I (ANALYSIS)

1. Determine the Density of a given sample
2. Determine the Viscosity of a given sample
3. Determine Drying & firing Shrinkage of given sample
4. Determine the M.O.R. of given sample
5. Determine the Moisture Test of given Dust
6. Determine the Green Strength of Tiles
7. Determine of Water Absorption of ceramic sample
8. Determine of Water Absorption of Ball Clay Bar
9. Determine of Water Absorption of China Clay Bar
10. Casting of ceramic ware
11. Drying of ceramic ware
12. Glazing of ceramic ware

Practical – II Report for Industrial Visit

1. Explain processing of Raw Materials
2. Identify different suitable Raw materials for products
3. Prepare flow chart of manufacturing process
4. Explain Different shaping Techniques
5. Explain Drying and Firing of Ceramic Products
6. Explain different steps for Quality Control and Pollution Control.

CT-205 CHEMISTRY PRACTICALS-II

RATIONALE: This course is designed to enable students to acquire on hand basic understanding of the chemical world, its origin and structure to help the potential application of the unexplored and unidentified compounds in the ceramic industry. These practicals make the students capable and competent to work in chemistry related Ceramic industries.

LEARNING OUTCOMES:

- Understand the concept of origin of chemistry.
- Develop an understanding of the chemical properties of compounds.
- Gain knowledge about the structure, function and applications of the chemicals compounds.

TEACHING AND EVALUATION SCHEME: Practical will be evaluated on the basis of continuous evolution of 150 Marks and End Semester Assessment for 50 Marks

Subject Code	Subject Title	Credits	Practical			Total Marks
			Hrs.	Continuous Evaluations	End Term Evaluations	
CT-205	Chemistry Practical- I	6	6	150	50	200

LIST OF EXPERIMENTS:

1. Qualitative Analysis of In Organic Salts (IQ) – 10 COMPOUNDS

Anions: Anions:- CO_3^{2-} , S^{2-} , SO_3^{3-} , SO_4^{2-} , NO_2^- , Cl^- , Br^- , CO_3^{2-} , S^{2-} , SO_3^{3-} , SO_4^{2-} , NO_3^- , Cl^- , Br^- , I^- , PO_4^{3-}

Cat ions: Cat ions:- Pb^{2+} , Cu^{2+} , As^{3+} , Al^{3+} , Fe^{3+} , Mn^{2+} , Ni^{2+} , Zn^{2+} , Ca^{2+} , Sr^{2+} , Ba^{2+} .

2. Volumetric Exercise:

- 1 To find out the concentration of hydroxide. Solution by titrating it against the N/5 Standard solution of Succinic Acid.
- 2 To make the Standard solution of sodium carbonate (about N/10) and determine the Concentration of Unknown H_2SO_4 with the above solution by using titration method
- 3 To find out the concentration of hydroxide. Solution by titrating it against the N/10 Standard solution of Oxalic Acid.

2. Demonstrations:

- Preparation of standard stock solution by w/v method and their different dilutions.
- Preparation of standard stock solution of HCl by v/v method and their different dilutions.

INSTRUCTION STRATEGIES

1. Explanation of Principles, protocols, expected result trends, handling of instruments and equipments, precautions and safety measures in class and demonstration of important steps.
2. Monitoring of the students performing the experiments.
3. Evaluation of results of each experiment.