CURRICULUM FOR DIPLOMA OF ASSOCIATE ENGINEER IN GLASS, CERAMICS & POTTERY TECHNOLOGY (3 - Years Course)

INTRODUCTION

The important characteristics of the cceramics industryare that it is the basic of the successful operation of many other industries. Refractories are the basic components of the metallurgical industry. Abrasives are es sential to the Machine tool and automobiles Industry. G lass products a re also essentia l to the automobiles Industry as well as architectural, electronic and electrical industries. For va rious spe cial elec trica l, magnetic inst rument are made of glass & ce ramics is essent ia l f or t he de velopment o f electron ic contro l de vice s computers etc. Modern ce ramic s pla ys ve ry important role in Rocket ry, Miss ile and in Satellit e s. Reacto rs are absolutely dependant on modern ceramics materials as a matter of fact almost in evey industrial production line, Offices and Homes are dependent on ceramics Materials. Newly developed devices are being in corpo rate with ceram ics materia ls because of their usef ul chemical, electrical mechanical thermal and structural properties. Thus ceramics are important because this is the need of a large and basic Indust ry an d also their prop ertie s are c rit ica l f or many applications.

OBJECTIVES

1) To train the students in various production techniques
2) Students are trained to be capable to identify, and analyze the ceramics materials and also to produce ceramics ware like insulators, Table wares, Tiles, Sanitary wares etc. from the local raw materials.
3) To familiarize the students with the machinery and equipments their installation and operations used in the glass industry.
4) To train the students in the design of various types of furnaces Kilns used in Glass and Ceramics Industry.
5) To familiarize the students with the formations of body and glazes.
6) To train the students for the eliminations of defects which come across in the running Industries.

Curriculum Salients:

Entry Level	Matric (Science)	
Duration of Course	3-Year	
Training Methodology	Practical (46%)	**1st Year**
	Theory (54%)	
	Practical (40%)	**2nd Year**
	Theory (60%)	
	Practical (37%)	**3rd Year**
	Theory (63%)	
Instructional Media	Urdu	
	English	

Scheme Of Studies

Glass, Ceramics & Pottery Development (3-Year Course)

1st Year				T	P	C	Page #
1.	GEN	111	Islamiat / Pak. Studies	1	0	1	5
2.	ENG	112	English	2	0	2	14
3.	MATH	113	Applied Math	3	0	3	17
4.	PHY	124	Applied Physics.	2	3	3	25
5.	CH	112	Applied Chemistry	1	3	2	34
6.	COMP	122	Computer Applications	1	3	2	43
7.	CHT	153	Basic Chemical Engineering	2	3	3	50
8.	MT	143	Basic Engineering Drawing and CAD	1	6	3	58
Total				**13**	**18**	**19**	

2nd Year				T	P	C	Page #
1.	GEN	211	Islamiyat / Pak. Studies	1	0	1	71
2.	GCT	202	Workshop Techniques	1	3	2	78
3.	GCT	213	Glass Technology	2	3	3	81
4.	GCT	224	Particle size reduction and glazes	3	3	4	85
5.	GCT	243	Properties of Glass & Ceramics Materials	2	3	3	95
6.	GCT	263	Ceramic Raw Materials	2	3	3	100
7.	GCT	253	Ceramic Production Technique	2	3	3	107
Total				**13**	**18**	**19**	

3rd Year				T	P	C	Page #
1.	GEN	311	Islamiat / Pak. Studies	1	0	1	
2.	GCT	302	Glass Manufacturing Processes	1	3	2	
3.	GCT	323	Special / Technical Ceramics	2	3	3	
4.	GCT	353	Sanitary wares and Tiles	2	3	3	
5.	GCT	373	Fuels and Kilns	2	3	3	
6.	MGM	311	Industrial Management & Human Relations	1	0	1	
7.	OHSE	301	Occupational Health, Safety & Environment	1	0	1	
8.	GCT	363	Project	0	6	2	
Total				**10**	**18**	**16**	

FIRST YEAR

اسلامیات/مطالعہ پاکستان

حصہ اول	اسلامیات	Gen III	ٹی	پی	سی
			1	0	1

حصہ دوم مطالعہ پاکستان

موضوعات حصہ اول اسلامیات سال اول

کتاب و سنت کل وقت: 20 گھنٹے

قرآن مجید

1- تعارف قرآن مجید 2- نزول قرآن 3- مکی و مدنی سورتوں کی خصوصیات 4- وحی کی اقسام 3

5- پندرہ منتخب آیات معہ ترجمہ

1- لن تنالوا البر حتی تنفقوا مما تحبون

2- واعتصموا بحبل الله جمیعا ولا تفرقوا

3- ولا یجرمنکم شنان قوم علی ان لا تعدلوا

4- ان الله یامرکم ان تودوا الامانات الی اهلها

5- ان الله یامر بالعدل والاحسان

6- ان الصلوة تنهی عن الفحشاء والمنکر

7- لقد کان لکم فی رسول الله اسوة حسنة

8- ان اکرمکم عند الله اتقاکم

9- وما اتاکم الرسول فخذوه ومانهاکم عنه فانتهو

10- واوفوبالعهد

11- وعاشروهن بالمعروف

12- یمحق الله الربوٰ ویربی الصدقات

13- واصبر علی ما اصابک

14- وقولوا قولا سدیدا

15- ان الدین عند الله الاسلام

(ب) **سنت**

1- **سنت کی اہمیت**

1- انما الاعمال بالنیات

2- انما بعث لاتمم مکارم الاخلاق

3- لایومن احدکم حتی یحب الا خیه ما یحب لنفسه

4- المسلم من سلم المسلمون من لسانه ویده

5- قل امنت بالله ثم استقم

6- خیرکم خیرکم لا هله

7- سباب المسلم فسوق وقتاله کفر

8- المومن اخوالمومن

9- کل المسلم علی المسلم حرام دمه وماله وعرضه

10- آیة المنافق ثلاثة اذا حدث کذب واذا اوتمن خان واذا وعد اخلف

2- **دین اسلام** (5)

2.1 اسلام کے بنیادی عقائد کی وضاحت اور انسان کی انفرادی واجتماعی زندگی پران کے اثرات

1- توحید

2- رسالت

3- آخرت

4- ملائکہ

5- آسمانی کتب

2.2 **عبادات** (5)

1- نماز 2- روزہ 3- حج 4- زکوٰۃ

مندرجہ بالا عبادات کی اہمیت وفضیلت، حکمتیں اور انسان کی انفرادی ومعاشرتی زندگی پر اس کے اثرات

4- دین اسلام

عمومی مقصد۔ دین اسلام کے بنیادی عقائد اور عبادات کے بارے میں جان سکے اور بیان کر سکے

خصوصی مقاصد:

- ☆ لفظ دین اسلام کے لغوی اور اصطلاحی معنی بیان کر سکے۔
- ☆ اسلام کے بنیادی عقائد کی اہمیت بیان کر سکے۔
- ☆ اسلام کے بنیادی عقائد کے انسان کی انفرادی و اجتماعی زندگی پر پڑنے والے اثرات بیان کر سکے
- ☆ عبادت کے لفظی و اصطلاحی معنی بیان کر سکے۔
- ☆ عقیدے اور عبادت کا فرق بیان کر سکے۔
- ☆ عبادات (نماز، روزہ، حج، زکوٰۃ) کے فوری احکامات اور انسانی زندگی پر ان کے اثرات بیان کر سکے
- ☆ اسلامی عقائد و عبادات کے مطابق اپنی زندگی ڈھال کر ایک اچھا مسلمان بن سکے۔

نصاب اخلاقیات سال اول (غیر مسلم طلباء کیلئے)

حصہ اول اخلاقیات	Gen III	ٹی	پی	سی
		1	0	1

کل وقت: 20 گھنٹے

حصہ دوم مطالعہ پاکستان

موضوعات

اخلاقیات کی تعریف اور اہمیت

اخلاقیات کا معیار (قانون۔عقل۔الہامی کتب)

مندرجہ ذیل اخلاق کی وضاحت

- دیانت داری
- وفاداری
- نظم وضبط
- راست گوئی
- صبر واستقلال
- حوصلہ مندی
- وقت کی پابندی
- صفائی
- اعتماد
- باہمی احترام
- مصلحت

نصاب اخلاقیات سال اول

تدریسی مقاصد

عمومی مقصد۔ اعلیٰ اخلاق کی وجہ سے ملکی ترقی میں قابل قدر اضافہ کر سکے۔

خصوصی مقاصد۔ طالب علم اس قابل ہوگا کہ:

- موضوعات کا مطلب بیان کر سکے۔
- عملی زندگی سے مثالوں کی نشاندہی کر سکے۔
- اپنی شخصیت اور معاشرے پر موضوعات کے مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے
- دیانت داری کی اہمیت بیان کر سکے۔
- وفاداری کی اہمیت بیان کر سکے۔
- نظم وضبط کی افادیت بیان کر سکے۔
- صدق بیان کی ضرورت بیان کر سکے۔
- حوصلہ مندی کے فوائد بیان کر سکے
- وقت کی پابندی کے فوائد بیان کر سکے
- صفائی اور باہمی اعتماد سے حسن کارکردگی کو بیان کر سکے
- مصلحت کے فوائد بیان کر سکے

نصاب اخلاقیات سال اول

تدریسی مقاصد

عمومی مقصد۔ اعلیٰ اخلاق کی وجہ سے ملکی ترقی میں قابل قدر اضافہ کر سکے۔

خصوصی مقاصد۔ طالب علم اس قابل ہوگا کہ:

- موضوعات کا مطلب بیان کر سکے۔
- عملی زندگی سے مثالوں کی نشاندہی کر سکے۔
- اپنی شخصیت اور معاشرے پر موضوعات کے مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے
- دیانت داری کی اہمیت بیان کر سکے۔
- وفاداری کی اہمیت بیان کر سکے۔
- نظم وضبط کی افادیت بیان کر سکے۔
- صدق بیان کی ضرورت بیان کر سکے۔
- حوصلہ مندی کے فوائد بیان کر سکے
- وقت کی پابندی کے فوائد بیان کر سکے
- صفائی اور باہمی اعتماد سے حسن کارکردگی کو بیان کر سکے
- مصلحت کے فوائد بیان کر سکے

مطالعہ پاکستان

حصہ دوم

تدریسی مقاصد۔ حریت فکر:

عمومی مقصد۔ طالب علم یہ جان لے کہ اسلام میں اور مسلمان قوم میں آزادی فکر کی کیا اہمیت ہے۔

خصوصی مقاصد:

- حریت فکر کا معنی و مفہوم بیان کر سکے۔
- آزادی فکر کی اہمیت بیان کر سکے۔
- خصوصاً اسلام میں آزادی اظہار رائے کی اہمیت بیان کر سکے۔
- ذہنی غلامی کے قومی سطح پر نقصانات بیان کر سکے۔
- جسمانی غلامی کے قومی سطح پر نقصانات بیان کر سکے۔

نظریہ پاکستان

عمومی مقصد۔ نظریہ پاکستان (دین اسلام) سے پوری طرح واقف ہو جائے

خصوصی مقاصد:

- نظریہ کی تعریف بیان کر سکے اور اس کی وضاحت کر سکے۔
- نظریہ پاکستان کی تعریف کر سکے اور اس کا مفہوم بیان کر سکے۔
- علامہ اقبال اور قائداعظم کے فرمودات کی روشنی میں نظریہ پاکستان بیان کر سکے۔

نظریہ پاکستان کا تاریخی پہلو

عمومی مقصد۔ نظریہ پاکستان کے تاریخی پس منظر سے واقفیت حاصل کر سکے۔

خصوصی مقاصد۔ محمد بن قاسم کے بارے میں بیان کر سکے۔

نصاب سال اول Gen III

حصہ دوم مطالعہ پاکستان کل وقت:12 گھنٹے

موضوعات

- حریت فکر

مسلمان قوم میں آزادی فکر کی تاریخ۔ مسلمانوں میں سیاسی آزادی کی اہمیت اور ضرورت۔ ذہنی وجسمانی غلامی کے نقصانات

- نظریہ پاکستان

قیام پاکستان کی اساس (دین اسلام) قیام پاکستان کی غرض و غایت۔ نظریہ پاکستان کی وضاحت۔ نظریہ پاکستان علامہ اقبال اور قائداعظم کے ارشادات کی روشنی میں

- نظریہ پاکستان کا تاریخی پہلو

محمد بن قاسم کی آمد۔ مجدد الف ثانی اور شاہ ولی اللہ کی تبلیغی خدمات، سید احمد شہید کی تحریک مجاہدین

- تعلیمی تحریکیں

علی گڑھ۔ ندوۃ العلماء۔ دیوبند۔ مدرسۃ الاسلام (سندھ) اسلامیہ کالج (پشاور) انجمن حمایت اسلام (لاہور)

- محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکے
- محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکے
- وہ بیان کر سکے کہ ہندوستان میں ہندو مسلم دوقومی نظریہ کا نکتہ آغاز کیا ہے۔
- مجدد الف ثانی کی علمی خدمات بیان کر سکے
- شاہ ولی اللہ کی علمی خدمات بیان کر سکے
- مجدد الف ثانی اور شاہ ولی اللہ نے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکے۔

علمی تحریکیں

عمومی مقصد۔

- برصغیر کی علمی تحریکوں سے آگاہی حاصل ہو سکے

خصوصی مقاصد

- علی گڑھ۔ دیوبند۔ ندوۃ العلماء۔ مدرسۃ الاسلام۔ اسلامیہ کالج۔ انجمن حمایت اسلام نے تعلیم کے ذریعہ جو سیاسی شعور مسلمانوں میں پیدا کیا اسے بیان کر سکے۔
- آزادی ہند کے سلسلہ میں تحریک مجاہدین کی خدمات بیان کر سکے۔

Eng-112 ENGLISH

Total contact hours

Theory	64	T	P	C
Practical	0	2	0	2

AIMS At the end of the course, the students will be equipped with cognitive skill to enable them to present facts in a systematic and logical manner to meet the language demands of dynamic field of commerce and industry for functional day-to-day use and will inculcate skills of reading, writing and comprehension.

COURSE CONTENTS

ENGLISH PAPER "A"

1. PROSE/TEXT 16 hrs.

1.1 First eight essays of Intermediate. English Book-II

2. CLOZE TEST 04 hrs.

1.2 A passage comprising 50-100 words will be selected from the text. Every 11thword or any word for that matter will be omitted. The number of missing word will range between 5-10. The chosen word may or may not be the one used in the text, but it should be an appropriate word.

ENGLISH PAPER "B"

3. GRAMMAR 26 hrs

3.1 Sentence Structure.
3.2 Tenses.
3.3 Parts of speech.
3.4 Punctuation,
3.5 Change of Narration.
3.6 One word for several
3.7 Words often confused

4. COMPOSITION 8 hrs

4.1 Letters/Messages
4.2 Job application letter
4.3 For character certificate/for grant of scholarship
4.4 Telegrams, Cablegrams and Radiograms, Telexes, Facsimiles
4.5 Essay writing
4.6 Technical Education, Science and Our life, Computers, Environmental Pollution, Duties of a Student. **4 hrs**

5. TRANSLATION 6 hrs

5.1 Translation from Urdu into English.
For Foreign Students: A paragraph or a dialogue.

RECOMMENDED BOOKS

1. Technical English developed by Mr. Zia Sarwar, Mr. Habib-ur –Rehman, Evaluated by Mr.Zafar Iqbal Khokhar, Mr. Zahid Zahoor, Vol - I, National Book Foundation

Eng-112 ENGLISH

INSTRUCTIONAL OBJECTIVES

PAPER-A

1. DEMONSTRATE BETTER READING, COMPREHENSION AND VOCABULARY

1.1 Manipulate, skimming and scanning of the text.
1.2 Identify new ideas.
1.3 Reproduce facts, characters in own words
1.4 Write summary of stories

2. UNDERSTAND FACTS OF THE TEXT

2.1 Rewrite words to fill in the blanks recalling the text.
2.2 Use own words to fill in the blanks.

PAPER-B

3. APPLY THE RULES OF GRAMMAR IN WRITING AND SPEAKING

3.1 Use rules of grammar to construct meaningful sentences containing a subjectand a predicate.
3.2 State classification of time, i.e. present, past and future and use verb tensecorrectly in different forms to denote relevant time.
3.3 Identify function words and content words.
3.4 Use marks of punctuation to make sense clear.
3.5 ' Relate what a person says in direct and indirect forms.
3.6 Compose his writings.
3.7 Distinguish between confusing words.

4. APPLY THE CONCEPTS OF COMPOSITION WRITING TO PRACTICALSITUATIONS

4.1 Use concept to construct applications for employment, for character certificate,for grant of scholarship.
4.2 Define and write telegrams, cablegrams and radiograms, telexes, facsimiles
4.3 Describe steps of a good composition writing.
4.4 Describe features of a good composition.
4.5 Describe methods of composition writing.
4.6 Use these concepts to organize facts and describe them systematically inpractical situation;

5. APPLIES RULES OF TRANSLATION

5.1 Describe confusion.
5.2 Describe rules of translation.
5.3 Use rules of translation from Urdu to English in simple paragraph andsentences.

Math-113 APPLIED MATHEMATICS

Total contact hours	96	**T**	**P**	**C**
Theory		3	0	3

Pre-requisite: Must have completed a course of Elective Mathematics at Matric level.

AIMS After completing the course the students will be able to

1. Solve problems of Algebra, Trigonometry, vectors. Menstruation, Matrices and Determinants.
2. Develop skill, mathematical attitudes and logical perception in the use of mathematical instruments as required in the technological fields.
3. Acquire mathematical clarity and insight in the solution of technical problems.

COURSE CONTENTS

1 QUADRATIC EQUATIONS 6 Hrs

1.1 StandardForm
1.2 Solution
1.3 Nature of roots
1.4 Sum & Productof roots
1 .5 Formation
1.6 Problems

2 ARITHMETIC PROGRESSION AND SERIES 3Hrs

2.1 Sequence
2.2 Series
2.3 nth term
2.4 Sum of the first n terms
2.5 Means
2.6 Problems

3 GEOMETRIC PROGRESSION AND SERIES 3Hrs

3.1 nth term
3:2 sum of the first n terms
3.3 Means
3.4 Infinite Geometric progression
3.5 Problems

4 BINOMIAL THEOREM 6 Hrs

4.1 Factorials
4.2 Binomial Expression
4.3 Binomial Co-efficient
4.4 Statement
4.5 The General Term
4.6 The Binomial Series.
4.7 Problems

5 PARTIAL FRACTIONS 6 Hrs

5.1 Introduction

5.2 Linear Distinct Factors Case I
5.3 Linear Repeated FactorsCase II
5.4 Quadratic Distinct Factors Case III
5.5 Quadratic Repeated Factors Case IV
5.6 Problems

6 FUNDAMENTALS OF TRIGONOMETRY 6 Hrs

6.1 Angles
6.2 Quadrants
6.3 Measurements of Angles
6.4 Relation between Sexagesimal& circular system
6.5 Relation between Length of a Circular Arc & the Radian Measure of its centralAngle
6.6 Problems

7 TRIGONOMETRIC FUNCTIONS AND RATIOS 6 Hrs

7.1 trigonometric functions of any angle
7.2 Signs of trigonometric Functions
7.3 Trigonometric Ratios of particular Angles
7.4 Fundamental Identities
7.5 Problems

8 GENERAL INDENTITIES 6 Hrs

8.1 The Fundamental Law
8.2 Deductions
8.3 Sum & Difference Formulae
8.4 Double Angle Identities
8.5 Half Angle Identities
8.6 Conversion of sum or difference to products
8.7 Problems

9 SOLUTION OF TRIANGLES 6 Hrs

9.1 The law of Sines
9.2 The law of Cosines
9.3 Measurement of Heights & Distances
9.4 Problems

10 MENSURATION OF SOLIDS 30 Hrs

10.1 Review of regular plane figures and Simpson's Rule
10.2 Prisms
10.3 Cylinders
10.4 Pyramids
10.5 Cones
10.6 Frusta
10.7 Spheres

11 VECTORS 9 Hrs

11.1 Sealers & Vectors
11.2 Addition & Subtraction

11.3 The unit Vectors I, j, k
11.4 Direction Cosines
11.5 Sealer or Dot Product
11.6 Deductions
11.7 Dot product in terms of orthogonal components
11.8 Deductions
11.9 Analytic Expression for a x b.
11.10 Problems.

12 MATRICES AND DETERMINANTS 9 Hrs

12.1 Definition of Matrix
12.2 Rows & Columns
12.3 Order of a Matrix
12.4 Algebra of Matrices
12.5 Determinants
12.6 Properties of Determinants
12.7 Solution of Linear Equations
12.8 Problems

REFERENCE BOOKS

Applied Mathematics Math-113, by Nasir -ud-Din Mahmood, Sana-ullah Khan, Tahir Hameed, Syed Tanvir Haider, Javed Iqbal, Vol - I, National Book Foundation

Math-113 APPLIED MATHEMATICS-I

INSTRUCTIONAL OBJECTIVES

1 USE DIFFERENT METHODS FOR THE SOLUTION OF QUADRATIC EQUATIONS

1.1 Define a standard quadratic equation.
1.2 Use methods of factorization and method of completing the square for solvingthe equations.
1.3 Derive quadratic formula.
1.4 Write expression for the discriminant
1.5 Explain nature of the roots of a quadratic equation.
1.6 Calculate sum and product of the roots.
1.7 Form a quadratic equation fromthe given roots.
1.8 Solve problems involving quadratic equations.

2 UNDERSTAND APPLY CONCEPT OF ARITHMETIC PROGRESSION AND SERIES

2.1 Define an Arithmetic sequence and a series
2.2 Derive formula for the nth term of an A.P.
2.3 Explain Arithmetic Mean between two given numbers
2.4 Insert n Arithmetic means between two numbers
2.5 Derive formulas for summation of an Arithmetic series
2.6 Solve problems on Arithmetic Progression and Series

3 UNDERSTAND GEOMETRIC PROGRESSION AND SERIES

3.1 Define a geometric sequence and a series.
3.2 Derive formula for nth term of a G.P.
3.3 Explain geometric mean between two numbers.
3.4 Insert n geometric means between two numbers.
3.5 Derive a formula for the summation of geometric Series.
3.6 Deduce a formula for the summation of an infinite G.P.
3.7 Solve problems using these formulas.

4 EXPAND AND EXTRACT ROOTS OF A BINOMIAL

4.1 State binomial theorem for positive integral index.
4.2 Explain binomial coefficients: (n,0), (n,1)…….(n,r),…….(n,n)
4.3 Derive expression for the general term.
4.4 Calculate the specified terms.
4.5 Expand a binomial of a given index. -
4.6 Extract the specified roots
4.7 Compute the approximate value to a given decimal place.
4.8 Solve problems involving binomials.

5 RESOLVE A SINGLE FRACTIONINTO PARTIALFRACTIONS USINGDIFFERENT METHODS.

5.1 Define a partial fraction, a proper and an improper fraction.
5.2 Explain all the four types of partial fractions.
5.3 Set up equivalent partial fractions for each type.
5.4 Explain the methods for finding constants involved.
5.5 Resolve a single fraction into partial fractions.
5.6 Solve problems involving all the four types.

6 UNDERSTAND SYSTEMS OF MEASUREMENT OF ANGLES.

6.1 Define angles and the related terms.
6.2 Illustrate the generation of angle.

6.3 Explain sexagesimal and circular systems for the measurement of angles
6.4 Derive the relationship between radian and degree.
6.5 Convert radians to degrees and vice versa.
6.6 Derive a formula for the circular measure of a central angle.
6.7 Use this formula for solving problems.

7 APPLY BASIC CONCEPTS AND PRINCIPLES OF TRIGONOMETRICFUNCTIONS

7.1 Define the basic trigonometric functions/ratios of an angle as ratios of the sidesof a right triangle.
7.2 Derive fundamental identities.
7.3 Find trigonometric ratios of particular angles.
7.4 Draw the graph of trigonometric functions.
7.5 Solve problems involving trigonometric functions.

8 USE TRIGONOMETRIC IDENTITIES IN SOLVING TECHNOLOGICALPROBLEMS

8.1 List fundamental identities
8.2 Prove the fundamental law
8.3 Deduce important results
8.4 Derive-sum and difference formulas
8.5 Establish half angle, double angle & triple angle formulas
8.6 Convert sum or difference into product& vice versa
8.7 Solve problems

9 USE CONCEPTS, PROPERTIES AND LAWS OF TRIGONOMETRIC FUNCTIONS FOR SOLVING TRIANGLES

9.1 Define angle of elevation and angle of depression.
9.2 Prove the law of sins and the law of cosines.
9.3 Explain elements of a triangle.
9.4 Solve triangles and the problems involving heights and distances.

10 USE PRINCIPLES OF MENSTRUATION IN FINDING SURFACES, VOLUMEAND WEIGHTS OF SOLIDS.

10.1 Define menstruation of plane and solid figures
10.2 List formulas for perimeters & areas of plane figure.
10.3 Define pyramid and cone.
10.4 Define frusta of pyramid and cone.
10.5 Define a sphere and a shell.
10.6 Calculate the total surface and volume of each type of solid.
10.7 Compute weight of solids.
10.8 Solve problems of these solids.

11. USE THE CONCEPT AND PRINCIPLES OF VECTORS IN SOLVINGTECHNOLOGICAL PROBLEMS.

11.1 Define vector quantity.
11.2 Explain addition and subtraction of vector
11.3 Illustrate unit vectors I, j, k.
11.4 Express a vector in the component form.
11.5 Explain magnitude, unit vector, directionconsines of a vector.
11.6 Derive analytic expression for dot product and cross product of two vector.
11.7 Deduce conditions of perpendicularly and parallelism of two vectors.
11.8 Solve problems

12. USE THE CONCEPT OFMATRICES & DETERMINANTS IN SOLVING TECHNOLOGICAL PROBLEMS

12.1 Define a matrix and a determinant.
12.2 List types of matrices.
12.3 Define transpose, ad joint and inverse of a matrix.
12.4 State properties of determinants.

12.5 Explain basic concepts.
12.6 Explain algebra of matrices.
12.7 Solve linear equation by matrices.
12.8 Explain the solution of a determinant.
12.9 Use Crammers Rule for solving linear equations

PHY – 124 APPLIED PHYSICS

Total Contact Hours	**160**	**T**	**P**	**C**
Theory	**64 hours**	**2**	**3**	**3**
Practical	**96 hours**			

COURSE AIMS:

The student will be able to understand the fundamental principles and concept of Physics. Use these to solve problems in practical situations / technological course and understand concepts to learn advance physics / technical course.

COURSE CONTENTS

1. MEASUREMENT 5 Hours

Fundamental units and derived units

Systems of measurement and S.I units

Concepts of dimensions, dimensional formula

Conversion from one system to another

Significant figures

2. SCALARS AND VECTORS 4 Hours

Revision of head to tail rule

Laws of parallelogram, triangle and polygon of forces

Resolution of a vector

Addition of vectors by rectangular components

Multiplication of two vectors, dot product and cross product

3. MOTION 5 Hours

Review of laws and equation of motion

Laws of conservation of momentum

Angular motion

Relation between linear and angular motion

Centripetal acceleration and force

Equation of angular motion

4. TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA 5 Hours

Center of gravity and center of mass

Equilibrium and its conditions

Torque and angular acceleration

Rotational inertia

5. WAVE MOTION **5 Hours**

Review Hook's Law of elasticity

Motion under an elastic restoring force

Characteristics of harmonic motion

S.H.M and circular motion

Simple pendulum

Wave form of S.H.M

Resonance

Transverse vibration of a stretched string

6. LIGHT **5 Hours**

Review laws of refection and refraction

Image formation by mirrors and lenses

Optical instruments

Interference, diffraction, polarization of light waves

7. LASERS **5 Hours**

Corpuscular theory of light

Emission and absorption of light

Stimulated absorption and emission of light

Laser principle

Structure and working of lasers

Types of lasers with brief description

Applications of basic concepts

Material processing

Laser welding

Laser assisted machining

Micro machining

Drilling, scribing and marking

8. HEAT **5 Hours**

Review of calorimetric and gas laws

Thermal expansion of solids, liquids and gases

Heat of fusion, vaporization

Humidity, absolute and relative

Law of cooling

Thermoelectricity

Thermocouple

9. THERMODYNAMICS **5 Hours**

Heat energy and internal energy

First law of thermodynamics

Isometric and adiabatic processes

Efficiency of heat engine

Second law of thermodynamic (both statement)

Heat engine and refrigerator

10. TRANSFER OF HEAT **5 Hours**

Review: modes of transfer of heat

Emission and absorption of heat

Black body radiation

Laws of energy distribution

Planck’s Quantum Theory

The photoelectric effect

X-rays, production, properties and uses

11. ATOMIC NUCLEUS **5 Hours**

Structure of the nucleus

Radioactivity

Radioactive series

Transmutation of elements

The fission reaction

The fusion reaction

12. NUCLEAR RADIATIONS **5 Hours**

Properties and interaction with matter

Radiation detectors

Radiation damage and its effects

Radiation therapy

Radioactive tracers

13. MAGNETIC & SEMI CONDUCTOR MATERIALS **5 Hours**

Magnetism

Domains theory

Para, dia and ferromagnetism and magnetic materials

Crystalline structure of solids

Conductors, semiconductors, insulators

INSTRUCTIONAL OBJECTIVES

1. USE CONCEPTS OF MEASUREMENT TO PRACTICAL SITUATIONS AND TECHNOLOGICAL PROBLEMS

Write dimensional formulae for physical quantities

Derive units using dimensional equations

Convert a measurement from one system to another

Use concepts of measurement and significant figures in problems solving

2. USE CONCEPTS OF SCALARS AND VECTORS IN SOLVING PROBLEMS INVOLVING THESE CONCEPTS

Explain laws of parallelogram, triangle and polygon of force

Describe method of resolution of a vector into components

Describe method of addition of vectors by rectangular components

Differentiate between dot product and cross product of vectors

Use the concepts in solving problems involving addition resolution and multiplication of vectors.

3. USE THE LAW OF CONSERVATION OF MOMENTUM AND CONCEPTS OF ANGULAR MOTION TO PRACTICAL SITUATIONS

Use law of conservation of momentum practical / technological problems

Explain relation between linear and angular motion

Use concepts and equations of angular motion to solve relevant technological problems

4. USE CONCEPTS OF TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA TO PRACTICAL SITUATION / PROBLEMS

Distinguish between center of gravity and center of mass

Explain rotational equilibrium and use conditions

Explain rotational inertia giving examples

Use the above concepts in solving technological problems

5. USE CONCEPTS OF WAVE MOTION IN SOLVING RELEVANT PROBLEMS

Explain Hook's law of elasticity

Derive formula for motion under an elastic restoring force

Derive formula for simple harmonic motion and simple pendulum

Explain wave form with reference to S.H.M and circular motion

Explain resonance

Explain transverse vibration of a stretched string

Use the above concepts and formula of S.H.M to solve relevant problems

6. USE THE CONCEPTS OF GEOMETRICAL OPTICS TO MIRRORS AND LENSES

Explain laws of reflection and refraction

Use mirror formula to solve problems

Use the concepts of image formation by mirrors and lenses to describe working of optical instruments, e.g. microscope, telescope, camera and sextant

7. UNDERSTAND THE STRUCTURE, WORKING AND USES OF LASERS

Explain the stimulated emission of radiation

Explain the laser principle

Describe the structure and working of lasers

Distinguish between types of lasers

Describe the applications of lasers

8. UNDERSTAND CONCEPTS OF HEAT

Explain calorimetric

Explain gas laws giving mathematical expressions

Explain thermal expansion of solids, liquids and gases

Distinguish between heat of fusion, vaporization

Distinguish between absolute and relative humidity

Describe laws of cooling

Explain basic concepts of thermoelectricity

Describe thermocouple, giving its principle, structure and working

9. UNDERSTAND LAWS OF THERMODYNAMICS

Distinguish between heat energy and internal energy

Explain first law of thermodynamics giving its applications

Distinguish between isometric and adiabatic processes

Explain second law of thermodynamics describing alternate statements

Distinguish between work of heat engine and refrigerator.

10. UNDERSTAND LAWS OF ENERGY DISTRIBUTION AND EMISSION OF RADIATION

Explain modes of transfer of heat

Explain back body radiation and laws of energy distribution

Describe Planck's Quantum Theory

Explain photoelectric effect

Explain production, properties and uses of X-rays.

11. UNDERSTAND THE STRUCTURE OF THE ATOMIC NUCLEUS AND RELEVANT ACTIVITIES

Describe the structure of the nucleus

Explain radioactivity and radioactive series

Explain transmutation of elements

Distinguish between fission reaction and fusion reaction

12. UNDERSTAND NUCLEAR RADIATIONS THEIR EFFECTS AND USES

Describe properties of nuclear radiations and their interaction with matter

Explain working of radiation detectors

Explain damaging effects of nuclear radiations

Explain radiation therapy

Describe radioactive tracers

Describe applications of radiation techniques in course contents

13. UNDERSTAND BASIC CONCEPTS CLASSIFICATION OF MAGNETIC MATERIALS

Explain domains theory of magnetism

Distinguish between Para, dia and ferromagnetic and magnetic materials

Distinguish between B and H

LIST OF PRACTICAL

1. Draw graphs representing the functions Y =
   mx for m = 0, 0.5, 1, 2
   Y = x2
   Y = 1 / x
2. Find the volume of a given solid cylinder using Vernier calipers
3. Find the area of cross-section of the given wire using micrometer screw gauge
4. Prove that force is directly proportional to a) mass, (b) acceleration, using Fletcher's trolley
5. Verify law of parallelogram of force using Grave sands apparatus
6. Verify law of triangle of forces and Lami's theorem
7. Determine the weight of a given body using
   Law of parallelogram of forces
   Law of triangle of forces
   Lami's theorem
8. Verify law of polygon of forces using Grave sands apparatus
9. Locate the positions and magnitude of resultant of like parallel forces
10. Determine the resultant of two unlike parallel forces
11. Find the weight of a given body using principles of moments
12. Locate the center of gravity of regular and irregular shaped bodies
13. Find young's modules of elasticity of a metallic wire
14. Verify Hook's law using helical spring
15. Study of frequency of stretched string with length
16. Study of variation of frequency of stretched string with tension
17. Study of resonance of air column in resonance tube and fling velocity of sound.
18. Find the frequency of the given tuning fork using resonance tube
19. Find velocity of sound in rod by kundt's tube
20. Verify rectilinear propagation of light and study shadow formation

21. Study effect of rotation of plane mirror on reflection
22. Compare the refractive indices of given glass slabs
23. Find focal length of concave mirror by locating center of curvature
24. Find focal length of concave mirror by object and image method
25. Find focal length of concave mirror with converging lens
26. Find refractive index of glass by spectrometer
27. Find refractive index of glass by spectrometer
28. Find focal length of converging lens by plane mirror
29. Find focal length of converging lens by displacement method
30. Find focal length of diverging lens using converging lens
31. Find focal length of diverging lens using concave mirror
32. Find angular magnification of an astronomical telescope
33. Find angular magnification of a simple microscope (magnifying glass)
34. Find angular magnification of a simple compound microscope
35. Study working and structure of camera
36. Study working and structure of sextant
37. Compare the different scales of temperature and verify the conversion formula
38. Determine the specific heat of lead shots
39. Find the coefficient of linear expansion of a metallic rod
40. Find the heat of fusion of ice
41. Find the heat of vaporization
42. Determine relative humidity using hygrometer

CH – 112 APPLIED CHEMISTRY

Total Contact Hours	**128**	**T**	**P**	**C**
Theory	**32 hours**	**1**	**3**	**2**
Practical	**96 hours**			

Pre-requisites: The student must have studied the subject of elective chemistry at secondary school level.

COURSE AIMS:

After studying this course a student will be able to:

1. Understand the significance and role of chemistry in the development of modern technology
2. Become acquired with the basic principles of chemistry as applied in the study of relevant technology.
3. Know the scientific methods for production, and use of materials of industrial & technological significance.
4. Gains skill for the efficient conduct of practical in a chemistry lab.

COURSE CONTENTS

1. INTRODUCTION AND FUNDAMENTAL CONCEPTS 2 Hours

Orientation with reference to this technology

Terms used & units of measurements in the study of chemistry

Chemical reactions & their types

2. ATOMIC STRUCTURE 2 Hours

Sub atomic particles

Architecture of atoms of elements. Atomic no. & atomic weight

The periodic classification of elements periodic law

General characteristics of a period and group

3. CHEMICAL BOND 2 Hours

Nature of chemical bond

Electrovalent bond with examples

Covalent bond (polar and non-polar, sigma & pie bonds with examples) Co-ordinate bond with examples

4. WATER **2 Hours**

Chemical nature and properties

Impurities

Hardness of water (types, causes and removal)

Scales of measuring hardness (degrees clark French, PPM, Mg- per liter)

Boiler feed water, scales and treatment

Sea water desalination, sewage treatment

5. ACIDS, BASES AND SALTS **2 Hours**

Definitions with examples

Properties, their strength, basicity and acidity

Salts and their classification with examples

Ph – value and scale

6. OXIDATION & REDUCTION **2 Hours**

The process, definition and examples

Oxidizing and reducing agents

Oxides and their classifications

7. NUCLEAR CHEMISTRY **2 Hours**

Introduction

Radioactivity (alpha, beta and gamma rays)

Half life process

Nuclear reaction and transformation of elements

8. CEMENT **2 Hours**

Introduction

Composition and manufacture

Chemistry of setting and hardening

Special purpose cements

9. GLASS **2 Hours**

Composition and raw material

Manufacture

Varieties and uses

10. PLASTICS AND POLYMERS **2 Hours**

Introduction and importance

Classification

Manufacture

Properties and uses

11. PAINTS, VARNISHES AND DISTEMPER **2 Hours**

Introduction

Constituents

Preparation and use

12. CORROSION **2 Hours**

Introduction with causes

Types of corrosion

Rusting of iron

Protective measures against corrosion

13. REFRACTORY MATERIALS AND ABRASIVE **2 Hours**

Introduction to refractories

Classification of refractories

Properties and uses

Introduction to abrasives

Artificial and natural abrasives and their uses

14. ALLOYS **2 Hours**

Introduction with need

Preparation and properties

Some important alloys and their composition

Uses

15. FUELS AND COMBUSTION **2 Hours**

Introduction of fuels

Classification of fuels

Combustion

Numerical problems of combustion

16. LUBRICANTS **1 Hours**

Introduction

Classification

Properties of lubricants

Selection of lubricants

17. POLLUTION **1 Hours**

The problems and its dangers

Causes of pollution

Remedies to combat the hazards of pollution

INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND THE SCOPE, SIGNIFICANCE AND FUNDAMENTAL ROLE OF THE SUBJECT

Define chemistry and its important terms

State the units of measurements in the study of chemistry

Write chemical formula of common compounds

Describe types of chemical reactions with examples

2. UNDERSTAND THE STRUCTURE OF ATOMS AND ARRANGEMENT OF SUB ATOMIC PARTICLES IN THE ARCHITECTURE OF ATOMS

Define atom

State the periodic law of elements

Describe the fundamentals sub atomic particles

Distinguish between atomic no. And mass no. Isotopes and isobars

Explain the arrangements of electrons in different shells and sub energy levels

Explain the grouping and placing of elements in the periodic table

3. UNDERSTAND THE NATURE OF CHEMICAL BOND

Define chemical bond

Describe the nature of chemical bond

Differentiate between electrovalent and covalent bonding

Explain the formation of polar and non polar, sigma and pi-bond with examples

Describe the nature of coordinate bond with examples

4. UNDERSTAND THE CHEMICAL NATURE OF WATER

Describe the chemical nature of water with its formula

Describe the general impurities present in water

Explain the causes and methods to removing hardness of water

Express hardness in different units like mg / liter, p.p.m, degrees Clark and degrees French

Describe the formation and nature of scales in boiler feed water

Explain the method for the treatment of scales

Explain the sewage treatment and desalination of sea water

5. UNDERSTAND THE NATURE OF ACIDS, BASES AND SALTS

Define acids, bases and salts with examples

State general properties of acids and bases

Differentiate between acidity and basicity and use the related terms

Define salts, state their classification with examples

Explain p-h value of solution and ph-scale

6. UNDERSTAND THE PROGRESS OF OXIDATION AND REDUCTION

Define oxidation

Explain the oxidation process with examples

Define reduction

Explain reduction process with examples

Define oxidizing and reducing agents and give at least six examples of each

Define oxides

Classify the oxides and give examples

7. UNDERSTAND THE FUNDAMENTALS OF NUCLEAR CHEMISTRY

Define nuclear chemistry and radio activity

Differentiate between alpha, beta and gamma particles

Explain half life process

Explain at least six nuclear reactions resulting in the transformation of some elements

State important uses of isotopes

8. UNDERSTAND THE MANUFACTURE, SETTING AND HARDENING OF CEMENT

Define Portland cement and give its composition

Describe the method of manufacture

Describe the chemistry of setting and hardening of cement

Distinguish between ordinary and special purpose cement

9. UNDERSTAND THE PROCESS OF MANUFACTURE OF GLASS

Define glass

Describe its composition and raw materials

Describe the manufacture of glass

Explain its varieties and uses

10. UNDERSTAND THE NATURE AND IMPORTANCE OF PLASTIC AND POLYMERS

Define plastics and polymers

Explain the mechanism of polymerization

Describe the preparation and uses of some plastic / polymers

11. KNOW THE CHEMISTRY OF PAINTS, VARNISHES AND DISTEMPERS

Define paints, varnishes and distemper

State composition of each

State methods of preparation of each and their uses

12. UNDERSTAND THE PROCESS OF CORROSION WITH ITS CAUSES AND TYPES

Define corrosion

Describe different types of corrosion. State the causes of corrosion

Explain the process of rusting of iron

Describe methods to prevent / control corrosion

13. UNDERSTAND THE NATURE OF REFRACTORY MATERIALS ABRASIVE

Define refractory materials

Classify refractory materials

Describe properties and uses of refractory

Define abrasive

Classify natural and artificial abrasives

Describe uses of abrasives `

14. UNDERSTAND THE NATURE AND IMPORTANCE OF ALLOYS

Define alloy

Describe different methods for the preparation of alloys

Describe important properties of alloys

Enlist some important alloys with their composition, properties and uses

15. UNDERSTAND THE NATURE OF FUELS AND THEIR COMBUSTION

Define fuels

Classify fuels and make distinction of solid, liquid and gaseous fuels

Describe important fuels

Explain combustion

Calculate air quantities in combustion gases

16. UNDERSTAND THE NATURE OF LUBRICANTS

Define a lubricant

Explain the uses of lubricants

Classify lubricants and site examples

State important properties of oils, greases and solid lubricants

State the criteria for the selection of lubricant for particular purpose / job

17. UNDERSTAND THE NATURE OF POLLUTION

Define pollution (air, water, food)

Describe the causes of environmental pollution

Enlist some common pollutants

Explain methods to prevent pollution

LIST OF PRACTICAL:

1. Salt analysis
2. Acidic radicals
3. Dilute acid group
4. Concentrated acid group
5. Special group
6. Basic radicals
7. 1st group radicals
8. 2nd group radicals
    a. 2nd A
    b. 2nd B
9. 3rd group radicals
10. 4th group radicals
11. 5th group radicals
12. 6th group radicals
13. Analytical balance weighing techniques
14. Separation or salts by
    a. Sublimation process
    b. Filtration process
    c. Sedimentation process
15. Practical note book
16. Salt analysis scheme

RECOMMENDED BOOKS

1. Text Book of intermediate Chemistry (I & II)
2. Ilmi Applied Science by Sh. Atta Muhammad
3. Polytechnic Chemistry by J.N. Reedy Tata Mcgraw Hill (New Dehli)
4. Chemistry for Engineers by P.C. Jain (New Delhi, India)

COMP – 122 COMPUTER APPLICATIONS

Total Contact Hours	**128**	**T**	**P**	**C**
Theory	**32 hours**	**1**	**3**	**2**
Practical	**96 hours**			

COURSE AIMS:

This subject will enable the student to be familiar with the operation of a Microcomputer. He will also learn DOS, BASIC language and word processing to elementary level.

COURSE CONTENTS

1. ELECTRONIC DATA PROCESSING 6 Hours

Basics of computers

Classification of computers

Block diagram of a computer system

Binary number system

BIT, BYTE, RAM, ROM. EROM, EPROM

Input and output devices

Secondary storage media details

Processors and types

Using computer for system software

Using computers for application software

Common types of software and their application

2. DISK OPERATING SYSTEM (DOS) 6 Hours

Internal commands

External commands

Batch files

Advance features

3. BASIC LANGUAGE 10 Hours

Introduction to high level language

Introduction to BASIC

REM statement

Assignment statement

Input statement

Read data statement

If-then statement

If-then else statement

For next statement

DIM statement

L print statement

STOP statement

END statement

Logic of a BASIC programme

Running a BASIC programme

Saving and retrieving a programme

Advance features

4. WORD PROCESSING **7 Hours**

Starting word processor session

Opening a document

Saving a document

Ending word processor session (temporarily)

Retrieving a document

Spell check

Margins and tab setting

Aligning paragraph

Printing a document

Advance features

5. COMPUTER GRAPHIC IN BASIC **3 Hours**

Graphic fundamentals
Points and lines
Dots in space
A lightening blot
Shapes
Expanding circles and rectangles

RECOMMENDED BOOKS

1. Ron. S. Gottfrid, Programming with BASIC
2. Any word Processor Latest Released (e.g. Word, Word Perfect etc.)
3. ABC's of DOS (latest release)
4. Judd Robbins, Mastering DOS 6.0 and 6.2

INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND ELECTRONIC DATA PROCESSING (EDP)

Know basics of computers

Know classification of computers

Know block diagram of a computer system

Know binary number system

Know some general terms used in computers

Know input and output devices

Know secondary storage media

Explain processor and its types

Know the use of computer for system software

Know use of computers for application software

Explain commonly used application of software

2. UNDERSTAND RISK OPERATING SYSTEM (DOS)

Know internal command of DOS

Know external commands of DOS

Describe batch files

Identify advanced features

3. UNDERSTAND BASIC LANGUAGE

Explain high level languages

Explain basic languages

Describe ram statement

Describe assignment statement

Explain input statement

Explain Read-Data statement

Explain If-then statement

Explain if-then else statement

Explain for next statement

Explain DIM statement

Explain LPRINT statement

Explain STOP statement

Explain END statement

Describe logic of basic program

Describe running a basic program

Describe saving and retrieving basic program

Describe some advance features of basic program

4. UNDERSTAND WORD PROCESSING SESSION

Describe word processing

Name command to be entered on DOS prompt to load word processor

Identify initial screen

Describe the command to open a document

Describe the procedure for naming the document

Explain importance of giving extension to a document

Describe saving and retrieving a document

Explain importance of saving the work at regular intervals

State temporary ending word processing session and document retrieval

State procedure to re-enter word processor

State procedure to re-open the document and editing

Describe spell check facility

Describe margins and tab setting

Describe to align paragraph

Describe re-editing techniques

Describe procedure to set up printer

Describe command for print outs

Explain multiple copy print out procedure

Explain some advance features

Describe procedure of condensed printing

Describe procedure for change of fonts

5. UNDERSTAND PROGRAMMING INSTRUCTIONS FOR COMPUTER GRAPHIC IN BASIC LANGUAGE

Identify graphic fundamentals in basic language

Draw points and lines

Draw dot in space

Draw lighting blot

Draw shapes

Draw expanding circles and rectangles

LIST OF PRACTICAL

DOS

1. Identify key board, mouse, CPU, disk drives, disks, monitor & printer
2. Practice for booting up of a computer system with DOS system disk and power off system at DOS prompt
3. Practice for CLS, VER, VOL, DATE & TIME commands
4. Practice for COPY, REN commands
5. Practice for DEL, TYPE, PATH, PROMPT, COPY CON, MD, CD, RD commands
6. Practice of the practical at Sr. No. 3, 4, 5.
7. Practice for FORMAT command with /s, /4, /u switches
8. Practice for DISKCOPY, DISKCOMP commands
9. Practice for PRINT, UNDELETE commands
10. Practice for the practical at Sr. No. 8, 9, 10, 11
11. Practice for creating a batch file

BASIC

1. Practice for loading & unloading BASIC software and identify role of function keys in basic.
2. Identify role of various keys in continuation with ALT keys in BASIC programming

3. Practice for CLS, LOAD, SVE, FILE, RENUM command by loading any existing BASIC program
4. Practice for editing any existing BASIC program
5. Prepare BASIC program to display sum of two numbers using INPUTS
6. Prepare BASIC program to display sum of two numbers using READ-DATA
7. Prepare BASIC program to multiply two numbers
8. Prepare BASIC program to calculate area of rectangle, when length and width are given
9. Prepare BASIC program to calculate area of circle when radius / diameter is given
10. Prepare very simple BASIC programs using IF-THEN-ELSE and FOR-NEXT statement
11. Identify DIM statement
12. Practice for LPRINT statement for various programs hard copy output

Word Processing

1. Practice for loading & unloading a word processor
2. Practice for creating document & saving it
3. Practice for spell check facility of the word processor
4. Practice for editing and existing document
5. Practice for various word processing menu options
6. Practice for margin and TAP setting and document alignment
7. Practice for some advance features

CHT – 153 BASIC CHEMICAL ENGINEERING

Total Contact Hours	**160**	**T**	**P**	**C**
Theory	**64 hours**	**2**	**3**	**3**
Practical	**96 hours**			

COURSE AIMS:

The student will be able to understand the fundamental principles and concept in Chemical Engineering and apply them to solve the problems in practical situations and in evaluation of the direction for further development in the process.

COURSE CONTENTS

1. UNITS AND DIMENSIONS 8 Hours

Primary and secondary quantities

Dimensions of secondary quantities

System of measurement

Units and their conversion

Conversion of units of following quantities into English / Metric system

Pressure

Viscosity

Density

Force

Energy

Work

Gas constant

Dimensional and dimension less formula.

2. GRAPH, TYPES OF GRAPH 8 Hours

Drawing simple graph

3. PRODUCTION OF LOW TEMPERATURE BY REFRIGERATION 8 Hours

Definition, methods of refrigeration

Refrigerant and their properties

Application of refrigeration

Schematic diagram of refrigeration

Working principles of refrigerator

4. PIPE AND TUBES 8 Hours

Types of pipes

Cast iron pipe, wrought iron pipe, steel pipe aluminum pipes, plastic

Pipe standards

Pipe fitting

Types of valves

Construction: working and application of gate valve

5. STEAM TRAP AND THEIR TYPES 8 Hours

Bucket trap, expansion trap, inverted bucket trap, impulse trap

6. THERMAL INSULATION 8 Hours

Insulation material, properties and uses

Insulation techniques for stream pipes and vessels

Insulation techniques for low temperature pipes

7. SYMBOLS 4 Hours

Symbols for fitting

Symbols for equipments

8. PETROLEUM TESTS 8 Hours

Flash point, aniline point pour point, cloud point, diesel index,

Sedimentation number

Octane number

9. INTRODUCTION TO PHOTOCOPYING 4 Hours

INSTRUCTIONAL OBJECTIVES

1. UNITS AND DIMENSION

The student will know the primary and secondary quantities

Define primary quantity and secondary quantity

Give examples of primary quantities and secondary quantities

Understand dimensions of secondary quantities

Explain the secondary quantities in terms of primary quantities

Write the dimension of secondary quantities

Understand the systems of measurement

Name different systems of measurement

Name basic quantities of each system

Develop dimensions of derived quantities in each system

Understand units and their conversions

Developed units to measure the derive quantities in different systems

Define different units used

Convert the units of one system into the other system

Understand dimensional and dimensional formula

Differentiate between dimensional formula and dimensionless formula

Check the dimension of and engineering formula. Like;

Reynolds number potential energy. Kinetic energy

2. GRAPH

Understand the concept of graph

Define graph

Explain the types of graph

Give comparison between tabular and graphic representation of data

Understand the method of drawing to draw a graph

Explain the steps necessary to draw a graph

Draw a simple graph

Note the end point from a graph

Take reading from a graph

Make extrapolation and interpolation on a graph

3. PRODUCTION OF LOW TEMPRATURE BY REFRIGERATION

Know the methods of refrigeration

Define the refrigeration

Name the different methods of refrigeration based on the refrigeration used

Compare different methods of refrigeration

Understand the refrigeration and their properties

Define the refrigeration

Name different refrigerants used in the field

Enlist the properties of a good refrigerant

Understand the application of refrigeration

Give domestic application of refrigeration

Give industrial application of refrigeration

Understand schematic diagram of refrigeration

Draw a schematic diagram of refrigeration

Explain the function of each component in the diagram

Understand working principles of refrigeration

Explain working principles of single fluid refrigerator

Explain working principles of two fluid refrigerator

4. PIPES AND TUBES

Know the types of pipes

Enlist the types of pipes used by chemical industries

Give the field of applications of different types of pipes used

Give characteristics of different types of pipes used by chemical engineer

Apply the pipe standards

Understand the concept of schedule nos used for pipe

Select the schedule no according to the pipe duty (pressure)

Understand pipe fitting

Define pipe fitting

Enlist the different pipe fitting used

Explain the functions of different pipe fitting used in chemical industries

Know the types of valves

Define valve

Enlist the types of a valves

Understand construction and working of valves

Explain the construction and working of gate value

Explain the construction and working of globe value

Explain the construction and working of ball value

Select a proper valve according to need

5. STEAM TRAP

Know the steam trap

Explain the function of steam trap

Enlist the types of steam traps

Understand different types of traps

Explain the construction and working of bucket trap

Explain the construction and working of inverted bucket trap

Explain the construction and working of expansion trap

Explain the construction and working of impulse trap

6. THERMAL INSULATION

Understand insulating materials, properties and uses

Define thermal insulation

Explain the need of thermal insulation

Enlist the insulating materials used in chemical industry

Enlist the properties of a good insulating materials

Apply the insulation techniques for steam pipes and valves

Explain the method of steam pipe insulation (lagging)

Calculate the thickness of insulation layer on steam pipe by using the formula ($q = KADT$)

Understand insulation technique for low temperature pipes

Decide the nature of insulation material for low temperature pipes

Explain the method of pipe insulation

7. SYMBOLS

Understand symbols of fittings

Read symbols of fittings

Draw symbols to represent different fittings

Understand symbols for equipments

Read symbols of equipments

Draw symbols to represent different equipments and vassals of chemical engineering

8. PETROLEUM TEST

Understand different tests of petroleum

Understand the importance of petroleum testing

Define flash point, aniline point pour point and cloud point

Explain procedure to perform above tests for petroleum sample

Define diesels index

Explain procedure to find diesel index

Define sedimentation number

Explain method to note sedimentation no.

Define octane number and octane number determination method

9. INTRODUCTION TO PHOTOCOPYING

Understand the photocopying

Explain the concept of photocopying

Explain the methods of photocopying

Enlist the precautions to be observed while operating a photocopier

LIST OF PRACTICAL

1. Calculation of dimensions of different secondary quantities
2. Determination of units of different quantities in different measuring systems
3. Conversion of units in different systems
4. Drawing of simple graph
5. Graph reading
6. Production of low temperature by use of refrigerant. Study of refrigerator / Deep-freezers
7. Pipe cutting
8. Pipe threading
9. Pipe fittings
10. Installation of valves
11. Insulation of steam traps
12. Insulation of steam pipe lines

RECOMMENDED BOOKS:

1. Manual for basic chemical engineering
3. Introduction to chemical engineering by watter L. Bedger and Julims T Bencharo
4. Introduction to chemical engineering by Little John

MT – 143 BASIC ENGINEERING DRAWING & CAD – I

Total Contact Hours	**224**	**T**	**P**	**C**
Theory	**32 hours**	**1**	**6**	**3**
Practical	**192 hours**			

COURSE AIMS:

At the end of this course the student will be able to understand the fundamentals of engineering drawing used in the various fields of industry especially in the Mechanical Technology. The student will be familiarized with the use of conventional drawing instruments as well as the modern technology used for this subject. The CAD portion of the subject will provide the student the knowledge and use of computer in the subject of Engineering Drawing.

COURSE CONTENTS

SECTION – I ENGINEERING DRAWING

1. USES AND APPLICATIONS OF TECHNICAL DRAWING 1 Hours

Technical drawing and the technician
Use of technical drawing
Common drawing forms
Application of drawing forms
Practices and conventions

2. DRAWING TOOLS AND ACCESSORIES 2 Hours

Drawing pencil
Drawing papers specifications
Drawing instruments
Use and care of drawing instruments and material

3. ALPHABET OF LINES USED IN DRAWING 2 Hours

Importance of the alphabet of lines
Common alphabet of lines
Uses and correct line weight-age of the line
Application of line

4. LETTERING **2 Hours**

Importance of good lettering

Single stroke of gothic

Letter stroke

Letter guide lines

Vertical single stroke gothic

Inclined single stroke gothic

Composition of lettering

5. DRAWING LINES TECHNOLOGY **2 Hours**

Introduction to sketching techniques

Sketching lines

Sketching circles and arcs

Sketching ellipse

Sketching views of objects

6. GEOMETRICAL CONSTRUCTIONS **2 Hours**

Introduction to geometry

Definition of terms

Different conventional shapes, surfaces and objects

Basic geometrical construction

Construction, ellipse, parabola

Involutes and cycloids

7. INTRODUCTION TO MULTI VIEW PROJECTIONS **3 Hours**

Definition and concept of multi-view drawings

Perceptual views of plan of projections

Orthographic projections

1^{st} angle and 3^{rd} angle projections

Principle views

Arrangement of views

Multi-view drawings

8. INTRODUCTION TO PICTORIAL DRAWINGS **2 Hours**

Uses of pictorial

Three types of pictorial views

Isometric sketching of rectangular block

Isometric sketching of arcs and circles

Oblique sketching of rectangular block

One point perspective sketching of rectangular block

Two point perspective sketching of a rectangular block

Preparation of pictorial drawings of simple objects

9. BASIC DIMENSIONING **2 Hours**

Definition of dimensioning

Types of dimensioning

Elements of dimensioning

System of measurements

Dimensioning multi-view drawings

Dimensioning pictorial views

Dimensioning rules and practices

Notes and specification

10. SECTIONING AND SECTIONAL VIEWS **2 Hours**

Definition and purpose

Cutting planes position and cutting plane lines

Types of sectional views

Conventional section lines of different materials

Practice sectioned views

11. DRAWING OF MACHINE ELEMENTS **2 Hours**

Terminology and drawing of rivets and riveted joints

Terminology and drawing of screw threads

Terminology and drawing of keys and cotters

Description and drawing of simple bearings

Describe and drawing of simple coupling

SECTION – II COMPUTER AIDED DESIGN – I

12. CAD FUNDAMENTALS 2 Hours

CAD and its importance

Purposes

Advantages

13. CAD SOFTWARE 2 Hours

CAD abbreviations

CAD help

Co ordinance systems

14. BORDER TEMPLATE 2 Hours

Drawing area

SNAP & GRID

P edit & Q save

15. TITLE BLOCK 2 Hours

Change command

Layer creation

Zooming

Types faces of CAD

Plotting

16. LINES & CIRCLES 2 Hours

Dedit

Analyzed line drawing

U & Redo command

Drawing a circle

INSTRUCTIONAL OBJECTIVES

1. USES AND APPLICATIONS OF TECHNICAL DRAWING

Know the uses of technical drawing

Describe the importance of technical drawing from the point of view of a technician

Explain the main uses of technical drawing from the point of view of a technician

Recognizes the different application of technical drawing

Identity commonly used drawing forms

Illustrate the different drawing forms

Differentiate different drawing forms

Develop technical vocabulary

2. KNOW THE COMMON DRAWING TOOLS AND ACCESSORIES

Identify the uses of different pencils for technical drawing

Identify different paper sizes for drawing

Identify different types of papers suitable for drawing

Identify different types of erasers and their uses

Maintain a will sharpened pencil for drawing

Describe the drawing instruments

State the use of drawing instruments

3. UNDERSTAND THE IMPORTANCE OF ALPHABET, CORRECT WEIGHT AGE AND APPLICATION OF LINES USES IN TECHNICAL DRAWING

Knows the importance of lines

Knows the alphabet of lines

Identify the lines characteristics of each alphabet of lines

Draw horizontal, vertical and inclined lines

Draw alone line with correct weight ages

4. APPLIES THE GOOD LETTERING ON A DRAWING

Knows the importance of lettering in a technical engineering drawing

Identify the letter style and guide lines

State letter strokes and guide lines

Perform better stroke in single stroke gothic

Print vertical single stroke letters and numbers

Print incline single stroke letters and numbers

Observe stability and pleasing appearance of letters in printing

5. UNDERSTAND SELECTING OF CIRCLES, ARCS AND VIEWS OF OBJECTS

Draw circular an arc using circular line method

Draw a circular arc using square method

Draw an ellipse using rectangular method

Draw views of simple objects

6. APPLY DRAWING SKILL WITH THE AID OF DRAWING INSTRUMENTS IN GEOMETRICAL CONSTRUCTION

Define common terms used in geometrical construction

Explain different geometrical shapes. Surface of objects

Draw basic geometrical construction

Draw involutes, cycloid, spiral, and tangent to circle and arc.

7. UNDERSTAND THE MULTI VIEW OF PROJECTIONS SPECIFIC OBJECTIVES

Define the concept of multi view drawings

Knows principles planes of projections

Knows the orthographic method of projection

Explain the 1^{st} and 3^{rd} angle projections

State six principle views

Practice multi view projections

8. APPLY THE USE, TYPES AND METHODS OF PICTORIAL VIEWS

Knows the use of pictorial views

Knows the pre requisite of pictorial drawings

State three types of pictorial drawings

Draw isometric view of rectangular blocks, arcs, circles

Draw oblique sketching of rectangular blocks

Draw one point perspective view of a rectangular block

Draw two point perspective view of a rectangular block

Prepare / draw pictorial drawings of simple objects

9. APPLY GOOD DIMENSIONING ON MULTI-VIEWS AND PICTORIALS

Define dimensioning

Identify the types of dimensioning

Enlist the elements of dimensioning

Identify the system of measurements

Indicate complete dimension on multi-view drawings

Indicate complete dimension or pictorial drawings

Follow the general rules for dimensioning

Indicate notes and specification or multi-view drawings

10. APPLY THE SECTIONING METHODS OF MATERIAL AND DRAW SECTIONAL VIEWS

Define sectioning and its purpose

Describe cutting planes and lines

State types of sectional views

Explain conventional section lines of different materials

Practice sectioning

11. APPLY DRAWING METHODS TO DRAW MULTI-VIEWS OF MACHINE ELEMENTS

Draw multi-views of vee-block

Draw multi-views of gland

Draw keys and cotters

Draw multi-views of simple bearing

SECTION – II COMPUTER AIDED DESIGN

12. UNDERSTAND CAD FUNDAMENTALS

Define CAD

Describe importance of CAD

States purpose of CAD

Explain advantages of CAD

Explain importance of CAD use age in industry

13. UNDERSTAND CAD SOFTWARE

Describe computer system requirements for CAD (e.g. Auto CAD release 12 or latest)

State procedure of giving command to CAD

State CAD (e.g. Auto CAD rel. 12 or latest) abbreviations

State use of function keys

Describe procedure of giving commands with a mouse

Explain procedure of getting general help for a specific command

Explain drawing cursor and co-ordinance read out

Explain Cartesian notion

Explain polar notation

14. UNDERSTAND BORDER TEMPLATE OF DRAWING

Describe setting up of drawing area

Describe setting of displayed digits

Explain changing the drawing limits

Explain use of grid system (Auto CAD rel-12 or latest)

Explain adjustment of drawing scale

Explain procedure of drawing line with line command

Explain p-edit command for widening boarder

Explain procedure of saving boarder template

15. UNDERSTAND ADDING A TITLE BLOCK TO THE BORDER DRAWING

Describe checking the drawing time

Explain change command

Explain creation of layer for title block

Explain procedure of creating a title block

Explain zoom command

Explain importance of saving a drawing

Explain use of CAD (Auto CAD R-12 or latest)

Explain filling in the title block by writing drawing title, name etc.

Explain procedure of plotting drawing on a plotter or printer

Explain Q-save command

16. UNDERSTAND DRAWING LINES AND CIRCLES

State beginning of a new drawing

Explain D-edit command (Auto CAD R-12 or latest)

Describe viewing the entire drawing

Explain drawing of angled line

Explain U-command

Explain Redo command

Explain drawing a circle with circle command

Explain automatic work saving procedures

LIST OF PRACTICAL:

A. (BASIC ENGINEERING DRAWING)

1. Lettering 5mm height
2. Lettering 3mm height
3. Use of tee square and set squares for drawing horizontal, vertical and inclined lines
4. Use of tee square and for drawing centers, crossing of lines
5. Use of compass, circles, half circles, radius
6. Draw round corners, figure inside and outside circle
7. Plane geometry angles and triangles
8. Plane geometry quadrilateral square rhombus, rectangle and parallelogram
9. Plane geometry parallel-lines, perpendicular, bisect line and angle
10. Plane geometry equal division of line and some radio with the help of compass and set square
11. Plane geometry of inscribe and circumscribe square, triangle and hexagon
12. Plane geometry of construction of polygon, five, six, seven and eight sides
13. Plane geometry of inscribe pentagon in a circle and pentagon by general and different methods
14. Plane geometry of tangent of circle inside and outside
15. Plane geometry of construction of ellipse with two methods
16. Plane geometry of construction of ellipse with next two methods
17. Plane geometry of construction of parabola curve 4 methods
18. Plane geometry of construction of hyperbola curve
19. Plane geometry of spiral curve
20. Plane geometry of helix curve
21. Plane geometry of construction of involutes curve of square rectangle hexagon and circle
22. Different types of drawing lines
23. Orthographic projection 1^{st} and 3^{rd} angle L block

24. Orthographic projection 1st and 3rd angle step block
25. Orthographic projection 1st and 3rd angle Vee block
26. Orthographic projection 1st and 3rd angle given block
27. Orthographic projection 1st and 3rd angle additional block
28. Orthographic projection and isometric drawing given block
29. Orthographic projection and isometric drawing given block next
30. Different types of sectioning
31. Different section lines for different material
32. Orthographic projection of vee block sectional views
33. Orthographic projection Gland sectional views
34. Orthographic projection open bearing sectional views
35. Concept for different types of drawings
36. Isometric and oblige drawings of cube with one hole
37. Isometric and oblige drawings of another given block
38. Missing lines and positions on given views
39. Missing lines and positions on given views next
40. Isometric scale and development of cube
41. Development of prism
42. Development of cylinder
43. Development of cone
44. Development of pyramid
45. Thread profile of square and vee threads
46. Different types of threads
47. Sketch of hexagonal nut and bolt
48. Rivet heads
49. Single riveted lap joint
50. Single riveted but joint

B. COMPUTER AIDED DESIGN (AUTO CAD REL – 12 OR LATEST)

1. Practice loading CAD software into computer memory
2. Practice unloading CAD software safety and cone to DOS prompt
3. Practice CAD abbreviations, auto CAD release 12 of latest (e.g. A for Arc, C for circle, E for Erase etc.)
4. Practice functions for short cuts
5. Practice to draw two points using Cartesian notation on graph paper
6. Practice to draw straight line using polar coordinates on graph paper
7. Set up drawing area using CAD software
8. Practice for turning GRID ON and OFF and SNAP on and OFF
9. Draw a line with line command
10. Widen border lines with pedit
11. Save border template (Q-Save)
12. Create layers and move border to it’s own layer
13. Create a layer for title block
14. Create title block
15. Practice for zoom command
16. Practice for CAD type face (Auto CAD Rel. 12 or latest)
17. Practice for filling title block
18. Practice for plotting the drawing on plotter or printer
19. Begin a new drawing
20. Practice with Dedit command to make changes in the drawing
21. Draw an angled line
22. Practice with U-command and Redo command
23. Draw a circle with circle command

RECOMMENDED BOOKS:

1. Z.H.Syed "Fundamentals of Construction"
2. Surrender singh "Engineering Materials"
3. N.Chaudary "Building Materials"
4. M.A.Zaman "Engineering Materials "
5. Kulkarne "Building Construction"
6. Arora and Gupta "Building Construction"
7. Mitchell "Building Construction"
8. Mckay "Building Construction"
9. French Wirk "Engineering Drawing"
10. Alan R.Miller "ABC's of Auto CAD Release - 12"

SECOND YEAR

GCT 202 WORKSHOP TECHNIQUES

Total Contact Hours	**128**	T	P	C
Theory	32	**1**	**3**	**2**
Practical	96			

COURSE AIM

This course enables the students to have the hands – on experience regarding electrification, welding, lathe Machine and general tools involved in industrial practices. Such practical working will formulate the professionalism in true spirit

COURSE CONTENTS

1. ELECTRIC WIRING AND CIRCUITS 08 HOURS

Wires and their gauges

Circuits and their types

Different electric circuits

2. LATHE MACHINE AND TOOLS UTILITY 08 HOURS

Lathe Machine and its parts

Structure and its functions

Drilling

Making holes

Drill chuck keys

Operation of lathe machines

Miscellaneous tools and utilities

3. WELDING WORKS 08 HOURS

Fuel medium for welding

Welding apparatus

Welding operations

Utility of Welding in ceramics industry

4. GENERAL TOOL KIT AND ITS APPLICATIONS 08 HOURS

Plain tool kit

L & N keys

Utility of tools

INSTRUCTIONAL OBJECTIVES

1. ELECTRIC WIRING AND CIRCUITS

Explain different wires and their gauges

Explain different Circuits and their types

Explain different electric circuits and their formation.

2. LATHE MACHINE AND TOOLS UTILITY

Describe Lathe Machine and its parts

Describe the Structure and functions of Lathe Machine.

Describe the drilling by using Machine.

Describe the making of holes

Describe the Drill chuck keys

Describe the Operation of lathe machines

Describe the Miscellaneous tools and utilities

3. WELDING WORKS

Explain Fuel medium for welding

Explain the welding apparatus

Explain the welding operations

Explain the Utility of Welding in ceramics industry

4. GENERAL TOOL KIT AND ITS APPLICATIONS

Describe the Plain tool kit

Describe the L & N keys

Describe the Utility of tools

LIST OF PRACTICAL

1. To make a hole of 3 Cm in a shaft.
2. To make a screw shaft
3. To make a metal die for pressing
4. To demonstrate the lightening of one bulb with one switch.
5. To demonstrate the lightening of one bulb with two switches.
6. To demonstrate the lightening of two bulbs with one switch.
7. To demonstrate the working of a fuse.
8. Joining of two cylinders by welding.
9. Make a cylindrical shape of a steel sheet by using welding.
10. Utility of different tool kits in ceramics industry.

GCT 213 GLASS Technology

Total Contact Hours	**160**	T	P	C
Theory	64	**2**	**3**	**3**
Practical	96			

COURSE AIM

The aim of this Course is to give comprehensive knowledge to the students regarding typical raw materials used and their availability in Pakistan. Also it provides information about typical composition of glass and effect of various oxides there on. This course also gives information regarding batch calculations and steps involved during glass preparation.

COURSE CONTENTS

A.

1. **Feldspar**

   Kinds of feldspar mineral; feldspar as a source of alumina; Melting temperature of feldspar and availability in Pakistan. **3 Hours**

2. **Glass Sand**

   Importance of glass sand, Impurities present in glass sand ; forms of Silica. **3 Hours**

3. **Limestone**

   Importance of Limestone, availability in Pakistan. **3 Hours**

4. **Dolomite**

   Availability in Pakistan, Chief Source of Magnisium Oxide MgO. **3 Hours**

5. **Cryolite**

   Use in glass, effect on viscosity

6. **Red Lead** Use in glass

7. **Quartz**

   Availability in Pakistan, Sandstone **.** **3 Hours**

8. **Soda Ash** Importance of soda Ash, Availability in Pakistan.

9. **Potassium Carbonate**

Main Source of K_2O, Manufacture of Potassium Carbonate Impurities in Potassium Carbonates **3 Hour**

10. **Potassium Nitrate and Potassium Hydroxide**

Main Source of K_2O, Manufacture of Potassium Carbonate Impurities in Potassium Carbonates

11. **Decolorizer**

12. **Colorants**
13. **Refining Agents** **4 Hours**
14. **Cullet**

15. **Phosphate Compounds**
16. **Zirconium** **4 Hours**
17. **Calumet**
18. **Barium Compounds. Etc**

B.

1. **Composition of Various Glasses**

Sheet Glass, Flat Glass, Plate Glass, Float Glass, Neutral Glass

10 Hours

2. **Effect of Metallic Oxide**

Effect of Iron Oxide effect of titanium oxide, Effect of Chromium Oxide, Effect of Sb_2O_3, PB_2O_3,Effect of cobalt oxide, effect of selenium, etc

8 Hours

C. Batch Calculation

D. Preparation of Glass Batch

Storage of Raw materials, Removal of impurities, Sand washing, Screw conveyors, Belt Conveyors, Bucket Elevators, Weighing and mixing, Addition of Cullet, Conveying to furnace, variable speed motor **10 Hours**

Instructional Objectives

1. Feldspar

1.1 Explain the kind of Feldspar and the effect of heat, use as flux, oxide obtained from feldspar, use of feldspar in glass composition, availability of feldspar in Pakistan.

2. Glass Sand

Describe the oxide obtained from the silica sand.

Describe the amount which can be used in glass composition
Describe the impurities present in glass sand and their effect on glass
Explain the sources of glass sand in Pakistan
Describe various form of silica

3-**limstone**

Define Lime Stone

Name the Oxide obtained from Lime stone and its effect on the melting of Glass

Availability of Lime Stone in Pakistan w.r.t Glass Industry

4- **Dolomite**

Describe Dolomite

Availability of Dolomite Stone in Pakistan w.r.t Glass Industry

Why Used in glass

Explain the calcinations and double carbonate.

5- **Cryolite**

Describe Cryolite

Sources of Cryolite

Discuss availability in Pakistan

6- **Red Lead**

Explain the Source of PbO

Explain the Availability

Explain the use of Lead Silicate

Describe the effect of PbO on glass melting and its properties.

7- **Quartz**

Describe the properties of Quartz mineral.

Availability of Quartz in Pakistan

Study the effect of Quartz in glass and the properties of glass

8- **Soda Ash**

Differentiate b/w Soda and Soda Ash

Sources of Soda

Explain effect of melting and the other properties of Glass

9- **Potassium Carbonate**

Describe as main source of K2O.

Explain the manufacturing of Potassium carbonate

Describe impurities present in the salt

Explain the effect of Potash on the properties of glass

10- **Potassium nitrate and Hydroxide**

Describe as source of Potash

Explain the manufacturing of the salts.

Describe impurities present in the salt

Explain the effect of Potash on the properties of glass

11- **Barium Compound**

Describe the Compound

Source of BaO

Describe preparation of carbonate from sulfate.

Use of BaSO4 as BaO

Describe effect of BaO on the properties of Glass

12- **Phosphate Compound**

- ✓ Describe various phosphate compounds

13- **Zirconium Compound**

Describe the use of Zirconia in glass

Discuss its effect on melting and properties of glass

14- **Calumite**

Define Calumite

Describe its use in glass and its effects

15- **Decolorizer**

15.11 Describe the various decolorizer used in glass batch

16- **Refining Agent**

Define Refining Agent

Chemistry of Refining Agent

Various oxide used as refining agents

17- **Cullet**

Describe Cullet

Describe the Factory and Foreign cullet

Describe washing and use in glass batch

B. Composition of various Glasses

Define Glass

Describe glass formers, Fluxes and stabilizers

Define Container Glass and various compositions

Define Heat resistant glass and explain its composition

Define Fiber glass and explain its composition

Explain the difference b/w sheet and plate glass

Define Neutral glass and explain its composition

Describe its uses

2. Effect of Metallic Oxide

Explain the effect and behavior of iron oxide on composition

Explain the effect and use of Titanium oxide on Glass composition

Explain the effect and use of Chromium oxide on Glass composition

2.4Explain the effect and use of Refining agent on Glass composition

2.5 Explain the effect and use of Cobalt oxide on Glass composition

3. Batch Calculations

Explain composition of batch from the given composition

Explain calculation of glass composition from given batch

Familization with different examples

4. Preparation of Glass Batch

Describe how raw materials are loaded and unloaded

Describe drying and washing of Silica sand

Describe Crushing and grinding of raw material w.r.t glass industry

Beneficiation of Silica sand

Describe the construction and working of screw and belt conveyor

Explain the construction and working of Bucket Elevators

Describe the weighting and mixing of major and minoer ingredients

Describe how cullet is added

Explain the amount of cullet to be added

Describe the conveying of mixed batch to glass furnace

Explain the working of batch charger and Variable speed motor

GCT- 224 PARTICLE SIZE REDUCTION AND GLAZES

Total Contact Hours	**192**	T	P	C
Theory	96	**3**	**3**	**4**
Practical	96			

COURSE AIM

The objective of this course is to provide absolute knowledge of size reduction and mixing processes and equipment. Simultaneously it will also focus on the types, compositions and effects of various glazes. Lastly, this course will enable the students to diagnose and overcome different glaze defects. It will also give information of various ceramics products.

COURSE CONTENTS

PAPER-A

1. PARTICLES SIZE REDUCTION AND CONTROL / GRADATION OF RAW MATERIAL 16 HOURS

1.1 Theories
- 1.1.1 Impact attrition and collision
- 1.1.2 Kick's, Bond's and Rittinger's Laws
- 1.1.3 Principles of Fracture
- 1.1.4 Comparing efficiencies with other processes (distillation drying etc)
- 1.1.5 Particle size analysis
  - Taylor Sieves
  - ASTM Sieves
  - Gravity Sedimentation
  - Centrifuge

2. MIXING METHODS 10 HOURS

- Blunger
- Pug mill
- U-Mixer
- Muller Mixer

3. CHANGE DURING FIRING 16 HOURS

- Thermal Decomposition

Clays and other Alumini-slicate oxides, Hydroxides, Carbonates,
Other ceramic raw materials
DTA and TGA
Changes in a Ceramic body
- Water smoking
- Dehydration
- Decomposition
- Oxidation
- Reduction

Sintering
- Solid State Sintering
- Sintering in the presence of a liquid phase
- Grain growth
- Vitrification
- Nucleation
- Crystallization

Microstructure
- Development of Microstructure in relation to sintering
- Typical Ceramic Microstructure and their control

4. CERAMIC PRODUCTS. 6 HOURS

Ceramic building materials

Ceramics in the home.

Chemical and technical ceramics

Specialized laboratory and engineering ware

Ceramics in the Electrical industry

Insulators.

GLAZES

1- THE NATURE OF GLASS AND GLAZES. 4 HOURS

Silica as the Basis of Glass.

Making of Glass (Brief).

The Distinction between Glass and Glazes.

2- EARLY TYPES OF GLAZES. 6 HOURS

Early lead Glazes.

Ash Glazes.

Slip Glazes.

Feldspathic Glazes.

Salt Glazes.

3- THE OXIDES AND THEIR FUNCTION IN GLAZE FORMING. 8 HOURS

Oxidation and the oxides.

The Glaze oxides.

The function of the oxides in glazes.

How glazes melt in the kiln.

Silica SiO_2.

Alumina Al_2O_3.

Sodium oxide Na_2O

Potassium oxide K_2O

Lead Oxide PbO

Calcium oxide CaO.

Barium oxide BaO.

Magnesium oxide MgO.

Zinc oxide ZnO.

Strontium oxide SrO.

Antimony oxide Sb_2O_3

Lithium oxide Li_2O

Boric oxide B_2O_3

4- GLAZE MATERIALS. 6 HOURS

Flint SiO_2

Clay Al_2O_3 $2SiO_2$ $.2H_2O$

Feldspar

Whiting $CaCO_3$

Magnesium Carbonate $MgCO_3$

Dolomite $CaCO_3$ $.MgCO_3$

Barium Carbonate $BaCO_3$

Talc ($3MgO$ $4SiO_2$ H_2O)

Strontium carbonate $SrCO_3$

Litharge PbO

White lead $2PbCO_3Pb(OH)_2$

Red lead Pb_3O_4

Zinc Oxide ZnO

Antimony Oxide Sb_2O_3

Soda Ash or sodium carbonate Na_2CO_3

5- THE COMPOSITION OF GLAZES. 6 HOURS

Fusion Points of Glazes

Fluxing Action of the various oxides.

The amounts of silica and alumina in glazes.

6- TYPES OF GLAZES. 6 HOURS

Low temperature alkaline glazes.

Lead glazes.

Glazes containing boron.

Bristol glazes.

Porcelain and stoneware glazes.

7- GLAZE DEFECTS, THEIR CAUSES AND CURES 6 HOURS

8- CERAMIC COLORS & STAINS 6 HOURS

Colors in Glazes

Red, Pink, Green, Blue and Black Colors

Their manufacture & effects on the Glaze and Bodies

Over-Glaze colors

Under-Glaze colors

Manufacturing of stains

Uses of stains

RECOMMENDED BOOKS

1. Clay and Glazes for the potter by D. Rhodes Pitman Publishing London
2. Read, H.H. “Rutley’s Elements of mineralogy “ Thomas murley 1948
3. Kaolin clays- JM Huber Corporation New York

INSTRUCTIONAL OBJECTIVES

PAPER-A

1. PARTICLES SIZE REDUCTION AND CONTROL / GRADATION OF RAW MATERIAL

1.2 Understand the theories of particles size reduction

Explain Impact attrition and collision
Explain Kick's, Bond's and Rittinger's Laws
Describe Principles of Fracture
Describe efficiency of size reduction process
Describe the methods of Particle size analysis of the following sieves:

Taylor Sieves
ASTM Sieves
Gravity Sedimentation
Centrifuge

2. MIXING METHODS

Explain the technology of mixing of raw materials by the following machines:

Blunger
Pugmill
U-Mixer
Muller Mixer

3. UNDERSTAND CHANGE DURING FIRING

Thermal Decomposition
Clays and other Alumini-slicate oxides, Hydroxides, Carbonates,
Other ceramic raw materials
DTA and TGA
Changes in a Ceramic body

3.5.1 Water smoking
3.5.2 Dehydration
3.5.3 Decomposition
3.5.4 Oxidation
3.5.5 Reduction

3.6 Sintering

3.6.1 Solid State Sintering
3.6.2 Sintering in the presence of a liquid phase
3.6.3 Grain growth
3.6.4 Vitrification
3.6.5 Nucleation

3.6.6 Crystallization
Microstructure
Development of Microstructure in relation to sintering
Typical Ceramic Microstructure and their control

4. CERAMIC PRODUCTS.

Describe Ceramic building materials

Explain the Ceramics in the home.

Explain the Chemical and technical ceramics

Explain the role of specialized laboratory and engineering ware

Explain the role of Ceramics in the Electrical industry

Explain the Insulators and their manufacturing

GLAZES

1. THE NATURE OF GLASS AND GLAZES.

Describe the Silica as the Basis of Glass.

Describe the Making of Glass in Brief.

Describe the Distinction between Glass and Glazes.

2. EARLY TYPES OF GLAZES.

Explain Early lead Glazes and their compositions.

Explain Ash Glazes and their compositions.

Explain Slip Glazes and their compositions.

Explain Feldspathic Glazes and their compositions.

Explain Salt Glazes and their compositions.

3. THE OXIDES AND THEIR FUNCTION IN GLAZE FORMING.

Define and explain the Oxidation and the oxides.

Define and explain the Glaze oxides.

Describe the function of the oxides in glazes.

Describe how glazes melt in the kiln.

Describe the effect of Silica SiO_2 on glaze forming.

Describe the effect of Alumina Al_2O_3 on glaze forming.

Describe the effect of Sodium oxide Na_2O on glaze forming.

Describe the effect of Potassium oxide K_2O on glaze forming.

Describe the effect of Lead Oxide PbO on glaze forming.

Describe the effect of Calcium oxide CaO on glaze forming.

Describe the effect of Barium oxide BaO on glaze forming.

Describe the effect of Magnesium oxide MgO on glaze forming.

Describe the effect of Zinc oxide ZnO on glaze forming.

Describe the effect of Strontium oxide SrO on glaze forming.

Describe the effect of Antimony oxide Sb_2O_3on glaze forming.

Describe the effect of Lithium oxide Li_2O on glaze forming.

Describe the effect of Boric oxide B_2O_3on glaze forming.

4. GLAZE MATERIALS.

Explain the character of Flint SiO_2 as glaze material.

Clay Al_2O_3 $2SiO_2$ $.2H_2O$ Explain the character of Flint SiO_2 as glaze material.

Feldspar Explain the character of Flint SiO_2 as glaze material.

Explain the character of Whiting $CaCO_3$ as glaze material.

Explain the character of Magnesium Carbonate $MgCO_3$ as glaze material.

Explain the character of Dolomite $CaCO_3$. $MgCO_3$ as glaze material.

Explain the character of Barium Carbonate $BaCO_3$ as glaze material.

Explain the character of Talc ($3MgO$ $4SiO_2$ H_2O) as glaze material.

Explain the character of Strontium carbonate $SrCO_3$ as glaze material.

Explain the character of Litharge PbO as glaze material.

Explain the character of White lead $2PbCO_3Pb(OH)_2$ as glaze material.

Explain the character of Red lead Pb_3O_4 as glaze material.

Explain the character of Zinc Oxide ZnO as glaze material.

Explain the character of Antimony Oxide Sb_2O_3 as glaze material.

Explain the character of Soda Ash or sodium carbonate Na_2CO_3 as glaze material.

5. THE COMPOSITION OF GLAZES.

Define Fusion point and explain Fusion Points of Glazes

Define Fluxing action and describe the Fluxing Action of various oxides.

Explain the variation in the amounts of silica and alumina in glazes.

6. TYPES OF GLAZES.

Describe Low temperature alkaline glazes.

Describe Lead glazes and their behavior.

Describe Glazes containing Boron and their behavior.

Describe Bristol glazes and their behavior.

Describe Porcelain and stoneware glazes and their behavior.

7. DESCRIBE DIFFERENT GLAZE DEFECTS, THEIR CAUSES AND CURES

8. CERAMIC COLORS & STAINS

Describe the Colors in Glazes

Describe the manufacture of Red, Pink, Green, Blue and Black Colors and their effects on the Glaze and Bodies

Describe the Over-Glaze colors

Describe the Under-Glaze colors

Describe the Manufacturing of stains

Describe the Uses of stains

9- CERAMIC PRODUCTS.

Explain the nature and results of Ceramic building materials

Explain the Ceramics in the home and its utility in daily life.

Explain the Chemical and technical ceramics

Explain the Specialized laboratory and engineering ware

Explain the Ceramics in the Electrical industry

Explain the Insulators and their manufacture.

LIST OF PRACTICALS

1. Study the effect of flow rate on the efficiency of a filter press.
2. Determination of horse power required and the rate of mixing for the mixing different quantities of materials such as salt and sand in dry and wet states.
3. Determination of the number of revolution and time required for homogenous mixing of two materials per unit weight and calculation of the efficiency of the mixer.
4. Determination the horse power required for crushing a definite quantity of a material e.g. red bricks.
5. Determination the horse power required for grinding and definite quantity of a material to hundred mesh in a mill. Also calculate the work index for such a grinding operation.
6. Slip preparation.
7. Familiarization with different glaze materials.
8. Familiarization with different body materials.
9. Preparation of different types of glazes.
10. Identification of different glazed defects and their remedies.

GCT 243 PROPERTIES OF GLASS AND CERAMICS MATERIALS

Total Contact House	**160**	**T**	**P**	**C**
Theory	**64**	**2**	**3**	**3**
Practical	**96**			

COURSE AIMS:

The students will be able to learn the characteristic properties of Glass and Ceramic Materials and apply this knowledge to comprehend and solve practical problems encountered during production process.

COURSE CONTENTS

1. MECHANICAL PROPERTIES OF MATERIALS 12 HOURS

Elastic Deformation
- Stress and strain
- Tensile and compressive deformations
- Sheer stress strain
- Poison's Ration

Elastic Moduli
- Rotation between cohesive energy and melting point
- Effect of temperature
- Anelasticity

1.3 Plastic Deformation
- Simple oxides
- Dislocation in slip
- Creep
- Effect of temperature

Polyphase Materials
- Mechanism
- Influence of temperature

Brittle Fracture
- Fracture Mechanism
- Fracture Energy
- Theoretical Strength of Ionic solids
- Flaws, their origins and role

Fracture in single and polyphase materials

Strength and strengthening of glass
- Flaws
- Influence of flaw size on the strength
- Methods of strengthening

Hardness and Abrasion
- Relationship with other properties

Elastic modules
Creep
Flow strength and phase assemblage
Abrasions

2. THERMAL PROPERTIES 12 HOURS

Specific Heat

Data on common ceramic material Effect of temperature
Latent heat of fusion
Fusion point
Melting point

Thermal Expansion

Simple lonic crystals: Thermal expansion in relation to potential energy curve, effect of phase transformation

Glass: Thermal expansion curve and its significance.

Thermal expansion, composition and structure of Glass

Polycrystalline materials: Relationship with composition and micro structure

Thermal Conductivity

Simple oxides: Relationship with other properties

Polycrystalline materials: Effect of micro structure porosity and Insulation

Thermal endurance of glasses w.r.t. composition

Thermal Stress

a) Stress in Glass: Permanent and temporary stress, Annealing and tempering
b) Thermal shock resistance of Glass
c) Spilling of Ceramics: Effect of Moisture, Effect of shape
d) Stress at interfaces: Glazes, Enamels and glass to metal seals, micro-stress in relation to micro-structure

3. OPTICAL PROPERTIES 12 HOURS

Reflection and Refection

Refractive index and dispersion: Effect of composition, pollarizability, density and temperature

Reflection in relation to surface texture: Specular reflection and diffused reflection, from glazed surfaces. Reduction of reflection loss

Scattering and opacity: Opacity in relation to refractive index, particle size, pore size, opal glass and glazes. Transparent and translucent ceramic materials

Absorption of Radiation

Ionic colour in vitreous system: Absorption spectrum of transition metal

Ions in U.V., Visible and I.R. regions, oxidation reduction equilibria effect of composition and structure

Colloidal colours: Carbon-surplur, Amber glass, se-ruby

U.V. and I.R absorption: Factors influencing I.R. and U.V. absorption

Fluorescence

Polarization and Birefringence

Crystals: Polariser-Analyser, Tint plate, Mineralogical microscope

Polycrystalline material under a microscope: Microstructures in transmitted and reflected light

Strain in glass: Strain and polarization of light, measurement of strain in glass, strain discs

Microstructure

Mineralogical Microscope

Preparation of Specimens

Microstructure of typical ceramics materials

Electron Microscope

4. CHEMICAL PROPERTIES 08 HOURS

Surface Chemistry of Vitreous Materials

Attack of water, Alkali and Acids: Reaction process and reaction rates

Effect of composition, weathering of glass surface. Alkali resistance, ion exchange

Electrode Glasses: Hydrogen and metal ion-electrode

Durability of Glazes and enamels: Effects of composition, effect of

Electrical stress in insulator glaze

Devitrification and phase separation

Chemical Attack on Refractories

Slag's and glasses

Molten Metals

Glasses

Aqueous Solution

5. ELECTRICAL PROPERTIES 08 HOURS

Conduction

Ionic Conduction: conduction in crystals and polycrystalline ceramics, conduction in glasses, effect of composition and structures

Electronic Condition: Band structure and transport, conduction in crystals and polycrystalline ceramics, semi-conducting glasses.

Dielectric Properties

Di-electric constant and Di-electric loss: polarization and Di- electric

Phenomena, effect of temperature and frequency. Di-electric behavior of

Poly crystalline ceramics. Dielectric behaviors of glasses in relation to

Composition and structure

Die-electric strength

Insulators

Ferro-electric phenomena: Fero-electric behaviors of ceramics in relation to structure

Piezo-electric ceramics.

Electro-opticphenomena in ceramics

6. MAGNETIC PROPERTIES 06 HOURS

7. PHYSICAL PROPERTIES 06 HOURS

INSTRUCTIONAL OBJECTIVES

1. MECHANICAL PROPERTIES OF MATERIALS

Understand Elastic Deformation
- Define Stress and strain
- Explain Tensile and compressive deformations
- Describe Sheer stress strain
- Discuss Poison's Ration

Understand Elastic Moduli
- Develop Rotation between cohesive energy and melting point
- Discuss Effect of temperature
- Explain Anelasticity

1.3 Understand Plastic Deformation
- Explain the role of Simple oxides
- Describe the process of Dislocation in slip
- Discuss Creep
- Illustrate the Effect of temperature

Understand Polyphase Materials
- Describe Mechanism
- Influence of temperature

Understand Brittle Fracture
- Describe Fracture Mechanism
- Describe Fracture Energy
- Explain Theoretical Strength of Ionic solids
- Describe the Flaws, their origins and role

Understand Fracture in single and polyphase materials

Understand Strength and strengthening of glass
- Describe the Flaws
- Describe the Influence of flaw size on the strength
- Explain the Methods of strengthening

Understand Hardness and Abrasion
- Explain the Relationship with other properties
- Describe Elastic modules
- Discuss Creep
- Explain Flow strength and phase assemblage
- Describe Abrasions

2. THERMAL PROPERTIES

Understand Specific Heat
- Explain the effect of common ceramic material Effect of temperature
- Define Latent heat of fusion
- Define Fusion point
- Describe Melting point

Understand Thermal Expansion
- Describe the Simple ionic crystals: Thermal expansion in

relation to potential energy curve, effect of phase transformation

Glass: Thermal expansion curve and its significance.

Thermal expansion, composition and structure of Glass

Polycrystalline materials: Relationship with composition and micro structure

Understand Thermal Conductivity

Describe the thermal conductivity in Simple oxides: Relationship with other properties

Describe the effect of Polycrystalline materials: Effect of micro structure porosity and Insulation

Explain Thermal endurance of glasses w.r.t. composition

Understand Thermal Stress

a) Describe the formation of Stress in Glass: Permanent and temporary stress, Annealing and tempering

b) Define Thermal shock resistance of Glass

c) Explain Spalling of Ceramics: Effect of Moisture, Effect of shape

d) Describe the Stress at interfaces: Glazes, Anamels and glass to metal seals, micro-stress in relation to micro-structure

3. OPTICAL PROPERTIES

Understand the Reflection and Refection

Define Refractive index and dispersion: Effect of composition, pollarizability, density and temperature

Describe the Reflection in relation to surface texture: Specular reflection and diffused reflection, from glazed surfaces. Reduction of reflection loss

Define Scattering and opacity: Opacity in relation to refractive index, particle size, pore size, opal glass and glazes. Transparent and translucent ceramic materials

Understand Absorption of Radiation

Understand Ionic colour in vitreous system: Absorption spectrum of transition metal

Describe ions in U.V., Visible and I.R. regions, oxidation reduction equilibria effect of composition and structure

Describe the behavior of Colloidal colors: Carbon-surplur, Amber glass, se-ruby

Explain U.V. and I.R absorption: Factors influencing I.R. and
U.V. absorption

Define Fluorescence

Understand Polarization and Birefringence

Define polarization, discuss the Crystals: Polariser-Analyser, Tintplate, Mineralogical microscope

Describe the behavior of Polycrystalline material under a microscope: Microstructures in transmitted and reflected light

Describe the Strain in glass: Strain and polarization of light, measurement of strain in glass, strain discs

Understand Microstructure

Mineralogical Microscope

Preparation of Specimens

Microstructure of typical ceramics materials

Electron Microscope

4. CHEMICAL PROPERTIES

Understand Surface Chemistry of Vitreous Materials

Explain the Attack of water, Alkali and Acids: Reaction process and reaction rates

Describe the Effect of composition, weathering of glass surface. Alkali resistance, ion exchange

Discuss Electrode Glasses: Hydrogen and metal ion- electrode

Explain the Durability of Glazes and enamels: Effects of composition, effect of

Explain the Electrical stress in insulator glaze

Define the Devitrification and phase separation

Understand Chemical Attack on Refractories

Describe the effect of Slags and glasses

Describe the effect of Molten Metals

Describe the effect of Glasses

Aqueous Solution

5. ELECTRICAL PROPERTIES

Understand Conduction

Define Ionic Conduction: conduction in crystals and polycrystalline ceramics, conduction in glasses, effect of composition and structures

Describe Electronic Condition: Band structure and transport, conduction in crystals and polycrystalline ceramics, semi-conducting glasses.

Understand Dielectric Properties

Define Di-electric constant and Di-electric loss: polarization and Di-electric

Explain Phenomena, effect of temperature and frequency.

Di-electric behavior of

Describe the Poly crystalline ceramics. Dielectric behavior of glasses in relation to

Describe the effect of Composition and structure

Describe the Die-electric strength

Describe the factors which effect the die-electric of Insulators

Describe the Ferro-electric phenomena: Fero-electric behavior of ceramics in relation to structure

Explain the Piezo-electric ceramics. Electro-optic phenomena in ceramics

6. MAGNETIC PROPERTIES

Para magnetism: Paramagnetic properties of crystalline and glass materials containing transition metal ions. Effect of valancy and coordination numbers.

Ferromagnetism: Elementary theory, Hysteresis, Curie point, Ferromagnetism

Ferromagnetic Ceramics: Spinals, Hexagonal Ferrites, Garnets, Ferromagnetic behavior in relation to structure, soft ferrites, Hard Ferities, and square loop Hysteresis ferities.

7. PHYSICAL PROPERTIES

Relations of Glass composition to:

Density and Specific Gravity

Viscosity

Surface Tension

Softening point

Annealing point etc.

LIST OF PRACTICALS

1. Dye penetration test
2. Microscopic examination of various types of white wares.
3. Microscopic examination of various types of refractory bricks.
4. Modulus of rupture
5. Compressive strength
6. Abrasion resistance
7. Chipping/impact strength
8. War page.
9. Lead solubility
10. Resistance to slag and glass.
11. Drying rate and grain strength

GCT 263 CERAMIC RAW MATERIALS

Total Contact Hours	**160**	**T**	**P**	**C**
Theory	**64**	**2**	**3**	**3**
Practical	**96**			

COURSE AIM

The students will be able to prepare different ceramics bodies after having comprehensive knowledge of the facts imparted by the various ingredients in raw materials.

Occurrence and availability
Physical and Chemical properties

Clay type **08 HOURS**

Origin of Clay
Primary and secondary group Kaolins
Montmorillonite
Little
Plasticity
Drawing and Firing of Clay
Clay Bodies
Testing procedures for evaluation on raw materials for their use in Glass Ceramics industry
Impurities in clays and role there-of

Classification **08 HOURS**

China clay
- Resources in Pakistan
- Application in Ceramics

Ball clay
- Resources in Pakistan
- Application in Ceramics

Fireclay
- Resources in Pakistan
- Application in Ceramics

Building clay
- Resources in Pakistan
- Application in Ceramics

Bentonite
- Resources in Pakistan
- Application in Ceramics

Fuller’s earth
- Resources in Pakistan
- Application in Ceramics

2. Silica Sources **08 HOURS**

- 2.1 Quartz
  - 2.1.1 Available sources in Pakistan
  - 2.1.2 Utility in Glass & Ceramics
  - 2.1.3 Other uses
- 2.2 Sand
  - 2.2.1 Available sources in Pakistan
  - 2.2.2 Utility in Glass & Ceramics
  - 2.2.3 Other uses
- 2.3 Sandstone
  - 2.3.1 Available sources in Pakistan
  - 2.3.2 Utility in Glass & Ceramics
  - 2.3.3 Other uses
- 2.4 Ganister
  - 2.4.1 Available sources in Pakistan
  - 2.4.2 Utility in Glass & Ceramics
  - 2.4.3 Other uses
- 2.5 Quartzite
  - 2.5.1 Available sources in Pakistan
  - 2.5.2 Utility in Glass & Ceramics
  - 2.5.3 Other uses

Polymorphic modifications-quartz

Transformation of quartz into Cristoballite, Tridymite

Action of Heat

Diatomaceous earth

Available sources in Pakistan
Utility in Glass & Ceramics
Other uses

3. Silimanite Group **04 HOURS**

Silimanite

Available sources in Pakistan
Use as Refractory & Insulator

Kyanite

Available sources in Pakistan
Use as Refractory & Insulator

Andalusite

Available sources in Pakistan
Use as Refractory & Insulator

Conversion to Mulite

4. Carbonate Sources **04 HOURS**

Limestone

Formation & Deposits of Limestone in Pakistan
Utility in low temperature bodies
Other uses

4.2 Magnasite
- 4.2.1 Formation & Deposits of Magnasite in Pakistan
- 4.2.2 Utility in Glass & Ceramics Industry
- 4.2.3 Other uses

4.3 Dolomite
- 4.3.1 Formation & Deposits of Dolomite in Pakistan
- 4.3.2 Utility in Glass & Ceramics Industry
- 4.3.3 Other use

4.4 Calcination

5. Fluxes **04 HOURS**

Feldspar
- Types of feldspar minerals
- Effect of heat
- Application as a flux in Ceramics Bodies
- Use as a flux in Glass Melting

Orthoclase-plagioclase series

Felspathoids-Nepheline
- Deposits, quality and uses in Pakistan

6. Miscellaneous **28 HOURS**

Bauxite
Diaspora
Pyrophyllite
Olivine
Chromite
Talc
Bone Ash
Woolastonite & zircon
Rutile
Fluorspar
Silicon Carbite
Graphite
Mica
Lithium-minerals and beryl

RECOMMENDED BOOKS

1. Read, H.H. "Rutley's Elements of mineralogy "Thomas murley 1948
2. Dana, E.S "Text book of mineralogy" 4th edition edited by William E. Fore, john wiley and sons N.Y 1951

INSTRUCTIONAL OBJECTIVES

Occurrence and availability
Physical and Chemical properties
Clay type

Origin of Clay
Primary and secondary group Kaolins
Montmorillonite Clay
Iltitle clay
Plasticity
Drawing and Firing of Clay
Clay Bodies
Testing procedures for evaluation on raw materials for their use in Glass Ceramics industry
Impurities in clays and role there-of

Classification Illustrate the occurrences of the following clays in Pakistan and give an account for their use in glass and ceramic industry

Chinaclay
- Resources in Pakistan
- Application in Ceramics

Ball clay
- Resources in Pakistan
- Application in Ceramics

Fireclay
- Resources in Pakistan
- Application in Ceramics

Building clay
- Resources in Pakistan
- Application in Ceramics

Bentonite
- Resources in Pakistan
- Application in Ceramics

Fuller's earth
- Resources in Pakistan
- Application in Ceramics

2. Silica Sources Illustrate the occurrences of the following Silica minerals in Pakistan and give an account for their use in glass and ceramic industry

2.1 Quartz
- 2.1.1 Available sources in Pakistan
- 2.1.2 Utility in Glass & Ceramics
- 2.1.3 Other uses

2.2 Sand
- 2.2.1 Available sources in Pakistan
- 2.2.2 Utility in Glass & Ceramics
- 2.2.3 Other uses

2.3 Sandstone
- 2.3.1 Available sources in Pakistan
- 2.3.2 Utility in Glass & Ceramics
- 2.3.3 Other uses

2.4 Ganister
- 2.4.1 Available sources in Pakistan
- 2.4.2 Utility in Glass & Ceramics
- 2.4.3 Other uses

2.5 Quartzite
- 2.5.1 Available sources in Pakistan
- 2.5.2 Utility in Glass & Ceramics
- 2.5.3 Other uses

Polymorphic modifications-quartz
- Transformation of quartz into Cristoballite, Tridymite
- Action of Heat

Diatomaceous earth
- Available sources in Pakistan
- Utility in Glass & Ceramics
- Other uses

3. Silimanite Group Illustrate the occurrences of the following Sillimanite group of minerals in Pakistan and give an account for their use in glass and ceramic industry

3.1 Silimanite
- 3.1.1 Available sources in Pakistan
- 3.1.2 Use as Refractory & Insulator

3.2 Kyanite
- 3.2.1 Available sources in Pakistan
- 3.2.2 Use as Refractory & Insulator

3.3 Andalusite
- 3.3.1 Available sources in Pakistan
- 3.3.2 Use as Refractory & Insulator

3.4 Conversion to Mulite

4. Carbonate Sources Illustrate the occurrences of the following carbonate in Pakistan and give an account for their use in glass and ceramic industry

4.1 Limestone
- 4.1.1 Formation & Deposits of Limestone in Pakistan
- 4.1.2 Utility in low temperature bodies
- 4.1.3 Other uses

4.2 Magnasite
- 4.2.1 Formation & Deposits of Magnasite in Pakistan
- 4.2.2 Utility in Glass & Ceramics Industry
- 4.2.3 Other uses

4.3 Dolomite
- 4.3.1 Formation & Deposits of Dolomite in Pakistan
- 4.3.2 Utility in Glass & Ceramics Industry

4.3.3 Other use

4.4 Calcination

5. Fluxes Illustrate the occurrences of the following fluxes in Pakistan and give an account for their use in glass and ceramic industry

5.1 Feldspar

5.1.1 Types of feldspar minerals

5.1.2 Effect of heat

5.1.3 Application as a flux in Ceramics Bodies

5.1.4 Use as a flux in Glass Melting

Orthoclase-plagioclase series

Felspathoids-Nepheline

5.3.1 Deposits, quality and uses in Pakistan

6. Miscellaneous

Bauxite

cribe Bauxite and it sources in Pakistan

cribe Bayer Process and it use as refractory and highj Alumina cement

Diaspora

cribe Diaspora and it sources in Pakistan

cribe purification Process and it use as refractory and high Alumina cement

Pyrophyllite

cibe Pyrophyllite and it sources in Pakistan

cuss it composition, and it application in Ceramics Industry

Olivine

cibe Olivine and it sources in Pakistan

cuss it composition, and it application in Ceramics Industry

Chromite

cibe Chromite and it sources in Pakistan

cuss it composition, and and explain the process for making Chromite brick

Talc

cribe Talc and Soapstone and its sources in Pakistan

cuss it composition, and it application in Tile Industry and glazes

Bone Ash

Production of Bone Ash from Kettle Bone

cuss ash grinding and removal of impurities and it substitute

Woolastonite & zircon

cribe the minerals and it sources.
cuss their composition, and it application in glass and ceramics industry

Rutile

cibe Rutile and it sources in Pakistan
cuss it composition, and it application in Glass & Ceramics Industry

Fluorspar

Descibe Fluorspar and it sources in Pakistan
Discuss it composition, and it application in Glass & Ceramics Industry

Silicon Carbide

Describe SiC and it manufacturing techniques
Discuss it composition, and it application in Glass & Ceramics Industry

Graphite

Describe Graphite and the local available sources
Discuss it composition, and it application in Glass & Ceramics Industry

Mica

Describe mICA and it sources
Discuss it composition, and it application in Glass & Ceramics Industry

Lithium-minerals and beryl

Describe minerals and it sources and purification
Discuss it composition, and it application in Glass & Ceramics Industry

LIST OF PRACTICALS

1. Study the operation of a sieve shaker through the use of variety of crushed solids. (Alternately, a manual sieve screen analysis may be carried out).
2. Study the operation of jaw crusher
3. Moisture analysis of raw materials.
4. Silica
   i) Gravimetric method based on dehydration of salicylic acid and residual silica by colorimetric method based on the formation of either yellow or blue silicomoly bidic acid.
5. Alumina EDTA titration
   i) Gravimetric method.
6. Sodium oxide
   i) Flame photometric method ii) Gravimetric Zineuranyl acetate method.
7. Potassium oxide
   i) Flame photometric method. ii) Potassium tetra-phenyl- boron method.

GCT 253 CERAMIC PRODUCTION TECHNIQUES

Total Contact Hours	**160**	**T**	**P**	**C**
Theory	64	2	3	3
Practical	96			

COURSE AIM

The students will be able to apply the principles of ceramic manufacturing to the commercial production of ceramic products in the industries and develop an organic relationship between the theory and the practice.

COURSE CONTENTS

1. SLIP CASTING **10 HOURS**

a. Properties of aqueous suspensions
b. Normal casting processes
c. Solid casting
d. Pressure casting
e. Deflocculates, their types , behavior, viscosity & thixotropy

2. PRESSING **10 HOURS**

a. Simple presses
b. Hydraulic presses
c. Dry pressing
d. Binders in pressing & their properties
e. ISO-static pressing
f. HIP pressing

3. THROWING **8 HOURS**

a. Effect of water on bodiesfor throwing
b. Pugmill & its effects on throwing bodies

4. JIGGERING **6 HOURS**

a. Jiggering

b. Its types

5. JOLLEYING **6 HOURS**

a. Jolleying

b. Its types

6. SINTERING **8 HOURS**

a. Various methods of sintering

b. New techniques of sintering

c. Sintering of Al_2O_3 & MgO

7. DRYING & FINISHING **10 HOURS**

a. Mechanism of Drying

b. Bulk drying

c. Dryers and types

d. Finishing techniques

8. INJECTION MOULDING TECHNIQUES **6 HOURS**

INSTRUCTIONAL OBJECTIVES

1. SLIP CASTING

Explain the Properties of aqueous suspensions

Explain the Normal casting processes

Define and Explain the Solid casting

Define and Explain the Pressure casting

Explain the Deflocculant, its types & behavior, viscosity & thixotropy

2. PRESSING

Define and Explain the Simple presses

Define and Explain the Hydraulic presses

Define and Explain the Dry pressing

Define and Explain the Binders in pressing & their properties

Define and Explain the Iso-static pressing

Define and Explain the HIP pressing

2. THROWING

Describe the Effect of water on bodiesfor throwing

Describe the Pugmill & its effects on throwing bodies

3. JIGGERING

Define and explain the Jiggering

Explain the types of jiggering

4. JOLLEYING

Define and explain the Jolleying

Explain the types of Jolleying

5. SINTERING

Describe the Various methods of sintering

Describe the New techniques of sintering

Describe the Sintering of Al_2O_3 & MgO

6. DRYING & FINISHING

Explain the Mechanism of Drying

Define and Explain the Bulk drying

Explain the Dryers and types

Explain the Finishing techniques

7. DEFINE AND DESCRIBE THE INJECTION MOULDING TECHNIQUES

RECOMMENDED BOOKS

1. Kingery,W.D “Ceramic Fabrication processes” MIT press, 1958
2. Introduction to ceramics by WD Kingery John wiley & Sons, New York London

LIST OF PRACTICALS

1. Study the theory and operation of filter press i.e. Filtering, washing cleaning of press by filtering various industrially important slurries.
2. Determinations of flash point and fire point.
3. Determination of Viscosity by Ostwald's Viscometer.
4. Determination of viscosity by Red wood viscometer.
5. Making and pressing of tiles i.e. Wall Tiles and Floor tiles by various types of Presses e.g. Friction Press, Toggle Press and Hydraulic Press.
6. Fabrication of refractory furniture for the use in Kilns.

THIRD YEAR

اسلامیات/مطالعہ پاکستان

نصاب (سال سوم)

		ٹی	پی	سی
حصہ اول	اسلامیات Gen 311	1	0	1
حصہ دوم	مطالعہ پاکستان			

موضوعات — کل وقت 20 گھنٹے

1 قرآن مجید

سورۃ الفاتحہ۔ آیۃ الکرسی۔ سورۃ البقرہ کی آخری آیات از امن الرسول تا آخر اور سورہ اخلاص معہ ترجمہ وتشریح

2 دس منتخب احادیث معہ ترجمہ وتشریح

- بنی الاسلام علی خمس شهادة ان لا اله الا الله و اقام الصلوة و ايتاء الزكوة و حج البيت وصوم رمضان
- الدين النصيحه
- المستشار الموتمن
- للمومن على المومن ست خصال يعوده اذا مرض و يشمته اذامات ويجيبه اذا دعاه ويسلم عليه اذالقيه و يشمت اذا عطس و ينصح له اذاغاب او شهد لا تخن من خانک
- لا يدخل الجنة قاطع
- ان الله حرم عليكم عقوق الامهات و اضاعة المال
- يسرا ولا تعسرا بشراً ولا تنفرا
- ذاق طعم الايمان من رضى بالله و بالاسلام دينا و بمحمدنبياً
- افضل الذكر لااله الا الله

3 حقوق وفرائض

حصول تعلیم بطور فرض ، والدین اور اولاد کے حقوق وفرائض، ہمسایہ کے حقوق

4 اسلام کی اخلاقی اقدار

صبر واستقلال۔ عفوودرگزر۔ ایفائے عہد۔ اخوت۔ ایثار وقربانی

Glass,

منتخب احادیث

عمومی مقصد۔ احادیث کی روشنی میں اسلامی تعلیمات پر عمل پیرا ہو سکے۔

خصوصی مقاصد

- احادیث کا ترجمہ بیان کر سکے۔
- احادیث کی تشریح کر سکے۔
- معاشرتی اور انفرادی زندگی میں احادیث سے راہنمائی حاصل کر سکے۔

حقوق و فرائض

عمومی مقصد ۔ اسلامی معاشرے کا ایک اچھا فرد بن سکے۔

خصوصی مقاصد

- والدین کے حقوق وفرائض بیان کر سکے۔
- ہمسائیوں کے حقوق بیان کر سکے۔
- اسلام میں حقوق وفرائض کی اہمیت بیان کر سکے۔
- حقوق وفرائض کی آگاہی کی صورت میں اپنے اندر خدمت خلق کا جذبہ پیدا کر سکے۔

اسلامی اقدار

عمومی مقصد ۔ طالب علم:

جان سکے گا کہ تعلیم کا مقصد حسن اخلاق سے متصف ہونا ہے

خصوصی مقاصد

- اخلاق کے معنی ومفہوم کو بیان کر سکے۔
- اسلام میں حسن اخلاق کی اہمیت بیان کر سکے۔
- قرآن وسنت کی روشنی میں صبر واستقلال کی اہمیت بیان کر سکے۔
- اسلام میں عفو ودرگذر کی اہمیت بیان کر سکے۔
- ایفائے عہد کی اہمیت بیان کر سکے۔
- اخوت کے معنی ومفہوم کو بیان کر سکے۔
- اخوت اسلامی کی اہمیت بیان کر سکے۔
- اسلام کی اعلیٰ اقدار کو اپنا کر مثالی معاشرہ پیدا کر سکے۔

نصاب اخلاقیات (غیر مسلم طلباء کے لئے)

ٹی	پی	سی
1	0	1

سال سوم Gen-311

کل وقت 20 گھنٹے

موضوعات

- احساس ذمہ داری
- مثبت ذہن
- عدل وانصاف
- قومی خدمت کا جذبہ
- فکر ونظر کی پاکیزگی
- احترام آدمیت
- شائستگی
- عفوودرگذر
- بردباری
- خودانحصاری
- اثر ونفوذ
- جامعیت
- اپنی ذات کی معرفت (بذریعہ ہم عصر طلباء۔اساتذہ۔اہم شخصیات،ادارہ)

نصاب (سال سوم)

مطالعہ پاکستان	Gen-311	ٹی	پی	سی
		1	0	1

حصہ دوم

کل وقت 12 گھنٹے

قیام پاکستان

موضوعات

- باؤنڈری کمیشن
- ریڈکلف ایوارڈ
- تقسیم بنگال وکلکتہ
- تقسیم پنجاب
- مسئلہ مہاجرین
- ریاستوں کا الحاق
- ریاست جموں وکشمیر
- نہری پانی کا تنازعہ
- قرارداد مقاصد
- علماء کے بائیس نکات
- 1956 - 1962 اور 1973 کے دساتیر کی اسلامی دفعات
- پاکستان کا محل وقوع اور اس کی جغرافیائی اہمیت
- قدرتی وسائل (تیل، گیس، کوئلہ)

مطالعہ پاکستان

حصہ دوم

قیام پاکستان

تدریسی مقاصد

عمومی مقصد: قیام پاکستان کے بعد درپیش مسائل سے آگاہی حاصل کرے اور بیان کرے۔

خصوصی مقاصد:

- باؤنڈری کمیشن کی تشکیل اور اس کے فرائض بیان کر سکے۔
- ریڈکلف اور اس کے ایوارڈ کے بارے میں بیان کر سکے۔
- بنگال اور کلکتہ کی تقسیم کی وجوہات بیان کر سکے۔
- پنجاب کی تقسیم کی تفصیل بیان کر سکے۔
- مہاجرین کی آمد سے جو مسائل پیدا ہوئے انہیں بیان کر سکے۔
- ریاستوں کے الحاق کے بارے میں تفصیل بیان کر سکے۔
- ریاست جموں کشمیر کے بارے میں بیان کر سکے۔
- نہری پانی کے تنازعہ کو بیان کر سکے۔
- قرارداد مقاصد کی تفصیلات بیان کر سکے۔
- 22 علماء کے متفقہ اسلامی نکات بیان کر سکے۔
- قیام پاکستان کے بعد نفاذ اسلام کی کوششوں کو بیان کر سکے۔
- پاکستان کے محل وقوع اور اس کی جغرافیائی اہمیت بیان کر سکے۔
- پاکستان میں قدرتی وسائل (تیل، گیس، کوئلہ) کے بارے میں بیان کر سکے۔

GCT 302 GLASS MANUFACTURING PROCESSES

Total Contact Hours	**128**	T	P	C
Theory	32	**1**	**3**	**2**
Practical	96			

COURSE AIM

The students would be able to apply the knowledge acquired through Elements of glass in order to prepare different types of industrial glasses while testing various properties thereof.

COURSE CONTENTS

1 GLASS CONDITIONING 4 HOURS

The temperature conditions required very greatly according to the articles being manufactured and the process used.

1. **FORMING MACHINES 4 HOURS**

1. Blow and blow machine
2. IS Machines
3. Press and blow machines
4. Mould and metal forming
5. Ribbon machine
6. Classification of machines
7. Effect related to the speed of production
8. Time cycle and temperature conditions
9. Forming defects
10. Viscosity and working
11. Bottle shape and design
12. Bottle weight

3. TUBE AND RODS MANUFACTURING 4 HOURS

Danner process

Updraw

process

Vello and downdraw process

Tube / rod drawing operations

4. THE PATTERN OF FLAT GLASS DEVELOPMENT 4 HOURS

Basic science of flat glass process

Stress and strain movement in sheet glass

Distortion and lines resulted in the design process

Updraw and downdraw sheet processes

Glass composition in different flat glass

5. ROLLED GLASS PROCESSES **3 HOURS**

Introduction

Table cast process

The intermittent double roll process

The continuous double roll process

5.5. Essential elements of continuous process

6. WIRED GLASS PROCESS **4 HOURS**

Boudin process

Drawn cylinder process

Wire mesh process

7. POLISHED PLATE GLASS PROCESS **4 HOURS**

8. FLAT DRAWN SHEET PROCESS **4 HOURS**

Drawn cylinder process

Fourcault updraw process

Colburn updraw process

Slot bushing downdraw process

Fusion downdraw process

9. FLOAT PROCESS **4 HOURS**

Introduction

Essential features of the process

Theory of the float process

Float ribbon formation

Chemical aspect of the process

Modified float process

Tinted float glass

Supertints float glass

Low iron float glass

10. LAMINATED SAFETY GLASS **2 HOURS**

Introduction

Manufacturing process

Application of the process

Cyclone resistant laminated glass

Characteristics of anti bandit glass

INSTRUCTIONAL OBJECTIVES

1 GLASS CONDITIONING

Explain where proper temperature conditioning starts in glass melting furnace; Explain effect of article being manufactured on the glass conditioning; Explain the control of refiner temperature; Describe with sketches general layout for owens and flow operation; Explain the working of fore hearth for glass conditioning; Explain the sketch of a bottle; Enlist various steps involved in making a bottle; Explain gathering of glass by Hand, By suction, By gob.

Feeder; Explain the dropping of glass in blank mould; explain the forming of finish by pressure; Explain the forming of parison in blank; Explain removing from blank mould; Explain shaping, buffering and elongation of parison; Explain the transfer to blow mould; Explain cooling in blow mould; Explain subsequent handling, annearling and cooling down.

2. FORMING MACHINES

Blow and blow machines; Explain with sketch the working of blow & blow machine; Explain the working of I.S. machines; Explain the working of press and blow machines; Enlist types of mould; Explain manufacture of moulds; Define “DOPes”; Explain designing of mould; Explain with sketch Westlake paste mould process cycle; Explain the working of ribbon machine; Enlist types of machines; Explain the trends in the speed of machines; Explain the time cycle and temperature

conditions; Classify the forming defects; Explain with sketch machine blown ware faults; Explain were defects and their causes; Explain the relationship of viscosity and working; Describe bottle shape and design parameters; Explain relationship of bottle weight and size.

3. TUBE AND RODS MANUFACTURING

Explain the Danner process for the manufacture of tube & rod; Describe advantages & disadvantages of danner process; Explain updraw process for production of tube & rod; Explain yellow and downdraw processes; Describe the advantages of vello & down draw process; Explain subsequent drawing operation of the four processes mentioned above.

4. THE PATTERN OF FLAT GLASS DEVELOPMENT

Explain the basic science of flat glass process; Describe the stress and stretch in an updrawn process as well as in a horizontal ribbon process; Explain lines and distortion in updraw and down draw sheet processes; Explain how the choice of glass composition is a matter of crucial importance; Describe typical glass composition of sheet glass.

5. **ROLLED GLASS PROCESSES**

Define the table cast process; Explain use of table east glass; Explain the intermittent double roll process; Describe the use of intermittent double roll glass; Describe the continuous double roll process; Explain various types of continuous double roll process; Describe essential elements of continuous double roll process.

6. WIRED GLASS PROCESS

Give various types of wired glass processes; Describe boundin & Pilkington double pass wired process; Explain the importance of quality of wire mesh.

7. POLISHED PLATE GLASS PROCESS

Explain the development of polish plate process; Describe the drawn cylinder process;

8. FLAT DRAWN SHEET PROCESS

Describe the equipment and operation of Foucault process; Explain the equipment and operation of the colburn updraw process and glaverbel modification; Explain the elements of slot bushing downward process; Explain the equipment and operation of fusion downdraw process.

9. FLOAT PROCESS

Explain the development of float process; Describe the float bath and equilibrium mode of operation; Explain the theory of float effect and equilibrium thickness; Explain the float ribbon formation: Explain the chemical aspects i.e. properties of tin, oxidation prevention, presence of S&O2 etc; Explain the main features of modified float glass; Explain the use of tinted glass for radiation control; Describe the metal oxides used for tinted glass; Define super tints; Explain the term “spectrally selective”; Explain the use of supertints; Explain the presence of green tinge when viewing from the edge; Describe the amount of iron oxide present in low iron glass.

10. LAMINATED SAFETY GLASS

Defined laminated safety glass; Explain the process of lamination; Explain the benefits of lamination; Describe the applications of laminated safety glass; Define optlight glass and explain the advantages of it; Explain and define cyclone resistant laminate; Explain the composition of an anti bandit glass; Explain edge delamination as a characteristic of laminated glass.

RECOMMENDED BOOKS

1. The Properties of Glass” 2nd edition, Reinhold publishing corp: 1954.
2. Gunther,R “ Glass melting tank furnace” Society of Glass technology

LIST OF PRACTICALS

1. Thermal expansion of Glass.
2. Use of Dilatometer (IS: 5623-1970; ASTM:C-337-57)
3. Under controlled heating rate (CP, LP, Mg and Tg)
4. Littleton softening point (ASTM:C-338-57)
5. Low temperature viscosity by fiber elongation method.
6. Preparation of paperweights.
7. Lenses making.
8. Batch reparation for soda lime glass,
9. Melting and study of soda lime glass.
10. Preparation of batches for various color glasses.

GCT 323 SPECIAL / TECHNICAL CERAMICS

Total Contact Hours	**160**	T	P	C
Theory	64	**2**	**3**	**3**
Practical	96			

COURSE AIM

The objective of this course is to make the students aware of latest techniques and materials that are being brought in to use for numerous practical importances, especially the medical and industrial equipment e.g. Bio – Ceramics, heat exchangers for chemical industry, etc.

COURSE CONTENTS

1. CERAMIC PARTS FOR VARIOUS INDUSTRIES 12 HOURS

Chemical Industry – Rashing rings etc.

Textile Industries – Thread guides etc.

Paper Industries – Nose &Cones etc.

2. HIGH TEMPERATURE CERAMICS
LIKE Ar_2O_3 – MULLITE – ZIRCON BODIES

12 HOURS

Insulators – Low & High Tension

Chemical Porcelain and Stoneware

Thread guides for textile Industry

Laboratory Porcelain

Mullite Porcelain

Alumina bodies for spark plugs

3. FABRICATION OF VARIOUS PARTS OF SHEATS FOR THERMOCOUPLES 10 HOURS

4. CHEMICAL PORCELAIN FOR MAKING OF CRUCIBLES, DISHES, GOUCH CRUCIBLES, VARIOUS TYPES OF CERAMIC CAPACITORS, INSULATORS AND RESISTORS, ETC. 10 HOURS

5. CERAMIC HEAT EXCHANGERS FOR CHEMICAL INDUSTRY. 10 HOURS

6. BIO-CERAMICS- INTRODUCTION, MAKING OF ARTIFICIAL TEETH, BONE PARTS, KNEE etc. 10 HOURS

INSTRUCTIONAL OBJECTIVES

1. **CERAMIC PARTS FOR VARIOUS INDUSTRIES**

   Describe the role of Advanced Ceramics in Chemical Industry – Rashing rings

   Describe the role of Advanced Ceramics in Textile Industries – Thread guides

   Describe the role of Advanced Ceramics in Paper Industries – Nose &Cones

2. **HIGH TEMPERATURE CERAMICS LIKE AL_2O_3 – MULLITE – ZIRCON BODIES**

   Explain Insulators–Low & High Tension as high temperature Ceramics

   Explain Chemical Porcelain and Stoneware as high temperature Ceramics

   Explain Thread guide for textile Industry as high temperature Ceramics

   Explain Laboratory Porcelain as high temperature Ceramics

   Explain Mullite Porcelains as high temperature Ceramics

   Explain Alumina bodies for spark plugs as high temperature Ceramics

3. **DESCRIBE THE FABRICATION OF VARIOUS PARTS OF SHEETS FOR THERMOCOUPLES**
4. **DESCRIBE THE CHEMICAL PORCELAIN FOR MAKING OF CRUCIBLES, DISHES, GOUCH CRUCIBLES, VARIOUS TYPES OF CERAMIC CAPACITORS, INSULATORS AND RESISTORS, ETC.**
5. **DESCRIBE THE CERAMIC HEAT EXCHANGERS FOR CHEMICAL INDUSTRY.**
6. **DESCRIBE THE BIO-CERAMICS AND INTRODUCE THE MAKING OF ARTIFICIAL TEETH, BONE PARTS KNEE ETC.**

RECOMMENDED BOOKS

1) Fine ceramics by FH Norton, McGraw Hill book co. London, New York
2) Advances in ceramics, Vol.9 American ceramic society.
3) Advanced Ceramics, Ramakrishna

LIST OF PRACTICALS

1. Preparation of raw Materials up to 99.5 % purity
2. Preparation of bodies by grinding & pulverizing.
3. Pressing of materials / extrusion / Casting, Drying & Finishing of Products and firing above $1250^{O}C$ according to body compositions.
4. Body composition of Spark plugs and its firing up to $1400^{O}C$.
5. Fabrication of thread guides for Textile Industry.
6. Development of Self – Glazed bodies.
7. Development of Dental Porcelain bodies.
8. Testing and Evaluation of the products.

GCT 353 SANITARY WARES & TILES

Total Contact Hours	**160**	T	P	C
Theory	64	**2**	**3**	**3**
Practical	96			

COURSE AIM

The students will be able to understand various bodies of tile and sanitary wares which is the most profitable ceramic industry of the county.

COURSE CONTENTS

1. TILE RAW MATERIALS **12 HOURS**

Talc
Clay
Quartz
Feldspar

2. TILE BODY **12 HOURS**

Grinding of Talc
Mixing of Clay, Quartz and Feldspar
Pulverizing of body composition
Granulation of the body materials

3. MANUFACTURING PROCESSES **14 HOURS**

Pressing by toggle, Hydraulic and Screw, etc.
Finishing
Glazing
Firing

4. SANITARY WARES – RAW MATERIALS **12 HOURS**

Clay
Quartz

Feldspar

5. FORMING OF SANITARY WARES 14 HOURS

Solid casting

Finishing

Glazing

Firing

INSTRUCTIONAL OBJECTIVES

1. TILE RAW MATERIALS

Describe Talc as tile raw material

Describe Clay as tile raw material

Describe Quartz as tile raw material

Describe Feldspar as tile raw material

2 TILE BODY

Explain the Grinding of Talc

Explain the Mixing of Clay, Quartz and Feldspar

Explain the Pulverizing of Moisture in body Composition

Explain the Granulation of the body materials

3 MANUFACTURING PROCESSES

Explains the Pressing by toggle, Hydraulic and Screw, etc.

Explain the Finishing

Explain the Glazing

Explain the Firing

4 SANITARY WARES – RAW MATERIALS

Describe Clay as tile raw material

Describe Quartz as tile raw material

Describe Feldspar as tile raw material

5 FORMING OF SANITARY WARES

Explain the Solid casting of sanitary wares

Explain the Finishing of sanitary wares

Explain the Glazing of sanitary wares

Explain the Firing of sanitary wares

RECOMMENDED BOOKS

1. Industrial Ceramics by Singer & Singer.

LIST OF PRACTICALS

1. Preparation of tile body
1. Granulation
2. Pressing of granules
3. Finishing and firing
4. Development of Acid – Proof tiles
5. Making of sanitary ware Moulds of various types.
6. Making of slip for Solid casting of sanitary wares.
7. Determination of slip viscosity, thixotropy and specific gravity
8. Casting of slip
9. Drying, finishing and firing

GCT 373 FUELS AND KILNS

Total Contact Hours	**160**	T	P	C
Theory	64	**2**	**3**	**3**
Practical	96			

COURSE AIM

Firing of the final product is of supreme importance in the ceramic industry because the main factor of the cost of product is dictated at this stage and most of the problems are diagnosed and encountered at this stage, therefore, this course will enable students about the workability of different fuel sources and the comprehensive insight of Kilns.

COURSECONTENTS

1. FUELS **10 HOURS**

Types of fuels
Solid fuels
Liquid fuels
Gaseous fuels

2. FURNACES KILNS **10 HOURS**

3. REFRACTORY **12 HOURS**

Types of materials,
Methods to
manufacture Uses and
properties
Types of refractories e.g. Acid, Basic & Neutral Refractory
Physical & Mechanical properties
P.C.E
Softening Point
Load Bearing capacity
Shrinkage and expansion
Thermal shock resistance
Spalling
Resistance to the action of slugs

4. CERAMIC DRYERS & THEIR TYPES **10 HOURS**

5. KILNS **12 HOURS**

Kilns and their types

Setting

Firing

Problems and solutions

6. PYROMETER **10 HOURS**

Mercury thermometers

Electrical resistances

Thermometers

Thermocouples

Measuring instruments

Radiations & Optical pyrometer

Automatic control of firing pyrometers, cones, their kinds, uses, difficulties & disadvantages in the use of the cones.

INSTRUCTIONAL OBJECTIVES

1. FUELS

Explain the types of fuels

Explain the utility of Solid fuels

Explain the utility of Liquid fuels

Explain the utility of Gaseous fuels

2 DESCRIBE THE FURNACES & HEATERS

3 REFRACTORY

Describe the Types of materials,

Describe the Methods to manufacture

Describe the Uses and properties of refractories

Describe the Types of refractories e.g. Acid, Basic & Neutral Refractory

Describe the Physical & Mechanical properties of refractories

Describe the P.C.E of refractories

Describe the Softening Point of refractories

Describe the Load Bearing capacity of refractories

Describe the Shrinkage and expansion of refractories

Describe the Thermal shock resistance of refractories

Describe the Spalling of refractories

Describe the Resistance to the action of slugs of refractories

4 EXPLAIN THE DRYERS AND THEIR TYPES

5 KILNS

Explain the Kilns and their types

Explain the Setting in kilns

Explain the Firing in kilns

Explain the Problems and solutions of kilns

6 PYROMETERY

Describe the Mercury thermometers

Describe the Electrical resistances

Describe the Thermometers

Describe the Thermocouples

Describe the Measuring instruments

Describe the Radiations & Optical pyrometery

Describe the Automatic control of firing pyrometeric cones, their kinds, uses, difficulties & disadvantages in the use of the cones.

RECOMMENDED BOOKS

1) Thrinks, W and Mawhinuey, M, " Industrial Furnaces" -1- " Principles, design and iperation" John wiley and sons, New York, 1953
2) Gilchrist, J.D. Fuels and refractories "Pergamon Press, 1965.
3) Refractories by Norton FH
4) Refractories by Chesters, Sheffield London.

LIST OF PRACTICALS

1. Study of the design of a pottery-baking kiln in a pottery industry.
2. Study of the selection of refectory bricks in different parts of furnace / Kiln.
3. Experiments related to the studies and calculation of furnace kiln and firing practice will be preformed in ceramic industries.
4. Breaking strength of insulations.
5. To determine the Calorific value of Coal, Coke, Wood, Oil and Natural gas.
6. To draw the sketches of various types of kilns i.e. up – Draft Kiln, Down – draft kiln, Tunnel Kiln and a 50 tone Glass Kiln.
7. To use the Optical Pyrometer.

MGM-311 INDUSTRIAL MANAGEMENT AND HUMAN RELATIONS

Total Contact Hour	T	P	C
Theory 32	1	0	1

AIMS: The study of this subject will enable the student to develop the management skills, Acquaint him with the principles of management and human relations and develop Psychological approach to solve the labor problems.

COURSE CONTENTS

1. INDUSTRIAL PSYCOLOGY **2 Hours**
- History and definition
- Nature and scope

2. LEADERSHIP **1 Hour**
- Definition and types
- 2.3 Qualities of a good leader

3. MOTIVATION **2 Hours**
- Definition
- Types (Financial and non financial motives)
- Conflict of motives

4. MORALE **1 Hour**
- Importance
- Development
- Measurement

5. HUMAN ENGINEERING **1 Hour**
- Importance of human factor in industry
- Man-machine system
- Strategy for making allocation decisions

6. INDUSTRIAL FATIGUE AND BOREDOM **2 Hours**
- Definition and distinction
- Psychological causes
- Objective causes
- Prevention

7. INDUSTRIAL ACCIDENTS **2 Hours**
- Psychological causes
- Objective causes
- Prevention

8. INDUSTRIAL PREJUDICE **2 Hours**
- Causes
- Remedies

9. PUBLIC RELATIONS **2 Hours**
- Importance
- Functions

10. GUIDANCE AND COUNSELLING **2 Hours**

- Importance
- Choice of job
- During service

11. JOB EVALUATION **2 Hours**

- Importance
- Methods
- Job satisfaction
- Work simplification

12. INDUSTRIAL MANAGEMENT **2 Hours**

- Introduction
- Functions of management.
- Subdivisions of management
- Objectives of industrial management

13. PERSONNEL SELECTION **2 Hours**

- Recruitment of employees
- Training
- Effects of training on production and product cost

14. WORKING CONDITIONS **2 Hours**

- Importance and consideration
- Effects on efficiency and per unit cost

15. TIME AND MOTION STUDY **3 Hours**

- Concept and importance
- Sequence of motion study
- Principles of motion study
- Steps to time study
- Determination of operations time

16. QUALITY CONTROL **2 Hours**

- Concept and advantages
- Methods.

17. ROLE OF FOREMAN IN MANAGEMENT **2 Hours**

- Foreman's abilities
- Duties and functions

BOOKS RECOMMENDED:

1. C.S. Meyers, Industrial Psychology, Oxford University Press, London.
2. Smith Wakley, Psychology of Industrial Behaviors, Mc-Graw Hill, New York.
3. Ghulam Hussain, Nizamat-e-Sanaat Aur Insani Rawabat, Ilmi Kitab Khana, Urdu Bazar, Lahore.
4. Andrew R. Megill, The Process of Management, William M New Man.
5. Richard N Omen, Management of Industrial Enterprises.

MGM-311 INDUSTRIAL MANAGEMENT AND HUMAN RELATIONS.

INSTRUCTIONAL OBJECTIVES

At the completion of this course, the students will be able to:

1. KNOW INDUSTRIAL PSYCHOWGY
- Describe brief history of industrial psychology
- Describe in detail definition of industrial psychology
- State nature and scope of industrial psychology

2. KNOW LEADERSHIP
- Define leadership
- Describe types of leadership
- State qualities of a good leader

3. UNDERSTAND MOTIVATION
- Define motivation
- Describe financial and non financial motives
- Explain conflict of motives

4. KNOW MORALE
- State importance of morale
- Describe development of morale
- State the method of measurement of morale

5. UNDERSTAND HUMAN ENGINEERING
- Explain importance of human engineering in the industry
- Explain man-machine system
- Explain strategy for making allocation decisions

6. UNDERSTAND INDUSTRIAL FATIGUE AND BOREDOM
- Define fatigue and boredom
- Describe psychological causes of fatigue and boredom
- Describe objective causes of fatigue and boredom
- Explain measures to prevent fatigue and boredom

7. UNDERSTAND INDUSTRIAL ACCIDENTS
- Explain psychological causes of industrial accidents
- Explain objective causes of industrial accidents
- Explain measures to prevent industrial accidents

8. UNDERSTAND INDUSTRIAL PREJUDICE
- Define prejudice
- Explain causes of industrial prejudice
- Explain remedies of industrial prejudice

9. UNDERSTAND THE SIGNIFICANCE OF PUBLIC RELATIONS
- Explain importance of public relations
- Explain functions of public relations

10. UNDERSTAND THE NEED FOR GUIDANCE AND COUNSELLING
- State importance of guidance and counseling
- Explain the role of guidance and counseling in choosing the job
- Describe help of guidance and counseling during service

11. UNDERSTAND JOB EVALUATION

Explain importance of job evaluation.
Explain methods of job evaluation.
Explain job satisfaction.
Explain work simplification.

12. UNDERSTAND INDUSTRIAL MANAGEMENT

Define management.
State functions of management.
Enlist subdivision of management.
Explain objectives of industrial management.

13. UNDERSTAND TRAINING AND ITS EFFECTS

Describe the recruitment procedure of employees in an industrial concern.
Explain training.
Identify the kinds of training.
Explain the effects of training on production and product cost.

14. UNDERSTAND THE EFFECT OF WORKING CONDITION ON EFFICIENCY

Explain importance of working condition.
Describe air-conditioning, ventilation, lighting and noise.
State the effects of good working conditions on efficiency and per unit cost.

15. UNDERSTAND TIME AND MOTION STUDY

Explain the concept.
Describe the importance of work-study.
Explain the sequence of motion study.
State the principles of motion study.
Describe the steps for carrying out time study.
Explain the method of determination of operations time.

16. UNDERSTAND THE METHOD OF QUALITY CONTROL

Define quality control
State the advantages of quality control.
Explain methods of quality control.

17. UNDERSTAND THE ROLE OF FOREMAN IN AN INDUS'TIUAL UNDERTAKING

Explain ability of the foreman.
Enlist duties of foreman.
Describe functions of foreman as middle management.

OHSE 301 OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT

Total contact hours		**T**	**P**	**C**
Theory:	32 Hours	**1**	**0**	**1**

Pre-requisite: None

AIMS: After completing the course the students will be able to understand the costs associated with occupational injuries and ways to develop positive attitudes towards occupational health and safety issues.

COURSE CONTENTS

1. PROMOTING HEALTH AND SAFETY
4 Hours

The Occupational Health and Safety (OH&S) program.
The essential components of a health and safety policy
The basic concepts to risk management.

2. MECHANICAL HAZARDS
2 Hours

Mechanical Hazards of power-driven tools and Machines
Types of Injuries.
Requirements and types of machine safeguards.
Lockout/tagout system.

3. FALLING, IMPACT, ACCELERATUION, AND LIFTING HAZARDS
2 Hours

Causes of falls and categories.
Elements of slip and fall prevention programmes.
Recommended procedures for ladder safety.
Impact and acceleration hazards.
Lifting hazards and their relation to back injuries.
Materials handling, both manual and mechanical.

4. ELECTRICAL HAZARDS
2 Hours

Sources of electrical hazards.
Effects of electricity on humans.
Methods of reducing electrical hazards.
Steps to be taken to assist a victim of electric shock.

5 FIRE HAZARDS
2 Hours

Sources of fire hazards.
Methods of reducing fire hazards.
Emergency procedures and means of escape.
Classification of fire extinguisher.

6. CHEMICAL HAZARDS
4 Hours

Occupational diseases and illnesses.
Agents which can cause disease and illness.
Three routes of entry of chemicals into the body.
6.4 Classification of effects of substances.

7. PHYSICAL HAZARDS
4 Hours

Noise.
Vibration.
Heat Stress.
Radiation.
Lasers
7.5 Lighting

8. CONFINED SPACES HAZARDS
2 Hours

Characteristics of a confined space.
Hazards involved in confined spaces.
Safety measures to be taken while working in confined spaces.

9. PERSONAL PROTECTIVE EQUIPMENT
4 Hours

Head protectors.
Types of protection for the feet.
Protection for hands and arms.
Protection of the eyes and face in various applications.
Types of hearing protection.
Respiratory protection.

10. ACCIDENT PREVENTION
4 Hours

Stages of an accident investigation and analysis.
The importance of good house-keeping in a workplace.
The essential sections of a Material "Safety Data Sheet.
Safe handling and storage of chemicals.

11. FIRST AID
2 Hours

ABCs of First Aid.
First Aid training program.
Contents of a typical First Aid kit.
MSDS

REFERENCE BOOKS

1. Proctor & Huges, Chemical Hazards of the Workplace, 4th edition, Hathaway, Proctor, Huges (Van Nostran Reinhold).
2. Sax's Dangerous Properties of Industrial Materials, 9th Edition, Lewis (Van Nostrand Reinhold).
3. The occupational Environment-Its Evaluation and control, Editor Dinardi (AIHA Press).
4. Basic Industrial Hygiene-A Training Manual, Brief (AIHA).
5. Encyclopedia of Occupational Health and Safety, 4th edition, (ILO).
6. Handbook of Industrial Solvents, Latest Edition, (Alliance of American Insurers).
7. Fundamentals of Occupational Safety and Health, Kohn, Friend, Winterberger.

OHSE- 301 OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT

INSTRUCTIONAL OBJECTIVES

1. PROMOTING HEALTH AND SAFETY

Outline the reasons for an Occupational Health and Safety (OH&S) program.
Illustrate the essential components of a health and safety policy
Realize the benefits of rules and regulations on OH&S.

2. MECHANICAL HAZARDS

Identify mechanical hazards of power-driven tools and machines
Describe types of injuries that can be caused by these tools and machines.
Requirements and types of machine safeguards.
Explain what a lockout/tagout system is.

3. FALLING, IMPACT ACCELERATION, AND LIFTING HAZARDS

List causes of falls and categorize them
Outline key elements of slip and fall prevention programs
Discuss recommended procedures for ladder safety
Describe impact and acceleration hazards
Identify lifting hazards and their relation to back injuries
3.6 Discuss materials handling, both manual and mechanical

4. ELECTRICAL HAZARDS

Describe soures of electrical hazards.
Describe the effects of electricity on humans
Describe some methods of reducing electrical hazards
Outline steps to be taken to assist a victim of electric shock

5. FIRE HAZARDS

Describe sources of fire hazards.
Describe methods of reducing fire hazards.
Describe emergency procedures and means of escape.
Describe the fire extinguisher classifications.

6. CHEMICAL HAZARDS

Describe occupational diseases and illnesses
Define, with some of their properties, agents which can cause disease and illness
Explain the three routes of entry of chemicals into the body
Describe classification of effects of substances.

7. PHYSICAL HAZARDS

Describe typical methods of controlling exposure to noise.
Explain typical methods of control of vibrations.
Describe the effects of radiation on humans and outline exposure control.
Describe typical effects of lasers on humans and outline exposure control.
Explain common problems of lighting and their effects.
Describe illnesses that can be caused by heat stress and discuss its control.

8. CONFINED SPACES HAZARDS

Discuss the characteristics of a confined space.
Explain the hazards involved in confined spaces.
Describe safety measures to be taken while working in confined spaces.

9. PERSONAL PROTECTIVE EQUIPMENT

Describe head protectors.
Describe various types of protection for the feet.
Describe protection for hands and arms.
Describe protection of the eyes and face in various applications.
Describe different types of hearing protection.
Outline safe handling and storage of chemicals.

10. ACCIDENT PREVENTION

Outline stages of an accident investigation and analysis.
Explain the importance of good house-keeping in a workplace.
Outline the essential sections of a Material Safety Data Sheet.
Discuss safe handling and storage of chemicals.

11. FIRST AID

State the ABCs of First Aid.
List the essential activities of a basic First Aid training program.
List the contents of a typical First Aid kit.
Recognize an MSDS as a source of information about First Aid.

GCT-363-Project

Note: **The project will be awarded at the start of academic year.**