



CURRICULUM

**For
THREE YEAR'S DIPLOMA
OF
ASSOCIATE ENGINEER
IN
PHARMACEUTICAL TECHNOLOGY**

REVISED BY, TEVTA PUNJAB

ADOPTED BY, SBTE KARACHI

OCTOBER 2020

DAE CHEMICAL TECHNOLOGY
WITH SPECIALIZATION IN *PHARMACEUTICAL*

SCHEME OF STUDIES

1st Year

Sr. #	Course No.	Subject	T	P	C
1.	Gen 111	Islamiat / Pak Studies	1	0	1
2.	Eng. 112	Technical English	2	0	2
3.	Math 113	Applied Math - I	3	0	3
4.	Phy 113	Applied Physics	2	3	3
5.	Comp 122	Computer Applications	1	3	2
6.	CHT 153(Rev.)	Basic Chemical Engineering	2	3	3
7.	CHT 164	General Chemistry	2	6	4
8.	MT 143(Rev.)	Basic Engineering Drawing & CAD-I	1	6	3
9.	Pht 113	Pharmaceutical Technology - I	2	3	3
Total			16	24	24

2nd Year

1.	Gen 211	Islamiat / Pakistan Studies	1	0	1
2.	Math 223	Applied Maths-II	3	0	3
3.	Mgm 211	Business Communication	1	0	1
4.	Mgm 221	Business Management & Industrial Economics	1	0	1
5.	CHT 244(Rev.)	Organic Chemistry	2	6	4
6.	CHT 254(Rev.)	Industrial Chemical Process - I	3	3	4
7.	CHT 263	Quantitative Analysis	1	6	3
8.	CHT 271	Safety Practice & Procedure	1	0	1
9.	CHT 283	Physical Chemistry	2	3	3
10.	CHT 293	Chemical Engineering – I	2	3	3
Total			17	21	24

3rd Year

			T	P	C
1.	Gen 311	Islamiat / Pakistan Studies	1	0	1
2.	Mgm 311	Industrial Management & Human Relations	1	0	1
3.	CHT 314(Rev.)	Instrumental Methods of Analysis	2	6	4
4.	CHT 343	Process Instrumentation & Control	2	3	3
5.	Pht 313	Quality Control in Pharmaceutical Industry	2	3	3
6.	Pht 323	Good Manufacturing Practices	3	0	3
7.	Pht 334	Pharmaceutical Technology- II	3	3	4
8.	CHT 372	Industrial Stoichiometry	2	0	2
9.	Pht 341	Entrepreneurship	1	0	1
Total			17	15	22

اسلامیات / مطالعہ پاکستان

ٹی پی سی
1 0 1
کل وقت: 20 گھنٹے

GEN III

حصہ اول اسلامیات

حصہ دوم مطالعہ پاکستان

موضوعات حصہ اول اسلامیات

سہل اول

کتاب و سنت

(ا) قرآن مجید

1- تفسیر قرآن مجید 2- نزول قرآن 3- مکی و مدنی سورتوں کی خصوصیات 4- وحی کی اقسام 5- پندرہ منتخب آیات مع ترجمہ

- 1.1 ننالوا البر حتی تنفقوا مما تحبون
- 1.2 واعتصموا بحبل اللہ جمیعاً ولا تفرقوا
- 1.3 ولا یجبر منکم شیء ان لا تعدلوا
- 1.4 ان اللہ یمرکم ان تودوا المائت الی اهلها
- 1.5 ان اللہ یمر بالعدل والاحسان
- 1.6 ان الصلوٰۃ تنہی عن الفحشاء والمنکر
- 1.7 لقد کان لکم فی رسول اللہ سۃ حسنہ
- 1.8 ان اکرمکم عند اللہ اتقاکم
- 1.9 وما آتاکم الرسول فخرزوا وما نہی عنہوا نتهوا
- 1.10 ولوفوا بالعہد
- 1.11 وما شروہن بالمعروف
- 1.12 یمحق اللہ الربو ویربى الصمدقات
- 1.13 واصبر علی ما اصابک
- 1.14 وقولوا لا سیدنا
- 1.15 ان الدین عند اللہ السلام

(ب) سفت

- 1- سنت کی اہمیت
- 2- دس منتخب احادیث مع ترجمہ و تفسیر

- 1- اعمالاً عملاً بالنیات
- 2- امانت لاتم مکارم الاخلاق
- 3- لا یومن احدکم حق یحب الاخیرہ ما یحب لنفسه
- 4- المسلم من سلم المسلمون من سبہ المسلمون من لسانہ ویدہ
- 5- فی امنت باللہ سلم استقم
- 6- حیرکم خیرکم ذالہ
- 7- سباب المسلم فسوق وقتالہ کفر
- 8- المؤمن اخو المؤمن
- 9- کأن المسلم عسی المسلم حیر لہ یمعہ ومالہ وفرقہ
- 10- ایتہ المعلق ثلاث اذا حدیث کذب واقاوت من خائن وانافنا خلف

دین اسلام

2.1 ہمام کے بنیادی مقصد کی وضاحت اور انسان کی اخروی و دنیوی زندگی پر ان کے اثرات

- 1- توحید
- 2- رسالت
- 3- آخرت
- 4- ملائکہ
- 5- اسطیغاث

2.2 عبادات

1- نماز 2- روزہ 3- حج 4- زکوٰۃ

مندرجہ بالا عبادات کی اہمیت و فضیلت، ملکیش اور انسان کی اخروی و معاشرتی زندگی پر ان کے اثرات

حصہ اول
حصہ اسلامیات

مدرسی مقاصد

۱۔ قرآن مجید

عمومی مقصد: طالب علم یہ سمجھنے کے قابل ہو کہ اسلام کی تعلیمت کا اصل سرچشمہ قرآن مجید ہے
خصوصی مقصد: طالب علم اس قابل ہو جائے گا کہ

قرآن مجید کی تحریف کر سکے گا

قرآن مجید کے نزول کی صورت بیان کر سکے

قرآن مجید کی دینی سورتوں کی پہچان کر سکے

مکتبہ آیات کا ترجمہ و تشریح کر سکے

عمومی مقصد: یہ سمجھنے کے قابل ہو جائے گا کہ مکتبہ قرآنی آیات کے ذریعے اسلامی اقدار کا مفہوم کیا ہے

قرآنی آیات کا ترجمہ و تشریح کر سکے

قرآنی تعلیمت کی روشنی میں اپنی اور معاشرتی اصلاح کر سکے

۲۔ سنت

عمومی مقصد: طالب علم سنت نبوی کی اہمیت اور ضرورت کو اچھی طرح سمجھنے کے قابل ہو جائے گا
خصوصی مقصد:

سنت کی تحریف بیان کر سکے

سنت کی اہمیت و ضرورت کی وضاحت کر سکے

سنت کی روشنی میں امور حسنہ پر عمل کر سکے

مکتبہ احادیث نبویہ

عمومی مقصد: احادیث کی روشنی میں اخلاقی اقدار سے ہمکنار حاصل کر سکے

خصوصی مقصد: احادیث کا ترجمہ و تشریح کر سکے

رسول اللہ ﷺ کے اسوۂ حسنہ کا، پیروں کا، عملی نمونہ بنائے

دین اسلام
 عمومی مقاصد: دین اسلامی کے بنیادی مقاصد 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 بنیویں مقاصد کی اہمیت بیان کر سکے
 اسلام کے بنیویں مقاصد سے انسان کی انفرادی و اجتماعی زندگی پر پڑنے والے اثرات بیان کر سکے
 عبادات کے لغوی و اصطلاحی معنی بیان کر سکے
 عقیدے اور عبادات کا فرق بیان کر سکے
 عبادات (نماز، روزہ، حج، زکوٰۃ) کے فوری، احکامات اور نفسانی زندگی پر ان کی اثرات بیان کر سکے
 اسلامی مقاصد و عبادات کے مطابق اپنی زندگی ڈھل کر ایک اچھا مسلمان بن سکے

انجیر مسلم طلباء کے لئے

GEN III

نصاب اختلاقیات سائنس ناول
حصہ دوم ملاحظہ پاکستان

موضوعات

کے بی سی
1 0 4
کل وقت 20 گھنٹے

اختلاقیات کی تعریف اور اہمیت
اختلاقیات کا معیار (لائون: عقل، الحی، کب)
مندرجہ ذیل اخلاق کی وضاحت

- ☆ وقت ادا کرنا
- ☆ حق داری
- ☆ نظم و ضبط
- ☆ راست گوئی
- ☆ صبر و استقامت
- ☆ حوصلہ مندی
- ☆ وقت کی پابندی
- ☆ سفاکی
- ☆ اعتدال
- ☆ باہمی احترام
- ☆ مصلحت

نصاب اخلاقیات (سولہ لکھ)

تعلیمی مقاصد

عمومی مقاصد: اعلیٰ اخلاق کی وجہ سے کل ترقی میں کل ترقی ترقی حاصل کر سکے

خصوصی مقاصد: طلباء اس علم سے دوسرا جہل ہو گا کہ

موضوعات کا مطلب بیان کر سکے ☆

عملی زندگی سے مشابہت کی نشاندہی کر سکے ☆

اپنی شخصیت اور معاشرے پر موضوعات کے مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے ☆

روایت رابری کی اہمیت بیان کر سکے ☆

وفا داری کی اہمیت بیان کر سکے ☆

لکھ و ضبط کی فلاحیت 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 ☆

صفا کی اور باہمی اختیار سے حسن کلر کی کو بیان کر سکے ☆

مصلحت کے فوائد بیان کر سکے ☆

صفحہ دوم	موضوعات	کل وقت 12 گھنٹے
1	حسرت قمر: مسلمان قوم میں آزلوی ٹکرنی تاریخ مسلمانوں میں سیاسی آزلوی کی اہمیت اور ضرورت - ذاتی و جمعی غلامی کے تعلقات	
2	نظریہ پاکستان قیام پاکستان کی اساس (ذہن احمدی) قیام پاکستان کی غرض ا غایت نظریہ پاکستان کی وضاحت - نظریہ پاکستان اور مردم اقبل اور قائد اعظم کے ارشادات کی روشنی میں	
3	نظریہ پاکستان کا تاریخی پسو مہرین قاسم کی سند - مجدد ملف مانی اور شہ الما ایشہ کی تبلیغی خدمات سید احمد شہید کی تحریک مجاہدین	
4	تقاسمی تحریکیں علی گڑھ - دعوت احمدیہ - (بیروت - مدرسہ للاسلام - (سندھ) اسلامیہ کالج (پٹنور) انجمن حملت اسلام (لاہور)	

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
 - ☆ ذاتی غذائی کے قومی سطح پر نقصانات کے بیان کر سکے
 - ☆ نسلی غذائی قومی سطح پر نقصانات بیان کر سکے
- نظریہ پاکستان
- عمومی مقصد:
- نظریہ پاکستان (دوین اسلام) سے پوری طرح واقفیت 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 قائد اعظم کے فرمودات کی روشنی میں نظریہ پاکستان بیان کر سکے
- نظریہ پاکستان کا تاریخی پس منظر
- عمومی مقصد:
- نظریہ پاکستان کے تاریخی پس منظر سے واقفیت حاصل کر سکے
- خصوصی مقاصد:
- ☆ محمد بن قاسم کے بارے میں بیان کر سکے

- ۶۰ محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکے
- ۶۱ محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکے
- ۶۲ بیان کر سکے کہ ہندوستان میں ہندو مسلم دو قومی نظریہ کا نکلنا آغاز کیا ہے
- ۶۳ مہدولف ٹائی کی علمی خدمات بیان کر سکے
- ۶۴ شلہولی اللہ کی علمی خدمات بیان کر سکے
- ۶۵ مہدولف ٹائی اور شلہولی اللہ نے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکے

علمی تحریکیں

- ۶۶ علمی مقصد
- ۶۷ ہر علمی تحریک کی علمی تحریکوں سے آگاہی حاصل کر سکے
- ۶۸ قصہ میں مقصد:
- ۶۹ علی گڑھ - دیوبند - تحریک العلماء مدرسہ الاسلام، اسلامیہ کالج - انجمن حمایت اسلام نے تعلیم کے ذریعہ سیاسی شعور مسلمانوں میں پیدا کیا اسے بیان کر سکے
- ۷۰ آزادی ہند کے سلسلہ میں تحریک محمدین کی خدمات بیان کر سکے

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 hours |
| 1.1 | First eight essays of Intermediate English Book-II | |
| 2 | CLOZE TEST | 4 hours |
| 2.1 | A passage comprising 50-100 words will be selected from the text. Every 11th word 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 hours |
| 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 hours |
| 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. | |
| 5. | TRANSLATION | 4 hours |
| 5.1 | Translation from Urdu into English. | 6 hours |
| | 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 Zahoora, Vol - I, National Book Foundation

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 subject and a predicate.
- 3.2 State classification of time, i.e present, past and future and use verb tense correctly 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
PRACTICAL SITUATIONS**

- 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 in practical 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 and sentences.

Math-113APPLIED 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 Standard Form
- 1.2 Solution
- 1.3 Nature of roots
- 1.4 Sum & Product of 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 Factors	Case 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 central Angle	
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 IDENTITIES	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 Scalars & Vectors
- 11.2 Addition & Subtraction
- 11.3 The unit Vectors $\mathbf{i}, \mathbf{j}, \mathbf{k}$
- 11.4 Direction Cosines
- 11.5 Scalar or Dot Product
- 11.6 Deductions
- 11.7 Dot product in terms of orthogonal components
- 11.8 Deductions
- 11.9 Analytic Expression for $\mathbf{a} \times \mathbf{b}$.
- 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

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 solving the 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 from the 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 n th 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 n th 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: $(n,0), (n,1), \dots, (n,r), \dots, (n,n)$
- 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 FRACTION INTO PARTIAL FRACTIONS USING DIFFERENT 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 TRIGONOMETRIC FUNCTIONS

- 7.1 Define the basic trigonometric functions/ratios of an angle as ratios of the sides of 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 TECHNOLOGICAL PROBLEMS

- 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 sines 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, VOLUME AND 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 SOLVING TECHNOLOGICAL PROBLEMS.

- 11.1 Define vector quantity.
- 11.2 Explain addition and subtraction of vector
- 11.3 Illustrate unit vectors \mathbf{i} , \mathbf{j} , \mathbf{k} .
- 11.4 Express a vector in the component form.
- 11.5 Explain magnitude, unit vector, direction cosines of a vector.
- 11.6 Derive analytic expression for dot product and cross product of two vector.
- 11.7 Deduce conditions of perpendicularity and parallelism of two vectors.
- 11.8 Solve problems

12. USE THE CONCEPT OF MATRICES & DETERMINANTS IN SOLVING TECHNOLOGICAL PROBLEMS

- 12.1 Define a matrix and a determinant.
- 12.2 List types of matrices.
- 12.3 Define transpose, adjoint 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 Crammer's Rule for solving linear equations

PHY-113 APPLIED PHYSICS

Total Contact Hours:

Theory	64	T	P	C
Practical	96	2	3	3

AIMS: The students will be able to understand the fundamental principles and concept of physics use these to solve problems in practical situations/technological courses and understand concepts to learn advance physics/technical courses.

COURSE CONTENTS

- 1 MEASUREMENTS. 2 Hours.
 - 1.1 Fundamental units and derived units
 - 1.2 Systems of measurement and S.I. units
 - 1.3 Concept of dimensions, dimensional formula
 - 1.4 Conversion from one system to another
 - 1.5 Significant figures
- 2 SCALARS AND VECTORS. 4 Hours.
 - 2.1 Revision of head to tail rule
 - 2.2 Laws of parallelogram, triangle and polygon of forces
 - 2.3 Resolution of a vector
 - 2.4 Addition of vectors by rectangular components
 - 2.5 Multiplication of two vectors, dot product and cross product
- 3 MOTION 4 Hours.
 - 3.1 Review of laws and equations of motion
 - 3.2 Law of conservation of momentum
 - 3.3 Angular motion
 - 3.4 Relation between linear and angular motion
 - 3.5 Centripetal acceleration and force
 - 3.6 Equations of angular motion
- 4 TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA. 4 Hours.
 - 4.1 Torque
 - 4.2 Centre of gravity and center of mass
 - 4.3 Equilibrium and its conditions
 - 4.4 Torque and angular acceleration
 - 4.5 Rotational inertia
- 5 WAVE MOTION. 5 Hours
 - 5.1 Review Hook's law of elasticity

5.2	Motion under an elastic restoring force	
5.3	Characteristics of simple harmonic motion	
5.4	S.H.M. and circular motion	
5.5	Simple pendulum	
5.6	Wave form of S.H.M.	
5.7	Resonance	
5.8	Transverse vibration of a stretched string	
6	SOUND.	5 Hours
6.1	Longitudinal waves	
6.2	Intensity, loudness, pitch and quality of sound	
6.3	Units of Intensity, of level and frequency response of ear	
6.4	Interference of sound waves, silence zones, beats	
6.5	Acoustics	
6.6	Doppler effect.	
7	LIGHT.	5 Hours
7.1	Review laws of reflection and refraction.	
7.2	Image formation by mirrors and lenses	
7.3	Optical instruments	
7.4	Wave theory of light	
7.5	Interference, diffraction, polarization of light waves	
7.6	Applications of polarization of light waves	
8	OPTICAL FIBER.	2 Hours
8.1	Optical communication and problems	
8.2	Review total internal reflection and critical angle	
8.3	Structure of optical fiber	
8.4	Fiber material and manufacture	
8.5	Optical fiber - uses.	
9	LASERS.	3 Hours
9.1	Corpuscular theory of light	
9.2	Emission and absorption of light	
9.3	Stimulated absorption and emission of light	
9.4	Laser principle	
9.5	Structure and working of lasers	
9.6	Types of lasers with brief description.	
9.7	Applications (basic concepts)	
9.8	Material processing	
9.9	Laser welding	
9.10	Laser assisted machining	
9.11	Micro machining	
9.12	Drilling, scribing and marking	
9.13	Printing	

- 10 HEAT. 4 Hours
- 10.1 Review of calorimetric and gas laws and mode of transfer of heat
 - 10.2 Thermal expansion of solids, liquids and gases
 - 10.3 Heat of fusion, vaporization
 - 10.4 Humidity, absolute and relative
 - 10.5 Law of cooling
 - 10.6 Thermoelectricity
 - 10.7 Thermocouple.
- 11 THERMODYNAMICS. 4 Hours
- 11.1 Heat energy and internal energy
 - 11.2 First law of thermodynamics & applications
 - 11.3 Isometric and adiabatic processes
 - 11.4 Efficiency of heat engine
 - 11.5 Second law of thermodynamics (both statements)
 - 11.6 Heat engine and refrigerator.
- 12 TRANSFER OF HEAT. 5 Hours
- 12.1 Review: Modes of transfer of heat
 - 12.2 Emission and absorption of heat
 - 12.3 Black body radiation
 - 12.4 Laws of energy distribution
 - 12.5 Planck's quantum theory
 - 12.6 The photoelectric effects
 - 12.7 X-ray, production, properties and uses
- 13 ELECTROMAGNETIC WAVES. 3 Hours
- 13.1 Magnetic field around a current carrying conduction
 - 13.2 Electric field induced around a changing magnetic flux
 - 13.3 Moving fields
 - 13.4 Types of electromagnetic waves
 - 13.5 Generation of radio waves
 - 13.6 Spectrum of electromagnetic waves
- 14 ATOMIC NUCLEUS. 5 Hours
- 14.1 Structure of the nucleus
 - 14.2 Radioactivity
 - 14.3 Radioactive series
 - 14.4 Transmutation of elements

- | | | |
|------|---|---------|
| 14.5 | The fission reaction | |
| 14.6 | The fusion reaction | |
| 14.7 | The nuclear reactor | |
| 15 | NUCLEAR RADIATIONS. | 5 Hours |
| 15.1 | Properties and integration with matter | |
| 15.2 | Radiations detector | |
| 15.3 | Radiation damage and its effects | |
| 15.4 | Radiation therapy | |
| 15.5 | Radioactive tracers | |
| 15.6 | Application of radiation techniques in archeology, agriculture, chemical industry, polymerization, sterilization, food preservation, gauging and control, radiography | |
| 16 | ARTIFICIAL SATELLITES. | 2 Hours |
| 16.1 | Review law of gravitation | |
| 16.2 | Escape velocity | |
| 16.3 | Orbital velocity | |
| 16.4 | Geosynchronous and geostationary satellites | |
| 16.5 | Use of satellites in data communication. | |
| 17 | MAGNETIC MATERIALS. 2 Hours | |
| 17.1 | Magnetism | |
| 17.2 | Domains theory | |
| 17.3 | Para and ferromagnetism and magnetic materials | |
| 17.4 | B.H. curve and hysteresis loop. | |
| 18 | SEMI CONDUCTOR MATERIALS. | 2 Hours |
| 18.1 | Crystalline structure of solids | |
| 18.2 | Conductors, semiconductors, insulators | |
| 18.3 | P-type and N-type materials | |
| 18.4 | P-N junction | |
| 18.5 | P-N junction as a diode | |
| 18.6 | Photovoltaic cell (solar cell) | |

RECOMMENDED BOOKS:

1. Tahir Hussain, Fundamentals of physics Vol-I, II
2. Farid Khawaja, Fundamentals of Physics Vol-I and II
3. Wells and Slusher, Schaum's Series Physics.
4. Nelkon and Oyborn, Advanced Level Practical Physics
5. Mehboob Ilahi Malik and Inam-ul-Haq, Practical Physics

6. Wilson, Lasers - Principles and Applications
7. M. Aslam Khan and M. Akram Sandhu, Experimental Physics Note Book

INSTRUCTIONAL OBJECTIVES

- 1. USE CONCEPTS OF MEASUREMENT TO PRACTICAL SITUATIONS AND TECHNOLOGICAL PROBLEMS.**
 - 1.1 Write dimensional formulae for physical quantities
 - 1.2 Derive units using dimensional equations
 - 1.3 Convert a measurement from one system to another
 - 1.4 Use concepts of measurement and significant figures in problem solving.
- 2. USE CONCEPTS OF SCALARS AND VECTORS IN SOLVING PROBLEMS INVOLVING THESE CONCEPTS.**
 - 2.1 Explain laws of parallelogram, triangle and polygon of forces
 - 2.2 Describe method of resolution of a vector into components
 - 2.3 Describe method of addition of vectors by head & tail rule
 - 2.4 Differentiate between dot product and cross product of vectors
 - 2.5 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.**
 - 3.1 Use law of conservation of momentum to practical/technological problems.
 - 3.2 Explain relation between linear and angular motion
 - 3.3 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.**
 - 4.1 Explain Torque
 - 4.2 Distinguish between Centre of gravity and center of mass
 - 4.3 Explain rotational Equilibrium and its conditions
 - 4.4 Explain Rotational Inertia giving examples
 - 4.5 Use the above concepts in solving technological problems.
- 5. USE CONCEPTS OF WAVE MOTION IN SOLVING RELEVANT PROBLEMS.**
 - 5.1 Explain Hooke's Law of Elasticity
 - 5.2 Derive formula for Motion under an elastic restoring force
 - 5.3 Derive formulae for simple harmonic motion and simple pendulum
 - 5.4 Explain wave form with reference to S.H.M. and circular motion
 - 5.5 Explain Resonance
 - 5.6 Explain transverse & longitudinal waves.
 - 5.7 Use the above concepts and formulae of S.H.M. to solve relevant problems.

- 6. UNDERSTAND CONCEPTS OF SOUND.**
 - 6.1 Describe longitudinal wave and its propagation
 - 6.2 Explain the concepts: Intensity, loudness, pitch and quality of sound
 - 6.3 Explain units of Intensity level and frequency response of ear
 - 6.4 Explain phenomena of silence zones, beats
 - 6.5 Explain Acoustics of buildings
 - 6.6 Explain Doppler Effect giving mathematical expressions and its application

- 7. USE THE CONCEPTS OF GEOMETRICAL OPTICS TO MIRRORS AND LENSES.**
 - 7.1 Explain laws of reflection and refraction
 - 7.2 Use mirror formula to solve problems
 - 7.3 Use the concepts of image formation by mirrors and lenses to describe working of optical instruments, e.g. microscopes, telescopes, cameras.
- 7 UNDERSTAND WAVE THEORY OF LIGHT.**
 - 7.1 Explain wave theory of light
 - 7.2 Explain phenomena of interference, diffraction, polarization of light waves
 - 7.3 Describe uses of polarization given in the course contents

- 9. UNDERSTAND THE STRUCTURE, WORKING AND USES OF OPTICAL FIBER.**
 - 9.1 Explain the structure of the Optical Fiber
 - 9.2 Explain its principle of working
 - 9.3 Describe use of optical fiber in industry and medicine.

- 10. UNDERSTAND THE STRUCTURE, WORKING AND USES OF LASERS.**
 - 10.1 Explain the stimulated emission of radiation
 - 10.2 Explain the laser principle
 - 10.3 Describe the structure and working of lasers
 - 10.4 Distinguish between types of lasers
 - 10.5 Describe the applications of lasers in the fields mentioned in the course contents.

- 11. UNDERSTAND CONCEPTS OF HEAT.**
 - 11.1 Explain calorimetric and modes of transfer of heat
 - 11.2 Explain Gas laws giving mathematical expressions
 - 11.3 Explain Thermal expansion of solids, liquids and gases
 - 11.4 Distinguish between absolute and relative humidity
 - 11.5 Distinguish between heat of fusion, vaporization
 - 11.6 Explain Law of cooling
 - 11.7 Explain basic concepts of Thermoelectricity
 - 11.8 Describe Thermocouple, giving its principle, structure and working.

- 12. UNDERSTAND LAWS OF THERMODYNAMICS.**
12.1 Distinguish between heat energy and internal energy
12.2 Explain first law of thermodynamics giving its applications by defining Isothermal and adiabatic process
12.3 Distinguish between isometric and adiabatic processes
12.4 Explain second law of thermodynamics describing alternate statements
12.4 Distinguish between work of heat engine and refrigerator.
- 13. UNDERSTAND LAWS OF ENERGY DISTRIBUTION AND EMISSION RADIATION.**
13.1 Explain modes of transfer of heat
13.2 Explain black body radiation and laws of energy distribution
13.3 Describe Planck's Quantum theory
13.4 Explain photoelectric effects
13.5 Explain production, properties and uses of x-rays
- 14. UNDERSTAND NATURE, TYPES, GENERATION AND SPECTRUM OF ELECTROMAGNETIC WAVES.**
14.1 Explain magnetic field due to current and electric field due to changing magnetic flux
14.2 Explain moving fields
14.3 Describe types of electromagnetic waves
14.4 Explain generation of radio waves
14.5 Explain spectrum of electromagnetic waves
- 15. UNDERSTAND THE STRUCTURE OF THE ATOMIC NUCLEUS AND RELEVANT ACTIVITIES.**
15.1 Describe the structure of the nucleus
15.2 Explain Radioactivity and Radioactive series
15.3 Explain transmutation of elements
15.4 Distinguish between fission reaction and fusion reaction
15.5 Explain the structure and working of the nuclear reactor
- 16. UNDERSTAND NUCLEAR RADIATIONS THEIR EFFECTS AND USES.**
16.1 Describe properties of nuclear radiations and their interaction with matter
16.2 Explain working of radiations detectors
16.3 Explain damaging effects of nuclear radiation
16.4 Explain radiations therapy
16.5 Describe radioactive tracers
- 17. UNDERSTAND TYPES AND USES OF ARTIFICIAL SATELLITES.**
17.1 Explain escape velocity
17.2 Explain orbital velocity
17.3 Distinguish between geosynchronous and geostationary satellite
17.4 Describe uses of artificial satellite in data communications

18. UNDERSTAND BASIC CONCEPTS AND CLASSIFICATION OF MAGNETIC MATERIALS.

- 18.1 Explain domains theory of magnetism
- 18.2 Distinguish between Para, dia and ferromagnetism and magnetic materials
- 18.3 Distinguish between B and H
- 18.4 Describe B.H. Curve
- 18.5 Describe hysteresis loop.

19. UNDERSTAND BASIC CONCEPTS OF SEMI-CONDUCTOR MATERIALS AND THEIR USES.

- 19.1 Explain crystalline structure of solids
- 19.2 Distinguish between conductors, semiconductors and insulators
- 19.3 Describe semiconductors giving example with reference to their structure
- 19.4 Distinguish between P-type and N-type materials
- 19.5 Explain working of P-N junction as a diode
- 19.6 Explain working of solar cell

LIST OF PRACTICAL

96 Hours

1. Draw graph representing the functions:
 - a) $Y = mx$ for $m=0, 0.5, 1, 2$
 - b) $Y = X^2$
 - c) $Y = 1/x$
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 fletchers' trolley.
5. Verify law of parallelogram of forces using Grave-sands apparatus.
6. Verify law of triangle of forces and Lami's theorem
7. Determine the weight of a given body using
 - a) Law of parallelogram of forces
 - b) Law of triangle of forces
 - c) Lami's theorem
8. Verify law of polygon of forces using Grave-sands apparatus
9. Locate the position 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 principle of moments
12. Locate the centre 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 spring with tension
17. Study resonance of air column in resonance tube and find 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 effects of plane mirror on reflection
22. Compare the reflective indices of given glass slabs
23. Find focal length of concave mirror by locating centre 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 reflective index of glass by apparent depth
27. Find reflective index of glass by spectrometer
28. Find focal length of converging lens by plane mirror
29. Find focal length of converging lens by displacement methods
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 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

Comp-122 COMPUTER APPLICATIONS

Total contact hours

Theory	32 Hours	T	P	C
Practical	96 Hours	1	3	2

Pre-requisite None

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

COURSE CONTENTS

- 1. ELECTRONIC DATA PROCESSING (EDP) 6 Hours**
 - 1.1 Basics of computers
 - 1.2 Classification of computers
 - 1.3 Block diagram of a computer system
 - 1.4 Binary number system
 - 1.5 BIT, BYTE, RAM, ROM, EROM, EPROM
 - 1.6 Input and output devices
 - 1.7 Secondary storage media details
 - 1.8 Processors and types
 - 1.9 Using computer for system software
 - 1.10 Using computers for application software.
 - 1.11 Common types of software and their application.
- 2. DISK OPERATING SYSTEM (DOS) 6 Hours**
 - 2.1 Internal commands
 - 2.2 External commands
 - 2.3 Batch files
 - 2.4 Advance features.
- 3. BASIC LANGUAGE 10 Hours**
 - 3.1 Introduction to high level languages
 - 3.2 Introduction to BASIC
 - 3.3 REM Statement
 - 3.4 Assignment statement
 - 3.5 Input statement
 - 3.6 Read-Data statement
 - 3.7 IF-THEN statement
 - 3.8 IF-THEN Else statement
 - 3.9 FOR-NEXT statement
 - 3.10 DIM statement
 - 3.11 L PRINT statement
 - 3.12 STOP statement
 - 3.13 END statement

- 3.14 Logic of a BASIC Programme
- 3.15 Running a BASIC Programme
- 3.16 Saving and Retrieving a Programme
- 3.17 Advance features

4. WORD PROCESSING

7 Hours

- 4.1 Starting word processor session
- 4.2 Opening a document
- 4.3 Saving a document
- 4.4 Ending word processor session (Temporarily)
- 4.5 Retrieving a document
- 4.6 Spell check
- 4.7 Margins and tab setting
- 4.8 Aligning Paragraph
- 4.9 Printing a document
- 4.10 Advance features

5. COMPUTER GRAPHIC IN BASIC

3 hours

- 5.1 Graphic fundamentals
- 5.2 Points and lines
- 5.3 Dots in space
- 5.4 A lightening blot
- 5.5 Shapes
- 5.6 Expanding circles and rectangles

RECOMMENDED BOOKS

- 1. Ron S. Gottfrid, Programming with BASIC,
- 2. Any Word Processor Latest Release (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).

- 1.1Describe basics of computers.
- 1.2Enlist different classification of computers.
- 1.3Explain block diagram of a computer system.
- 1.4Describe binary number system.
- 1.5State the terms used in computers such as BIT, BYTE, RAM, ROM, EROM, EPROM.
- 1.6Identify input and output devices.
- 1.7Describe secondary storage media.
- 1.8Explain processor.
- 1.9Name different types of processors.
- 1.10 Explain the use of computer for system software.
- 1.11 Explain the use of computer for application software.
- 1.12 Enlist common types of software and their application.
- 1.13 Explain various application of above softwares mentioned in 1.12

2. UNDERSTAND DISK OPERATING SYSTEM (DOS).

- 2.1Explain the use of various internal commands of DOS.
- 2.2Explain the use of various external commands of DOS.
- 2.3Describe batch files.
- 2.4Identify advanced features

3. UNDERSTAND BASIC LANGUAGE.

- 3.1Explain high level languages.
- 3.2Explain Basic language.
- 3.3Describe Rem statement
- 3.4Describe assignment statement
- 3.5Explain Input statement
- 3.6Explain Read-Data statement
- 3.7Explain If-Then Statement
- 3.8Explain If-then-Else Statement
- 3.9Explain For-Next Statement
- 3.10 Explain DIM Statement
- 3.11 Explain LPRINT statement
- 3.12 Explain stop statement
- 3.13 Explain end Statement
- 3.14 Describe Logic of Basic program
- 3.15 Describe running a Basic Program
- 3.16 Describe saving & retrieving Basic Program
- 3.17 Describe some Advance features of Basic program

4. UNDERSTAND WORD PROCESSING

SESSION 4.1. Describe word-processing

- 4.2 Name command to be entered on Dos-prompt to load word-processor
- 4.3 Identify initial screen
- 4.4 Describe the command to open a document
- 4.5 Describe the procedure for naming the document
- 4.6 Explain importance of giving extension to a document
- 4.7 Describe saving and retrieving a document
- 4.8 Explain importance of saving the work at regular intervals
- 4.9 State temporarily ending word-processing session & document retrieval
- 4.10 State procedure to re-enter word processor
- 4.11 State procedure to re-open the document and editing
- 4.12 Describe spell-check facility
- 4.13 Describe Margins & Tab Setting
- 4.14 Describe to align paragraph
- 4.15 Describe Re-editing techniques
- 4.16 Describe procedure to set-up printer
- 4.17 Describe command for printouts
- 4.18 Explain multiple-copy printout procedure
- 4.19 Explain some advance features
- 4.20 Describe procedure of condensed printing
- 4.21 Describe procedure for change of fonts

5. UNDERSTAND PROGRAMMING INSTRUCTIONS FOR COMPUTER GRAPHIC IN BASIC LANGUAGE

- 5.1 Identify graphic fundamentals in basic language
- 5.2 Explain to draw points and lines
- 5.3 Explain to draw dot in space
- 5.4 Explain to draw lighting blot
- 5.5 Explain to draw shapes
- 5.6 Explain to draw expanding circles and rectangles

LIST OF PRACTICALS

96 hours

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 practicals at S. No. 3, 4, 5
- 7 Practice for FORMAT command with /s, /4, /u switches
- 8 Practice for DISKCOPY, DISKCOMP commands
- 9 Practice for SCANDISK, XCOPY, DELTREE, TREE, LABEL commands
- 10 Practice for PRINT, UNDELETE commands
- 11 Practice for the practicals at S. No. 8, 9, 10, 11
- 12 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 key in BASIC programming
- 3 Practice for CLS, LOAD, SAVE, 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 a 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 an existing document
- 5 Practice for various word-processing Menu Options
- 6 Practice for printing a document
- 7 Practice for margin and TAB setting and document alignment
- 8 Practice for some advance features

CHT-153 (Rev.) BASIC CHEMICAL ENGINEERING

Total contact hours

Theory	64 Hours	T	P	C
Practical	96 Hours	2	3	3

OBJECTIVES:

1. To introduce the students with the basic concepts of fundamental units of measurement and their interconversion; to train the students for representation of data with the help of various types of graphs.
2. To introduce the students with the various types of pipes, pipe fittings, valves, steam traps and thermal insulation
3. To give a clear understanding of symbols used in chemical plants and provide sufficient knowledge about flow diagrams

CONTENTS

HOURS

1.0 HISTORY AND SCOPE OF CHEMICAL ENGINEERING

04

- 1.1 History of Chemical Engineering
- 1.2 Scope of Chemical Engineering
- 1.3 Classification of Chemical Industries
- 1.4 Chemical Plant Layout and its Sections

2.0 CONCEPT OF UNIT OPERATIONS AND UNIT PROCESSES

04

- 2.1 Introduction of Unit Operations and Unit Processes
- 2.2 List of Unit Operations
- 2.3 List of Unit Processes

3.0 FLOW DIAGRAMS, MAJOR EQUIPMENTS AND STANDARD SYMBOLS

12

- 3.1 Flow diagrams and types
- 3.2 Major process equipment
- 3.3 Standard symbols
- 3.4

4.0 UNITS AND DIMENSIONS

08

- 4.1 Physical quantities and their classification
- 4.2 System of Measurements
- 4.3 Units and Dimensions
- 4.4 Unit conversion

4.5	Dimensional and Dimensionless quantities	
4.6	Related Problems	
5.0	REPRESENTATION OF SCIENTIFIC DATA	12
5.1	Scientific data	
5.2	Types of data representation	
5.3	Graphs and their types	
5.4	Drawing different types of graphs and charts	
6.0	PIPE AND TUBES	12
6.1	Type of pipes	
6.2	Cast iron pipe, wrought iron pipe, steel pipe Aluminum pipes, plastic pipe, Rubber pipes	
6.3	Pipe standards	
6.4	Pipe fitting	
6.5	Types of valves	
6.6	Construction, working and application of gate valve, globe valve ball valve, plug cock, needle valve, butterfly valve	
7.0	STEAM TRAPS	04
7.1	Introduction to steam and steam traps	
7.2	Types of steam traps	
8.0	THERMAL INSULATION	08
8.1	Insulating material, properties and uses.	
8.2	Insulation technique for steam pipes and vessels	
8.3	Insulation technique for low temperature pipes	

REFERENCE BOOKS

- 1 “Chemical engineering-A special study” by John McLean.
- 2 “Chemical process industries” by R. Norris Shreve.
- 3 “Introduction to chemical Engineering” by Walter L. Bedger and Julims T. Bencharo
- 4 “Introduction to chemical Engineering” by Little John
- 5 “Chemical engineering- an introduction” by Morton M. Denn.
- 6 Himmelblau David M. (2003), “Basic Principles and Calculations in Chemical Engineering” 7th Ed., Published by Prentice Hall PTR.
- 7 Coulson J. M., Richardson J. f. “Chemical Engineering” Vol-6, The English Book Society and Pergamon Press.

INSTRUCTIONAL OBJECTIVES**1.0 HISTORY AND SCOPE OF CHEMICAL ENGINEERING**

- 1.1 Describe the history of Chemical Engineering
- 1.2 Describe the scope of Chemical Engineering
- 1.3 Classify the different Chemical Industries
- 1.4 Enlist the different types of chemical industries in Pakistan
- 1.5 Understand the Chemical Plant Layout and its Sections

2.0 CONCEPT OF UNIT OPERATIONS AND UNIT PROCESSES

- 2.1 Introduction of Unit Operations and Unit Processes
 - 2.1.1 To define the Unit Operations and Unit Processes
 - 2.1.2 Industrial application of Unit Operations
 - 2.1.3 Industrial application of Unit Processes
- 2.2 List of Unit Operations
 - 2.2.1 Distillation
 - 2.2.2 Evaporation
 - 2.2.3 Absorption
 - 2.2.4 Drying
 - 2.2.5 Filtration
 - 2.2.6 Screening etc.
- 2.3 List of Unit Processes
 - 2.3.1 Combustion
 - 2.3.2 Nitration
 - 2.3.3 Halogenation
 - 2.3.4 Sulphonation
 - 2.3.5 Alkylation
 - 2.3.6 Amination etc.

3.0 FLOW DIAGRAMS, MAJOR EQUIPMENTS AND STANDARD SYMBOLS

- 3.1 Flow diagrams and types
 - 3.1.1 Define the flow diagrams

3.1.2 Understand the types of flow diagrams

3.1.2.1 Block flow diagram

3.1.2.2 Process flow diagram

3.1.2.3 Piping & instrumentation diagram

3.2 Major process equipment

3.2.1 Heat transfer equipment

3.2.2 Mass transfer equipment

3.2.3 Auxiliary equipment

3.3 Standard symbols for major processing equipment

4.0 UNITS AND DIMENSIONS

4.1 Physical quantities and their classification

4.1.1 Define primary quantity and secondary quantity

4.1.2 Give examples of primary quantities and secondary quantities

4.2 System of Measurements

4.2.1 Name different systems of measurement.

4.2.2 Name basic quantities of each system

4.2.3 Develop dimensions of derived quantities .

4.3 Units and Dimensions

4.3.1 Develop units to measure the derive quantities in different systems

4.3.2 Define different units used

4.3.3 Define Units of primary and secondary quantities

4.4 Unit conversion

4.4.1 Convert the units of one system into the other system

4.5 Dimensional and Dimensionless quantities

4.5.1 Differentiate between dimensional formula and dimensionless formula

4.5.2 Check the dimension of an engineering group as Reynolds Number Potential Energy, Kinetic Energy.

5.0 REPRESENTATION OF SCIENTIFIC DATA

5.1 Scientific data

- 5.1.1 Understand the concept of scientific data
- 5.2 Types of data representation
 - 5.2.1 Tabular data representation
 - 5.2.2 Graphical data representation
 - 5.2.3 Give comparison between tabular and graphic representation of data
- 5.3 Graphs and their types
 - 5.3.1 Define graph
 - 5.3.2 Explain the types of graph
 - 5.3.2.1 Pie
 - 5.3.2.2 Line
 - 5.3.2.3 Bar
 - 5.3.2.4 Column
 - 5.3.2.5 Area
- 5.4 Drawing different types of graphs and charts
 - 5.4.1 Explain the steps necessary to draw a graph
 - 5.4.2 Draw a simple graph
 - 5.4.3 Note the end point from a graph
 - 5.4.4 Take reading from a graph
 - 5.4.5 Make extrapolation and interpolation on a graph

6.0 PIPES AND TUBES

- 6.1 Know the types of pipes
 - 6.1.3 Enlist the types of pipes used by chemical industries
 - 6.1.4 Give the field of applications of different types of pipes used
 - 6.1.5 Give characteristics of different types of pipes used by chemical engineer
- 6.2 Apply the pipe standards.
 - 6.2.1 Understand the concept of schedule No. for pipe
 - 6.2.2 Select the schedule No according to the pipe duty (Pressure).
- 6.3 Introduction to pipe fittings
 - 6.3.1 Define pipe fittings
 - 6.3.2 Enlist the different pipe fitting used
 - 6.3.3 Explain the functions of different pipe fittings used in chemical industries

- 6.4 Types of valves
 - 6.4.1 Define valve
 - 6.4.2 Enlist the types of a valves
- 6.5 Understand construction and working of valves
 - 6.5.1 Explain the construction and working of gate valve (rising and non-rising stem)
 - 6.5.2 Explain the construction and working of globe valve
 - 6.5.3 Explain the construction and working of ball valve, needle valve, butterfly valve and safety valves
 - 6.5.4 Select a proper valve according to need

7.0 STEAM TRAPS

- 7.1 Introduction to steam and steam traps
 - 7.1.1 Explain the function of steam trap
 - 7.1.2 Enlist the types of steam traps
- 7.2 Types of steam traps
 - 7.2.1 Explain the construction and working of bucket trap
 - 7.2.2 Explain the construction and working of inverted Bucket trap
 - 7.2.3 Explain the construction and working of expansion trap
 - 7.2.4 Explain the construction and working of impulse trap

8.0 THERMAL INSULATION

- 8.1 Understand insulating materials, properties and uses
 - 8.1.1 Define thermal insulation
 - 8.1.2 Explain the need of thermal insulation
 - 8.1.3 Enlist the insulating materials used in chemical industry
 - 8.1.4 Enlist the properties of a good insulating material
- 8.2 Apply the insulation technique for steam pipes and valves
 - 8.2.1 Explain the method of steam pipe insulation (lagging)
 - 8.2.2 Calculate the thickness of insulation layer on steam pipe by using the formula
- 8.3 Understand insulation technique for low temperature pipes
 - 8.3.1 Decide the nature of insulation material for low temperature pipes
 - 8.3.2 Explain the method of pipe insulation

LIST OF PRACTICALS

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. Pipe cutting
7. Pipe Threading
8. Pipe fittings
9. Installation of valves
10. Insulation of steam traps
11. Insulation of steam pipe lines
12. Drawing of symbols on charts
13. Drawing of Block Flow Diagram of different processes

CHT- 164 GENERAL CHEMISTRY

T	P	C
2	6	4

OBJECTIVES

- 1 To present the students the principles of General chemistry.
- 2 To develop understanding of the scientific methods as applied to the development of laws of chemistry.
- 3 To prepare the students for advance Laboratory Work.
- 4 To present the basic knowledge of Metallurgy to the students.

COURSE OUTLINES

HOURS

1 CONCEPT OF CHEMISTRY

02

- 1.1 Language of Chemistry
- 1.2 Molecular formula, Empirical formula
- 1.3 Chemical Equation

2 CHEMICAL LAWS

02

- 2.1 Law of conservation of mass, Law of constant proportion and their problems.
- 2.2 Law of Reciprocal proportion, Law of multiple proportion and their problems.

3 ATOMIC STRUCTURE

04

- 3.1 Passage of electricity through electrolytes solution and gases.
- 3.2 Rutherford atomic model and its defects.
- 3.3 Plank's theory, different types of spectrum and Bohr's theory, Defects in Bohr's theory.
- 3.4 Calculation of Energy, Radius and wave number.
- 3.5 Frequency of Electron by Bohr's atomic model.

4 CHEMICAL BOND

06

- 4.1 Ionic Bond
- 4.2 Covalent bond, definition with examples in each case.
- 4.3 Ionization Potential, Electron Affinity.
- 4.4 Electronegativity and Bond Energy.
- 4.5 Co-ordinate covalent Bond, sigma and --- Bond definition with example in each
- 4.6 Hybridization, structure of CH₄, H₂O and NH₃ etc.

5 GASES

06

5.1	Behavior of gases, Kinetic theory of gases.	
5.2	Boyle's and Charles law, General gas equation solution of problems (concerning gas laws)	
5.3	Graham's law of diffusion Dalton's law of partial pressure and Gay Lussac law.	
6	LIQUIDS	04
6.1	Properties of liquid viscosity its measurement.	
6.2	Surface tension and its measurement.	
7	SOLIDS	04
7.1	Preparation and properties of solid.	
7.2	Classification of solid classification of crystal Lattice Energy.	
8	SOLUTIONS	04
8.1	Solution Types of solution units.	
8.2	Ideal and non-ideal solution	
9	OXIDATION/REDUCTION	04
9.1	Oxidation and reduction important oxidizing and reducing agents.	
9.2	Balancing of equation by oxidation number method.	
10	WATER	04
10.1	Impurities and causes of water hardness.	
10.2	Hard and soft water, removal of permanent and temporary hardness	
11	ALLOYS DEFINITION AND CHEMISTRY	02
11.1	Composition, properties and uses of stainless steel.	
11.2	German silver Bronze.	
11.3	Nichrome and Amalgam	
11.4	Bell metal and solder	
11	ACID AND BASE	04
12.1	Concept of acid and base and their properties	
12.2	Strong and weak acid and base examples	
12.3	Basicity and acidity	
12	SALTS	04

13.1	Types of salts	
13.2	Salt analysis	
13	METALS	04
14.1	Difference between metal and non-metal	
14.2	General methods of purification of ores	
14	IRON ORES, IRON PURIFICATION	04
15.1	Manufacture of pig iron from blast furnace	
15.2	Manufacture of steel and its uses	
15	COPPER	02
16.1	Ores Extraction	
16.2	Refining and uses of copper.	
16	ALUMINIUM	02
17.1	Ores, Extraction and uses	
17	CHROMIUM	02
18.1	Ores, Extraction and uses.	

TEXT AND REFERENCE BOOKS

- 1 Chemistry part I for class XI
- 2 Chemistry part II for class XII
Recommended by the text book Board Punjab.
- 3 Practical chemistry for Intermediate classes.
- 4 Chemistry by Mr. Tariq Jamil.

CHT-164 GENERAL CHEMISTRY

INSTRUCTIONAL OBJECTIVES

1. CONCEPT OF CHEMISTRY

- 1.1 Understand language of chemistry
 - 1.1.1 Give symbols of various elements
 - 1.1.2 Describe valency
 - 1.1.3 Explain radicals
- 1.2 Write molecular formula and empirical formula
 - 1.2.1 Write molecular formula of different compounds
 - 1.2.2 Write empirical formula of different compounds
- 1.3 Understand chemical equation
 - 1.3.1 Write skeleton equation
 - 1.3.2 Balance chemical equation by hit and trial method
 - 1.3.3 Balance chemical equation by partial equation method
 - 1.3.4 Balance chemical equation by ionic method

2. CHEMICAL LAWS

- 2.1 Understand law of conservation of mass and law of constant proportion
 - 2.1.1 State law of conservation of mass
 - 2.1.2 State law of constant proportion
 - 2.1.3 Solve the problem based on law of constant proportion
- 2.2 Understand law of reciprocal proportion and law of multiple proportions
 - 2.2.1 State law of reciprocal proportion
 - 2.2.2 State law of multiple proportions
 - 2.2.3 Solve problems based on law of multiple proportion

3. ATOMIC STRUCTURE

- 3.1 Understand passage of electricity through electrolytic solution
 - 3.1.1 Name the atomic particles
 - 3.1.2 Describe discovery of electron
 - 3.1.3 Describe discovery of proton
 - 3.1.4 Explain discovery of neutron
- 3.2 Understand Rutherford's model and Bohr's atom
 - 3.2.1 Enlist theories of atom
 - 3.2.2 Describe Rutherford's model atom
 - 3.2.3 Describe defects in Rutherford's model
- 3.3 Understand Plank's theory
 - 3.3.1 Illustrate Plank's theory

- 3.3.2 Defects in Plank's theory
- 3.3.3 Define band spectrum
- 3.3.4 Define line spectrum
- 3.3.5 Explain Bohr's theory
- 3.3.6 Give arrangement of electrons in Bohr's atom
- 3.3.7 Postulates of Bohr's theory
- 3.4 Understand energy of atom
 - 3.4.1 Define wave number
 - 3.4.2 Calculate energy of atom
- 3.5 Understand frequency of electron
 - 3.5.1 Define frequency of electron
 - 3.5.2 Calculate frequency of electoral

4. CHEMICAL BOND

- 4.1 Understand ionic bond
 - 4.1.1 Define ionic bond
 - 4.1.2 Illustrate ionic compounds
 - 4.1.3 Enlist ionic compounds
- 4.2 Understand covalent bond
 - 4.2.1 Explain covalent bond
 - 4.2.2 Define single bond and give examples
 - 4.2.3 Illustrate double bond and give examples
 - 4.2.4 Describe triple bond and give examples
 - 4.2.5 Describe covalent compounds
 - 4.2.6 Name covalent compounds
- 4.3 Know ionization potential
 - 4.3.1 Define ionization potential
 - 4.3.2 Illustrate electron affinity
 - 4.3.3 Give ionization potential of different atoms
- 4.4 Know electronegativity
 - 4.4.1 Explain electronegativity
 - 4.4.2 Define bond energy
 - 4.4.3 Give example of electronegativity
- 4.5 Understand co-ordinate bond
 - 4.5.1 Describe co-ordinate bond
 - 4.5.2 Understand hybridization
 - 4.5.3 Describe hybridization
- 4.6 Give example of Sigma bond
 - 4.6.1 Distinguish between Sigma and pie bond
 - 4.6.2 Illustrate structure of different hybridized atom

5 GASES

- 5.1 Understand behavior of gases
 - 5.1.1 Explain kinetic theory of gases

- 5.1.2 Describe temperature effect on gases
- 5.2 Understand gas laws
 - 5.2.1 State Boyle's law
 - 5.2.2 State Charles law
 - 5.2.3 Describe absolute temperature
 - 5.2.4 Derive ideal gas equation
 - 5.2.5 Solve problem based on ideal gas equation
 - 5.2.6 State Graham's law of diffusion
 - 5.2.7 Explain Dalton's law of partial pressure
 - 5.2.8 State Gay Lussac's law
 - 5.2.9 Solve problems based on Graham's law of diffusion
 - 5.2.10 Solve problems based on Gay Lussac's law

8 LIQUIDS

- 6.1 Understand properties of liquids
 - 6.1.1 Define viscosity
 - 6.1.2 Give units of viscosity in different systems
 - 6.1.3 Enlist methods of measurement of viscosity
 - 6.1.4 Explain measurement of viscosity by Ostwald's viscometer
 - 6.1.5 Describe temperature effect on viscosity
- 6.2 Understand surface tension
 - 6.2.1 Describe surface tension
 - 6.2.2 Name the units of surface tension
 - 6.2.3 Enlist methods for the measurement of surface tension.
 - 6.2.4 Explain measurement of surface tension by Torsion balance.

6. SOLIDS

- 7.1 Understand properties of solids.
 - 7.1.1 Enlist the properties of solids
 - 7.1.2 Explain density
 - 7.1.3 Give units of density
 - 7.1.4 Give effect of temperature on volume.
 - 7.1.5 Define amorphous state
 - 7.1.6 Explain colloidal state.
 - 7.1.7 Distinguish amorphous state, colloidal state and solid state.
- 7.2 Understand crystals
 - 7.2.1 Name and types of crystals
 - 7.2.2 Define crystal lattice.

7. SOLUTIONS

- 8.1 Understand types of solution

- 8.1.1 Name of types of solution
- 8.1.2 Give example of different type of solution
- 8.1.3 Enlist the units used for the concentration of solution
- 8.1.4 Know ideal and no ideal solution
- 8.2 Know ideal and no ideal solution.
 - 8.2.1 Give examples of ideal solution
 - 8.2.2 Distinguish between ideal solution and non-ideal solution

8. OXIDATION/REDUCTION

- 9.1 Understand oxidation and reduction.
 - 9.1.1 Describe oxidation with examples
 - 9.1.2 Describe reduction with examples
 - 9.1.3 Enlist oxidizing agent
 - 9.1.4 Name reducing agent.
- 9.2 Understand balancing equation by oxidation number
 - 9.2.1 Calculate oxidation number of an element in a compound.
 - 9.2.2 Balance the equation.

9. WATER

- 10.1 Enlist water sources
- 10.2 Name the impurities of water
- 10.3 Explain causes of hardness..
- 10.4 Define hard water
- 10.5 Describe soft water.
- 10.6 Explain causes of hardness.
- 10.7 Explain removal of permanent hardness by different methods.
- 10.8 Explain removal of temporary hardness by different methods.

10. ALLOYS

- 11.1 Composition of alloys
 - 11.1.1 Define alloys
 - 11.1.2 Give examples of alloys with their composition
 - 11.1.3 Enlist general properties of alloys
 - 11.1.4 Give uses of alloys.
- 11.2 Know German silver and bronze
 - 11.2.1 Give composition of German silver.
 - 11.2.2 Give composition of bronze
 - 11.2.3 Enlist uses of German silver.
 - 11.2.4 Give uses of bronze
- 11.3 Know Nichrome and Amalgam

- 11.3.1 Give the composition of Nichrome
- 11.3.2 Enlist uses of Nichrome
- 1.3.3 Define amalgam
- 11.4 Understand bell metal and solder.
 - 11.4.1 Give composition of bell metal
 - 11.4.2 Define solder
 - 11.4.3 Give composition of solder
 - 11.4.4 Enlist uses of bell metal
 - 11.4.5 Give uses of solder

11. ACID AND BASE

- 11.1 Understand properties of acid and base
 - 12.1.1 Define acid
 - 12.1.2 Distinguish between acid and base
 - 12.1.3 Describe general properties of acids
 - 12.1.4 Explain in general properties of bases.
- 11.2 Understand strong and weak acid
 - 12.2.1 Give examples of strong acid
 - 12.2.2 Enlist examples of weak acid
 - 12.2.3 Distinguish between strong and weak acid
- 11.3 Know acidity and basicity
 - 12.3.1 Define acidity.
 - 12.3.2 Define basicity
 - 12.3.3 Calculate acidity and basicity

12 SALTS

- 12.1 Understand types of salts
 - 12.1.1 Define salt
 - 12.1.2 Name types of salt
 - 12.1.3 Explain metal salt with examples
 - 12.1.4 Explain acidic salt with examples
 - 12.1.5 Explain basic salt with examples
 - 12.1.6 Illustrate double salt with examples
 - 12.1.7 Distinguish between double salt and complex salt

13 METALS

- 13.1 Understand metals
 - 14.1.1 Define metals
 - 14.1.2 Give examples of materials
 - 14.1.3 Differentiate metals and non-metals
- 13.2 Understand purification of ores
 - 14.2.1 Define ores
 - 14.2.2 Name impurities of ores

14.2.3 Enlist methods of purification of ores

14.2.4 Explain different methods of purification of ores

13.3 Understand methods of extraction of metals

14.3.1 Name methods of extraction of metals

14.3.2 Describe different methods of extraction

14 IRON

14.1 Understand iron purification

15.1.1 List ores of iron

15.1.2 Name impurities of iron ores

15.1.3 List steps involved in the purification of iron

14.2 Understand manufacture of pig iron

15.2.1 Define pig iron

15.2.2 Name the furnaces
used for manufacture of pig iron

15.2.3 List the material required for melting of pig iron

15.2.4 Explain reactions of blast furnace

14.3 Understand manufacture of steel

15.3.1 Enlist types of steel

15.3.2 Give composition of steel

15.3.3 Describe manufacture of steel

15 COPPER

15.1 Understand extraction of copper

16.1.1 Enlist ores of copper

16.1.2 Name the extraction methods of copper

16.1.3 Name equipment used for extraction of copper

16.1.4 Describe copper extraction

15.2 Understand copper refining and uses of copper

16.2.1 Explain refining of copper

16.2.2 Enlist of copper

16. ALUMINIUM

16.1 Understand extraction of aluminium

16.1.1 List ores of aluminium

16.1.2 Name methods of aluminium extraction

16.1.3 Explain electrolysis of bauxite

16.1.4 Give the uses of aluminium

17. CHROMIUM

17.1 Understand chromium extraction

17.1.1 Enlist chromium ores

- 17.1.2 Describe chromium extraction
- 17.1.3 Name alloys of chromium
- 17.1.4 Enlist use of chromium

CHT-164 GENERAL CHEMISTRY

LIST OF PRACTICALS

- 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
 - i. 2nd A
 - ii. 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 of Salts By
 - a. Sublimation Process
 - b. Filtration Process
 - c. Sedimentation Process
- 15 Practical Note Book
- 16 Salt Analysis Scheme

MT-143 (Rev.) BASIC ENGINEERING DRAWING & CAD-I

T	P	C
1	6	3

Total contact hrs.

Theory	32
Practicals	192

Pre-requisite: None

AIMS At the end of this course the students will be able to understand the fundamentals of engineering drawing used in the various fields of industry specially 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 & use of computer in the subject of Engineering Drawing.

COURSE CONTENTS

PART-A ENGINEERING DRAWING

- 1. USES AND APPLICATIONS OF TECHNICAL DRAWING** **1 Hours**
 - 1.1 Technical drawing and the technician.
 - 1.2 Use of technical drawing.
 - 1.3 Common drawing forms.
 - 1.4 Application of drawing forms.
 - 1.5 Practices and conventions.
- 2. DRAWING TOOLS AND ACCESSORIES.** **2 Hours**
 - 2.1 Drawing pencil
 - 2.2 Drawing papers specifications
 - 2.3 Drawing Instruments
 - 2.4 Use and care of drawing instruments and material.
- 3. ALPHABET OF LINES USED IN DRAWING** **2 Hours**
 - 3.1 Importance the alphabet of lines.
 - 3.2 Common alphabet of lines
 - 3.3 Uses and correct line weightage of the line.
 - 3.4 Application of line
- 4. LETTERING.** **2 Hours**
 - 4.1 Importance of good lettering.
 - 4.2 Single stroke of gothic.
 - 4.3 Letter strokes.
 - 4.4 Letter guide lines.
 - 4.5 Vertical single stroke gothic
 - 4.6 Inclined single stroke gothic
 - 4.7 Composition of lettering
- 5. DRAWING LINES TECHNOLOGY** **2 Hours**
 - 5.1 Introduction to sketching techniques
 - 5.2 Sketching lines

5.3	Sketching circles and arcs	
5.4	Sketching ellipse.	
5.5	Sketching views of objects	
6.	GEOMETRICAL CONSTRUCTIONS	2 Hours
6.1	Introduction to geometry	
6.2	Definition of terms	
6.3	Different conventional shapes, surfaces and objects	
6.4	Basic geometrical construction	
6.5	Construction, ellipse, parabola	
6.6	Involute and cycloids	
7.	INTRODUCTION TO MULTI-VIEW PROJECTIONS	3 Hours
7.1	Definition and concept of multi-view drawings	
7.2	Proceptual vies of plan of projections	
7.3	Orthographic projections	
7.4	1st angle and 3rd angle projections	
7.5	Principal views	
7.6	Arrangement of views	
7.7	Multi-view drawings	
8.	INTRODUCTION TO PICTORIAL DRAWINGS.	2 Hours
8.1	Uses of pictorial	
8.2	Three types of pictorial views	
8.3	Isometric sketching of rectangular block	
8.4	Isometric sketching of Arcs and circles	
8.5	Oblique sketching of rectangular block	
8.6	One point perspective sketching of a rectangular block.	
8.7	Two point perspective sketching of a rectangular block.	
8.8	Preparation of pictorial drawings of simple objects.	
9.	BASIC DIMENSIONING.	2 Hours
9.1	Definition of dimensioning.	
9.2	Types of dimensioning.	
9.3	Elements of dimensioning.	
9.4	System of measurements.	
9.5	Dimensioning multi-view drawings.	
9.6	Dimensioning pictorial views.	
9.7	Dimensioning rules and practices.	
9.8	Notes and specification	
10.	SECTIONING AND SECTIONAL VIEWS.	2 Hours
10.1	Definition and purpose.	
10.2	Cutting planes position and cutting plane lines	
10.3	Types of sectional views.	
10.4	Conventional section lines of different materials.	
10.5	Practice sectioned views.	
11.	MULTI-VIEW DRAWING OF MACHINE ELEMENTS	2 Hours
11.1	Terminology and drawing of rivets and riveted joints	
11.2	Terminology and drawing of screw threads	

- 11.3 Terminology and drawing of keys and cotters
- 11.4 Description and drawing of simple bearings
- 11.5 Describe and drawing of simple coupling

PART-B : CAD-I

12. CAD FUNDAMENTALS	2 Hours
12.1 CAD & its importance	
12.2 Purposes	
12.3 Advantages	
13. CAD SOFTWARE	2 Hours
13.1 CAD Abbreviations	
13.2 CAD Help	
13.3 Co-ordinate systems	
14. BORDER TEMPLATE	2 Hours
14.1 Drawing area	
14.2 SNAP & GRID	
14.3 Pedit & Qsave	
15. TITLE BLOCK	2 Hours
15.1 Change Command	
15.2 Layer creation	
15.3 Zooming	
15.4 Typefaces of CAD	
15.5 Plotting	
16. LINES & CIRCLES	2 Hours
16.1 Dedit	
16.2 Analyzed line drawing	
16.3 U & Redo command	
16.4 Drawing a circle	

RECOMMENDED BOOKS:

1. Engineering drawing by French Wirk
2. ABC's of Auto CAD Release-12 by Alan R Miller

INSTRUCTIONAL OBJECTIVES

SECTION-I ENGINEERING DRAWING

1. USES AND APPLICATIONS OF TECHNICAL DRAWING

1.1 Know the uses of Technical Drawing

1.1.1 Describe the importance of Technical Drawing from the point of view of a Technician

1.1.2 Explain the main uses of Technical Drawing from the point of view of a Technician

1.2 Recognizes the different application of Technical drawing

1.2.1 Identify commonly used drawing forms

1.2.2 Illustrate the different drawing forms

1.2.3 Differentiate different drawing forms

1.2.4 Develop Technical vocabulary

2. KNOW THE COMMON DRAWING TOOLS AND ACCESSORIES

2.1 Identify the uses of different pencils for Technical Drawing.

2.2 Identify different paper sizes for drawing.

2.3 Identify different types of papers suitable for drawing.

2.4 Identify different types of erasers and their uses.

2.5 Maintain a well sharpened pencil for drawing.

2.6 Describe the drawing instruments.

2.7 State the use of drawing instruments.

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

3.1 Knows the importance of lines.

3.2 Knows the Alphabet of lines.

3.3 Identify the lines characteristics of each alphabet of lines.

3.4 Draw horizontal, vertical and inclined lines

3.5 Draw alone line with correct weightages

4. APPLIES THE GOOD LETTERING AN A DRAWING

4.1 Know the importance of lettering in a Technical engineering drawing.

4.2 Identify the letter style used in Technical drawing.

4.3 State letter strokes and guide lines.

4.4 Perform better stroke in single stroke gothic.

4.5 Print vertical single stroke letters and numbers.

4.6 Print inclined single stroke letters and numbers.

4.7 Observe stability and pleasing appearance of letters in printing

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

5.1 Draw circular an arc using circular line method.

- 5.2 Draw a circular arc using square method.
- 5.3 Draw an ellipse using rectangular method.
- 5.4 Draw views of simple objects.

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

- 6.1 Define common terms used in geometrical construction.
- 6.2 Explain different geometrical shapes, surfaces of objects.
- 6.3 Draw basic geometrical construction.
- 6.4 Draw involute, cycloid, spiral, tangent to circle and are

7. UNDERSTAND THE MULTI VIEW OF PROJECTIONS SPECIFIC OBJECTIVE

- 7.1 Define the concept of multi-view drawings.
- 7.2 Knows principle planes of projections.
- 7.3 Knows the orthographic method of projection.
- 7.4 Explain the 1st and 3rd angle projections.
- 7.5 State six principle views.
- 7.6 Practice multi-view projections.

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

- 8.1 Knows the use of pictorial views.
- 8.2 Knows the pre-requisite of pictorial drawing.
- 8.3 State three types of pictorial drawings.
- 8.4 Draw isometric view of rectangular Blocks, Ares, circles.
- 8.5 Draw oblique sketching of rectangular blocks.
- 8.6 Draw one-point perspective view of a Rectangular block.
- 8.7 Draw Two point perspective view of a rectangular block.
- 8.8 Prepare/draw pictorial drawings of simple objects.

9. APPLY GOOD DIMENSIONING ON MULTIVIEWS AND PICTORIALS.

- 9.1 Define dimensioning.
- 9.2 Identify the types of dimensioning.
- 9.3 Enlist the elements of dimensioning.
- 9.4 Identify the system of measurements.
- 9.5 Indicate complete dimension on multi view drawings.
- 9.6 Indicate complete dimension or pictorial drawings.
- 9.7 Follow the general rules for dimensioning.
- 9.9 Indicate notes and specification or multiview drawings.

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

- 10.1 Define sectioning and its purpose.
- 10.2 Describe cutting planes and lines.
- 10.3 State types of sectional views.
- 10.4 Explain conventional section lines of different materials.

11. APPLY DRAWING METHODS TO DRAW MULTIVIEWS OF MACHINE

ELEMENTS. 11.1 Draw multiviews of vee-block.

11.2 Draw multiviews of Gland

11.3 Draw keys & cotters.

11.4 Draw Multi views of simple bearing.

SECTION-II COMPUTER AIDED DESIGN.

12. UNDERSTAND CAD

FUNDAMENTALS. 12.1 Define CAD.

12.2 Describes importance of CAD.

12.3 States purpose of CAD.

12.4 Explain advantages of CAD.

12.5 Establish importance of CAD usage in industry.

13. UNDERSTAND CAD SOFTWARE.

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

13.2 State procedure of giving command to CAD.

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

13.4 State use of function keys.

13.5 Describe procedure of giving commands with a mouse.

13.6 Explain procedure of getting general help for a specific command.

13.7 Explain drawing cursor and coordinate read out.

13.8 Explain cartesian notion.

13.9 Explain polar notation.

14. UNDERSTAND BORDER TEMPLATE OF A

DRAWING. 14.1 Describe setting up of drawing area.

14.2 Describe setting of displayed digits.

14.3 Explain changing the drawing limits.

14.4 Explain use of grid system (auto rel-12 or latest).

14.5 Explain adjustment of drawing scale.

14.6 Explain procedure of drawing line with line command.

14.7 Explain P-edit command for widening boarder.

14.8 Explain procedure of saving boarder template.

15. UNDERSTAND ADDING A TITLE BLOCK TO THE BORDER

DRAWING. 15.1 Describe checking the drawing time.

15.2 Explain Change command.

15.3 Explain creation of layer for title block.

15.4 Explain procedure of creating a title block.

15.5 Explain Zoom command.

- 15.6 Explain importance of saving a drawing.
- 15.7 Explain use of CAD (Autocad R-12 or latest).
- 15.8 Explain filling in the title block by writing drawing title, name etc.
- 15.9 Explain procedure of plotting drawing on a plotter or printer.
- 15.10 Explain Qsave command.

16. UNDERSTAND DRAWING LINES AND

- CIRCLES.**
- 16.1 State beginning of a new drawing.
 - 16.2 Explain Dedit command (autocad R-12 or latest).
 - 16.3 Describe viewing the entire drawing.
 - 16.4 Explain drawing of angled line.
 - 16.5 Explain U-command.
 - 16.6 Explain Redo command.
 - 16.7 Explain drawing a circle with circle command.
 - 16.8 Explain automatic work saving procedures.

LIST OF PRACTICALS

192 Hours

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 centres, 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 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 involute curve of square rectangle hexagon and circle
22. Different types of drawing lines.
23. Orthographic projection 1 and 3rd angle L block
24. Orthographic projection 1 and 3rd angle Step Block
25. Orthographic projection 1 and 3rd angle Vee block
26. Orthographic projection 1 and 3rd angle Given Block
27. Orthographic projection 1 and 3rd angle Additional Block
28. Orthographic projection and Isometric Drawing Given Block
29. Orthographic projection and Isometric Drawing Given Block next
30. Orthographic projection and Isometric Drawing Given Block next
31. Different types of sectioning
32. different section lines for different material
33. Orthographic projection of Vee block sectional views.
34. Orthographic projection Gland sectional views
35. Orthographic projection Open bearing sectional views
36. Concept for different types of Drawings
37. Isometric and oblige drawings of cube with one hole.
38. Isometric and oblige drawings of another given block.

39. Missing lines and portions on given views
40. Missing lines and portions on given views next
41. Missing lines and portions on given views next
42. Missing lines and portions on given views next
43. Isometric scale and development of cube
44. Development of prism
45. Development of cylinder
46. Development of Cone
47. Development of Pyramid
48. Thread profile of square and vee threads.
49. Different types of threads
50. Sketch of hexagonal nut and bolt
51. Rivet heads
52. Single riveted lap joint
53. Single riveted but joint

B. COMPUTER AIDED DESIGN (Auto cad Rel-12 or latest).

1. Practice loading CAD software into computer memory.
2. Practice un loading CAD software safely 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 function keys 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 (QSAVE)
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 faces (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

Pht-113 PHARMACEUTICAL TECHNOLOGY - I

T	P	C
2	3	3

Course Objectives:

At the end of this course students will be acquainted with status of Pharmaceutical industry in Pakistan, types of Pharmaceutical Dosage Forms, manufacturing of these dosage forms along with stability parameters and methods of application.

Course Contents

Introduction about Pharmaceutical industry of Pakistan, future challenges for pharmaceutical industry in Pakistan, Pharmaceutical exports opportunities. 04 hours

1. **Liquid Dosage Forms** 08 hours
 - 1.1 Solubility
 - 1.2 Types of liquid dosage preparations
 - 1.3 Preparation of oral solutions, syrups and elixirs
 - 1.4 Stability considerations in the liquid dosage forms
- 2 **Semi Solid Dosage Forms (emulsions, suspensions and gels)** 18 hours
 - 2.1 Types of semisolid dosage forms and methods of preparation
 - 2.2 Manufacturing Parameters
 - 2.3 HLB system
 - 2.4 Stability considerations
 - 2.5 Batch Size
 - 2.6 Equipments used for manufacturing and packaging
- 3 **Suppositories** 08 hours
 - 3.1 Methods of preparation and equipment used
 - 3.2 Classification of suppository bases
 - 3.3 Packaging
 - 3.4 Stability and storage considerations
- 4 **Pharmaceutical Aerosols** 08 hours
 - 4.1 Aerosol principle
 - 4.2 Components of aerosol system

- 4.3 Types of aerosol systems
- 4.4 Advantage and uses of aerosol dosage form
- 4.5 Filling, packaging and storage

5 Otic, Nasal and Ophthalmic Preparations

08 hours

- 5.1 Methods of preparation and equipment used
- 5.2 Sterility and stability considerations
- 5.3 Packaging and storage

6 Transdermal Dosage Form (Creams, Ointments, Lotions and pastes) 10 hours

- 6.1 Structure and Functions of Skin, hair and neils
- 6.2 Percutaneous absorption and factors affecting percutaneous absorption
- 6.3 Types of transdermal dosage forms
- 6.4 Methods of preparation of different transdermal dosage forms
- 6.5 Equipments used for preparation of transdermal dosage forms
- 6.6 Types of bases and their selection

BOOKS RECOMMENDED:

- 1. Pharmaceutical Technology by Gayathri V. Patil and Harpal Singh
- 2. Modern Pharmaceutical Industry – A Primer by Thomas M Jacobsen and Albert I Werthimer
- 3. Remington: The Science and Practice of Pharmacy by David B Troy and Paul Beringer
- 4. Pharmaceutical Dosage Forms and Drug Delivery System by Howard Ansel and Nicholas Popovich.

List of Practical (96 hours)

1. Preparations of solutions by chemical reactions. (Buchner filler)
2. Preparations of emulsions by agitators,
3. Preparations of emulsions by mixers
4. Preparations of emulsions by colloidal mills and homogenizers)
5. Preparations of suspensions by hammer mills
6. Preparations of suspensions by ball mills
7. Preparations of suspensions by roller mills
8. Preparation of ointments and creams by Hobart mixer
9. Preparation of ointments and creams by rotating mixer
10. Use of tube filling machine under Laminar Flow Hood
11. Preparation of suppositories through compression molding
12. Preparation of suppositories through fusion (cold compression machine, automatic molding machine)

Instructional Objectives:

Introduction:

- a) Introduction about Pharmaceutical industry of Pakistan
- b) How medicine demand for country is managed
- c) Regulation of pharmaceutical sector by Govt of Pakistan
- d) Describe the future challenges for pharmaceutical industry in Pakistan,
- e) What are Pharmaceutical exports opportunities?

1. Liquid Dosage Forms

- 1.1 Define the solutions
- 1.2 Explain the term Solubility
- 1.3 Describe the solubility of organic and inorganic molecules with examples
- 1.4 What are the factors which can affect solubility
- 1.5 What are the types of liquid dosage preparations
- 1.6 How oral solutions are prepared
- 1.7 How syrups are prepared and what are the essential ingredients required for preparation of syrups
- 1.8 How medicated and non medicated elixirs are prepared
- 1.9 Describe the important stability considerations for liquid dosage forms

2 Semi Solid Dosage Forms (emulsions, suspensions and gels)

- 2.1 Describe the types of semisolid dosage forms
- 2.2 Describe the reasons and important features of pharmaceutical suspensions
- 2.3 How suspensions are prepared in laboratory and industrial scale
- 2.4 Explain the emulsions with their purpose of manufacturing
- 2.5 Explain the theories of emulsification and types of emulsifiers commonly used for preparation of emulsions
- 2.6 Describe the methods of formulation of emulsions
- 2.7 What is HLB system how it affects formulation of emulsions.
- 2.8 Describe the term Rheology with its importance in formulation of semisolid dosage forms
- 2.9 How Rheology is measured with the help of Brookfield viscometer
- 2.10 Why gels are used as semisolid dosage form
- 2.11 Describe the important stability considerations for semisolid dosage forms
- 2.12 Describe the working of equipments used for manufacturing of semisolid dosage forms

3 Suppositories

- 3.1 Describe the suppository dosage form
- 3.2 Describe types of rectal, vaginal and urethral preparations

- 3.3 What are important factors affecting absorption of rectal suppositories
- 3.4 Explain equipments used for preparation of suppositories by molding and compression methods.
- 3.5 Classify and explain the suppository bases
- 3.6 Explain methods of packaging of suppositories
- 3.7 Describe stability and storage considerations for suppositories

4 Pharmaceutical Aerosols

- 4.1 Describe the Aerosol principle
- 4.2 What are components of aerosol system
- 4.3 Enlist and explain the different types of aerosol systems
- 4.4 Describe advantages and uses of aerosol dosage form
- 4.5 Explain the filling, packaging and storage of aerosols

5 Otic, Nasal and Ophthalmic Preparations

- 5.1 What are ophthalmic preparations
- 5.2 Describe ophthalmic solutions, suspensions, ointments and inserts
- 5.3 Explain the importance of isotonicity, sterility and viscosity for stability and preservation of ophthalmic preparations
- 5.4 Enlist types of nasal and otic preparations
- 5.5 Explain the methods and equipments used for preparation of otic, nasal and ophthalmic preparations.

6 Transdermal Dosage Form

- 6.1 Describe and differentiate structure and functions of Skin, hair and nails
- 6.2 Explain percutaneous absorption and factors affecting percutaneous absorption
- 6.3 How many types of transdermal dosage forms are used
- 6.4 Explain the methods of preparation of ointments and creams
- 6.5 Explain the working of different equipments used for manufacturing of creams and ointments.
- 6.6 Enlist types of ointment bases
- 6.7 Explain the properties of ointment bases and factors affecting the selection of ideal base
- 6.8 Describe lotions, pastes, plasters, liniments and tinctures.

اسلامیات / مطالعہ پاکستان

GEN 211

مضب (سہل دوئم)

نمبر کول اسلامیات

نمبر دور مطالعہ پاکستان

موضوعات

کُل وقت: 20 گھنٹے

کُل نمبر: 100

کُل وقت: 20 گھنٹے

- 1- سورۃ المؤمنین آیت تا پیرہ آیات کا مع ترجمہ
- 2- دس منتخب احادیث مع ترجمہ و تفسیر
- 3- خیال رکھو کہ من تعصم القرآن و علمہ
- 4- لا یموت المؤمن الا فانیۃ لم یولد الا فانیۃ لا یمن الا بعدہ
- 5- ویاکم واطفلن ان احفظن اکرب الحدیث
- 6- من احديث فی امرنا بقاءہ لیس متہ فہو رد
- 7- من حمل علیہ السلاح فلیس منا
- 8- لاؤ کافل البیتیم فی الجنۃ
- 9- لا ضرر ولا ضرار فی الاسلام
- 10- کلکم راع وکلکم راع وکلکم مسؤول عن رعیۃ
- 11- میرا طیبہ
- 12- مکی زندگی و الارث و الجنۃ و الجہنم
- 13- مکی زندگی و موافقت و مشق و عبادت و کمال (اسباب و نتائج)
- 14- حضور ﷺ بحیثیت
- 15- قطب جمعہ لا انا
- 16- معہ کل سرور کو خاندان
- 17- اسلامی معاشرہ
- 18- حکم تعلیم اور اس کے مقاصد عدل و انصاف امر بالمعروف نہی عن المنکر
- 19- جملہ کتب طالیہ سجدہ التبیات (فضیلت)
- 20- اسلامی ریاست کی تعریف اسلامی ریاست کی خصوصیات اسلامی حکومت کے فرائض اسلامی طرز حکومت

اسلامیات

تدریس مقاصد

عمومی مقاصد بطالعلم یہ جان سکے کہ آیات قرآنی کی روشنی میں مومن کے اوصاف کیا ہیں
قرآن مجید
خصوصی مقاصد:

- ☆ قرآنی آیات کا ترجمہ بیان کر سکے
- ☆ قرآنی آیات کی تشریح کر سکے
- ☆ قرآنی آیات کی روشنی میں ایک مومن کے اوصاف بیان کر سکے
- ☆ قرآنی آیات میں بیان کردہ مومن کے اوصاف اپنے اندر پیدا کر سکے
- ☆ احادیث نبویہ
- ☆ عمومی مقصد احادیث کی روشنی میں اسلامی اخلاقی اقدار (انفرادی و اجتماعی) سے آگاہ ہو سکے
- ☆ خصوصی مقاصد:
- ☆ احادیث کا ترجمہ بیان کر سکے
- ☆ احادیث کی تشریح کر سکے
- ☆ احادیث کی روشنی میں اسلام کی اخلاقی اقدار کی وضاحت کر سکے
- ☆ ان احادیث کی دی گئی تعلیمات کے مطابق اپنی زندگی گزار سکے
- ☆ سیرت طیبہ
- ☆ عمومی مقصد: حضور ﷺ کی سیرت طیبہ کے بارے میں جان سکے
- ☆ خصوصی مقاصد:
- ☆ حضور ﷺ کی ابتدائی زندگی انحصار کے ساتھ بیان کر سکے
- ☆ حضور ﷺ کی ہجرت کا واقعہ بیان کر سکے
- ☆ حضور ﷺ کی مدنی زندگی انحصار سے بیان کر سکے
- ☆ حضور ﷺ کی بطور معلم خصوصیات بیان کر سکے

- ☆ حضور ﷺ کی بطور سربراہ خاندان بیان کر سکے
اسلامی معاشرہ
- ☆ عمومی مقصد: اسلامی معاشرہ کی خصوصیات سے آگاہی حاصل کر سکے
خصوصی مقاصد:
- ☆ اسلامی معاشرہ کا معنی و مفہوم بیان کر سکے
- ☆ اسلامی معاشرہ کی امتیازی خصوصیات بیان کر سکے
- ☆ اسلامی معاشرہ میں عدل و احسان کی اہمیت بیان کر سکے
- ☆ تبلیغ کے لغوی معنی بیان کر سکے
- ☆ تبلیغ کی اہمیت و ضرورت بیان کر سکے
- ☆ جہلوں کے لفظی و اصطلاحی معنی بیان کر سکے
- ☆ جہلوں کی اہمیت بیان کر سکے
- ☆ جہلوں اور فتنوں میں فرق بیان کر سکے
- ☆ جہلوں کی مختلف اقسام بیان کر سکے
- ☆ اقطار مسجد کی تعریف کر سکے
- ☆ مسجد کی سابقہ حیثیت کو بحال کرنے کے بارے میں اقدامات کو بیان کر سکے
- اسلامی ریاست**
- ☆ عمومی مقصد: اسلامی ریاست کی خصوصیات بیان کر سکے
خصوصی مقاصد:
- ☆ ریاست کی تعریف بیان کر سکے
- ☆ اسلامی ریاست میں طرز حکومت سے آگاہی حاصل کر سکے
- ☆ اسلامی ریاست کی خصوصیات بیان کر سکے
- ☆ اسلامی ریاست کے اغراض و مقاصد بیان کر سکے
- ☆ اسلامی ریاست کے قیمتی کیلئے جدوجہد کر سکے

نصاب مطالعہ پاکستان

ٹی بی سی
۱ ۵ ۱
کل وقت: ۱۲ گھنٹے

سہ ماہی	☆
حصہ دوم	☆
موضوعات	☆
۱۰ قومی نظریہ	☆
تحریک پاکستان	☆
انجمن کانگریس	☆
مسلم لیگ	☆
تقسیم بنگلہ	☆
میشن کمشنر	☆
تحریک خلافت	☆
سندھ تحریک	☆
تجلیز رسمی	☆
نمودار پورٹ	☆
قائمہ اعظم کے چودہ نکات	☆
خطبہ آلہ آباد	☆
انتخابات ۱۹۳۸ اور اشعلیٰ بھٹو	☆
قرارداد پاکستان	☆

مقصود دوم
سفاہ پاکستان

تدریس مقاصد

تحریک پاکستان

عمومی مقصد: قیام پاکستان کے سبب و محرکات کو بیان کر سکے
خصوصی مقاصد:

- ☆ قومیت کے مفہوم کو بیان کر سکے
- ☆ دو قومی نظریہ کی تعریف و توضیح کر سکے
- ☆ دو قومی نظریہ اہمیت بیان کر سکے
- ☆ ہندوستانی مسلمانوں کی محرومیوں کو بیان کر سکے
- ☆ قومی تشخص کو عمل رکھنے کے لئے مسلمان ہند کی مساعی بیان کر سکے
- ☆ آزادی ہند اور قیام پاکستان علامہ اقبال اور قائد اعظم کی مساعی بیان کر سکے
- ☆ قیام پاکستان سے مستقبل اسلامی مملکت کے قیام کے لئے مسلم عوام کی کوششوں کو بیان کر سکے
- ☆ مسلم لیگ کے قیام پاکستان کے لئے جدوجہد بیان کر سکے

(غیر مسلم طلباء کے لئے)

نی ڈی ٹی
1 D 1
کل وقت: 20 منٹ

نصاب اختلاقیات
سال دوم

موضوعات

معاشرتی قدر اور اہمیت۔ قوم۔ قوی سطح۔ شہری سطح۔ صنعتی اربابوں کی سطح۔ ضروریات۔ درجہ

☆ حقوق و فرائض

☆ قوت پرورش

☆ قوت ارادی

☆ لگن و جذبہ

☆ وسیع النظری

☆ بے غرضی

☆ منسلک دوستی

☆ حفاظتی شعور

☆ پاس آزدی

☆ کمال فکری

☆ تعزات کو قبول کرنا

☆ خود شناسی

DAE Technology

نصاب اخلاقیات

سہ ماہی

تدریس مقاصد

عمومی مقاصد :

طالب علم: اخلاقیات کی اہمیت اور ضرورت سے سمجھ ہو سکے اور بیان کر سکے

خصوصی مقاصد : طالب علم اس قابل ہو کہ

موضوعات کا مطلب بیان کر سکے

عملی زندگی سے مثالوں کی نشاندہی کر سکے

اپنی شخصیت اور حاشیے پر موضوعات کے متعلق مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے

اعلیٰ اخلاقی قداریں سے

قیادت برداشت۔ قوت ارادی۔ مکتبہ جذبہ۔ وسیع نظری۔ بے غرض۔ انسانی دوستی خالص۔ شعور۔ پس ترقی۔

کمال اخلاقی اور ذہنی نشانی کی اہمیت بیان کر سکے

اخلاقیات سے متعلق ہر قسم کی ترقی خدمت بہتر طور پر انجام دے سکے

Math 223 APPLIED MATHEMATICS-II

Total Contact Hours	T	P	C
Theory 96 Hours	3	0	3

Pre-requisite: Must have completed Mathematics I.

AIMS The students will be able to:

1. Solve problems of Calculus and Analytic Geometry.
2. Develop mathematical skill, attitudes and logical perception in the use of mathematical instruments.
3. Apply principles of Differential Calculus to work out rate measures, velocity, acceleration, maxima & minima values
4. Use Principles of Integral Calculus to compute areas & volumes.
5. Acquire proficiency in solving technological problems with mathematical clarity and insight.

COURSE CONTENTS

- | | |
|---|--------------------|
| 1. FUNCTIONS & LIMITS. | 6 Hours |
| 1.1 Constant & Variable Quantities | |
| 1.2 Functions & their classification | |
| 1.3 The concept of Limit | |
| 1.4 Limit of a Function | |
| 1.5 Fundamental Theorems on Limit | |
| 1.6 Some important Limits | |
| 1.7 Problems | |
|
2. DIFFERENTIATION |
6 Hours |
| 2.1 Increments | |
| 2.2 Differential Coefficient or Derivative | |
| 2.3 Differentiation ab-initio or by first Principle | |
| 2.4 Geometrical Interpretation of Differential Coefficient | |
| 2.5 Differential Coefficient of X^n , $(ax + b)^n$ | |
| 2.6 Three important rules | |
| 2.7 Problems | |
|
3. DIFFERENTIATION OF ALGEBRAIC FUNCTIONS |
9 Hours |
| 3.1 Explicit Functions | |
| 3.2 Implicit Functions | |
| 3.3 Parametric forms | |
| 3.4 Problems | |

4.	DIFFERENTIATION OF TRIGONOMETRIC FUNCTIONS	6 Hours
4.1	Differential Coefficient of Sin x, Cos x, Tan x from first principle.	
4.2	Differential Coefficient of Cosec x, Sec x, Cot x.	
4.3	Differentiation of inverse Trigonometric functions.	
4.4	Problems.	
5.	DIFFERENTIATIONS OF LOGARITHMIC & EXPONENTIAL FUNCTIONS	6 Hours
5.1	Differentiation of $\ln x$	
5.2	Differentiation of $\log_a x$	
5.3	Differentiation of a^x	
5.4	Differentiation of e^x	
5.5	Problems	
6.	RATE OF CHANGE OF VARIABLES.	6 Hours
6.1	Increasing and decreasing functions	
6.2	Maxima and Minima values	
6.3	Criteria for maximum & minimum values	
6.4	Methods of finding maxima & minima	
6.5	Problems	
7.	INTEGRATION	9 Hours
7.1	Concept	
7.2	Fundamental Formulas	
7.3	Important Rules	
7.4	Problems	
8.	METHODS OF INTEGRATION	9 Hours
8.1	Integration by substitution	
8.2	Integration by parts	
8.3	Problems	
9.	DEFINITE INTEGRALS	6 Hours
9.1	Properties	
9.2	Application to area	
9.3	Problems	
10.	DIFFERENTIAL EQUATIONS	6 Hours
10.1	Introduction	
10.2	Degree and Order	
10.3	First order differential equation	
10.4	Solution	
10.5	Problems	
11.	PLANE ANALYTIC GEOMETRY & STRAIGHT LINE	6 Hours

- 11.1 Coordinate System
- 11.2 Distance Formula
- 11.3 The Ratio Formula
- 11.4 Inclination and slope of a line
- 11.5 The slope Formula
- 11.6 Problems

12. EQUATIONS OF STRAIGHT LINE

6 Hours

- 12.1 Some important Forms
- 12.2 General Form
- 12.3 Angle Formula
- 12.4 Parallelism & Perpendicularity
- 12.5 Problems

13. EQUATIONS OF CIRCLE

6 Hours

- 13.1 Standard form of Equation
- 13.2 Central form of Equation
- 13.3 General form of Equation
- 13.4 Radius & Coordinates of the centre
- 13.5 Problems

14. STATISTICS

9 Hours

- 14.1 Concept of mean, median and mode
- 14.2 Standard deviation
- 14.3 Laws of probability
- 14.4 Problems

REFERENCE BOOKS

1. Thomas Finny- Calculus and Analytic Geometry
2. Ghulam Yasin Minhas - Technical Mathematics Vol - II, Ilmi Kitab Khana, Lahore.
3. Prof. Riaz Ali Khan- Polytechnic Mathematic Series Vol I & II, Majeed Sons, Faisalabad
4. Prof. Sana Ullah Bhatti - Calculus and Analytic Geometry, Punjab Text Book Board, Lahore.

INSTRUCTIONAL OBJECTIVES

1. USE THE CONCEPT OF FUNCTIONS AND THEIR LIMITS IN SOLVING SIMPLE PROBLEMS.

- 1.1 Define a function.
- 1.2 List all type of functions.
- 1.3 Explain the concept of limit and limit of a function.
- 1.4 Explain fundamental theorems on limits.
- 1.5 Derive some important limits.
- 1.6 solve problems on limits.

2. UNDERSTAND THE CONCEPT OF DIFFERENTIAL COEFFICIENT

- 2.1 Derive mathematical expression for a differential coefficient.
- 2.2 Explain geometrical interpretation of differential coefficient.
- 2.3 Differentiate a constant, a constant associated with a variable and the sum of finite number of functions.
- 2.4 Solve related problems.

3. USE RULES OF DIFFERENTIATION TO SOLVE PROBLEMS OF ALGEBRAIC FUNCTIONS.

- 3.1 Differentiate ab-initio x^n and $(ax+b)^n$.
- 3.2 Derive product, quotient and chain rules.
- 3.3 Find derivatives of implicit functions and explicit functions.
- 3.4 Differentiate parametric forms, functions w.r.t another function and by rationalization.
- 3.5 Solve problems using these formulas.

4. USE RULES OF DIFFERENTIATION TO SOLVE PROBLEMS INVOLVING TRIGONOMETRIC FUNCTIONS.

- 4.1 Differentiate from first principle $\sin x, \cos x, \tan x$.
- 4.2 Derive formula Derivatives of $\sec x, \csc x, \cot x$.
- 4.3 Find differential coefficients of inverse trigonometric functions
- 4.3 Solve problems based on these formulas.

5. USE RULES OF DIFFERENTIATION TO LOGARITHMIC AND EXPONENTIAL FUNCTIONS.

- 5.1 Derive formulas for differential coefficient of Logarithmic and exponential functions.
- 5.2 Solve problems using these formulas.

5. UNDERSTAND RATE OF CHANGE OF ONE VARIABLE WITH RESPECT TO ANOTHER.

- 6.1 Derive formula for velocity, acceleration and slope of a line.

- 6.2 Define an increasing and a decreasing function, maxima and minima values, point of inflexion.
- 6.3 Explain criteria for maxima and minima values of a function.
- 6.4 Solve problems involving rate of change of variables.
- 7. USE RULES OF INTEGRATION IN SOLVING RELEVANT PROBLEMS.**
 - 7.1 Explain the concept of integration.
 - 7.2 State basic theorems of integration.
 - 7.3 List some important rules of integration.
 - 7.4 Derive fundamental formulas of integration.
 - 7.5 Solve problems of integration based on these rules/formulas.
- 8. UNDERSTAND DIFFERENT METHODS OF INTEGRATION**
 - 8.1 List standard formulas of Integration.
 - 8.2 Integrate a function by substitution method.
 - 8.3 Find integrals by the method of integration by parts.
 - 8.4 Solve problems using these methods.
- 9. UNDERSTAND METHODS OF SOLVING DEFINITE INTEGRALS.**
 - 9.1 Define definite integral.
 - 9.2 List properties of definite integrals.
 - 9.3 Find areas under the curves using definite integrals.
 - 9.4 Solve problems of definite integrals.
- 10. USE DIFFERENT METHODS OF INTEGRATION TO SOLVE DIFFERENTIAL EQUATIONS**
 - 10.1 Define a differential equation, its degree and order
 - 10.2 Explain method of separation of variables to solve differential equation of first order and first degree.
 - 10.3 Solve differential equations of first order and first degree
- 11. UNDERSTAND THE CONCEPT OF PLANE ANALYTIC GEOMETRY.**
 - 11.1 Explain the rectangular coordinate system.
 - 11.2 Locate points in different quadrants.
 - 11.3 Derive distance formula.
 - 11.4 Prove section formulas.
 - 11.5 Derive Slope Formula
 - 11.6 Solve problem using these formulas.
- 12. USE EQUATIONS OF STRAIGHT LINE IN SOLVING PROBLEMS.**
 - 12.1 Define a straight line.
 - 12.2 Write general form of equation of a straight line.
 - 12.3 Derive slope intercept and intercept forms of equations of a straight line.
 - 12.4 Derive expression for angle between two straight lines.
 - 12.5 Derive conditions of perpendicularity and parallelism of two straight lines.

12.6 Solve problems involving these equations/formulas.

13. SOLVE TECHNOLOGICAL PROBLEMS USING EQUATIONS OF CIRCLE.

13.1 Define a circle.

13.2 Describe standard, central and general forms of the equation of a circle.

13.3 Convert general form to the central form of equation of a circle.

13.4 Derive formula for the radius and the coordinates of the center of a circle from the general form.

13.5 Derive equation of the circle passing through three given points.

13.6 Solve problems involving these equations.

14. UNDERSTAND THE BASIC CONCEPT OF STATISTICS.

14.1 Define mean, median and mode

14.2 Explain standard deviation

14.3 State laws of probability

14.4 Calculate the above mentioned quantities using the proper formula.

Mgm-211 BUSINESS COMMUNICATIONS

T	P	C
1	0	1

Total contact hours

Theory 32 Hrs.

Prerequisites: The students shall already be familiar with the language concerned.**AIMS** The course has been designed to enable the students to.

1. Develop communication skills.
2. Understand basic principles of good and effective business writing in commercial and industrial fields.
3. Develop knowledge and skill to write technical report with confidence and accuracy.

COURSE CONTENTS

- | | |
|---|----------------|
| 1. COMMUNICATION PROCESS. | 6 Hours |
| 1.1 Purposes of communication | |
| 1.2 Communication process | |
| 1.3 Distortions in communication | |
| 1.4 Consolidation of communique | |
| 1.5 Communication flow | |
| 1.6 Communication for self development | |
| 2. ORAL COMMUNICATION SKILLS. | 6 Hours |
| 2.1 Significance of speaking. | |
| 2.2 Verbal and non-verbal messages. | |
| 2.3 Strategic steps of speaking. | |
| 2.4 Characteristics of effective oral messages. | |
| 2.5 Communication Trafficking. | |
| 2.6 Oral presentation. | |
| 3. QUESTIONING SKILLS. | 3 Hours |
| 3.1 Nature of question. | |
| 3.2 Types of questions. | |
| 3.3 Characteristics of a good question. | |
| 3.4 Questioning strategy | |
| 4. LISTENING SKILLS. | 5 Hours |
| 4.1 Principles of active listening. | |
| 4.2 Skills of active listening. | |
| 4.3 Barriers to listening. | |
| 4.4 Reasons of poor listening. | |

- 4.5 Giving Feedback.
- 5. INTERVIEWING SKILLS. 3 Hours**
- 5.1 Significance of interviews.
- 5.2 Characteristics of interviews.
- 5.3 Activities in an interviewing situation
- 5.4 Types of interviews.
- 5.5 Interviewing strategy.
- 6. REPORT WRITING. 3 Hours**
- 6.1 Goals of report writing
- 6.2 Report format.
- 6.3 Types of reports.
- 6.4 Report writing strategy.
- 7. READING COMPREHENSION. 2 Hours**
- 7.1 Reading problems.
- 7.2 Four Reading skills.
- 8. GROUP COMMUNICATION. 4 Hours**
- 8.1 Purposes of conducting meetings.
- 8.2 Planning a meeting.
- 8.3 Types of meetings.
- 8.4 Selection of a group for meeting.
- 8.5 Group leadership skills.
- 8.6 Running a successful meeting.
- 8.7 Active participation techniques.

RECOMMENDED BOOKS

1. Sh. Ata-ur-Rehman Effective Business Communication & Report Writing.
2. Ulman J.N. Could JR. Technical Reporting.

INSTRUCTIONAL OBJECTIVES

- 1. UNDERSTAND THE COMMUNICATION PROCESS.**
 - 1.1 State the benefits of two way communication.
 - 1.2 Describe a model of communication process.
 - 1.3 Explain the major communication methods used in organization.
 - 1.4 Identify the barriers to communication and methods of overcoming these barriers.
 - 1.5 Identify misconceptions about communication.
- 2. UNDERSTAND THE PROCESS OF ORAL.**
 - 2.1 Identify speaking situations with other peoples.
 - 2.2 Identify the strategy steps of speaking.
 - 2.3 Identify the characteristics of effective speaking.
 - 2.4 State the principles of one-way communication.
 - 2.5 State the principles of two-way communication.
 - 2.6 Identify the elements of oral presentation skills.
 - 2.7 Determine the impact of non-verbal communication on oral communication.
- 3. DETERMINE THE USES OF QUESTIONING SKILLS TO GATHER AND CLARIFY INFORMATION IN THE ORAL COMMUNICATION PROCESS.**
 - 3.1 Identify different types of questions.
 - 3.2 Determine the purpose of each type of question and its application.
 - 3.3 Identify the hazards to be avoided when asking questions.
 - 3.4 Demonstrate questioning skills.
- 4. DEMONSTRATE THE USE OF ACTIVE LISTENING SKILL IN THE ORAL COMMUNICATION PROCESS.**
 - 4.1 State the principles of active listening.
 - 4.2 Identify skills of active listening.
 - 4.3 Identify barriers to active listening.
 - 4.4 State the benefits of active listening.
 - 4.5 Demonstrate listening skills.
 - 4.6 Explain the importance of giving and receiving feed back.
- 5. Determine the appropriate interview type for the specific work-related situation and conduct a work-related interview.**
 - 5.1 State the significance of interviews.
 - 5.2 State the characteristics of interviews.
 - 5.3 Explain the activities in an interviewing situation.
 - 5.4 Describe the types of interviews.
 - 5.5 Explain the interviewing strategy.
 - 5.6 Prepare instrument for a structured interview.

- 6. PREPARE A REPORT OUT-LINE, BASED ON SUBJECT MATTER AND AUDIENCE.**
 - 6.1Identify the different types of reports.
 - 6.2Determine when to use an informal or formal report presentation.
 - 6.3Identify the stages of planning a report.
 - 6.4Identify the parts of a report and choose the parts appropriate for each type of report.
 - 6.5Draft a report outline.
- 7. DEMONSTRATE READING COMPREHENSION.**
 - 7.1Identify major reading problems.
 - 7.2Identify basic reading skills.
 - 7.3State methods of previewing written material.
 - 7.4Identify methods of concentration when reading.
 - 7.5Demonstrate reading comprehension.
- 8. UNDERSTAND THE PRINCIPLES OF GROUP COMMUNICATIONS.**
 - 8.1State the purpose and characteristics of major types of meeting.
 - 8.2Explain responsibilities of a meeting/committee.
 - 8.3Identify problems likely to be faced at meeting and means to overcome these problems.
 - 8.4Distinguish between content and process at meetings.
 - 8.5Explain the key characteristics of a good group facilitator.

Mgm 221 BUSINESS MANAGEMENT AND INDUSTRIAL ECONOMICS

Total Contact Hours

Theory	32	T	P	C
Practical	0	1	0	1

AIMS The students will be able to develop management skills, get acquainted the learner with the principles of management and economic relations and develop commercial/economic approach to solve the problems in the industrial set-up.

COURSE CONTENTS

- 1. ECONOMICS** **2 Hours**
 - 1.1 Definition: Adam Smith, Alfred Marshall, Prof. Robins.
 - 1.2 Nature and scope
 - 1.3 Importance for technicians.
- 2. BASIC CONCEPTS OF ECONOMICS** **1 Hour**
 - 2.1 Utility
 - 2.2 Income
 - 2.3 Wealth
 - 2.4 Saving
 - 2.5 Investment
 - 2.6 Value.
- 3. DEMAND AND SUPPLY.** **2 Hours**
 - 3.1 Definition of demand.
 - 3.2 Law of demand.
 - 3.3 Definition of supply.
 - 3.4 Law of supply.
- 4. FACTORS OF PRODUCTION.** **2 Hours**
 - 4.1 Land
 - 4.2 Labour
 - 4.3 Capital
 - 4.4 Organization.
- 5. BUSINESS ORGANIZATION.** **3 Hours**
 - 5.1 Sole proprietorship.
 - 5.2 Partnership
 - 5.3 Joint stock company.
- 6. ENTREPRENEURIAL SKILLS** **4 Hours**
 - 6.1 Preparing, planning, establishing, managing, operating and evaluating relevant resources in small business.

6.2	Business opportunities, goal setting.	
6.3	Organizing, evaluating and analyzing opportunity and risk tasks.	
7.	SCALE OF PRODUCTION.	2 Hours
7.1	Meaning and its determination.	
7.2	Large scale production.	
7.3	Small scale production.	
8.	ECONOMIC SYSTEM	3 Hours
8.1	Free economic system.	
8.2	Centrally planned economy.	
8.3	Mixed economic system.	
9.	MONEY.	1 Hour
9.1	Barter system and its inconveniences.	
9.2	Definition of money and its functions.	
10.	BANK.	1 Hour
10.1	Definition	
10.2	Functions of a commercial bank.	
10.3	Central bank and its functions.	
11.	CHEQUE	1 Hour
11.1	Definition	
11.2	Characteristics and kinds of cheque.	
11.3	Dishonour of cheque.	
12.	FINANCIAL INSTITUTIONS	2 Hours
12.1	IMF	
12.2	IDBP	
12.3	PIDC	
13.	TRADE UNION	2 Hours
13.1	Introduction and brief history.	
13.2	Objectives, merits and demerits.	
13.3	Problems of industrial labour.	
14.	INTERNATIONAL TRADE.	2 Hours
14.1	Introduction	
14.2	Advantages and disadvantages.	
15.	MANAGEMENT	1 Hour
15.1	Meaning	
15.2	Functions	

16. ADVERTISEMENT

2 Hours

- 16.1 The concept, benefits and draw-backs.
- 16.2 Principal media used in business world.

17. ECONOMY OF PAKISTAN

1 Hour

- 17.1 Introduction
- 17.2 Economic problems and remedies.

BOOKS RECOMMENDED

- 1. Nisar-ud-Din, Business Organization, Aziz Publisher, Lahore
- 2. M. Saeed Nasir, Introduction to Business, Ilmi Kitab Khana, Lahore.
- 3. S.M. Akhtar, An Introduction to Modern Economics, United Limited, Lahore.

INSTRUCTIONAL OBJECTIVES

- 1. UNDERSTAND THE IMPORTANCE OF ECONOMICS.**
 - 1.1 State definition of economics given by Adam Smith, Alfred Marshall and Professor Robins.
 - 1.2 Explain nature and scope of economics.
 - 1.3 Describe importance of study of economics for technicians.
- 2. UNDERSTAND BASIC TERMS USED IN ECONOMICS.**
 - 2.1 Define basic terms, utility, income, wealth, saving, investment and value.
 - 2.2 Explain the basic terms with examples
- 3. UNDERSTAND LAW OF DEMAND AND LAW OF SUPPLY.**
 - 3.1 Define Demand.
 - 3.2 Explain law of demand with the help of schedule and diagram.
 - 3.3 State assumptions and limitation of law of demand.
 - 3.4 Define Supply.
 - 3.5 Explain law of Supply with the help of schedule and diagram.
 - 3.6 State assumptions and limitation of law of supply.
- 4. UNDERSTAND THE FACTORS OF PRODUCTION**
 - 4.1 Define the four factors of production.
 - 4.2 Explain labour and its features.
 - 4.3 Describe capital and its peculiarities.
- 5. UNDERSTAND FORMS OF BUSINESS ORGANIZATION.**
 - 5.1 Describe sole proprietorship, its merits and demerits.
 - 5.2 Explain partnership, its advantages and disadvantages.
 - 5.3 Describe joint stock company, its merits and demerits.
 - 5.4 Distinguish public limited company and private limited company.
- 6. UNDERSTAND ENTREPRENEURIAL SKILLS**
 - 6.1 Explain preparing, planning, establishing and managing small business set up
 - 6.2 Explain evaluating all relevant resources
 - 6.3 Describe organizing analyzing and innovation of risk of task
- 7. UNDERSTAND SCALE OF PRODUCTION.**
 - 7.1 Explain scale of production and its determination.
 - 7.2 Describe large scale production and its merits.
 - 7.3 Explain small scale of production and its advantages and disadvantages.
- 8. UNDERSTAND DIFFERENT ECONOMIC SYSTEMS.**
 - 8.1 Describe free economic system and its characteristics.
 - 8.2 Explain centrally planned economic system, its merits and demerits.
 - 8.3 State mixed economic system and its features.

- 9. UNDERSTAND WHAT IS MONEY**
 - 9.1 Define money
 - 9.2 Explain barter system and its inconveniences.
 - 9.3 Explain functions of money.
- 10. UNDERSTAND BANK AND ITS FUNCTIONS.**
 - 10.1 Define bank.
 - 10.2 Describe commercial bank and its functions.
 - 10.3 State central bank and its functions.
- 11. UNDERSTAND CHEQUE AND DISHONOR OF CHEQUE.**
 - 11.1 Define cheque.
 - 11.2 Enlist the characteristics of cheque.
 - 11.3 Identify the kinds of cheque.
 - 11.4 Describe the causes of dishonor of a cheque.
- 12. UNDERSTAND FINANCIAL INSTITUTIONS.**
 - 12.1 Explain IMF and its objectives.
 - 12.2 Explain organisational set up and objectives of IDBP.
 - 12.3 Explain organisational set up and objectives of PIDC.
- 13. UNDERSTAND TRADE UNION, ITS BACKGROUND AND FUNCTIONS.**
 - 13.1 Describe brief history of trade union.
 - 13.2 State functions of trade union.
 - 13.3 Explain objectives, merits and demerits of trade unions.
 - 13.4 Enlist problems of industrial labour.
- 14. UNDERSTAND INTERNATIONAL TRADE.**
 - 14.1 Explain international trade.
 - 14.2 Enlist its merits and demerits.
- 15. UNDERSTAND MANAGEMENT**
 - 15.1 Explain meaning of management.
 - 15.2 Describe functions of management.
 - 15.3 Identify the problems of business management.
- 16. UNDERSTAND ADVERTISEMENT.**
 - 16.1 Explain the concept of advertisement.
 - 16.2 Enlist benefits and drawbacks of advertisement.
 - 16.3 Describe principal media of advertisement used in business world.
- 17. UNDERSTAND THE ECONOMIC PROBLEMS OF PAKISTAN.**
 - 17.1 Describe economy of Pakistan.
 - 17.2 Explain economic problems of Pakistan
 - 17.3 Explain remedial measures for economic problems of Pakistan.

CHT 244(Rev.) ORGANIC CHEMISTRY

T	P	C
2	6	4

OBJECTIVES.

1. Understand the basic principles of organic chemistry.
2. Apply basic principle of organic chemistry in the laboratory work

COURSE CONTENTS

HOURS

- | | | |
|-----------|--|-----------|
| 1. | INTRODUCTION TO ORGANIC CHEMISTRY | 04 |
| 1.1 | Source of organic compounds and applications | |
| 1.2 | Classification of organic compounds with their general formula and functional groups | |
| 1.3 | Difference between organic and inorganic chemistry | |
| 2. | TYPES OF ORGANIC REACTION | 04 |
| 2.1 | Substitution reactions with examples. | |
| 2.2 | Addition reaction with examples. | |
| 2.3 | Elimination reaction with examples. | |
| 2.4 | Rearrangements reactions with examples | |
| 3. | ISOMERISM AND TYPES | 02 |
| 3.1 | Definition and types of Isomerism | |
| 3.2 | Hydrocarbons - Definition and classification with examples and general formula. | |
| 3.3 | Homologous Series. | |
| 3.4 | Nomenclature of organic compounds according to IUPAC system | |
| 3.5 | Nomenclature of various organic compounds according to IUPAC system | |
| 4. | ALKANES | 02 |
| 4.1 | Definition | |
| 4.2 | Preparation | |
| 4.3 | General chemical properties of alkanes | |
| 5. | ALKENES | 02 |
| 5.1 | Definition | |
| 5.2 | Preparation | |
| 5.3 | General chemical properties of alkenes | |

6.	ALKYNES	02
6.1	Definition	
6.2	Preparation	
6.3	General chemical properties of alkynes	
7.	ALKYL HALIDES	04
7.1	Definition	
7.2	Classification	
7.3	Methods of preparation.	
7.4	General chemical properties of RX	
7.5	Organometallic compounds, Definition preparation of RMgX (Grignard reagent)	
7.6	Properties (chemical & physical) of RMgX	
7.7	Properties of RMgX	
8.	ALCOHOLS	04
8.1	Definition	
8.2	Classification	
8.3	Preparation of alcohol.	
8.4	General reactions of alcohol	
9.	ETHERS	02
9.1	Definition	
9.2	Preparation of ether	
9.3	General reactions of ether	
10.	ALDEHYDES	04
10.1	Definition	
10.2	Preparation of aldehydes	
10.3	General reactions of aldehydes	
11.	KETONES	02
11.1	Definition	
11.2	Preparation of ketones	
11.3	General reactions of ketones	
12.	CARBOXYLIC ACIDS	04

12.1	Definition	
12.2	Classification	
12.3	Preparation of carboxylic acids	
12.4	General reactions of carboxylic acids	
13.	DERIVATIVES OF CARBOXYLIC ACIDS	04
13.1	Preparation of acid chlorides along with chemical properties.	
13.2	General methods of preparation of acid anhydrides.	
13.3	Chemical properties of acid anhydrides	
14.	AMIDES	04
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14.2	Methods of preparations	
14.3	Chemical properties	
15.	ESTERS	02
15.1	Definition	
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15.3	Chemical properties	
16.	AMINES	04
16.1	Definition	
16.2	Methods of preparations	
16.3	Preparation of all types of amines	
16.4	General reactions of amines	
17.	AROMATIC HYDRO CARBONS	02
17.1	Definition	
17.2	Classification	
17.3	Methods of preparation of Benzene.	
17.4	Chemical properties of Benzene.	
18.	PHENOLS	04
18.1	Definition	
18.2	Classification	
18.3	General methods of preparation.	
18.4	General reactions of phenols.	
19.	CARBOHYDRATES	04

- 19.1 Classification
- 19.2 Preparation of Glucose
- 19.3 Reactions of Glucose
- 19.4 Fructose, methods of preparation and reaction of fructose.
- 19.5 Comparison between glucose and fructose.

20. PROTEINS

02

- 20.1 Definition
- 20.2 Classification
- 20.3 Chemical composition, molecular shape
- 20.4 Chemical properties and reactions of protein.

RECOMMENDED BOOKS

- 1 Mannual on Organic Chemistry -I,II (Polytechnic manual series)
- 2 Chemistry part -II (for f.sc students) by Dr.KMibne Rasa, Dr M.A.Afzal
- 3 Organic Chemistry for B.Sc students by B.S Bahl
- 4 Organic Chemistry by Khalid Masood Sheikh

INSTRUCTIONAL OBJECTIVES.

1. INTRODUCTION TO ORGANIC CHEMISTRY

- 1.1 Student will be able to understand organic chemistry.
 - 1.1.1 Define organic chemistry
 - 1.1.2 Differentiate between organic and inorganic compounds
 - 1.1.3 Give the application of organic chemistry daily life
- 1.2 Understand the general formula and functional groups of organic compounds
 - 1.2.1 Give general classification of organic compounds
 - 1.2.2 Write general formula for each class of organic compounds
 - 1.2.3 Write the functional group for each class of organic compounds

2. TYPES OF ORGANIC REACTIONS

- 2.1 Understand the types of organic reactions
 - 2.1.1 Enlist the types of organic reactions
 - 2.1.2 Explain substitution reaction
 - 2.1.3 Explain addition reaction
 - 2.1.4 Explain Elimination reaction
 - 2.1.5 Explain rearrangement reaction
 - 2.1.6 Give examples of different types of reaction

3. ISOMERISM

- 3.1 Understand isomerism
 - 3.1.1 Define isomerism
 - 3.1.2 Give types of isomerism in organic compounds
 - 3.1.3 Explain different isomeric forms
 - 3.1.4 Give examples of different isomeric forms

4. ALKANES

- 4.1 Understand the Hydrocarbons
 - 4.1.1 Define hydrocarbon
 - 4.1.2 Give classification of hydrocarbons
 - 4.1.3 Write general formula for hydrocarbons
 - 4.1.4 Explain homologous series
- 4.2 Understand the Nomenclature of organic compounds
 - 4.2.1 Explain conventional method of naming organic compounds
 - 4.2.2 Explain IUPAC system for naming organic compounds

- 4.2.3 Write names of organic compounds according IUPAC system
- 4.3 Understand the concept of alkanes
 - 4.3.1 Define alkanes
 - 4.3.2 Write general formula for alkanes and alkyl Radicals
 - 4.3.3 Name alkanes and alkyl radicals
 - 4.3.4 Explain general methods of preparation of alkanes
 - 4.3.5 Explain general properties of alkanes

5. ALKENES

- 5.1 Understand the concept of alkenes
 - 5.1.1 Define alkenes
 - 5.1.2 Name alkenes
 - 5.1.3 Explain general methods of preparation of alkenes
 - 5.1.5 Enlist the uses of ethene

6. ALKYNES

- 6.1 Understand the concept of alkynes
 - 6.1.1 Define alkynes
 - 6.1.2 Enlist different types of alkynes
 - 6.1.3 Explain the methods of preparation of acetylene
 - 6.1.4 Explain the properties of acetylene
 - 6.1.5 Give the uses of C_2H_2

7. ALKYL HALIDES

- 7.1 Understand the concept of alkyl halides
 - 7.1.1 Define alkyl halide
 - 7.1.2 Give the type of alkyl halides
 - 7.1.3 Name different alkyl halides
 - 7.1.4 Explain general methods of preparation of alkyl Halides
 - 7.1.5 Explain general properties of Alkyl Halides
 - 7.1.6 Enlist uses of alkyl Halides
- 7.2 Understand the concept of organometallic compounds
 - 7.2.1 Define organometallic compounds
 - 7.2.2 Explain the methods of preparation of Grignard Reagent ($R-Mg-X$)
 - 7.2.3 Explain the properties of $R-Mg-X$

8. ALCOHOLS

- 7.1 Define alcohol
- 7.2 Give classification of alcohols
- 7.3 Explain general methods of preparation of alcohols
- 7.4 Explain general properties of alcohols
- 7.5 Explain the methods of preparation of ethyl alcohol
- 7.6 Enlist the uses of ethyl alcohol

9. ETHERS

- 8.1 Define ether
- 8.2 Give general formula of ethers
- 8.3 Explain general methods of preparation of ethers
- 8.4 Explain general properties of ethers.

10. ALDEHYDES

- 9.1 Define aldehyde
- 9.2 Name different aldehydes
- 9.3 Explain general methods of preparation of aldehydes
- 9.4 Explain general properties of aldehydes
- 9.5 Enlist the uses of aldehydes

11. KETONES

- 11.1 Define ketone
- 11.2 Name different
- 11.3 Explain methods of preparation of acetone
- 11.4 Explain the properties of acetone
- 11.5 Enlist the uses of acetone

12. CARBOXYLIC ACIDS

- 12.1 Name different carboxylic acids
- 12.2 Give the types of carboxylic acids
- 12.3 Explain the general methods of preparation of mono carboxylic acids
- 12.4 Explain the properties of mono carboxylic acids
- 12.5 Enlist the uses of carboxylic acids

13. DERIVATIVES OF CARBOXYLIC ACID

- 13.1 Understand the concept acid chlorides
 - 13.1.1 Define acid chlorides
 - 13.1.2 Name acid chlorides
 - 13.1.3 Explain general methods of preparation of acid chlorides
 - 13.1.4 Explain general properties of acid chlorides

- 13.2 Understand the concept of acid anhydride

- 13.2.1 Define acid anhydride
- 13.2.2 Name acid anhydride
- 13.2.3 Give general methods of preparation of acetic anhydride
- 13.2.4 Give properties of acetic anhydride
- 13.2.5 Enlist the uses of acetic anhydride
- 13.3 Understand the concept of acid amide
 - 13.3.1 Define acid amide
 - 13.3.2 Name acid amides
 - 13.3.3 Explain general methods of preparation of acid amides
 - 13.3.4 Explain the properties of acid amides

14. ESTERS

- 14.1 Define esters
- 14.1 Name esters
- 14.1 Give general methods of preparation of esters
- 14.1 Give general properties of esters

15. AMINES

- 15.1 Define amine
- 15.2 Give classification of amines
- 15.3 Name different types of amines
- 15.4 Explain the method of preparation of primary amines
- 15.5 Explain the method of preparation of secondary amine
- 15.6 Explain the method of preparation of tertiary amine
- 15.7 Explain the general properties of amines

16. AROMATIC HYDROCARBONS

- 16.1 Define aromatic hydrocarbons
- 16.2 Differentiate between open chain (aliphatic) and close chain (aromatic) compounds
- 16.3 Give classification of aromatic compounds
- 16.4 Explain the nomenclature of aromatic compounds
- 16.5 Explain the methods of preparation of benzene
- 16.6 Explain the properties of benzene

17. PHENOLS

- 17.1 Define phenol
- 17.2 Explain the nomenclature of phenol
- 17.3 Explain general methods of preparation of phenol
- 17.4 Explain general properties of phenol

18. CARBOHYDRATES

- 18.1 Define carbohydrate

LIST OF PRACTICALS.

1. Detection of Sulphur, Nitrogen and halogens in the organic compounds.
2. Preparation and properties of methane.
3. Preparation and properties of Acetylene.
4. Preparation of iodoform
5. Preparation and properties of Acetic acid.
6. Preparation of Acetamide.
7. Preparation of Ethyle ether.
8. Preparation of Nitrobenzene.
9. Preparation of Acetone.
10. Chemical test of aldehyde.
11. Chemical test of Ketone.
12. Preparation of Urea from Ammonium cyanate
13. Preparation of oxalic acid from cane sugar.
14. Preparation of Acetadehyde.
15. Preparation and properties of methyl orange.
16. Preparation of aqueous fermic acid.
17. Preparation of Acetic Anhydride.
18. Preparation of Acetylene chloride.
19. Preparation of Ethyl Amine
20. Preparation of Ethyle benzene
21. Color reactions of proteins
22. Preparation of Ethyl bromide
23. Preparation of Ethyl Acetate
24. Preparation of chloroform from Acetone.
25. Determination of Amino Acids in Proteins.
26. Preparation of Aniline
27. Purification of organic substance by Soxhlet apparatus.
28. Reaction and test of Saccharide.

NOTE:- (Each experiment will be conducted in two consecutive periods)

OBJECTICES

1. Understand manufacturing procedure employed by modern chemical industries.
2. Understand the operation of the equipment necessary to carry out the chemical reaction on industrial scale.
3. Prepare the flow sheet diagram of chemical Industries.
4. To present each chemical industry from the view point of statistics of production, consumption and location in Pakistan.

COURSE CONTENTS

	HOURS
1. INTRODUCTION (INDUSTRIAL CHEMICAL PROCESS)	03
1.1 Unit operation and unit process, examples Batch process, continuous process.	
1.2 Flow charts.	
2 WATER CONDITIONING	18
2.1 Introduction to soft water, hard water, causes of water hardness	
2.2 Softening, purification and clarification (definition)	
2.3 Ion-Exchange method	
2.4 Sodium cation exchange process	
2.5 Mixed bed resins.	
2.6 Hydrogen cation exchange process	
2.7 Soda lime process (cold soda lime, Hot soda lime process)	
2.8 Deaeration of water and its importance.	
2.9 Demineralization and desalting of water	
2.10 Boiler feed water	
2.11 Industrial waste water	
2.12 Mineral water preparation	
3 CHLORO ALKALI INDUSTRIES	18
3.1 Introduction	
3.2 Manufacture of Soda ash, Raw material, Treatment of raw materials	
3.3 Flow chart of Slurry process	
3.4 Unit operations and unit processes.	
3.5 Manufacture of Sodium Bicarbonate.	

- 3.6 Flow sheet, unit operations and processes.
- 3.7 Uses of Sodium carbonate and Sodium bicarbonate.
- 3.8 Manufacture of caustic soda by electrolysis of NaCl, Pretreatment of NaCl solution.
- 3.9 Diaphragm cell method.
- 3.10 Mercury cell method
- 3.11 Membrane cell method.
- 3.12 Comparison of the three cell methods.
- 3.13 By-products of caustic soda manufacture.
- 3.14 Uses of chlorine and Hydrogen.
- 3.15 Manufacture of bleaching Powder.
- 3.16 Manufacture of Calcium hypochlorite.
- 3.17 Manufacture of Sodium hypochlorite
- 3.18 Manufacture of HCl as the by-products of chlorr-alkali industry
- 3.19 Unit operations and unit processes involved.
- 3.20 Uses of HCl

4 SULPHURIC ACID

12

- 4.1 Formula, uses and importance in industrial developments
- 4.2 Raw materials
- 4.3 Brief introduction of Lead Chamber Process
- 4.4 Sulphuric acid manufacturing by contact process and its flow sheet
- 4.5 Unit operations and unit processes
- 4.6 Treatment of vent gas of contact process
- 4.7 Energy requirements

5 AMMONIA

09

- 5.1 Ammonia, uses, economics.
- 5.2 Manufacture of Ammonia from Natural gas.
- 5.3 Steam-Natural gas reforming, Primary reforming, Secondary reforming.
- 5.4 Shift conversion.
- 5.5 CO₂ absorption and separation
- 5.6 Removal of Carbon monoxide.
- 5.7 Compression of N₂ and H₂
- 5.8 Ammonia synthesis, Ammonia converter (equipment)
- 5.9 Flow chart
- 5.10 Unit operations and unit processes
- 5.11 Liquefaction of Ammonia.
- 5.12 Storage of Ammonia
- 5.13 Manufacture of Nitric Acid from Ammonia, flow sheet
- 5.14 Unit operations and unit processes.

6	AMMONIUM NITRATE	06
6.1	Manufacture of Ammonium Nitrate, Raw material, Flow sheet	
6.2	Unit operations and unit processes	
6.3	Uses of Ammonium Nitrate and its storage.	
7	UREA	06
7.1	Formula uses, Raw material.	
7.2	Flow sheet	
7.3	Unit operations and unit processes	
7.4	Prilling Tower and Prilling of Urea.	
8	PHOSPHATE FERTILIZERS	02
8.1	MAP, DAP formula, uses.	
8.2	Raw materials, Processing of phosphate rock	
8.3	Flow diagram	
8.4	Unit operations and unit processes	
9	PORTLAND CEMENT	09
9.1	Portland cement	
9.2	Raw materials	
9.3	Manufacture method, Dry process	
9.4	Flow sheet (Dry process)	
9.5	Unit operations and unit processes	
9.6	Kiln (living and heating zones) reactions.	
9.7	Setting and Hardening of cement	
9.8	Different types of cement	
10	LIME	03
10.1	Lime, formula, uses.	
10.2	Calcination of lime stone, unit operations and unit processes	
10.3	Slacked lime manufacture.	
11	GYPSUM	03
11.1	Formula, uses, processing of Rock	
11.2	Preparation of gypsum, chemical reactions	

- 11.3 Uses of plaster of paris.
- 11.4 Hardening of plaster

12 PETROLEUM INDUSTRY

09

- 12.1 Introduction to Petroleum and its constituents
- 12.2 Natural gas.
- 12.3 Liquified Petroleum Gas (LPG)
- 12.4 Compresed Natural Gas (CNG)
- 12.5 Products of refining
- 12.6 Conversion process, cracking or pyrolysis
- 12.7 Reforming, catalytic reforming
- 12.8 Polymerization
- 12.9 Alkylation.
- 12.10 Isomenization.

RECOMMENDED BOOK

1. Austin George T. (1997), "Shreve's Chemical Process Industries" 6th Ed. McGraw-Hill International Edition.
2. Alan Heaton (1994), "The Chemical Industry" 2nd Ed. Published by Blackie Academic & Professional
3. Haidari Iqbal (1992), "Chemical Industry in Pakistan", Industrial Research Service Karachi.
4. Pandey G. N. (2000), "A Textbook of Chemical Technology" 2nd Ed. Vol-I & II Vikas Publishing House (Pvt) Limited.
5. Kirk Othmer (1999), "Encyclopedia of Chemical Technology" Wiley Inter Science Publishers.
6. Government of Pakistan. (2003), "Prospects of Chemical Industry in Pakistan" Expert Advisory Cell, Ministry of Industries and Production, Islamabad.
7. Moulijn Jacob A, Makkee Michiel, Diepen Annelies Van, (2007), "Chemical Process Technology:" John Wiley & Sons, Ltd.
8. James A. Kent (2003), "Riegel Handbook of Industrial Chemistry", 10th Ed. Springer/Van Nostrard Reinhold

INSTRUCTIONAL OBJECTIVES**1. INTRODUCTION****1.1UNIT PROCESS**

- 1.1.1 Define unit process
- 1.1.2 Give examples of nit process
- 1.1.3 Distinguish unit operation and unit process
- 1.1.4 Explain continuous process with examples.
- 1.1.5 Explain batch process with examples

1.2FLOW CHARTS

- 1.2.1 Name types of flow charts.
- 1.2.2 Distinguish between block diagram and symbolic diagram.
- 1.2.3 Read different flow charts.

2. WATER CONDITIONING**2.1water conditioning**

- 2.1.1 Enlist impurities of water.
- 2.1.2 Name salts responsible for water hardness
- 2.1.3 Give water softening methods.
- 2.1.4 Explain water purification
- 2.1.5 Describe clarifications

2.2Ion exchange methods

- 2.2.1 Enlist resins used for ion exchange method
- 2.2.2 Describe ion exchange method
- 2.2.3 Explain regeneration of resins
- 2.2.4 Give reactions involved in Ion-exchange method.

2.3sodium cation exchange

- 2.3.1 Enlist uses of soft water.
- 2.3.2 Describe water softening by sodium cation exchange process

2.4mixed bed resins.

- 2.4.1 Name mixed bed resins
- 2.4.2 Explain mixed bed resins refining of water.

2.5hydrogen cation exchange process

- 2.5.1 Give formula of hydrogen cation exchange
- 2.5.2 Draw flow sheet diagram for hydrogen-cation exchange process.
- 2.5.3 Explain hydrogen cation exchange process

2.6soda lime process and phosphate conditioning

- 2.6.1 Describe soda lime process

- 2.6.2 Explain cold soda lime process
- 2.6.3 Explain phosphate conditioning.
- 2.7 de-aeration of water.
 - 2.7.1 Define term de-aeration
 - 2.7.2 Give the importance of de-aeration for boiler water
 - 2.7.3 Explain de-aeration methods.
- 2.8 demineralization and de-salting
 - 2.8.1 Enlist minerals in water
 - 2.8.2 Describe demineralization
 - 2.8.3 Explain de-salting.

2. CHLORALKALI INDUSTRIES

- 3.1 Chloro-alkali industries.
 - 3.1.1 Define chloro-alkali
 - 3.1.2 Enlist the products of chloro-alkali industries.
 - 3.1.3 Enlist the chloro-alkali industries in Pakistan
- 3.2 soda ash manufacture
 - 3.2.1 Name the process of soda ash manufacture
 - 3.2.2 Give raw materials used for soda ash manufacture by Solvay process
 - 3.2.3 Define brine solution
 - 3.2.4 Explain purification of brine solution
- 3.3 Draw flow sheet.
 - 3.2.1 Draw flow sheet of Solvay process for manufacture of soda ash.
 - 3.2.2 Enlist unit operations of soda ash manufacture.
 - 3.2.3 Explain unit process of soda ash manufacture
 - 3.2.4 Give uses of soda ash.
- 3.4 sodium bi carbonate manufacture
 - 3.4.1 Give commercial name of sodium bi carbonate
 - 3.4.2 Give raw material used for sodium bi carbonate manufacture
 - 3.4.3 Draw flow sheet of sodium bicarbonate manufacture
 - 3.4.4 Enlist unit operation and unit processes
 - 3.4.5 Explain unit process of sodium bi carbonate manufacture.
 - 3.4.6 Enlist uses of sodium bi carbonate
- 3.5 Caustic soda manufacture.
 - 3.5.1 Give chemical name of caustic soda
 - 3.5.2 name methods of caustic soda manufacture
 - 3.5.3 Name cells used for caustic soda manufacture
 - 3.5.4 Draw diagram of diaphragm cell
 - 3.5.5 Draw flow sheet for the manufacture of caustic soda using diaphragm cell
 - 3.5.6 Name unit operations for caustic soda manufacture by diaphragm cell
 - 3.5.7 Explain unit processes for caustic soda manufacture by diaphragm cell

- 3.5.8 Draw diagram of mercury cell
- 3.5.9 Draw flow sheet for the manufacture of caustic soda by mercury cell
- 3.5.10 Enlist unit operation for manufacture of caustic soda by mercury cell
- 3.5.11 Describe unit processes for manufacture of caustic soda by mercury cell
- 3.5.12 Draw diagram of membrane cell
- 3.5.13 Draw flow sheet for the manufacture of caustic soda by membrane cell
- 3.5.14 Name unit operations for the manufacture of caustic soda by membrane cell
- 3.5.15 Describe nit process for manufacture of caustic soda by mercury cell
- 3.5.16 Give the comparison of the three cells used for caustic soda manufacture.
- 3.5.17 Give the byproducts of caustic soda manufacture.
- 3.5.18 Illustrate uses of chlorine
- 3.5.19 Give uses of hydrogen

- 3.6 bleaching power manufacture
 - 3.6.1 Enlist raw materials for bleaching powder manufacture.
 - 3.6.2 Draw flow sheet for bleaching powder manufacture.
 - 3.6.3 Explain bleaching power manufacture
 - 3.6.4 Name unit operations of bleaching powder manufacture
 - 3.6.4 Name unit operations of bleaching powder manufacture.
 - 3.6.5 Give uses of bleaching power manufacture.

- 3.7 calcium hypochlorite manufacture.
 - 3.7.1 Describe raw material for the calcium hypochlorite manufacture
 - 3.7.2 Draw flow sheet for calcium hypochlorite manufacture
 - 3.7.3 Explain calcium hypochlorite manufacture.
 - 3.7.4 Give unit operation for calcium hypochlorite manufacture.
 - 3.7.5 Enlist uses of calcium hypochlorite.

- 3.8 sodium hypochlorite manufacture
 - 3.8.1 Give raw materials for soda hypochlorite manufacture.
 - 3.8.2 Draw flow sheet for the manufacture of sodium hypochlorite
 - 3.8.3 Enlist unit operations for sod hypochlorite manufacture.
 - 3.8.4 Enlist uses of sod hypochlorite.

- 3.9 hydrochloric acid manufacture
 - 3.9.1 Define muriatic acid (HCl)
 - 3.9.2 Enlist methods of manufacture of hydrochloric acid
 - 3.9.3 Draw flow sheet for hydrochloric acid manufacture by synthesis process.
 - 3.9.4 Enlist unit operation for hydrochloric acid manufacture by synthesis
 - 3.9.5 Explain unit process for hydrochloric acid manufacture by synthesis
 - 3.9.6 Enlist uses of hydrochloric acid

4. **SULPHURIC ACID**

- 4.1 sulfuric acid manufacture.
 - 4.1.1 Define oil of vitriol (H_2SO_4)

- 4.1.2 Give formula of Sulphuric Acid
- 4.1.3 Give formula of Sulphuric Acid
- 4.1.4 Enlist uses of sulphuric acid
- 4.1.5 Illustrate importance of sulfuric acid in industrial development
- 4.1.6 Enlist raw materials for sulfuric acid manufacture
- 4.1.7 Name methods for sulphuric acid manufacture.
- 4.1.8 Draw flow sheet diagram for sulfuric acid manufacture by lead chamber process.
- 4.1.9 Enlist unit operations for lead chamber process
- 4.1.10 Describe unit process of lead chamber process.
- 4.1.11 Draw flow sheet for sulfuric acid manufacture by contact process
- 4.1.12 Enlist unit operation for contact process
- 4.1.13 Explain unit processes for contact process.
- 4.1.14 Enlist vent gases of contact process
- 4.1.15 Illustrate vent gases treatment of contact process.
- 4.1.16 Give energy requirements for contact process.

5. AMMONIA

5.1 ammonia and nitric acid manufacture.

- 5.1.1 Enlist uses of ammonia
- 5.1.2 Name method used for ammonia manufacture.
- 5.1.3 Give raw materials for Ammonia manufacture by synthesis process.
- 5.1.4 Enlist the steps involved in the manufacture of Ammonia from natural gas.
- 5.1.5 Define reforming of natural gas.
- 5.1.6 Describe primary reforming
- 5.1.7 Explain secondary reforming
- 5.1.8 Explain shift conversion
- 5.1.9 Describe carbon di oxide absorption
- 5.1.10 Illustrate separation of carbon di oxide
- 5.1.11 Describe removal of carbon mono oxide before ammonia manufacture.
- 5.1.14 Draw diagram of Ammonia convertor
- 5.1.15 Describe unit process of Ammonia convertor
- 5.1.16 Draw flow sheet for Ammonia manufacture from natural process.
- 5.1.17 Describe unit processes involved in ammonia manufacture.
- 5.1.18 Illustrate liquefaction of ammonia
- 5.1.19 Describe storage of liquid ammonia
- 5.1.10 Name the method used for the manufacture of nitric acid from ammonia.
- 5.1.21 Draw flow sheet for manufacture of nitric acid from ammonia
- 5.1.22 Explain unit operation involved in nitric acid manufacture.
- 5.1.23 Explain unit processes involved in nitric acid manufacture.

6. AMONIUM NITRIATE

6.1 ammonium nitrate manufacture

- 6.1.1 Describe raw materials for ammonium nitrate manufacture.
- 6.1.2 Draw flow sheet for ammonium nitrate manufacture.
- 6.1.3 Enlist unit operations involved in ammonium nitrate manufacture.
- 6.1.4 Explain unit processes involved in ammonium nitrate manufacture.
- 6.1.5 Give uses of ammonium nitrate
- 6.1.6 Explain storage of ammonium nitrate.

7. UREA.

7.1 urea manufacture.

- 7.1.1 Write formula of urea
- 7.1.2 Enlist uses of urea
- 7.1.3 Draw flow sheet for urea manufacture
- 7.1.4 Describe unit operations involved in urea manufacture
- 7.1.5 Explain unit processes involved in urea manufacture
- 7.1.6 Explain prilling of urea

8 PHOSPHATE FERTILIZER

8.1 mono ammonium phosphate and di-ammonium phosphate 8.1.1

Give formula of mono ammonium phosphate

- 8.1.2 Write formula of di ammonium phosphate
- 8.1.3 Enlist uses of ammonium phosphate
- 8.1.4 Enlist raw materials of ammonium phosphate
- 8.1.5 Describe beneficiation of phosphate rock
- 8.1.6 Draw flow sheet for manufacture of ammonium phosphate
- 8.1.7 Describe unit operations involved in ammonium phosphate manufacture
- 8.1.8 Explain unit process involved in ammonium phosphate manufacture

9 PORT LAND CEMENT

9.1 Portland cement manufacture

- 9.1.1 Define Portland cement
- 9.1.2 Enlist uses of cement
- 9.1.3 Enlist raw materials
- 9.1.4 Name methods of cement manufacture
- 9.1.5 Draw flow sheet for cement manufacture by dry process
- 9.1.6 Describe unit operations involved in cement manufacture by dry process
- 9.1.7 Give different zone in rotary kiln
- 9.1.8 Enlist unit operation involved in cement manufacture by semi wet process
- 9.1.9 Distinguish between rotary kiln for dry process and wet process
- 9.1.10 Illustrate physical properties of clinkers
- 9.1.11 Explain briefly the function of gypsum in cement
- 9.1.12 Describe hardening of cement
- 9.1.13 Name various types of cement
- 9.1.14 Describe various type of cement

10 LINE

10.1 lime processing

- 10.1.1 Write formula for lime
- 10.1.2 Enlist uses of lime
- 10.1.3 Enlist unit operation involved in lime processing
- 10.1.4 Describe Unit processes involved in lime processing

11 GYPSUM

11.1 gypsum processing

- 11.1.1 Write formula of gypsum
- 11.1.2 Enlist uses of gypsum
- 11.1.3 Describe calcination of gypsum
- 11.1.4 Enlist uses of plaster
- 11.1.5 Describe hardening of plaster

12 PETROLEUM INDUSTRY

12.1 petroleum industry

- 12.1.1 Enlist constituents of petroleum
- 12.1.2 Give composition of natural gas
- 12.1.3 Describe unit operations and unit processes for processing of natural gas

- 12.1.3 Enlist uses of natural gas
- 12.2 the LPG
 - 12.2.1 Define L.P.G.
 - 12.2.2 Draw flow sheet for L.P.G manufacture
 - 12.2.3 Explain steps involved in L.P.G. manufacture
- 12.3 the CNG
 - 12.3.1 CNG station machinery
 - 12.3.2 CNG properties
 - 12.3.3 Hazards
 - 12.3.4 Metering
- 12.4 Refining of Petroleum
 - 12.4.1 Define refining
 - 12.4.2 Explain refining of petroleum
 - 12.4.3 Enlist petroleum refining products
 - 12.4.4 Explain cracking or pyrolysis
 - 12.4.5 Give examples of pyrolysis
 - 12.4.6 Explain reforming
 - 12.4.7 Explain catalytic reforming
 - 12.4.8 Explain polymerization
 - 12.4.9 Give examples of polymerization
 - 12.4.10 Give examples of alkylation
 - 12.4.11 Explain isomerization
 - 12.4.12 Give examples of isomerization

LIST OF PRACTICALS.

1. Detection of soft and hard water.
2. Determination of hardness of water.
3. Determination of dissolved oxygen in water.
4. Determination of total chlorides in water.
5. Determination of sulphates contents in water.
6. Determination of carbonates in water.
7. Determination of bi-carbonates in water.
8. Determination of iron contents in water.
9. Determination of calcium contents in water.
10. Preparation of Ammonium Nitrate in lab.
11. Preparation of Ammonium Sulphate in lab.
12. Purification by crystallization.
13. PH value determination.
14. Preparation of lime by the calcination of lime stone
15. Preparation of plaster of Paris from gypsum.
16. Demineralization of water.
17. Analysis of mineral water

CHT- 263 QUANTITATIVE ANALYSIS

T **P** **C**
1 **6** **3**

COURSE CONTENTS

HOURS

1	INTRODUCTION	02
1.1	Definition and its importance in daily life and Industrial importance	
1.2	Types of analysis, Qualitative analysis, Quantitative analysis, Volumetric analysis, Gravimetric analysis	
1.3	Instrumental methods of analysis, conventional methods of analysis	
2.	SAMPLING	02
2.1	Sampling techniques for liquid, solid and gas samples.	
2.2	Storage of sample.	
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3.1	Personal errors.	
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3.3	Indeterminate errors.	
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5.2	Standard solutions.	
5.3	Methods of expression of concentration.	

- 5.4 Equivalent weight, Molecular weight.
- 5.5 Calculation of equivalent weight of acids.
- 5.6 Calculation of equivalent weight of bases.
- 5.7 Calculation of equivalent weight of oxidizing compounds.
- 5.8 Calculation of equivalent weight of reducing compounds.
- 5.9 Normal solution and Normality
- 5.10 Molar solution and Molarity
- 5.11 Molal solution and Molality
- 5.12 Preparation of solutions of different normalities.
- 5.13 Preparation of solution of different molalities.

6.PREPARATION OF INDICATORS

03

- 6.1 Internal indicator.
- 6.2 External indicator.
- 6.3 Universal indicator.
- 6.4 Behavior of different indicators in acidic solutions and in basic solutions.
- 6.5 Preparation of indicator solution.
(Phenolphthalein, methyl orange, methyl red, methyl blue, litmus solution, starch solution, phenyl amine).

7.VOLUMETRIC ANALYSIS

08

- 7.1 Types of volumetric analysis (on the bases of reagent used).
- 7.2 Acidmetry - alkalimetry.
- 7.3 Redox - titration.
- 7.4 Iodometry.
- 7.5 Iodimetry
- 7.6 Argentometry.
- 7.7 Apparatus for volumetric analysis.
- 7.8 Mathematical calculations based on $N_1V_1 = N_2V_2$ and amount per liter = Normality * equivalent weight.

8. GRAVIMETRIC ANALYSIS

08

- 8.1 Apparatus for gravimetric analysis.
- 8.2 Free water contents, combined water contents (water of crystallization)
- 8.3 Determination of free and combined water gravimetrically.
- 8.4 Desiccants and use of desiccator.
- 8.5 Gravimetric determination of silver.
- 8.6 Gravimetric determination of magnesium.
- 8.7 Gravimetric determination of calcium.
- 8.8 Gravimetric determination of silica.
- 8.9 Gravimetric analysis of cement.

Percentage.

Gram per liter.

Parts per million (PPM)

Parts per billion (PPM)

RECOMMENDED BOOKS

1. Samuel H. Maron & Jerome B. Lando. (1974), "Fundamentals of Physical Chemistry" Mecomillan Publishing Co. Inc.
2. Barrow, Gordon M. (1996), "Physical chemistry". 6th Edition, New York: McGraw-Hill
3. Pashley, Richard M., Karaman, Marilyn E. (2004), "Applied Colloid and Surface Chemistry", New York, John Wiley and sons.
4. Bhal B.S., Tuli, G.D., Bhat A. (2006), "Essentials of Physical Chemistry".
5. Silbey R, R.A. Alberty, M.G, Bawendi, (2006), "Physical Chemistry", 4th Edition, Wiley India.
6. Gabor A. S. Yimin Li, (2010), "Introduction to Surface Chemistry and Catalysis, 2nd Edition, Wiley&Sons.

INSTRUCTIONAL OBJECTIVES.

1 INTRODUCTION

- 1.1 Define quantitative analysis.
- 1.2 Illustrate importance of quantitative analysis.
- 1.3 Distinguish qualitative analysis and quantitative analysis.
- 1.4 Explain volumetric analysis.
- 5.14 Describe gravimetric analysis.
- 1.6 Define instrumental methods of analysis.

2 SAMPLING

- 2.1 Define sampling.
- 2.2 Describe methods of sampling.
- 2.3 Explain sampling of liquids for liquid, solid and gas liquids.
- 2.4 Illustrate storage of samples.

3 ERRORS IN ANALYSIS

- 3.1 Enlist errors in analysis.
- 3.2 Explain personal error.
- 3.3 Describe determinate error.
- 3.4 Illustrate indeterminate error.
- 3.5 Detect different errors.

4 ANALYTICAL PROCEDURES

- 4.1 Describe working principle of electric balance.
- 4.2 Explain weighing operation.
- 4.3 of volume using burette, Illustrate measurement
Pipette and measuring
flask.
- 4.4 Prepare sample solution.
- 4.5 Explain Titration.
- 4.6 Describe precipitation.
- 4.7 Explain filtration.
- 4.8 Illustrate drying.
- 4.9 Explain ignition.
- 4.10

5 PREPARATION OF STANDARD SOLUTION

- 5.1 Define primary standard.
- 5.2 Define secondary standard.
- 5.3 Define equivalent weight.
- 5.4 Describe standard solution.
- 5.5 Enlist methods of expression of solution concentration.
- 5.6 Calculate equivalent weight of different compounds.
- 5.7 Explain Normal solution.
- 5.8 Explain terms of solution concentration like normality, molarity and formality.
- 5.9 Prepare solution of different normalities.
- 5.10 Prepare solution of different molarities
- 5.11 Calculate normality and molarity

6 INDICATOR

- 6.1 Define indicator.
- 6.2 Distinguish internal indicator.
- 6.3 Describe universal indicator.
- 6.4 Illustrate behavior of different indicators in acidic/basic solutions.
- 6.5 Prepare different indicators (like phenolphthalein, methyl orange, starch, litmus solution and diphenylamine).

7 VOLUMETRIC ANALYSIS

- 7.1 Define volumetric analysis.
- 7.2 Enlist type of reagent based volumetric analysis.
- 7.3 Describe acidimetry, alkalyimetry.
- 7.4 Explain redox titrations.
- 7.5 Distinguish Iodoimetry and iodimetry.
- 7.6 Explain argentometry.
- 7.7 Solve problems based on $N_1 V_1 = N_2 V_2$
- 7.8 Solve problems based on
Amount/liter = Normality x Equivalent weight.

8 GRAVIMETRIC ANALYSIS

- 8.1 Define gravimetric analysis.
- 8.2 Describe gravimetric analysis apparatus.
- 8.3 Calculate free water content.
- 8.4 Calculate water of crystallization.
- 8.5 Explain desiccator.

- 8.6 Enlist desiccants.
- 8.7 Determine magnesium from given sample.
- 8.8 Determine calcium from given sample.
- 8.9 Determine silica from given sample.
- 8.10 Cement analysis

9 REPORTING OF ANALYSIS RESULTS

- 9.1 Define percentage.
- 9.2 Define gram per liter.
- 9.3 Describe parts per million.
- 9.4 Describe parts per billion.

LIST OF PRACTICALS.

1. Calibration of
 - i. Burette
 - ii. Measuring cylinder.
 - iii. Measuring flask
 - iv. Pipette.
2. Weighing practice on analytical balance.
3. Weighing practice on digital balance.
4. Preparation of N/10 solution of primary standard Na_2CO_3 , Oxalic Acid)
5. Calculation method for preparation of N/10 (approximate) solution of secondary standard (NaOH, H_2SO_4).
6. Determination of normality of approximately prepared solution by titrating against some standard solution. HCl, H_2SO_4 and Nowlt solution
7. Preparation of indicator solution.
 - i. Phenolphthalein solution.
 - ii. Methyl orange solution.
 - iii. Litmus solution.
 - iv. Starch solution.
 - v. Diphenyl amine.
8. Determination of equivalent weight if an organic acid (oxalic acid)
9. Determination of acetic acid in vinegar.
10. Determination of alkaline value of soda ash.
11. Determination of percentage of NaOH and Na_2CO_3 in the mixture of two bases.
12. Preparation of (approx.) M/20 KMnO_4 solution.
13. Standardizing the M/20 KMnO_4 solution
14. Determination of iron contents in iron wire.
15. Determination of Fe^{+2} and Fe^{+3} in the iron salt.
16. Redox titration using external indicator.
17. Redox titration using internal indicator.
18. Standardization of 0.1 N iodine solution with $\text{Na}_2\text{S}_2\text{O}_3$ sol.
19. Standardization of $\text{Ba}_2\text{S}_2\text{O}_3$ solution versus a known iodine sol.
20. Determination of antimony in antimony salt.
21. Determination of available chlorine in bleaching powder.
22. Determination of chlorine in soluble salt by volhards method.
23. Estimation of chloride in a given sample of NaCl by AgNO_3 by using moters methods.
24. Gravimetric determination of free water (moisture contents) and combined water (water crystallization)
25. Analysis of cement.
 - i. Determination of percentage loss on ignition.
 - ii. Determination of percentage of total silica.
 - iii. Determination of percentage of insoluble residue.
 - iv. Determination of percentage of moisture contents.
 - v. Determination of percentage of calcium contents.
 - vi. Determination of percentage magnesium contents.

CHT- 271 SAFETY PRACTICE AND PROCEDURE

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OBJECTIVES

1. To acquaint students with causes of accidents in industry and instruct them how to eliminate hazards.
2. To train students in a fundamentals of fire protection.
3. To introduce students to the fundamentals of first aid.
4. To promote in students and value of plants layout for safe performance.
5. To provide the students ready reference of outstanding accepted safe standards, codes and technical aids.

COURSE CONTENTS

1. Introduction to safety and its place in industry.
2. Accidents and accident costs.
3. Analyzing causes of accidents.
4. Fundamentals of accident prevention.
5. Industrial noise and its control, illumination for safety and comfort.
6. Industrial hygiene and sanitation.
7. Personnel protective equipment.
8. Fire hazards and causes
9. Hazards symbols
10. Plant layout for fire safety
11. Importance of plant maintenance and housekeeping safety.
12. Plant inspection and safety inventory.
13. Case studies:
 - i. Mines Coal and salt mines.
 - ii. Petroleum industry.
 - iii. Paint industry and paint shops.
 - iv. Paper and board mills.
 - v. Printing industry.
 - vi. Food processing industry.
 - vii. Vegetable oil and soap industry.
 - ix. Caustic alkali industry.
 - x. Fertilizers (Ammonia, Urea, Nitrate) industry
 - xi. Plastic and fiber industry.
 - xii. Power plants.
14. Antidotes of different chemicals.
15. First aid, extended medical services.

16. Employees training in safe practices, methods of promoting safety. With special attention on women and employees.
17. Accident investigation, Record and Report.

BOOKS RECOMMENDED.

1. Industrial Accident prevention.
2. Pakistan Labour.

INSTRUCTIONAL OBJECTIVES

1. INTRODUCTION

- 1.1 safety in chemical industry.
- 1.2 philosophy of accidents.
 - 1.1.1 Define accident
 - 1.1.2 Enlist various types of accidents.
 - 1.1.3 Explain accident analysis
 - 1.1.4 Explain master sheet and work sheet of accident analysis.
 - 1.1.5 Name remedial/prevention measures.
 - 1.1.6 Explain facts in selection preventions
 - 1.1.7 Describe causes of attach
- 1.1.8 Explain preventive measures in chemical industries, like petroleum, paints, paper and board printing industries. Food processing
 - Vegetable oils and Ghee
 - Acid and alkali industry
 - Fertilizers urea, Ammonia Ammonium Nitrate
 - Plastics and Fibre Industry
 - Power plants

2 ACCIDENT COST

- 2.1 Accident cost.
 - 2.1.1 Various types of accidents in various chemical industry.
 - 2.1.3 Explain laws of the cost of accidents
 - 2.1.4 Describe location where accident has occurred, like
 - At work place
 - Running machinery
 - Reaction vessels/Reactors
 - 2.1.5 Explain management role of reliance
 - 2.1.6 Differentiate the responsibility of safety engineer and supervisor.
 - 2.1.7 Explain degree of responsibility.
 - 2.1.8 Explain the use of Gloves, Apron, Goggles and masks in health hazardous atmosphere (Antidotes of chemical)
 - 2.1.9 Calculate cost of lost of time of (n) used employee.
 - 2.1.10 Commute in terms of money cost of time lost by other employees who stop work
 - 2.1.11 Calculate the cost of time spent by first aid attendant and hospital department staff.
 - 2.1.12 Explain Insurance rules for various injuries like
 - Loss of nail of a finger
 - Cuts on hands and face
 - Slips and falls Handling of toxic material
 - Miscellaneous operations and calculate compensation medical cost on the basis of set formula

3 EMPLOYEES TRAINING

- 3.1 training of employees.
 - 3.1.1 Define training and education of an employee.
 - 3.2.2 Explain safety educational method

- 3.3.3 Enlist various methods of training and education.
- 3.4.4 Describe planned training with examples.
- 3.5.5 Differentiate between, education training and supervision of an employee.
- 3.6.6 Explain safety organization(Industry) as educational medium to avoid accidents for women workers.

4 ACCIDENT INVESTIGATION RECORD AND REPORT

- 4.1 Accident Investigation terminology and maintain record of reports.
 - 4.1.1 Define accident investigation.
 - 4.1.2 Describe the accident fully, whether the injured person fell or was struck
 - 4.1.3 Narrate various factors of accident
 - 4.1.4 Name the machine, tool, appliance, gas, liquid involved in accident
 - 4.1.5 State of motors, pulley's gears etc.
 - 4.1.6 Enlist total number of such accidents occurred in an year.
 - 4.1.7 Specify remedial measures in the form of a report such as
 - Better illumination needed.
 - Better ventilation.
 - Providing goggles.
 - Enforcing instruction especially to women/men who work on plant operations.
 - 4.1.8 Explain the importance of training of an employee.

5 INDUSTRIAL NOISE AND CONTROL

- 5.1 Industrial noise and control.
 - 5.1.1 Define Industrial noise.
 - 5.1.2 Enlist types of noise with frequency.
 - 5.1.3 Explain the complexity of noise on worker in a chemical industry.
 - 5.1.4 Describe causes of noise.
 - 5.1.5 Explain the relationship of noise to accident and prevention.
 - 5.1.6 Explain noise standards.
 - 5.1.7 Describe medical view point on noise and its control.
 - 5.1.8 Explain control medium of noise.

6 INDUSTRIAL HYGIENE AND PLANT SANITATION

- 6.1 Industrial Hygiene and sanitation.
 - 6.1.1 Define Industrial Hygiene and sanitation.
 - 6.1.2 Name various Hygiene and sanitation methods.
 - 6.1.3 Explain all methods and its effect upon accident prevention.

7 FIRE PREVENTION HAZARDS

- 7.1 fire hazards and prevention.
 - 7.1.1 Define fire hazards.
 - 7.2.2 Enlist types of fires in a chemical Industry.
 - 7.2.3 Name fire fighting and extinguishing equipments.
 - 7.2.4 Explain origin of the fire.
 - 7.2.5 Describe fire resistive designs and construction/equipments.
 - 7.2.6 Explain method of fire prevention.
 - 7.2.7 Explain the use of fire extinguish and the chemicals it contains.
 - 7.2.8 Describe the use of chemical to avoid accidents due to fire.

OBJECTIVES.

1. the scientific methods as applied to the development of the laws of chemistry and physics.
2. Techniques for the control of chemical phenomenon from the study of laws of chemistry and physics.
3. Acquire the techniques used in analytical methods.

COURSE CONTENTS.

- 1. THERMOCHEMISTRY. 06**
 - 1.1 Introduction.
 - 1.2 Exothermic and endothermic reaction.
 - 1.3 Heat of Reaction.
 - 1.4 Factor affecting heat of reaction
 - 1.5 Heat of formation.
 - 1.6 Heat of combustion.
 - 1.7 Application of heat of combustion.
 - 1.8 Heat of Neutralization.
 - 1.9 Hess's law of constant heat summation.
- 2. THERMODYNAMICS. 04**
 - 2.1 First law of thermodynamics.
 - 2.2 Heat changes at constant pressure and at constant volume.
- 3. SOLUTION. 12**
 - 3.1 Solution, types of solutions.
 - 3.2 Concentration.
 - 3.3 Normality, Normal solution.
 - 3.4 Molarity, Molar solution Molality.
 - 3.5 Percentage composition.
 - 3.6 Properties of solution.
 - 3.7 Electrolytes.
 - 3.8 Definition of solubility.
 - 3.9 Effect of temperature and pressure on solubility.
 - 3.10 Elevation of boiling point and its applications.
 - 3.11 Depression of freezing point and its applications.
- 4. COLLOIDAL STATE. 08**
 - 4.1 Preparation of colloidal solutions.
 - 4.2 Properties of colloidal solutions.
 - 4.3 Application of colloidal chemistry in industry.
- 5. PHOTOCHEMISTRY. 06**
 - 5.1 Sources of photochemical reactions.
 - 5.2 Photochemical reaction.
 - 5.3 Laws of photochemistry.
 - 5.4 Measurement of intensity of Radiation.

5.5	Photosensitisation.	
5.6	Photosynthesis.	
5.7	Photophysical phenomena. Luminescence	
	Phosphorescence.	
5.8	Application of photochemistry.	
6.	ELECTROCHEMISTRY.	06
6.1	Electrolytes and electrolysis.	
6.2	Electrolytes and Ohm's Law.	
6.3	Conductivity of electrolytes.	
6.4	Faraday's Law of electrolytes.	
6.5	Effect of dilution on conductivity.	
6.6	Measurement of conductivity.	
7.	RADIOACTIVITY.	10
7.1	Natural radioactivity.	
7.2	Artificial radioactivity.	
7.3	Properties of A-ray.	
7.4	Properties of B-rays.	
7.5	Properties of R-rays.	
7.6	Protons, neutrons and alpha emission	
7.7	Positrons and other particles discovered.	
7.8	Detection and measurement of Radioactivity.	
7.9	Nuclear fission and its application.	
7.10	Nuclear fusion and its applications.	
7.11	Radioactive disintegration series.	
7.12	Isotopes with examples.	
7.13	Isobars with examples.	
8.	CHEMICAL KINETICS.	06
8.1	Velocity of a chemical reaction.	
8.2	Reaction rate and velocity constant.	
8.3	Factors which affect reaction rate	
9.	CHEMICAL EQUILIBRIUM.	06
9.1	Law of mass action.	
9.2	Equilibrium mixtures and measurement of equilibrium constant.	
9.3	Hydrolysis of bicarbonates.	
9.4	Reaction between an organic acid and an alcohol reaction between hydrogen and iodine.	
9.5	Application of equilibrium constant.	
9.6	Effect of temperature, pressure, concentration and catalyst.	

RECOMMENDED BOOKS.

1. Chemistry for Class XI
Published by Punjab Text Book Board, Lahore.
2. Essentials of Physical Chemistry by B.S. Bhal, G.D. Tuli.

INSTRUCTIONAL OBJECTIVES.**1. PHYSICAL CHEMISTRY**

1.1chemistry

- 1.1.1 Define thermo chemistry
- 1.1.2 Distinguish exothermic and endothermic reactions.
- 1.1.3 Give examples of exothermic and endo thermic reactions.
- 1.1.4 Explain heat of reaction
- 1.1.5 Enlist factors affecting heat of reaction
- 1.1.6 Describe heat of formation
- 1.1.7 Illustrate heat of combustion
- 1.1.8 Enlist heat of combustion application
- 1.1.9 Describe heat of neutralization
- 1.1.10 State Hess's law of constant heat summation
- 1.1.11 Solve problems based on Hess's law

2 THERMODYNAMICS

2.1thermodynamics

- 2.1.1 State first law of thermodynamics
- 2.1.2 Calculate heat changes at constant volume
- 2.1.3 Calculate heat change at constant pressure

3 SOLUTION

3.1solution

- 3.1.1 Define solution
- 3.1.2 Give examples of types of solution
- 3.1.3 Define concentration
- 3.1.4 Explain normality
- 3.1.5 Describe molarity
- 3.1.6 Explain percentage composition
- 3.1.7 Illustrate properties of solution
- 3.1.8 Explain electrolysis
- 3.1.9 Define solubility
- 3.1.10 Describe effect of temperature and pressure on solubility
- 3.1.11 Explain elevation of boiling point
- 3.1.12 Enlist elevation of boiling point application
- 3.1.13 Explain depression of freezing point
- 3.1.14 Enlist depression of freezing point applications

4 COLLOIDAL STATE

4.1colloidal state

- 4.1.1 Explain colloidal state
- 4.1.2 Prepare different colloidal solutions
- 4.1.3 Describe properties of colloidal solutions
- 4.1.4 Enlist colloidal chemistry application in industry

5 PHOTO CHEMISTRY

5.1Understand photo chemistry

- 5.1.1 Enlist sources of photo chemical radiations
- 5.1.2 Describe photo chemical reactions
- 5.1.3 State different laws of photo chemistry
- 5.1.4 Enlist different instruments used to measure intensity of radiations

- 5.1.5 Describe photos sensitization
- 5.1.6 Define photo synthesis
- 5.1.7 Define luminescence
- 5.1.8 Explain briefly fluorescence
- 5.1.9 Define phosphorescence
- 5.1.10 Enlist applications of photo chemistry

6 UNDERSTAND ELECTRO CHEMISTRY

- 6.1 Describe electrolytes
- 6.2 State ohm's law
- 6.3 Describe conductivity of electrolytes
- 6.4 State faraday's laws of electrolysis
- 6.5 Explain effect of dilution on conductivity
- 6.6 Enlist instruments used to measure the conductivity

7 UNDERSTAND RADIOACTIVITY

- 7.1 Define natural radioactivity
- 7.2 Define artificial radioactivity
- 7.3 Enlist properties of alphas, Beta rays, gamma rays
- 7.4 Describe particles of atom like proton, neutron, positron
- 7.5 Explain the method, for radio activity measurement
- 7.6 Define nuclear fission and nuclear fusion
- 7.7 Enlist nuclear fission and nuclear fusion application
- 7.8 Explain radioactive disintegration series
- 7.9 Give examples of Isobars and Isotopes

8 UNDERSTAND CHEMICAL KINETICS

- 8.1 Calculate velocity of chemical kinetics
- 8.2 Explain reaction rate
- 8.3 Describe velocity constant
- 8.4 Enlist factors which effect reaction rate

9 UNDERSTAND CHEMICAL

EQUILIBRIUM 9.1.1 State law of mass action

- 9.1.2 Define equilibrium mixtures
- 9.1.3 Measure equilibrium constant
- 9.1.4 Explain hydrolysis of $BiCl$
- 9.1.5 Describe reaction between organic acid and an alcohol
- 9.1.6 Illustrate reaction between hydrogen and Iodine
- 9.1.7 Enlist equilibrium constant application
- 9.1.8 Describe effect of temperature, pressure, concentration and catalyst on equilibrium constant

LIST OF PRACTICALS.

		No. of Practicals.
1.	To weigh the chemicals on an analytical balance (use of sensitive analytical balance)	03
2.	To determine the melting point of a given organic compounds.	01
3.	To determine the boiling point of a given liquid.	01
4.	Determine the specific gravity of the given liquid.	02
5.	Determine the viscovity by viscometer (ostwalds viscometer)	02
6.	Determine of solubility of common salt at room temperature.	01
7.	To separate the mixture by sublimation.	02
8.	To obtain alcohol from a mixture of alcohol and water by distillation.	02
9.	To determine the equivalent weight of magnescium (To verify the law of constant composition)	02
10.	Preparation of standard solution of alkalies and acids e.g NaOH, KOH, ocalic acid and succinic acid.	04
11.	Prepare approximate solution of H ₂ SO ₄ and determine its exact mormility by titrating it against standard N/10 NaoH.	02
12.	Detemination of surface tension by stalgo meter.	02
	- Determination of surfacetension of liquid by using torsion balance.	
	- Preparation of collodial solution and study the properties of colliodal solution.	
	- Determination of equilibrium constant and rate of reaction (Ist degree reaction and 2nd degree reaction).	
	- Preparation of Neon signs.	

OBJECTIVES.

1. Apply technical principles of unit operation in chemical engineering.
2. To apply principles of unit operation in the laboratory work.
3. Know the construction of working of chemical process of equipment related to different industrial operations, its uses and applications.

COURSE CONTENTS.

1	UNIT OPERATIONS OF CHEMICAL ENGINEERING	12
1.1	Flow of fluids, types of fluids.	
1.2	Fluids statics, fluids dynamics.	
1.3	Mechanism of fluids flow.	
1.4	Reynold's number, significance of Reynold number	
1.5	Manometers, types	
1.6	'U' tube manometers.	
1.7	Inclined and well type manometers.	
1.8	Viscosity, units of viscosity.	
1.9	Bernouli's theorem.	
1.10	Fluids Heads, friction losses	
1.11	Friction in pipes, sudden enlargement and contraction losses in fittings	
	Module	
2.	MEASUREMENT OF FLUIDS;	08
2.1	Venturi-meter, orificemeter.	
2.2	Rotameters, Pitot tubes & weirs.	
2.3	Displacement meters.(i) Disc meter	
2.4	(ii) Current meter	
3.	PUMPS	12
3.1	Pumps types of pumps.	
3.2	Pump's terminology i.e. capacity velocity head, suction heads and net positive suction Head, cavitation	
3.3	Centrifugal pumps, types, construction and working	
3.4	Construction and working of rotary pumps.	
3.5	Construction and operation of reciprocating pumps i.e. Piston pumps	
3.6	Plunger Pump, Simplex type, their construction and working principles..	
3.7	Theory of compression, compressor selection.	
3.8	Construction and working of reciprocating compressor.	
3.9	Construction and working of centrifugal compressor.	
4.	HEAT TRANSFER	12
4.1	Modes of Heat transfer, Fourier law.	
4.2	Thermal conductivity, pipe insulation.	
4.3	Film Coefficient	
4.4	Overall heat transfer coefficient.	

4.5	Factors affecting heat transfer coefficient.	
4.6	Classification of heat exchange equipments.	
4.7	Double pipe heat exchanger, shell and tube heat exchanger.	
4.8	Floating head heat exchangers	
4.9	Extended surface heat exchangers and condensers.	
5.	EVAPORATION.	12
5.1	Basic principles of evaporation.	
5.2	Types of evaporators.	
5.3	Construction and operation of	
	i) Short tube evaporator	
	ii) Long tube vertical evaporator.	
5.4	Forced circulation upward flow (climbing film) evaporator.	
5.6	Constriction and working of.	
	i) Falling film evaporators.	
	ii) Agitated film evaporator.	
5.7	Evaporator accessories.	
5.8	Surface condenser, contact condensers.	
5.9	Multiple evaporators.	
5.10	Principle economy and capacity.	
5.11	Effect of boiling point elevation.	
5.12	Methods of feeding.	
5.13	Removal of non-condensed gases	
5.14	Removal of condensates, salt removal	
6.	EVAPORATOR PROBLEMS	08
6.1	Scale formation and its removal	
6.2	Steam table and their use, choice of steam pressure	
6.3	Trouble shootings in operation of evaporators, remedies	

RECOMMENDED BOOKS.

1. I. M. Coulson and J. H. Richardson Introduction to Chemical Engineering
2. A. H. Perry Chemical Engineering Hand Book

INSTRUCTIONAL OBJECTIVES.

1.1 THE STUDENT WILL BE ABLE TO UNDERSTAND THE UNIT OPERATIONS

- 1.1.1 Define unit operation and unit process
- 1.1.2 Give examples of unit operations
- 1.1.3 Give examples of unit process
- 1.1.4 Explain basic laws (law of material balance law of energy balance) of chemical energy
- 1.1.5 Differentiate between steady state and non stesdy state systems

2.1 UNDERSTAND THE FLUID

- 2.1.1 Define fluid
- 2.1.2 Give types of fluid
- 2.1.3 differentiate between newtonion and non newtonian fluids
- 2.1.4 Give examples of the two types of fluids

2.2 UNDERSTAND THE FLUID PRESSURE

- 2.2.1 Define fluid statics
- 2.2.2 Develop a relationship to calculate the pressure exerted by liquid column

2.3 UNDERSTAND THE MANOMETER

- 2.3.1 Define manometer
- 2.3.2 Give the types of manometers
- 2.3.3 Explain the construction and working of simple manometer(u-tube manometer)
- 2.3.4 Explain the construction and working of differential manometer
- 2.3.5 Explain the construction and working of inclined tube manometer
- 2.3.6 Calculate pressure drop from manometer readings

2.4 UNDERSTAND THE FLUID DYNAMICS

- 2.4.1 Define fluid dyamics
- 2.4.2 Explain the mechanism of fluid flow by Reynold experiment
- 2.4.3 Differentiate between laminar flow and turbulent flow
- 2.4.4 Explain Reynolds number
- 2.4.6 Differentiate between point velocity, maximum velocity and mean velocity of the flowing fluid

2.5 UNDERSTAND THE VISCOSITY

- 2.5.1 Define viscosity
- 2.5.2 Explain the units of viscosity
- 2.5.3 Calculate the viscosity of fluids by using hagen poiscuille equation

2.6 UNDERSTAND BERBOULLI'S THEOREM

- 2.6.1 Explain bernoulli's theorem

- 2.6.2 Develop a mathematical equation for bernoulli's theorem
- 2.6.3 Explain fluid heads
- 2.6.4 Calculate the H.P of the pump required to pump the liquid from station A & B , by using bernoulli's equation

2.7 UNDERSTAND FRICTION LOSSES

- 2.7.1 Enlist different kinds of friction losses
- 2.7.2 Calculate the head loss due friction in pipes
- 2.7.3 Calculate the head loss due to sudden enlargement
- 2.7.4 Calculate the head loss due to sudden contraction
- 2.7.5 Explain the losses in fittings in terms of equivalent pipe length

2.8 UNDERSTAND THE MEASUREMENT OF DISCHARGE OF FLUIDS

- 2.8.1 Enlist the equipment used for the measurement of flow rate of fluids
- 2.8.2 Explain the construction and working of orifice meter
- 2.8.3 Explain the methods of installation of an orifice meter
- 2.8.4 Explain the construction and working of venturimeter
- 2.8.5 Give comparison between orifice meter and venturimeter
- 2.8.6 Explain the construction and working of pilot tube
- 2.8.7 Explain the construction and working of rotameter
- 2.8.8 Explain the construction and working of weirs

3.1 UNDERSTAND THE TERMINOLOGY OF PUMPS

- 3.1.1 Define pump
- 3.1.2 Define pump capacity
- 3.1.3 Explain suction head
- 3.1.4 Explain net positive suction head
- 3.1.5 Explain discharge head
- 3.1.6 Explain velocity head
- 3.1.7 Explain pump efficiency

3.2 UNDERSTAND THE TYPES OF POSITIVE DISPLACEMENT PUMPS

- 3.2.1 Define positive displacement pump
- 3.2.2 Explain the classification of positive displacement pumps
- 3.2.3 Explain the construction and working of a reciprocating pump (piston pump)
- 3.2.4 Explain the construction and working of a plunger pump
- 3.2.5 Explain the construction and working of diaphragm pump
- 3.2.6 Explain the construction and working of a gear pump
- 3.2.7 Explain the construction and working of cycloidal pump

3.3 UNDERSTAND THE CONSTRUCTION AND WORKING OF DIFFERENT TYPES OF CENTRIFUGAL PUMPS

- 3.3.1 Define centrifugal pump
- 3.3.2 Give the classification of centrifugal pumps
- 3.3.3 Explain the construction and working of a volute pump
- 3.3.4 Explain cavitation in a c.f pump
- 3.3.5 Explain priming of a c. f pump
- 3.3.6 Explain head and thrust in a c. f pump

- 3.3.7 Explain the construction of a turbine pump
- 3.4 UNDERSTAND THE SELECTION METHOD OF A PUMP**
 - 3.4.1 Enlist the factors that are to be considered in the selection of a pump
 - 3.4.2 Give comparison between centrifugal pump and reciprocating pump
 - 3.4.3 Enlist the pump losses
- 4.1 UNDERSTAND THE BLOWERS**
 - 4.1.1 Define blower
 - 4.1.2 Explain the construction and working of cycloidal blower
 - 4.1.3 Explain the construction and working of nash blower
 - 4.1.4 Explain the construction and working of centrifugal blower
- 4.2 UNDERSTAND THE COMPRESSORS**
 - 4.2.1 Define compressor
 - 4.2.2 Explain the working principle of reciprocating compressor
 - 4.2.3 Explain the working principle of centrifugal compressor
 - 4.2.4 Enlist the factors one should consider while selecting a compressor
- 5.1 UNDERSTAND MODES OF HEAT TRANSFER**
 - 5.1.1 Define heat
 - 5.1.2 Enlist modes of heat transfer
 - 5.1.3 Explain conduction
 - 5.1.4 Explain convection
 - 5.1.5 Explain radiation
 - 5.1.6 Give examples of the three modes of heat transfer
- 5.2 MAKE CALCULATIONS RELATED TO CONDUCTION**
 - 5.2.1 State Fourier's law of heat conduction
 - 5.2.2 Give mathematical form of Fourier's law
 - 5.2.3 Explain thermal conductivity
 - 5.2.4 Give units of thermal conductivity
 - 5.2.5 Explain the effect of thermal conductivity
 - 5.2.6 Develop a formula to calculate heat flow through compound resistance in flat wall
 - 5.2.7 Develop a formula to calculate heat flow through cylindrical wall
 - 5.2.8 Calculate heat loss through a flat furnace wall
 - 5.2.9 Calculate heat loss through a cylindrical furnace wall
 - 5.2.10 Calculate the thickness of insulation layer on a hot pipe
- 5.3 MAKE CALCULATIONS RELATED TO CONVECTION**
 - 5.3.1 State Newton's law of heat convection
 - 5.3.2 Explain film coefficients
 - 5.3.3 Develop an equation for overall heat transfer coefficient by combining film coefficients
 - 5.3.4 Give the factors affecting overall heat transfer coefficient
 - 5.3.5 Calculate the overall heat transfer coefficient when film coefficients are given

5.4 UNDERSTAND TEMPERATURE DROP IN FLOWING FLUIDS

- 5.4.1 Differentiate between co-current flow and counter current flow
- 5.4.2 Calculate temperature in parallel flow
- 5.4.3 Calculate temperature drop in counter current flows
- 5.4.4 Calculate mean temperature difference
- 5.4.5 Calculate log mean temperature difference

5.5 MAKE CALCULATIONS RELATED TO CONDUCTION

- 5.5.1 State stefan boltzman law of heat radiation
- 5.5.2 Explain black body
- 5.5.3 Explain grey body
- 5.5.4 calculate the heat transfer by radiation

5.6 UNDERSTAND HEAT TRANSFER EQUIPMENTS

- 5.6.1 Define heater
- 5.6.2 Define heat exchanger
- 5.6.3 Give the classification of heat exchangers
- 5.6.4 Explain the construction and working of pipe heat exchanger
- 5.6.5 Explain the construction and working of tubular (shell and tube) heat exchanger
- 5.6.6 Explain the construction and working of floating head heat exchanger
- 5.6.7 Explain the finned tubes heater

6.1 UNDERSTAND DIFFERENT TYPES OF EVAPORATORS

- 6.1.1 Define evaporation
- 6.1.2 Enlist types of evaporators
- 6.1.3 Explain construction and working of horizontal tube Evaporator
- 6.1.4 Explain construction and working of short tubes evaporator
- 6.1.5 Explain construction and working of long tubes evaporator
- 6.1.6 Explain construction and working of climbing film evaporator
- 6.1.7 Explain construction and working of falling film evaporator

6.2 UNDERSTAND EVAPORATOR ACCESSORIES

- 6.2.1 Define evaporator accessories
- 6.2.2 Enlist evaporator accessories
- 6.2.3 Enlist different types of condenser
- 6.2.4 Explain the working of a contact condenser
- 6.2.5 Explain the construction and working of a steam ejector
- 6.2.6 Explain the construction and working of an entrainment separator

6.3 UNDERSTAND MULTIPLE EFFECT EVAPORATOR

- 6.3.1 Explain basic principle of multiple effect evaporation
Explain construction and working of a tiple effect evaporator
Enlist the methods of feeding

Explain forward feeding method
Explain backward feeding method
Explain mixed feeding method
Explain economy and capacity of a multiple effect evaporator

6.4 MAKE CALCULATIONS RELATED TO EVAPORATOR

6.4.1 Explain the use of steam table

6.4.2 Calculate the amount of steam required for evaporating a given feed to a desired concentration in a single effect evaporator

6.5 UNDERSTAND THE PROBLEMS OF EVAPORATORS

6.5.1 Explain the effect of non-condensed gases and their removal
Explain scale formation, its effects and removal
Explain trouble shootings in the operation of evaporator and their remedies

LIST OF PRACTICALS.

1. Introduction to the unit operation laboratory.
2. Study the operating characteristics and performance of a centrifugal type pump. Dismantle and assemble centrifugal pump.
3. Calibrate a storage tank to obtain weight and volume relationship per unit height and study of important values used in chemical industry.
4. Prepare a graph of co-efficient of discharge of an orifice vs Reynold number.
5. Make flow measurement by venturimeter.
6. Measurement of friction in pipes.
7. Determine the efficiency of a boiler.
8. Determine overall heat transfer co-efficient from hot gases and to note the effect of stirring on overall heat transfer co-efficient.
9. Determine the heat losses from a steam pipe and observe the effect of lagging.
9. To determine the overall heat transfer and efficiency of equipment exemplified by the preheater and condenser of a climbing and falling film type evaporator when
 - a) Feed rate is constant.
 - b) Steam pressure is constant.

نی پا کی	GEN-312	اسلامیات / سطرالعہ پاکستان	نصاب (اسل سوئٹ)
1 0 1			حمد اور اسلامیات
کسی وقت 20 منٹ			حصہ دوم سطر پاکستان
			موضوعات
			قرآن مجید
			1- سورۃ الفاتحہ۔ ایتہ الفری۔ سورۃ البقرۃ کی سترہ آیات از اسم الرسول سے آغاز اور سورۃ الفلق مع ترجمہ و تفسیر
			2- بنی منتخب احادیث سے ترجمہ و تفسیر
			3- بنی الاسلام علی خمس شہادت لہ الا لہ الا لہو اقلیم الصلوٰۃ وایضا الزکوۃ و حج البیت و صوم رمضان
			4- لہ بنی النصیب حنہ
			5- لہ منشاء موت من
			6- للمومن علی المومن سنت خصائی يعود ماذا مرض و تشہد لزامات و رجیہ لہا دعا
			7- لہسم علیہ انقلبہ و لیسنتہ انا عظمی و فصیحہ لہ اغاب و شہد
			8- لا تغن عن غنک
			9- لا یغنی عن الحنہ قاطع
			10- ان اللہ حرم علیکم عقوق لمہات و اضاعتہ اعمال
			11- لیسر اولاتعسر اولاتنفرا
			12- دلق طعم الایمان من مرضی باللہ و بالاسلام دیت بمعجمہ نبیا
			13- لخص الذکر لہ الا اللہ
			14- حقوق و فرائض
			15- حصن تعلیم بطور فرض۔ والدین اور کولہ کے حقوق و فرائض۔ ہمدیہ کے حقوق
			16- اسلام کی اخلاقی اقدار
			17- عبرت و استقامت۔ غم و رگدرد۔ ایمان و عہد۔ موت۔ ایمان و قرین

سال سوئم
حصہ اول اسلامیات

تدریس مقاصد

قرآن حکیم

عمومی مقصد: منتخب سورتوں اور آیات کی روشنی میں اسلام کے بنیادی مقاصد اور عبادات جان سکے
خصوصی مقاصد: طالب علم اس قتل ہو جائے گا کہ
سورۃ الفاتحہ: آیۃ الکرسی۔ سورۃ بقرۃ کی آخری آیات از امن الرسول سے اور سورۃ اخلاق کا ترجمہ و تشریح کر سکے
طالب علم درج ذیل کا مفہوم بیان کر سکے

- ☆ رب العالمین صرف اللہ تعالیٰ ہے
- ☆ اللہ رحم کرنے والا ہے
- ☆ قیامت کے دن ہادشائی اللہ کی ہوگی
- ☆ عبادت اور استغاثت کا حقدار صرف اللہ ہے
- ☆ طالب علم درج ذیل کا مفہوم بیان کر سکے
- ☆ اللہ پاک ہر عیب سے پاک ہے
- ☆ اللہ کے اسمائے حسنہ حق اور قیوم ہیں
- ☆ تعلیم انبیاء پر ایمان لانا ضروری ہے
- ☆ رسولؐ ملا کہ کتب سلویہ پر ایمان لانا فرض ہے
- ☆ اطاعت حقیقی صرف اللہ کے لیے ہے
- ☆ اسلامی احکامات پر عمل کرنا انسانی بساط میں ہے
- ☆ کفر کو اللہ کی مدد کے بغیر شکست نہیں دی جاسکتی
- ☆ اللہ ایک ہے
- ☆ اللہ کسی کا محتاج نہیں نہ اس کا کوئی شریک ہے

منتخب احادیث

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

- ☆ احادیث کا ترجمہ بیان کر سکے

۶۱	احادیث کی تشریح کر سکے
۶۲	معاشرتی اور انفرادی زندگی میں احادیث سے رہنمائی حاصل کر سکے
	حقوق و فرائض
	عمومی مقصد: اسلامی معاشرے کا ایک اچھا فرد بن سکے
	خصوصی مقاصد:
۶۳	والدین کے حقوق و فرائض بیان کر سکے
۶۴	ہمسایوں کے حقوق بیان کر سکے
۶۵	اسلام میں حقوق و فرائض کی اگلی کی صورت میں اپنے اندر خدمت خلق کا جذبہ پیدا کر سکے
	اسلامی اقدار
	عمومی مقصد: طالب علم بن سکے گا کہ تعلیم کا مقصد حسن اخلاق سے متصف ہو رہا ہے
	خصوصی مقاصد
۶۶	اخلاق کے معنی و مفہوم کو بیان کر سکے
۶۷	اسلام میں حسن اخلاق کی اہمیت بیان کر سکے
۶۸	قرآن و سنت کی روشنی میں صبر و استقلال کی اہمیت بیان کر سکے
۶۹	اسلام میں عفو و درگزر کی اہمیت بیان کر سکے
۷۰	ایمان کے عہد کی اہمیت بیان کر سکے
۷۱	اموت کے معنی و مفہوم کو بیان کر سکے
۷۲	اموت اسلامی کی اہمیت بیان کر سکے
۷۳	اسلام کی اعلیٰ قدر کو اپنا کر مثالی معاشرہ پیدا کر سکے

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کل وقت: 20 گھنٹے

GEN 3II

نصاب (سل سوئم)
مظاہرہ پاکستان
حصہ دوم

موضوعات

- ☆ قیام پاکستان
- ☆ پونڈری کمیشن
- ☆ ریڈ کلف ایوارڈ
- ☆ تقسیم بنگلہ و کلکتہ
- ☆ تقسیم پنجاب
- ☆ مسئلہ مہاجرین
- ☆ ریاست کا الحاق
- ☆ ریاست جموں و کشمیر
- ☆ سری پلنی کا تنازعہ
- ☆ قرار و اہم مقاصد
- ☆ علماء کے بائیس نکات
- ☆ 1956-1962 اور 1973 کے دستاویز کی اسلامی دفعات
- ☆ پاکستان کا محل وقوع اور اس کی جغرافیائی اہمیت
- ☆ قدرتی وسائل (تیل۔ گیس۔ کوئلہ)

مطالعہ پاکستان (حصہ دوم) قیام پاکستان

تدریس مقاصد

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

- ☆ باؤنڈری کمیشن تشکیل اور اس کے فرائض بیان کر سکے
- ☆ ریڈ کلف اور اس کے ایوارڈ کے بارے میں بیان کر سکے
- ☆ بنگلہ اور گلگتہ 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-کونک) کے بارے میں بیان کر سکے

(غیر مسلم طلباء کے لئے)

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کل وقت: 20

Gen III

نصاب اخلاقیات

سال سوئم

موضوعات

☆ احساس ذمہ داری

☆ مثبت ذہن

☆ عدل و انصاف

☆ قومی خدمت کا جذبہ

☆ ذکر و نظر کی پاکیزگی

☆ احترام آدمیت

☆ شائستگی

☆ حضور درگزر

☆ بردباری

☆ خود انحصاری

☆ اثر و نفوذ

☆ جامعیت

☆ اپنی ذات کی معرفت (پذیرا، ہم عمر طلباء اساتذہ اہم شخصیات لوا رہ)

(غیر مسلم طلباء کے لئے)

نصاب اخلاقیات

سہل سوئم

تدریس مقاصد

- ☆ عمومی مقصد: ملکی ترقی کے لیے اعلیٰ اوصاف کے ساتھ بہتر طور پر ملک و ملت کی خدمت کر سکے
- ☆ خصوصی مقاصد: طالب علم اس قابل ہو گا کہ
- ☆ موضوعات کا مطلب بیان کر سکے
- ☆ عملی زندگی سے مثالوں کی نشاندہی کر سکے
- ☆ موضوعات کی اہمیت بیان کر سکے
- ☆ اپنی شخصیت اور معاشرے پر موضوعات کے مطابق اثرات پیدا کرنے کے طریقے بیان کر سکے
- ☆ مثبت ذہن کے ساتھ کام کر سکے
- ☆ عدل و انصاف سے ادارہ میں، دفتر میں بہتر ماحول پیدا کر سکے
- ☆ ماحول کو اخلاقی طور پر پاکیزہ بنائے
- ☆ کارکنوں کی بہتر طور پر دل جوئی کر سکے
- ☆ کارکردگی میں اضافہ کر سکے
- ☆ باہمی احترام کی برکات سے استفادہ کر سکے

Mgm-311 INDUSTRIAL MANAGEMENT AND HUMAN RELATIONS.

Total Contact Hours	T	P	C
Theory 32	1	0	1

AIMS: The study of this subject will enable the student to develop the management skill, acquaint him with the principles of management and human relations and develop psychological approach to solve the labour problems.

COURSE CONTENTS

- | | | |
|-----------|---|----------------|
| 1. | INDUSTRIAL PSYCHOLOGY. | 2 Hours |
| 1.1 | History and definition. | |
| 1.2 | Nature and scope. | |
| 2. | LEADERSHIP | 1 Hour |
| 2.1 | Definition and types. | |
| 2.3 | Qualities of a good leader. | |
| 3. | MOTIVATION | 2 Hours |
| 3.1 | Definition. | |
| 3.2 | Types (Financial and non- financial motives). | |
| 3.3 | Conflict of motives. | |
| 4. | MORALE | 1 Hour |
| 4.1 | Importance. | |
| 4.2 | Development. | |
| 4.3 | Measurement. | |
| 5. | HUMAN ENGINEERING. | 1 Hour |
| 5.1 | Importance of human factor in industry. | |
| 5.2 | Man-machine system. | |
| 5.3 | Strategy for making allocation decisions. | |
| 6. | INDUSTRIAL FATIGUE AND BOREDOM. | 2 Hours |
| 6.1 | Definition and distinction. | |
| 6.2 | Psychological causes. | |
| 6.3 | Objective causes. | |
| 6.4 | Prevention | |
| 7. | INDUSTRIAL ACCIDENTS | 2 Hours |
| 7.1 | Psychological causes. | |
| 7.2 | Objective causes. | |
| 7.3 | Prevention | |
| 8. | INDUSTRIAL PREJUDICE | 2 Hours |
| 8.1 | Causes | |

	8.2 Remedies	
9.	PUBLIC RELATIONS.	2 Hours
	9.1 Importance	
	9.2 Functions	
10.	GUIDANCE AND COUNSELLING	2 Hours
	10.1 Importance	
	10.2 Choice of job.	
	10.3 During service.	
11.	JOB EVALUATION	2 Hours
	11.1 Importance	
	11.2 Methods	
	11.3 Job satisfaction	
	11.4 Work simplification.	
12.	INDUSTRIAL MANAGEMENT	2 Hours
	12.1 Introduction	
	12.2 Functions of management.	
	12.3 Subdivisions of management	
	12.4 Objectives of industrial management.	
13.	PERSONNEL SELECTION.	2 Hours
	13.1 Recruitment of employees.	
	13.2 Training.	
	13.3 Effects of training on production and product cost.	
14.	WORKING CONDITIONS.	2 Hours
	14.1 Importance and consideration.	
	14.2 Effects on efficiency and per unit cost.	
15.	TIME AND MOTION STUDY.	3 Hours
	15.1 Concept and importance.	
	15.2 Sequence of motion study.	
	15.3 Principles of motion study.	
	15.4 Steps to time study.	
	15.5 Determination of operations time.	
16.	QUALITY CONTROL.	2 Hours
	16.1 Concept and advantages	
	16.2 Methods.	

17.ROLE OF FOREMAN IN MANAGEMENT.

2 Hours

- 17.1 Foreman's abilities.
- 17.2 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 PSYCHOLOGY.**
 - 1.1Describe brief history if industrial psychology.
 - 1.2Describe in detail definition of industrial psychology.
 - 1.3State nature and scope of industrial psychology.
- 2. KNOW LEADERSHIP.**
 - 2.1Define leadership.
 - 2.2Describe types of leadership.
 - 2.3State qualities of a good leader.
- 3. UNDERSTAND MOTIVATION.**
 - 3.1Define motivation.
 - 3.2Describe financial and non financial motives.
 - 3.3Explain conflict of motives.
- 4. KNOW MORALE.**
 - 4.1State importance of morale.
 - 4.2Describe development of morale.
 - 4.3State the method of measurement of morale.
- 5. UNDERSTAND HUMAN ENGINEERING.**
 - 5.1Explain importance of human engineering in the industry.
 - 5.2Explain man-machine system.
 - 5.3Explain strategy for making allocation decisions.
- 6. UNDERSTAND INDUSTRIAL FATIGUE AND BOREDOM.**
 - 6.1Define fatigue and boredom.
 - 6.2Describe psychological causes of fatigue and boredom.
 - 6.3Describe objective causes of fatigue and boredom.
 - 6.4Explain measures to prevent fatigue and boredom.
- 7. UNDERSTAND INDUSTRIAL ACCIDENTS.**
 - 7.1Explain psychological causes of industrial accidents.
 - 7.2Explain objective causes of industrial accidents.
 - 7.3Explain measures to prevent industrial accidents.
- 8. UNDERSTAND INDUSTRIAL PREJUDICE.**
 - 8.1Define prejudice

- 8.2 Explain causes of industrial prejudice.
- 8.3 Explain remedies of industrial prejudice.
- 9. UNDERSTAND THE SIGNIFICANCE OF PUBLIC RELATIONS.**
 - 9.1 Explain importance of public relations.
 - 9.2 Explain functions of public relations.
- 10. UNDERSTAND THE NEED FOR GUIDANCE AND COUNSELLING.**
 - 10.1 State importance of guidance and counselling.
 - 10.2 Explain the role of guidance and counselling in choosing the job.
 - 10.3 Describe help of guidance and counselling during service.
- 11. UNDERSTAND JOB EVALUATION.**
 - 11.1 Explain importance of job evaluation.
 - 11.2 Explain methods of job evaluation.
 - 11.3 Explain job satisfaction.
 - 11.4 Explain work simplification.
- 12. UNDERSTAND INDUSTRIAL MANAGEMENT.**
 - 12.1 Define management.
 - 12.2 State functions of management.
 - 12.3 Enlist subdivision of management.
 - 12.4 Explain objectives of industrial management.
- 13. UNDERSTAND TRAINING AND ITS EFFECTS.**
 - 13.1 Describe the recruitment procedure of employees in an industrial concern.
 - 13.2 Explain training.
 - 13.3 Identify the kinds of training.
 - 13.4 Explain the effects of training on production and product cost.
- 14. UNDERSTAND THE EFFECT OF WORKING CONDITION ON EFFICIENCY.**
 - 15.1 Explain importance of working condition.
 - 15.2 Describe air-conditioning, ventilation, lighting and noise.
 - 15.3 State the effects of good working conditions on efficiency and per unit cost.
- 15. UNDERSTAND TIME AND MOTION STUDY.**
 - 15.1 Explain the concept.
 - 15.2 Describe the importance of work study.
 - 15.3 Explain the sequence of motion study.
 - 15.4 State the principles of motion study.
 - 15.5 Describe the steps for carrying out time study.
 - 15.6 Explain the method of determination of operations time.

16. UNDERSTAND THE METHODS OF QUALITY CONTROL.

- 16.1 Define quality control
- 16.2 State the advantages of quality control.
- 16.2 Explain methods of quality control.

17. UNDERSTAND THE ROLE OF FOREMAN IN AN INDUSTRIAL UNDERTAKING.

- 17.1 Explain ability of the foreman.
- 17.2 Enlist duties of foreman.
- 17.3 Describe functions of foreman as middle management.

CHT 314(Rev.) INSTRUMENTAL METHODS OF ANALYSIS.

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Objectives

- 1 To enable students to understand construction and working mechanism of instruments used for analytical purpose.
- 2 To enable students to understand the principles/properties of light for analytical purpose.
- 3 Handsome working experience of different analytical equipments.

COURSE CONTENTS.**HOURS**

- 1. INTRODUCTION. INSTRUMENTAL METHODS OF ANALYSIS. 04**
 - 1.1 Light and its properties.
 - 1.2 Radiant energy. Reflection , Refraction, Absorbance.
 - 1.3 Light waves transmittance and their energy.
- 2. COLORIMETRY. 06**
 - 2.1 Fundamental law of colorimetry.
 - 2.2 Borger's Law , Bear's Lambert's Law.
 - 2.3 Photo emissive tube construction and working.
 - 2.4 Photo meter.
 - 2.5 Single beam photo meter. Construction and working.
 - 2.6 Double beam photo meter. Construction and working.
 - 2.7 Borger, Bear's law applied to photo electric colorimetry.
- 3. FLUORESCENCE, PHOTO SCENES (DEFINITION, APPLICATION.) 04**
 - 3.1 Fluorescence methods for the Fluorescence development.
 - 3.2 Relationship between florescent intensity and concentration.
 - 3.3 Filter flourometer.
 - 3.4 Construction, operating parts and working of fluorescence meter.
- 4. TURBIDIMETRY AND NEPHELOMETRY. 04**
 - 4.1 Application.
 - 4.2 Nephelometer
 - 4.3 Construction and working.
 - 4.4 Turbidimeter, its construction and working.
- 5. SPECTROPHOTOMETRY. 08**
 - 5.1 Spectrum of light, visible spectra.
 - 5.2 Ultra violet spectra.
 - 5.3 Infrared spectra.
 - 5.4 Absorption spectra, emission spectra.
 - 5.5 Molecular structure, origin of spectra.
 - 5.6 Specto photo meter.

5.7	Construction and working of a spectro photo meter.	
5.8	Ultra violet spectro photo meter.	
5.9	Construction and working parts.	
5.10	Infrared spectro photo meter.	
5.11	Construction and working parts.	
5.12	Application of spectrophotometer.	
6.	FLAME PHOTO METRY.	04
6.1	Definition, application.	
6.2	Flame photo meter.	
6.3	Parts of flame photo meter.	
6.4	Flow meter.	
6.5	Atomise Burner.	
6.6	Optical system.	
6.7	Photo sensitive detector.	
6.8	Recording equipment.	
6.9	Commercial flame photo meter.	
6.10	Construction and working.	
7.	REFRACTIVE INDEX AND REFRACTOMETRY.	04
7.1	Effect of temperature.	
7.2	Application.	
7.3	Refractometer.	
7.4	Abbe's refracto meter, construction and working.	
7.5	Fisher s refractometer, construction and working.	
8.	POLARIMETRY.	04
8.1	Optical active material, optical activity.	
8.2	Plane polarized light.	
8.3	Levo rotatory dextro rotatory.	
8.4	Calculation of optical rotation.	
8.5	Specific rotation.	
8.6	Polarimeter, construction and working.	
8.7	Application of polarimetry.	
9.	GAS CHROMATOGRAPHY.	04
9.1	Definition.	
9.2	Principle of gas chromatography.	
9.3	Study of gas Chromatography instrument (gas chromatography) essential parts.	
10.	POTENTIOMETRY: ELECTRODE POTENTIAL	04
10.1	E.M.F. of a cell.	
10.2	Indicating electrodes, reference electrode.	
10.3	Glass electrode, hydrogen electrode.	
10.4	Application of potentiometry.	

11. PH VALUE: POH VALUE. 08

- 11.1 Application of PH measurement
- 11.2 PH meter.
- 11.3 Construction working.
- 11.4 Buffer solution.
- 11.5 Properties of buffer solution.
- 11.6 Buffer capacity, Dilution value.
- 11.7 Standard Buffer solution.
- 11.8 Preparation of standard buffer solution.
- 11.9 Measurement of PH value.
- 11.10 Colorimetric determination of PH value.
- 11.11 PH paper methods, indicator method.
- 11.12 By direct reading PH meter.

12.ELECTROLYSIS, APPLICATIONS. 06

- 12.1 Equipment for electrolysis.
- 12.2 Electrolysis, analyzer and its parts.
- 12.3 Reactions on anode and cathode.
- 12.4 Separation of metals by electrolysis (Procedure).
- 12.5 Faraday's Laws of electrolysis.
- 12.6 Numericals.

13.CONDUCTIVITY AND CONDUCTOMETRY. 04

- 13.1 Conductivity cell, cell constant.
- 13.2 Conductivity bridge.
- 13.3 Measurement of specific conductance equivalent conductance.
- 13.4 Molar conductivity.
- 13.5 Application of Conductometer.

RECOMMENDED BOOK:

- 1. Instrumental Methods of Analysis by, Willand, H.N. Meriit and Dean J.A.
- 2. Industrial Instrumentation by S.K. Singh
- 3. Fundamentals of Industrial Instrumentation and Control by William C. Dunn

CHT 314(Rev.) INSTRUMENTAL METHODS OF ANALYSIS

INSTRUCTIONAL OBJECTIVES.

1 INTRODUCTION

- 1.1 Student will be able to understand the instrumental method of analysis
 - 1.1.1 Define instrumental method of analysis
 - 1.1.2 Give 4 merits of I.M.A.
 - 1.1.3 Enlist the demerits of I.M.A.
 - 1.1.4 Name different I.M.A.

2 LIGHT

- 2.1 Understand light
 - 2.1.1 Define light
 - 2.1.2 Enlist different properties of light
 - 2.1.3 Explain different properties of light
- 2.2 Understand radiant energy
 - 2.2.1 Define radiant energy
 - 2.2.2 Give different units for the measurement of wave length
 - 2.2.3 Calculate radiant energy by using the formula $E=hc$

3 COLORIMETRY

- 3.1 Understand colorimetry
 - 3.1.1 Define colorimetry
 - 3.1.2 Define transmittance and absorbance
 - Enlist photometric laws
 - Define bouge's law
 - Define beer's law
- 3.2 Understand photo electric colorimetry
 - 3.2.1 Define photo electric colorimetry
 - Enlist different photo dectectors
 - Explain the construction and working of photo tube/cell.
- 3.3 Understand photo meter
 - 3.3.1 Define photometer
 - Explain the working of single beam photometer
 - Explain the working of double beam photometer
 - Give comparison of the two photometers
 - Calculate the concentration of sample solution from photometer readings by using Borger-Beer's law equation

4 PHOTO LUMINESCENCE

- 4.1 Photo Luminescence
 - 4.1.1 Define photo luminescence
 - 4.1.2 Give examples of photo luminescence

- 4.1.3 Differentiate between Fluorescence and luminescence.
- 4.1.4 Explain the methods of making Fluorescence spectrum
- 4.1.5 Develop a relationship between Fluorescence intensity and concentration
- 4.2 Fluorescence
 - 4.2.1 Define Fluorescence.
 - 4.2.2 Draw working diagram of filter Fluorescence.
 - 4.2.3 Draw working diagram of spectro Fluorescence.
 - 4.2.4 Explain the function of operating parts of Fluorescence.

5 TURBIDIMETRY AND NEPHLOMETRY

- 5.1 Understand turbidimetry and Nephelometry
 - 5.1.1 Define turbidimetry
 - 5.1.2 Define Nephelometry
 - 5.1.3 Give industrial applications of turbidimetry
 - 5.1.4 Explain the construction and working of turbidimeter
 - 5.1.5 Explain the construction and working of Nephelometer

6 SPECTRO PHOTOMETRY

- 6.1 Understand spectro photometry
 - 6.1.1 Define spectrophotometry
 - 6.1.2 Define dispersion of light
 - 6.1.3 Explain spectrum of light
 - 6.1.4 Explain visible spectra UV-spectra IR-spectra
 - 6.1.5 Explain Absorption spectra, emission spectra, molecular spectra and origin of spectra
- 6.2 Understand spectro photometer
 - 6.2.1 Enlist essential parts of spectro photometer
 - 6.2.2 Draw working diagram of spectro-photometer
 - 6.2.3 Explain the working of spectro-photometer
 - 6.2.4 Explain construction and working of UV-spectro photometer
 - 6.2.5 Explain construction and working of IR-spectro photometer
 - 6.2.6 Application of spectro photometry.

7 FLAME PHOTOMETRY

- 7.1 Understand flame photometry
 - 7.1.1 Define flame photometry
 - 7.1.2 Give applications of flame photometry
 - 7.1.3 Enlist essential parts of flame photometer.
 - 7.1.4 Explain construction and working of a commercial flame photometer

8 REFRACTOMETR

- Y 8.1 Refractometry
 - 8.1.1 Explain refraction of light
 - 8.1.2 Explain refractive index
 - 8.1.3 Explain the effect of temperature on refractive index
 - 8.1.4 Define refractometry

- 8.1.5 Give applications of refractometry
- 8.1.6 Explain the construction and working of Abbe's refractometer
- 8.1.7 Explain the construction and working of fisher s refractometer

9 POLARIMETRY

9.1 Polarimetry

- 9.1.1 Define plane polarised light
- 9.1.2 Define optical active material and optical activity
- 9.1.3 Define levo rotatory material and dextro rotatory material
- 9.1.4 Give examples of optical active materials
- 9.1.5 Calculate specific rotation by using the formula $[\alpha] = 100 \times$
- 9.1.6 Draw working diagram of polarimeter
- 9.1.7 Enlist parts of a polarimeter
- 9.1.8 Explain the function of different parts of polarimeter
- 9.1.9 Applications of polarimetry.

10 GAS CHROMATOGRAPHY

10.1 Gas chromatography

- 10.1.1 Define gas chromatography
- 10.1.2 Explain principle of gas chromatography
- 10.1.3 Draw working diagram of gas.
- 10.1.4 Chromatograph.
- 10.1.5 Enlist essential parts of gas chromatograph.
- 10.1.6 Enlist different detectors used
- 10.1.7 Explain the construction and working of detectors
 - (a) Conductivity detector
 - (b) Thermal conductivity detector
 - (c) Flame ignition detector
 - (d) Density box detector

11 POTENTIOMETRY

11.1 Potentiometry

- 11.1.1 Define potentiometry
 - Explain electrode potential
 - Explain e.m.f. of a cell
 - Calculate e.m.f. of a cell
- Differentiate between indicating electrode and reference electrode Enlist different reference electrodes
- Explain the construction and working of
 - (a) Hydrogen electrode
 - (b) Glass electrode
 - (c) Calomal electrode
 - (d) Antimony electrode

12 PH-VALVE AND BUFFER SOLUTION

12.1 PH-Valve

- 12.1.1 Define PH-Valve
 - Define POH-Volve
 - Enlist applications of PH-measurement
- 12.2 Buffer solution
 - 12.2.1 Define Buffer solution
 - 12.2.2 Give properties of Buffer solution
 - 12.2.3 Explain Buffer capacity Buffering valve
 - 12.2.4 Explain dilution valve
 - 12.2.5 Explain the preparation of standard Buffer solution
- 12.3 Measurement of PH-Value
 - 12.3.1 Explain colorimetric determination of PH-Valve
 - (a) PH-paper method
 - (b) Indicator method
 - (c) Pocket comparator method
 - 12.3.2 Explain the construction and working of direct reading PH-meter.
- 13 ELECTROLYSIS**
 - 13.1 Define Electrolyte
 - 13.2 Define Electrolysis
 - 13.3 Give applications of electrolysis
 - 13.4 Draw a sketch to show the essential parts of Electrolytic analyzer
 - 13.5 Explain the reaction at anode
 - 13.6 Explain the reaction at cathode
 - 13.7 Explain the procedure of separation of metals by electrolysis
 - 13.8 Explain Faradays laws of electrolysis
 - 13.9 Calculate the amount of material deposited by electrolysis(1st law based)
 - 13.10 Calculate the chemical equivalent of given material by electrolytic method(2nd law based)
- 14 CONDUCTOMETRY**
 - 14.1 Define Resistance and conductivity
 - 14.2 Define specific resistance
 - 14.3 Define specific conductance equivalent conductance and molecular conductance
 - 14.4 Give the units of resistance and conductance
 - 14.5 Explain the construction of conductivity cell
 - 14.6 Calculate cell constant
 - 14.7 Explain the construction and working of conductivity bridge
 - 14.8 Describe the measurement of conductivity and its applications.

LIST OF PRACTICALS.

1. Study of reflection, refraction, dispersion of light.
2. Determination of Ammonia in water by Nessler reagent in colorimetry.
3. Determination of chlorine in water by visual colorimeter.
4. Determination of concentration of CuSO_4 sample by visual colorimeter.
5. Determination the absorbance of transmittance for different concentration of coloured solution by spectrophotometer.
6. Study the effect of wave length on the absorption of light by coloured solution.
7. Draw a concentration and absorption curve for coloured solutions.
8. Colorimetric determination of Nickel with Dimethyloxime (Nephelometry).
9. Determination of PO_4 and SO_4 contents by using Nephelometer.
10. Determination of Manganese in steel by using spectrophotometer (auto-recording).
11. Study and operation of flame photometer.
12. Setting of flame by using controlling instruments.
13. Measurement of refractive index of various liquid by using Abbe Refractometer and Fisher Refractometer.
14. Determination of calcium, sodium Potassium by using Photometer.
16. Determination of specific rotation of optical active materials.
17. Determination of concentration of source solution by using polarimeter.
18. Determination of Ph value of industrial samples by:
 - i. Indicating method.
 - ii. PH paper method.
 - iii. Pocket comparator method.
 - iv. PH meter (Direct reading).
19. Perform plating of a protective metal by electroplating techniques.
20. Verification of Faraday law.
21. Measurement of cell constant, sp. conductivity, equivalent conductivity, molecular conductivity by using conductivity bridge/meter.
22. Analysis of flue gases by using Orsat apparatus.
23. Study of Gas Chromatography by presentation.
24. Study of U-V spectro photometer by presentation.
25. Industrial Labs visits.

Note: Class teacher can change the Practicals in accordance with the National and Industrial need and the availability of instruments . In this connection he will get guidance from head of department.

CHT- 343 PROCESS INSTRUMENTATION AND CONTROL

T	P	C
2	3	3

OBJECTIVES:-

- 1 To equipped students with the knowledge of temperature, pressure, flow sensors and transducers.
- 2 Understand the mechanism of various control instruments used in various chemical industries.
- 3 Explain the function and working of control instruments used for different process variables. after going through the curriculum.
- 4 To inform the students about the control room of a chemical plant.

- | | |
|--|-----------|
| 1. INTRODUCTION. | 8 |
| 1.1 Importance of process instrumentation in Chemical industry. | |
| 1.2 How measurement are made. | |
| 1.3 Introduction to important process variables. | |
| 1.4 Temperature, Pressure | |
| 1.5 Flow, Level | |
| 2 BASIC PRINCIPLES INVOLVED IN PROCESS INSTRUMENTATION. | 10 |
| 2.1Pascal's law. | |
| 2.2Bernoulli's theorem. | |
| 2.3Hook's law. | |
| 2.4Thermoelectric effects. | |
| 2.5Wheatstone Bridge circuit | |
| 2.6Capacitance, Resistance, Inductance. | |
| 3 TEMPERATURE MEASURING INSTRUMENTS | 8 |
| 3.1 Thermometers. | |
| 3.2 Liquid-filled thermometer. | |
| 3.3 Hg-filled thermometer. | |
| 3.4 Bi-metallic thermometers. | |
| 3.5 Pressure spring thermometers. | |
| 3.6 Thermocouples. | |
| 3.7 Resistance thermometers | |
| 3.8 Pyrometers (Optical radiation) | |
| 3.9 Pneumatic Temperature transmitters. | |
| 4 PRESSURE MEASURING INSTRUMENTS | 10 |
| 4.1 U -tube manometer. | |
| 4.2 Inclined manometer | |
| 4.3 Well type manometer | |

4.4	Inverted bell type manometer	
4.5	Bourdon tube	
4.6	(a) Spiral	
4.7	(b) Helix	
4.8	Bellows	
4.9	Pneumatic Pressure transmitters.	
4.10	Transducer	
4.11	Definition of transducer	
4.12	Electrical transducer	
4.13	Mechanical transducer	
4.14	The Pirani gauge.	
4.15	Load cells.	
4.16	Differential pressure transmitter.	
5	FLOW MEASURING INSTRUMENTS	8
5.1	Head meters	
5.2	Orifice meter	
5.3	Venturi meter	
5.4	Flow nozzles	
5.5	Variable area meters (Rota meters)	
5.6	Magnetic flow meters	
5.7	Open channel flow measuring instruments.	
5.8	Transducer for flow sensor devices.	
6	LIQUID LEVEL MEASURING INSTRUMENTS	8
6.1	Direct liquid level measuring instruments.	
6.2	Bob and tape	
6.3	Sight glass	
6.4	Floats	
6.5	Probe type level detector.	
6.6	Indirect liquid level measuring instruments	
6.7	Pressure gauge.	
6.8	Purge or bubbler systems.	
6.9	Control loop	
6.10	Pneumatic control valve	
6.11	On-Off control.	
7	CONTROL ROOM OF A CHEMICAL PLANT.	12
7.1	Parameter for control in a plant.	
7.2	Flow controller indicators.	
7.3	Level indicator controller.	
7.4	Temperature indicator controller.	
7.5	Pressure indicator controller.	
7.6	P.L.C based controllers.	
7.7	Elements of digital control system.	

REFERENCES

1. Industrial Instrumentation fundamentals by Austin E Fribance McGraw-Hill Book company
2. Instrumentation by Franklyn .W Kirk and Nicholas. Rinbo American Technical society Chicage, Illinois

INSTRUCTIONAL OBJECTIVES.

1. IMPORTANCE OF CONTROL INSTRUMENTS

- 1.1 Name various process variable used in chemical industry
- 1.2 Explain each variable a-
 Temperature b-
 Pressure
 c-Flow
 d-Level
- 1.3 Explain the basic principles involved in process instrumentation
- 1.4 Define Pascal's Law
- 1.5 Explain Pascal's law with examples
- 1.6 Explain Bernoulli's theorem
- 1.7 Enlist uses of Bernoulli's theorem
- 1.8 Define thermoelectric effect
- 1.9 Draw neat sketch of wheat stone bridge circuit and explain it
- 1.10 Define each one of the followings
 - a-Capacitance
 - b-Resistance
 - c-Inductance
 - d-Impedance
- 1.11 Explain each one of no 10

2. TEMPERATURE

- 2.1 Define temperature
- 2.2 Distinguish between heat and temperature
- 2.3 Enlist various temperature scale
- 2.4 Read temperature on Celsius scale
- 2.5 Read temperature on Fahrenheit scale

3 THERMAMETRY

- 3.1 Describes liquid filled thermo-meter
- 3.2 Explain mercury filled thermometer(with diagram)
- 3.3 Explain bi metallic thermometer.
- 3.4 Explain pressure spring thermometer

4 THERMOCOUPLES

- 4.1 Define thermocouple
- 4.2 Explain the primer of thermocouple
- 4.3 Enlist various types of thermocouples
- 4.4 Explain iron constantan thermocouple
- 4.5 Explain chromium/Aluminum thermo couples
- 4.6 Describe pt/rh-pt thermocouple

4.7 Identify the use of each thermocouples for different temperature ranges

5 RESISTANCE THERMOMETER

5.1 Define resistance thermometer

5.2 Explain the principle of resistance thermometer

5.3 Draw the diagram of wheat stone bridge circuit and label its parts.

5.4 Describe the operation of the resistance thermometer

6 PYROMETERY AND PYROMETERS

6.1 Define pyrometer.

6.2 Enlist types of pyrometers

6.3 Draw a neat sketch of the radiation pyrometer

6.4 Describe the functioning of radiation pyrometer.

6.5 Draw the diagram of optical pyrometer

6.6 Explain the function and operation of the pyrometers

6.7 Identify the pyrometer on the basis of temperature range and electrical circuit

7 TEMPERATURE TRANSMITTER

7.1 Define temperature transmitter

7.2 Enlist types of temperature transmitters

7.3 Explain the principle of temperature transmitter.

7.4 Draw the diagram

7.5 Explain the electrical operation of the transmitter

7.6 Identify the transmitters electronic on the bases of their operation and temperature change

8 PRESSURE

8.1 Define pressure

8.2 Enlist various pressure measuring instruments.

8.3 Describe U-tube manometer.

8.4 Explain well type mano meter.

8.5 Explain well type meter.

8.6 Draw the neat sketch of a a-
Bourdon gauge b-
bellows

8.7 Explain bourdon gauge.

8.8 Explain the principle of differential pressure instruments

8.9 Describe differential pressure instruments

8.10 Differentiate between differential pressure and direct pressure measuring instruments

8.11 List the uses of d/p measuring instrument

8.12 Differentiate between pneumatic and electronic pressure transmitters

8.13 Load cell

9 TRANSDUCERS

9.1 Define transducers

- 9.2 Enlist types of transducers
- 9.3 Draw diagrams of transducers.
- 9.4 Explain the mechanical/electrical transducer
- 9.5 Differentiate between mechanical and electrical transducer
- 9.6 Enlist five advantages of electrical transducer and there disadvantages of mechanical transducer
- 9.7 Explain piirani gauge

10 FLOW MEASURING INSTRUMENTS

- 10.1 Describe flow of the fluid
- 10.2 Name type of flow
- 10.3 Enlist flow measuring instruments
- 10.4 Describe orifice meter
- 10.5 Explain venture-meter
- 10.6 Explain flow nozzle
- 10.7 Explain Rota meter
- 10.8 Explain magnetic flow meter
- 10.9 Explain pilot tube
- 10.10 Draw diagram of flow meter
- 10.11 Differentiate between
 - a-orifice meter & venturimeter
 - b-Rotameter and pilot tube
- 10.12 Enlist characteristics of each flow meter
- 10.13 Flow measuring transducers.

11 LEVEL MEASSURING INSTRUMENTS

- 11.1 Define level of the fluids
- 11.2 Name type of level meter.
- 11.3 Enlist level measuring instruments
- 11.4 Explain the principle of electrical level measuring instruments
- 11.5 Draw diagram of the level measuring instrument
- 11.6 Describe sight glass
- 11.7 Describe flood method
- 11.8 Explain the use of pressure gauge for in direct level measurements
- 11.9 Explain radio active system of level measurement
- 11.10 Explain the sonic principle
- 11.11 Explain the ultra sonic method for liquid level measurement
- 11.12 Explain liquid level measurement by load cell
- 11.13 Enlist four uses of electrical level measuring instrument

12 CONTROL SYSTEM

- 12.1 Define control system
- 12.2 Explain control loop with its working principle
- 12.3 Names various type of controllers

- 12.4 Explain pneumatic control valve
- 12.5 Explain on-off control system
- 12.6 List uses of each controller

- 13 CONTROL ROOM OF A CHEMICAL PLANT.**
- 13.1 Parameter for control in a plant.
 - 13.2 Flow controller indicators.
 - 13.3 Level indicator controller.
 - 13.4 Temperature indicator controller.
 - 13.5 Pressure indicator controller.
 - 13.6 P.L.C based controllers.
 - 13.7 Elements of digital control system.

List of Practical.

- 1. Types of thermocouples and their measuring ranges.**
2. Calibration of thermocouple.
3. The calibration of digital thermometer.
 - a. Draw a comparison chart of various temperature measuring instruments.
4. Construction and working of Bourdon gauge.
5. Calibration of pressure gauges by dead weight tester.
6. Pressure transducers and their working.
7. Construction and working of level indicators and controllers.
8. Construction and working of an incubator.
9. Explain the mechanism of control in a P.L.C (Programmable Logic Control).
10. Use of computer for indicating recording and controlling temperature.

Pht-313 QUALITY CONTROL IN PHARMACEUTICAL INDUSTRY

Theory: 64
Practical: 96

T	P	C
2	3	3

Course Objectives:

The main objective of this course is to develop understanding in the students about Quality Control tests performed for different dosage forms in Pharmaceutical Industry, This course will introduce concepts of Good Storage Practices (GSP) and Good Laboratory Practices (GLP) used in pharmaceutical industry among students.

Course Content:

- 1. Concepts of Total Quality Management: 16 hours**
 - 4.4 Quality Assurance
 - 4.5 Quality Control
 - 4.6 Quality Management
- 2. Tests for Tablets: 08 hours**
 - 2.1 Hardness
 - 2.2 Thickness
 - 2.3 Friability
 - 2.4 Disintegration
 - 2.5 Dissolution
- 3. Tests for Capsules 08 hours**
 - 3.1 Disintegration test
 - 3.2 weight uniformity check
- 4. Tests for Sterile Products 08 hours**
 - 4.1 Leaker test,
 - 4.2 Clarity test,
 - 4.3 LAL test
 - 4.4 Microbiological Environmental Monitoring,
 - 4.5 Media Fills and their Application,
 - 4.6 Contamination of Aqueous based non sterile products, Class A,B,C,D.
- 5 Tests for Creams and Ointments (08 hours)**
 - 5.1 Particle Size determination,
 - 5.2 Weight Variation Test,
 - 5.3 Viscosity measurement).
- 6 Quality Control for Packaging Materials (04 hours)**
- 7 Quality Control requirements as per Drug Law 1976. (12 hours)**

BOOKS RECOMMENDED

- 1) Remington: The Science and Practice of Pharmacy, 21st Edition, Volume II.
- 2) Pharmaceutical Quality Assurance in Class, Industry and Market by Karamat A Javaid
- 3) Microbiological Contamination Control in Pharmaceutical Clean Room Edited by Nigel HALLS, CRC Press.

PhT-313 QUALITY CONTROL IN PHARMACEUTICAL INDUSTRY

LIST OF PRACTICALS

96 hours

1. Tests for Tablets
 - 1.1 Hardness
 - 1.2 Thickness
 - 1.3 Friability
 - 1.4 Disintegration
 - 1.5 Dissolution
2. Tests for Capsules
 - 2.1 Disintegration test
 - 2.2 Weight uniformity
3. Tests for sterile products
 - 3.1 Leaker test
 - 3.2 Clarity test, LAL test),
4. Tests for creams and ointments
 - 4.1 Particle Size determination
 - 4.2 Weight Variation Test
 - 4.3 Viscosity measurement

Pht-313 QUALITY CONTROL IN PHARMACEUTICAL INDUSTRY

Instructional objectives:

1. Introduction:

1.1 Define and differentiate following concepts

- a) Total Quality Management,
- b) Quality Assurance,
- c) Quality Control

1.1 Discuss in detail each principle of total quality management

1.2 Discuss quality tools and techniques and their role in improvement of quality of drugs

2. Tests for Tablets:

Discuss in detail following physical and chemical tests of compressed tablets with working of equipment, test limits and effect of results on quality of drug

- a) Hardness,
- b) Thickness,
- c) Friability,
- d) Disintegration,
- e) Dissolution

3. Tests for Capsules:

Discuss in detail following physical tests of capsules with working of equipments, test limits and effect of results on quality of drug

- i. Disintegration test,
- ii. weight uniformity

4. Tests for Sterile Products

4.1 Discuss in detail following physical and microbiological tests of sterile products with working of equipment, test limits and effect of results on quality of drug

- a) Leaker test,
- b) Clarity test,
- c) LAL test,

- a. Discuss Microbiological Environmental Monitoring of Class A,B,C,D of clean rooms
- b. Describe media fills and their Application
- c. Discuss contamination of aqueous based non sterile products,

5 Tests for Creams and Ointments

Discuss in detail following physical tests of creams and ointments with working of equipments, test limits and effect of results on quality of drug

- a) Particle Size determination,
- b) Weight Variation Test,
- c) Viscosity measurement.

6 Quality Control for Packaging Materials

Discuss in detail physical, chemical and microbiological tests of packaging materials used for packaging of tablets, capsules, injectable, semisolids and solutions with working of equipment, test limits and effect of results on quality of drugs.

7 Discuss in detail following

- a. Clauses of Drug Law 1976 along with new regulations
- b. Composition and role of different regulatory bodies notified in drug law in regulation of GMP requirements and quality of drugs.

Pht-333 GOOD MANUFACTURING PRACTICES

Theory: 96

T	P	C
3	0	3

Course Objectives:

At the end of this course students will understand the Good Manufacturing Practices guidelines adopted in Pharmaceutical industry, Good Storage Practices (GSP) and Good Laboratory Practices (GLP).

Course Content:

It includes discussion about:-

PART-A

1. QA, QC and GMP relationships **(06 hours)**
2. Personnel, Organization and Training **(06 hours)**
3. Premises, Building and Facilities including :- **(08 hours)**
 - 3.1 Features of Location,
 - 3.2 Site security,
 - 3.3 Structure and finishes,
 - 3.4 Plant services systems and utilities,
 - 3.5 HVAC, Lighting, Water (potable, purified, water for injections),
 - 3.6 Water treatment, Waste disposal.
4. Contamination and Contamination control including :- **(06 hours)**
 - 3.7 Contamination types and sources
 - 3.8 Control of contamination,
 - 3.9 Cleaning and disinfection.
5. Equipment including:- **(06 hours)**
 - 5.1 regulatory requirements,
 - 5.2 Cleaning of equipment,
 - 5.3 calibration of equipment,
 - 5.4 Machine maintenance.
6. Materials Control including:- **(06 hours)**
 - 6.1 starting materials flow charts,
 - 6.2 Quarantine, released and rejected status,
 - 6.3 Packaging materials, sampling techniques.
7. Production and Process Controls including:- **(06 hours)**
 - 7.1 Batch Manufacturing formula,
 - 7.2 Methods and records.
8. Packaging and Labeling Control including:- **(06 hours)**
 - 8.1 Packaging operations
 - 8.2 Batch packaging instructions and record.

PART-B

9. Holding and Distribution including:- (08 hours)
9.1 Storage areas,
9.2 returned or recalled products,
9.3 Goods holding, Goods Out,
9.4 Cold chain distribution,
9.5 Warehousing.
10. Laboratory Controls including:- (06 hours)
10.1 ISO 17025 requirements,
10.2 Testing and release for distribution,
10.3 Analytical validation, Sterility test.
11. Records and Reports including:- (06 hours)
11.1 general requirements of documentation,
11.2 Computer Systems Validation,
11.3 Batch Processing Records, Batch Manufacturing
11.3 Records, Laboratory Records,
11.5 Document Control and Revisions.
12. Returned and Salvaged Drug Products. (04 hours)
13. GMP and Sterile Manufacturing
including:- 13.1 definitions of Sterility,
13.2 methods of Sterilization,
13.3 Heat sterilization, Steam sterilization, Filtration.
14. Validation including :- (08 hours)
14.1 General principles,
14.2 Installation Qualification,
14.3 Operational Qualification,
14.4 Product Qualification, Retrospective Validation,
14.5 Design Qualification,
14.6 Installation Qualification,
14.7 Operational Qualification.
15. Self-Inspection and Quality Audit (06 hours)

Recommended BOOKS

- Good Pharmaceutical Manufacturing Practices – Rationale and Compliance by John Sharp CRC Press.

Pht-333 GOOD MANUFACTURING PRACTICES

Instructional Objectives

1. To make students understand QA, QC and GMP concepts and their differences and relationships with each other.
2. To aware students about Personnel, Organization and Training concepts in pharmaceutical industry.
3. Students can know about Premises, Building and Facilities including features of Location, Site security, structure and finishes, plant services systems and utilities, HVAC, Lighting, Water (potable, purified, water for injections), Water treatment, Waste disposal.
4. Students can understand Contamination and Contamination control including contamination types and sources, control of contamination, cleaning and disinfection.
5. Students can know about Equipment including regulatory requirements, cleaning of equipment, calibration of equipment, machine maintenance.
6. Students can understand about Materials Control including starting materials flow charts, Quarantine, released and rejected status, Packaging materials, sampling techniques.
7. Students can understand Production and Process Controls including Batch Manufacturing formula, methods and records.
8. Students can understand Packaging and Labeling Control including Packaging operations, batch packaging instructions and record.
9. Students can know about Holding and Distribution including Storage areas, returned or recalled products, Goods holding, Goods Out, Cold chain distribution, Warehousing.
10. Students can know about Laboratory Controls including ISO 17025 requirements, Testing and release for distribution, Analytical validation, Sterility test.
11. Students can know about Records and Reports including general requirements of documentation, Computer Systems Validation, Batch Processing Records, Batch Manufacturing Records, Laboratory Records, Document Control and Revisions,
12. Students can know about Returned and Salvaged Drug Products.

13. To make students aware about Sterile Manufacturing including definitions of Sterility, methods of Sterilization, Heat sterilization, Steam sterilization, Filtration, Validation
14. General principles, Installation Qualification, Operational Qualification, Product Qualification, Retrospective Validation, Design Qualification, Installation Qualification, Operational Qualification.
15. Students can understand Self-Inspection and Quality Audit concept.

PhT- 334 PHARMACEUTICAL TECHNOLOGY- II

COURSE OBJECTIVES

Theory: 96

Practical: 96

T	P	C
3	3	4

Course Objectives :

This course will not only develop understanding in students about two major routes of administration, but also train them in manufacturing of five major pharmaceutical dosage forms administered through these routes. Students will get information regarding their manufacturing methods, procedures and packaging techniques.

Course Contents:

PART-A

1. Capsules: (20 hours)

1.1 Types of capsules (Hard Gelatin Capsules, Soft Gelatin Capsules)

1.1.1 Capsules, Types of Capsules.

1.1.2 Hard gelatin Capsules.

1.1.3 Soft gelatin Capsule

1.2 Sizes of Capsule

1.2.1 “00”

1.2.2 “0”

1.2.3 “1”

1.2.4 “2”

1.2.5 “3”

1.3 Capsules manufacturing process flow

1.3.1 Granulation / Mixing

1.3.2 Blistering

1.3.3 Packaging

1.4 Methods and equipment used for preparation of capsules

1.5 Capsule filling, sealing and polishing

1.6 Methods of evaluation of capsules,

1.7 Microencapsulation

1.8 Preventive Maintenance

1.8.1 Introduction to maintenance

1.8.2 Planned maintenance

1.8.3 Lubrication

1.8.4 Maintenance Plans

2. Tablets (20 hours)

2.1 Types of tablets

2.2 Types :-

2.2.1 Compressed .

2.2.2 Film

2.2.3 Enteric coated

- 2.2.4 Double Layer
- 2.2.5 Chewable
- 2.3 Capsules manufacturing process flow
 - 2.3.1 Granulation
 - 2.3.2 Compression
 - 2.3.3 Coating
 - 2.3.4 Blistering
 - 2.3.5 Packaging
- 2.4 Preparation of powders and physical characters evaluation
- 2.5 Preparation of granules by dry and wet granulation, physical characteristics evaluation
- 2.6 Compression of tablets and evaluation of compressed tablets
- 2.7 Effervescent tablets
- 2.8 Preventive Maintenance
 - 1.8.1 Introduction to maintenance
 - 1.8.2 Planned maintenance
 - 1.8.3 Lubrication
 - 1.8.4 Maintenance Plans
- 3. **Coating of Tablets** (10 hours)
- 3.1 Types of coated tablets
- 3.2 Methods of preparation of coated tablets
- 3.3 Equipment used for coating of tablets
- 3.4 Evaluation methods of coated tablets

PART-B

- 4. **Parenteral Products** (20 hours)
 - 4.1 Parenteral routes of administration
 - 4.2 Types of Injections
 - 4.3 Methods of preparation of injections
 - 4.4 Equipment used for preparation of injections
 - 4.5 Methods of sterilization
 - 4.6 Sterile fluids
- 5. **Surgical Products** (06 hours)
 - Surgical procedure, Wound dressing, Bandages, Cotton Pad
- 6. **Packaging of Pharmaceutical Products** (20 hours)

BOOKS RECOMMENDED

1. Pharmaceutical Technology by Gayathri V. Patil and Harpal Singh
2. Modern Pharmaceutical Industry – A Primer by Thomas M Jacobsen and Albert I Werthimer
3. Remington: The Science and Practice of Pharmacy by David B Troy and Paul Beringer
4. Pharmaceutical Production Facilities – Design and Applications by Graham C Cole

LIST OF PRACTICALS (96 hours)

1. Preparations and mixing of powders
 - 1.1 roller mill,
 - 1.2 hammer mill,
 - 1.3 ball mill, c
 - 1.4 centrifugal impact mill,
 - 1.5 fluid energy mill,
 - 1.6 twin shell blender)
2. Preparation of tablets by dry and wet granulation
 - 2.1 twin shell blender,
 - 2.2 fluidized bed granulator,
 - 2.3 rotary granulator and sifter,
 - 2.4 tablet press machine,
 - 2.5 fluidized bed dryer and tray dryer,
 - 2.6 tablet compression machine,
 - 2.7 blister packaging machine
3. Tablet coating
 - 3.1 conventional coating pan,
 - 3.2 strunck immersed tube coating machine
 - 3.3 fluidized bed coating machine
4. Preparation of gelatin capsules
 - 4.1 hand operated capsule filler,
 - 4.2 semiautomatic capsule filling machine)
5. Preparation, filtration, filling and sterilization of Parenterals.
 - 5.1 auger type powder filler,
 - 5.2 screen / membrane filters,
 - 5.3 filling and sealing machine,
 - 5.4 autoclave and dry heat sterilizer

Instructional Objectives:

1. Capsules:

- 1.1 Enlist and differentiate different types of capsules
- 1.2 Describe different methods and equipments used for preparation of capsules
- 1.3 Describe processes of capsule filling, sealing and polishing
- 1.4 What are methods of evaluation of physical characteristics of capsules,
- 1.5 Explain the Microencapsulation

2. Tablets:

- 2.1 Enlist and explain different types of tablets
- 2.2 Define pharmaceutical powders and explain how powders are prepared.
- 2.3 How tablets are prepared by following methods
 - f) direct compression,
 - g) dry granulation
 - h) wet granulation
- 2.4 Describe physical characters evaluation of powders and granules.
- 2.5 Describe tablet compression and blistering in detail.
- 2.6 Evaluate physical characteristics of compressed tablets
- 2.7 Demonstrate working of different machines used for granulation, compression and blistering.
- 2.8 Describe Effervescent tablets

3. Coating of Tablets

- 3.1 Enlist and differentiate different types of coated tablets
- 3.2 Describe methods of preparation of
 - iii. sugar coated,
 - iv. film coated,
 - v. enteric coated
 - vi. gelatin coated tablets
- 3.3 Describe working of equipment used for coating of tablets
- 3.4 Describe methods of evaluation of coated tablets

4. Parenteral Products

- 4.1 Describe different parenteral routes of administration
- 4.2 Explain different types of Injections
- 4.3 Describe methods and equipment used for preparation of injections

4.4 Explain in detail following methods of sterilization of parenteral dosage form

- a) Steam sterilization
- b) Dry heat sterilization
- c) Sterilization by filtration
- d) Gas sterilization
- e) Sterilization by radiation

4.5 Describe in detail Sterile fluids

5. Surgical Products

Describe in detail

- a) Surgical procedure,
- b) Wound dressing,
- c) Bandages,
- d) Cotton Pad

6. Packaging of Pharmaceutical Products

6.1 Describe components of packaging material

6.2 Explain techniques used for packaging of different pharmaceutical dosage forms

6.3 Describe methods of evaluation of physical characteristics of pharmaceutical packaging

COURSE CONTENTS.

- | | | |
|-----------|--|-----------|
| 1. | UNITS AND DIMENSIONS | 04 |
| 1.1 | Definition | |
| 1.2 | Conversion of units in English/metric system | |
| 1.3 | Calculation based on unit conversion | |
| 2. | BEHAVIOUR OF GAS | 12 |
| 2.1 | Ideal gas laws | |
| 2.2 | Boyl's law | |
| 2.3 | Charles's law | |
| 2.4 | Gas equation | |
| 2.5 | Absolute Temperature | |
| 2.6 | Absolute Zero | |
| 2.7 | Absolute temperature scales | |
| 2.8 | Standard conditions | |
| 2.9 | Value of gas constant 'R' in different systems | |
| 2.10 | Calculation based on gas equation | |
| 2.11 | Dalton's law of partial pressure | |
| 2.12 | Amagats law of partial volume | |
| 2.13 | Avogadro's number | |
| 2.14 | Mole fraction and percent | |
| 2.15 | Pressure fraction and percent | |
| 2.16 | Mass fraction and percent | |
| 2.17 | Volume fraction and percent | |
| 2.18 | Mole percent and percent | |
| 2.19 | Prove Mole percent = volume percent = pressure percent | |
| 2.20 | Calculation based on percentage and fractions for gaseous mixtures | |
| 2.21 | Vander Waal's equation | |
| 3. | CHEMICAL EQUATION | 08 |
| 3.1 | Limiting reactant | |
| 3.2 | Excess reactant | |
| 3.3 | Theoretically required amount of reactant | |
| 3.4 | Percent excess of reactant | |
| 3.5 | Degree of completion of reaction | |
| 3.6 | Percent conversion of reactant | |
| 3.7 | Percent yield | |
| 3.8 | Calculation based on chemical equation | |
| 4. | MATERIAL BALANCE | 16 |
| 4.1 | Law of material balance | |
| 4.2 | Steps involved in making material balance calculation | |
| 4.3 | Tie component | |

4.4	Material balance without chemical change	
4.5	Material balance involving chemical change	
4.6	Calculation based on simultaneous equation	
4.7	Calculation based on combustion problems	
5.	ENERGY BALANCE	08
5.1	Energy unit	
5.2	Law of Energy Balance	
5.3	Specific heat at constant volume	
5.4	Specific heat at constant pressure	
5.5	Latent heat	
5.6	Enthalpy	
6.	THERMO CHEMISTRY	08
6.1	Heat of Reaction	
6.2	Heat of Formation	
6.3	Heat of Combustion	
6.4	Hesis law of Heat Submission	
7.	THERMODYNAMICS	08
7.1	First law of Thermodynamics	
7.2	Heating at constant volume	
7.3	Heating at constant pressure	

TEXT BOOKS

1. Manual on Stoichiometry (Chemical Technology) Polytechnic Manual pens
2. An Introduction to Chemical Engg. by Charles E. Little John
3. Himmelblau David M. (2003), "Basic Principles and Calculations in Chemical Engineering" 7th Ed., Published by Prentice Hall PTR.
4. Hougen Olaf A., Waston Kenneth M. (2004), "Chemical Process Principles", John Wiley and Sons & CBS Publishers.
5. B.I.Bhatt, (2004), Stoichiometry", McGraw Hill

INSTRUCTIONAL OBJECTIVES.

1 UNIT AND DIMENSION

1.1 Understand unit and dimension

- 1.1.1 Explain unit and dimension
- 1.1.2 Enumerate the system of units
- 1.1.3 Define English system, metric system and S.I system
- 1.1.4 Explain derived units

2 BEHAVIOUR OF GAS

2.1 Understand behaviour of gases

- 2.1.1 Explain facts and observation about gases
- 2.1.2 Enlist the gas laws
- 2.1.3 Define ideal gas law
- 2.1.4 State boyle's law
- 2.1.5 State Charles's law
- 2.1.6 Derive general gas equation
- 2.1.7 Describe Absolute temperature
- 2.1.8 Define Absolute Zero
- 2.1.9 Define Absolute temperature scale
- 2.1.10 Define the standard conditions of temp pressure(STP or NTP)
- 2.1.11 Calculate value of R in different system
- 2.1.12 Solve problems based on gas equation
- 2.1.13 Explain dalton's law of partial pressure
- 2.1.14 Define amagats law
- 2.1.15 Explain the Application of problems
- 2.1.16 Describe avogadro's number
- 2.1.17 Explain mole fraction and percent
- 2.1.18 Illustrate pressure fraction, mass fraction, volume fraction
- 2.1.19 Prove mole percent=volume percent=pressure percent
- 2.1.20 Solve problems of gaseous mixture based on %age and fraction
- 2.1.21 Derive vander wall's equation
- 2.1.22 Solve problems based on vanders wall's equation

3 CHEMICAL EQUATION

3.1 Understand chemical equation

- 3.1.1 Define limiting reactant
- 3.1.2 Define excess reactant
- 3.1.3 Calculate theoretical required amount of reactant
- 3.1.4 Calculate excess of reactant
- 3.1.5 Define degree of competition reaction
- 3.1.6 Describe percent conversion of reaction
- 3.1.7 Describe percent field
- 3.1.8 Solve problems based on chemical equation

4 MATERIAL BALANCE

4.1 Understand material balance

- 4.1.1 Enlist the steps involved in making material balance calculation
- 4.1.2 Define the components
- 4.1.3 Describe material balance with out chemical change
- 4.1.4 Explain material balance involving chemical change
- 4.1.5 Solve problems based on simultaneous equation
- 4.1.6 Solve problems based on combustion process

5 ENERGY BALANCE

5.1 Understand energy balance

- 5.1.1 Define energy unit
- 5.1.2 State law of energy balance
- 5.1.3 Explain specific heat at constant volume and constant pressure
- 5.1.4 Define latent heat
- 5.1.5 Explain enthalpy

6 THERMO CHEMISTRY

6.1 Understand thermo chemistry

- 6.1.1 Define heat of reaction, heat of formation and heat of combustion
- 6.1.2 State Hess's law of heat summation
- 6.1.3 Calculate heat of combustion of gases/ fuels
- 6.1.4 Calculate heat of reaction applying Hess's law

7 THERMODYNAMICS

7.1 Understand thermodynamics

- 7.1.1 State first law of thermodynamics
- 7.1.2 Calculate specific heat at constant volume and at constant pressure

Pht –341 Entrepreneurship

Total Contact Hours	= 32 Hrs	T	P	C
Theory	= 32 Hrs	1	0	1

Course Objective

- 1- Understanding the concept and elements of small business enterprise.
- 2- Apply the techniques for generating business ideas as well as for identifying and assessing business opportunities.
- 3- Understand the procedures required for establishing an enterprise.
- 4- Understand the procedures for assessing market and for selecting location for a small business.
- 5- Understand the importance of financial record keeping in a small business.
- 6- Develop business plan and evaluate it in real market situation.
- 7- Apply the concepts of Chemical / Pharmaceutical Engineering on planning, designing and layout of related technical projects.

Course Contents

1- Entrepreneurship and Management

4 Hr

- 1.1 The concept of entrepreneurship
- 1.2 Entrepreneurial style Vs Managerial style
- 1.3 Terminology used in entrepreneurship
- 1.4 Classification of business; difference between social and commercial business
- 1.5 Reasons for Entrepreneurship; importance in society, self employment, benefits & limitation, Importance of relations/links
- 1.6 Entrepreneurial motivation; setting goals and risk assessment.
- 1.7 Small enterprises; elements, ideas, motivation, resources, business plan etc.

2- Entrepreneurship and innovation

3 Hr

- 2.1 Creativity and innovation; creativity potential, techniques for developing creative abilities
- 2.2 Business ideas; resources of business ideas, collective thinking and creative thinking,
- 2.3 Risk involved in innovation
- 2.4 Identifying and assessing business opportunities

3- Entrepreneurs

5 Hr

- 3.1 Entrepreneurial characteristics
- 3.2 Assessment of entrepreneurial potential; assessment of individuals
- 3.3 Entrepreneurial Leadership: abilities for a successful businessman
- 3.4 Self discipline; check list for attaining self discipline

- 3.5 Decision making skills; steps for decision making, rating of decision making skills
- 3.6 Principles of negotiation; resolving business issues through negotiation

4- Establishment of An Enterprise

8 Hr

- 4.1 Market; Five 'W' of market, competitors, assessment of market size & demand
- 4.2 Business location; importance, selection of site
- 4.3 Legal forms of business; Proprietorship, Partnership, limited company, Cooperative, advantages & disadvantages
- 4.4 Costing of product; direct and indirect cost
- 4.5 Break even analysis: fixed and variable costs, calculating break even indicates & applications
- 4.6 Finance & sources of financing; equity financing & loan financing, initial capital & working capital estimation

5- Management of an Enterprise

8 Hr

- 5.1 Hiring and managing people; hiring procedures, term & condition of services and Job description etc.
- 5.2 Managing sales & supplies; characteristics of successful sales personals, importance of advertisement, life cycle of product, selection of supplies, work order, delivery & payment etc.
- 5.3 Management of capital; operating cycle concept, management of cash & stock etc.
- 5.4 Accounting and book keeping: cash book, balance sheet etc.
- 5.5 Income tax; income tax returns, computation of business income
- 5.6 Sales tax; basic scheme of sale tax, assessment of return etc

6- Business Plan

4 Hr

- 6.1 Purpose of business plan
- 6.2 Components of business plan; outline, process of writing business plan
- 6.3 Analysis of business plan: feasibility; breakeven point, evaluating problem in starting business
- 6.4 Standard business plan

DAE Chemical Technology with Sp. in Pharmaceutical
LIST OF EQUIPMENT AND MACHINERY FOR 50 STUDENTS

Sr #	ITEMS	Approved Qty	Unit Rate	Amount	Lab
1	Jaw Crusher: Equiped with 3 phase 50 to 220 volt, V.Belt Drive with 3 to 3.5 jaw opening, 500 RPM speed capacity50-150 lb/hr.bench space 14.5x21 to reduce rock lamps from 2.5 dia to pass on 10 mesh or finer sieve jaws made of manganese steel corrugated faces	1	65000	65000	Chemical Engineering Lab
2	Pulverizer: Bronz casting steel rotor 220 volt, 3 phase, 50N, I HP Motor 2600 RPM with V.Belt drive at guards 1.00 ammeter Extra retaining screen with fabric bags for outlet mounted on legs 2 casters for easy movement.	1	103000	103000	Chemical Engineering Lab
3	Centrifugal pump: with 1/2 HP motor single phase capacity 250gal/min, 30 feet Head, 220 volt in casting.	1	90000	180000	Chemical Engineering Lab
4	Sample Grinder: Open door dise type with locking, hand wheel to regulate product size with bearings, cast iron traction with stud disc 0" with 6" dia disc capacity 200lb/hr at 20mesh with 2 HP motor, 220 Volt 50 N mounted on a common mounting base.	2	35000	35000	Chemical Engineering Lab
5	Ball mill(Lab size): with welded stud base extra thick shell with integral cast lifter bars. Capacity: 150lb/hr complete with 250 lbs of stud balls, with 1.5 / 2 HP 3 phase motor 550 volts 50N operation.	1	56000	56000	Chemical Engineering Lab
6	Jar mill: complete with Trojan porcelain jar, fitting and pebbles furnished with 1/4 HP, single phase 220 v motor with covered and chain drive mounted on unit base.	1	40000	40000	Chemical Engineering Lab
7	Sieve Shaker: Height 32" width 34" depth 17" weight in cladding 0.25 HP motor and time switch Capacity: 290lb for 115 vac. 60HZ speed 1750 RPM with sieve set.	1	55000	55000	Chemical Engineering Lab

8	REACTION UNIT Model. Re/fv(manual version) TECHNICAL SPECIFICATION - Zinc-plated and painted carbon-steel structure. - dimension: 1300x6000x1600mm - shell and -tube exchanger with A/S.-304 stainless steel tubes and borosilicate glass shell, exchange surface of 0.6(m) ² - spiral plate exchanger, made of A/S.-316 stainless steel exchange surface of 0.6 (m) ² - A/S/ - 304 stainless steel connection lines and valves. - Magnetic induction electronic indicator. cold water flow meter, 0-10,00 l/hr scale. - 4 double thermo-resistances, pt 100 - 4 electronic temperature indicator UTILITIES. - Cold water consumption 1000L/hr max - Hot water consumption = 1000L/hr max - T= 95c - power supply : single-phase 220v 50hz+ground P=0.5 kw max - Compressed air consumption 5(m) ³ /hr p=1.4 bar	1	130000	130000	Chemical Engineering Lab
	UTILITIES.- Cold water consumption 1000L/hr max- Hot water consumption = 1000L/hr max- T= 95c- power supply : single-phase 220v 50hz+ground P=0.5 kw max - Compressed air consumption 5(m) ³ /hr p=1.4 bar			0	
9	Pen sky-martens Flash point tester (semi-automatic type) Semi-automatic type Acc. To ASTM D-93 for flash point determinations from 65 to + 370 c equipped with all accessories	2	130000	260000	Analytical lab

10	Redwood viscometer: Equipped with electric heater complete with 2 thermometer and one measuring flask 50ml with base 220v. The electric heater can effectively be controlled by means of a triac-heat out put regulator.	1	65000	65000	Analytical lab
11	Aniline point tester: operating on thin film method ASTM D 611, method and - Din 51787 With all accessories.	2	175000	350000	Analytical lab
12	Cloud and pour point tester: operating to Din 51597-ASTM D-97 manual tester for test consisting of stainless steel bath cover made of pvc with in served air jacket colling coil for connection to a thermostat controlled cooler hand stirrer, 1 test jar, 2 thermometer.	4	96000	384000	Analytical lab
13	Portable mixer: with direct drive 4 inch diameter Stainless steel propellers. 1/4 HP single phgase 50 cycles. 220 v motor mounted on metalic stand.	1	9000	9000	Chemical Engg
14	Mixing Tank: Capacity 10 gallons stainless steel dull polished inside, Desalted ouside slopping bottom of out let connection reinforced top rim, steel legs. Complete with stainless steel cover. Outlet valve casters and mixer frame.	1	15000	15000	Chemical Engg
15	PH-meter (Digital): PH 0-14, mv 12000, Temperature 20 to 150C, Resolution 0.01/ 1 mv/0.1c Temperature compensation, manual and automatic (Bench Type)	2	60000	120000	Analytical lab
16	PH-meter (Checker) Portable: Range 0.00 - 14.00 PH, pocket type small (Bench type)	4	18000	72000	Analytical lab
17	Melting Point Apparatus: Digital, temperature range 0-150C Approx, rapid heating Apparatus working on 220 v	4	35000	140000	Analytical lab
18	Water Deminerilizer: Equipped with different cell showing % sodium chloride, water in put/ Out put flow rate 50lit/hr, power 220-240v	2	25000	50000	I.C.P
19	Viscosity Bath (0-40C): Sample holding capacity 4-6 Nos, thermostatic control stainless steel and glass frame for oil bath auto stirring, Operating voltage 220v	2	30000	60000	Analytical lab

20	Viscosity Bath (100C): Adjustment of set point temperature, sample holding capacity 4-6 Nos, with timer and stirring facility, power 220v stainless steel glass body for oil contact	2	45000	90000	Analytical lab
21	Abbe's Refractometer: Precision English type, range ND = 1.300-1.700 Minimum unit scale ND 0.0005 sugar concentration 0-955 min. unit scale for sugar concentration 0.25 thermostat 0-70C	2	230000	460000	Analytical lab
22	Electronic Balance: Digital, Top loading, capacity 300gms, sensitivity 0.01 gms for 220v, weight modes Gm, once, lbs and kg.	4	50000	200000	For All Lab
23	Plate and frame filter press: Plate size 2 inch * 12 inch, frame 12*12inch, No. of plate = 13 No. of frame = 12 complete with plunger pump and drive motor 1 HP single phase 220v	2	30000	60000	Chemical Engg
24	Hand die threading set: :Universal quick opening die head, with drop head threader size: 1/8 inch to 1.25 inches.	2	12000	24000	Basic chemical Engg.
25	Spectrophotometer : Digital, filter 42-87 nm (7 Nos) With sample holder, electric supply 220.240 v, photo meter read out A and % T	2	165000	330000	Analytical lab
27	Rectifier: To convert AC to DC Ac in put 220v Dc voltage up to 12v ampere up to 500	2	37000	74000	Analytical lab
29	Nephlo meter (digital portable): Both for coarse and homogeneous solutions. Power supply 220v Wave length 42-87 nm, Latest Model	1	85000	85000	Analytical lab
30	Magnetic stirrers with hot plate: Electric, speed regulation of 150-2000 rpm, Selectable reversible stirring motion.	6	25000	150000	For All Lab
31	Uv-v/s Spectrophotometer: With operational and maintenance manual Wave length accuracy +/-1nm Wave length calibration internal automatic Wave length repeatability 0.1nm Wave length resolution 0.1nm spectral band width: 5nm max Source lamp selection, Automatic changeover external out put:Rs.232 serial or parallel photometric range -3.0 to 3.0 ABS	1	300000	300000	Analytical lab

32	Diesel index determination Apparatus: According to A D IN / ASTM STANDARD	1	75000	75000	I.C.P
33	Reynold's Demonstration Unit with hydraulic Bench: To observe laminar, transitional and turbulent pipe flow Reynolds experiment pipe dia 8-10mm Dy-reservoir, Capacity: 0.45-0.50 lit	1	610000	610000	Chemical Engg
34	Electric Drill Machine: Aluminum body type, with complete bit set Size: 1.5mm - 12.5mm 220v, 50-single phase	2	8000	16000	Basic chemical Engg.
35	Tray Dryer (complete with all accessories) small scale drying unit used for dew on striation of drying rfate. Heat and mass transfer drying test on solids. Capacity 2-3 kg of solid -2 drying compartment 0.25 - 0.3 mx 0.25 - 0.3 x 0.35 - 0.4 m consisting of digital balance, are mom meter, aerated psychomotor.	1	300000	300000	Chemical Engg
36	First aid kit: Equipped With all standards accessories and Medicines	4	5000	20000	Gernal Chemical Lab
37	Glass electrodes: Can fitted with PH Meter and titrimeter	6	9000	54000	Analytical lab
38	Calmel electrodes: Can fitted with PH Meter and titrameter	6	9000	54000	Analytical lab
39	Paltinum Electrodes: For conductivity bridge	6	10000	60000	Analytical lab
40	Water distillation unit	2	60,000	120000	organic/physica l
41	Water purifier	4	32,000	128000	organic/physica l
42	Platinum wire(sealed in glass rod,used for flame test 1-1.5 cm in length)	24	5,000	120000	organic/physica l
43	Tintometer	1	375,000	375000	I.C.P
44	Hot plate	4	45,008	180032	organic/physica l
45	Oven	3	124,100	372300	organic/physica l
46	Muffle furnace	2	78,880	157760	organic/physica l

47	Moisture tester	2	150,000	300000	Chemical Egeeneering lab
48	Water softener (mixed bed type)	1	135,000	135000	I.C.P
49	Electronic aqua analyzer	1	260,000	260000	I.C.P
50	Cation type	1	115,000	115000	I.C.P
51	Anion type	1	115,000	115000	I.C.P
52	Vitamin tester (digital)	1	160,000	160000	I.C.P
53	Double jacketed soap pan	1	80,000	80000	I.C.P
54	Bladder	1	25,000	25000	I.C.P
55	Cake cutter	1	10,000	10000	I.C.P
56	Natural Gas Burner	50			organic/physical
57	Protein tester	1	750,000	750000	I.C.P
58	Soxhlet apparatus	1	32,480	32480	organic/physical
59	West paul balance	1	25,000	25000	organic/physical
60	Density meter	1	10,000	10000	organic/physical
61	Saybolt viscometer	2	30,200	60400	organic/physical
62	Ostwald's viscometer	24	1,500	36000	organic/physical
63	Staglomer	4	4,500	18000	organic/physical
64	Dobosque Clorimeter	2	300,000	600000	Analytical lab
65	Spectronics-21 with accessories	2	70,000	140000	Analytical lab
66	Flame Photometer	1	375,000	375000	Analytical lab
67	Polari meter	1	375,000	375000	Analytical lab
68	Conductivity Bridge with Accessories	2	27,000	54000	Analytical lab
69	Technical Orsat Apratus for the analysis of flue gases	2	50,000	100000	Analytical lab

70	Electrician Tool Kit	2	10,000	20000	Analytical lab
71	Aluminium Ladder 8 feet	2	5,000	10000	Analytical lab
73	Air Conditioner Unit	2	25000	50000	Analytical lab
74	Hydraulic bench Equipped with all accessories for Oriface discharge, energy losses in pipe & fittings, Venturi Discharge, orifice meter, pitot tube ARME fileld, UK	1	600,000	600000	Chemical Engineering Lab
75	Multiple pump test Rig with Accessories	1	360,000	360000	Chemical Engineering Lab
77	Flaring tool set	1	3,500	3500	Basic chemical Engg. & Technology Practice Lab
78	Gate Valve 2 inch	4	2,500	10000	Basic chemical Engg. & Technology Practice Lab
79	Globe Valve 2 inch	4	2,500	10000	Basic chemical Engg. & Technology Practice Lab
80	Check Valve 2 inch	4	2,500	10000	Basic chemical Engg. & Technology Practice Lab
81	Safety Valve 2 inch	4	5,000	20000	Basic chemical Engg. & Technology Practice Lab
82	Butter fly Valve 2 inch	4	2,500	10000	Basic chemical Engg. & Technology Practice Lab
83	Plug cook Valve 3/4 inch	4	2,500	10000	Basic chemical Engg. & Technology Practice Lab
84	Expansion steam trap 1/2 inch	4	5,000	20000	Basic chemical Engg. & Technology Practice Lab
85	Bucket steam trap 1/2 inch	4	5,000	20000	Basic chemical Engg. & Technology Practice Lab
86	Impulse steam trap 1/2 inch	4	10,000	40000	Basic chemical Engg. & Technology Practice Lab

87	Work bench	10	10,000	100000	Basic chemical Engg. & Technology Practice Lab
88	G.I Pipe sizes 1 Inch, 2 Inch	30 Feet Each		2250	Basic chemical Engg. & Technology Practice Lab
89	Plateform Balance	1	5,000	5000	Basic chemical Engg. & Technology Practice Lab
	Digital Display capacity 30 kg accuracy 10-15 gm. Korea/Taiwan				
90	Pipe cutter (circular blade) Size 3" dia, China	2	5,000	10000	
91	Pipe Fittings				Basic chemical Engg. & Technology Practice Lab
	Union 3/4 inch	12	70	840	
	Tee 3/4 inch	12	60	720	
	Elbow 3/4 inch	12	50	600	
	Reducing Elbow 3/4 inch	12	70	840	
	Nipple 3/4 inch	12	50	600	
	Socket 3/4 inch	12	40	480	
	Stop Cock 3/4 inch	12	180	2160	
	Bend 3/4 inch	12	50	600	
	Stopper 3/4 inch	12	30	360	
	Union 1 Inch	12	120	1440	
	Tee 1 Inch	12	80	960	
	Elbow 1 Inch	12	60	720	
	Reducing Elbow 1 Inch	12	70	840	
	Nipple 1 Inch	12	60	720	
	Socket 1 Inch	12	50	600	
	Stop Cock 1 Inch	12	220	2640	
	Bend 1 Inch	12	65	780	
	Stopper 1 Inch	12	40	480	
92	Pipe wrench				
	Bosi, Japan with following sizes			600	
	6"	2	300		
	12"	6	500	3000	
	18"	6	800	4800	
93	Screw driver, Germany	6	180	1080	
	07 pcs. Set chrome vanadium with steel headed top.				
94		3			
	Screw Wrench		200	600	

	Alloy steel, Bosi Japan		350	1050	
	Size 6", 10", 12", 15"		500	1500	
	(4 Pcs) set.		700	2100	
95	Straight peen Hammer	2	250	500	
	Pak made weight 500 gm with wooden handle				
	Pak made weight 250 gm with wooden handle				
96	Plier (3 piece set), Japan	6	900	5400	
	8" Combination				
	8" Cutter				
97	Socket Set	2	2500	5000	
	UK/Japan 5-10 mm size				
98	Centrifuge machine	4	12000	48000	
	Power driven speed 3000 rpm 06 tubes with cover				
99	Water distillation unit (still) capacity 5 lit/hr	3	15000	45000	
	Electric Heater emersion rod 2000 watt, steel body, water container with sight glass koria/china with collecting Jug 1 lit capacity (China)				
101	Micro Scope	2	16000	32000	
	Complete with all accessories as Model No. Switt-M-7000 D or equivalent				
102	Vacum Pump	1	15000	15000	
	Rocker-300, Rocker				
103	Conductivity/TDS meter	1	13000	13000	
	Model WAG 9032 WAGTECH/UK or equivalent				

DAE CHEMICAL TECHNOLOGY

List of Apparatus/**Glass ware** for **General Chemistry/Organic Chemistry/Physical Chemistry Labs/Analytical Labs/Process** Lab for 50 Students

Note: The Glass ware for all of these Labs amounts to a total of Rs. 300,000

Sr. No.	Items		
1	Brix Hydrometer	Without thermometer Length 25 cm, graduated in 0.5 Brix	
		0---30 Bx Range	
		30---60 Bx Range	
		60---90 Bx Range	
2	Brix Hydrometer	With thermometer Length 25 cm graduated in 0.1 Bx	
		0---10 Bx Range	
		10---20 Bx Range	
		20---30 Bx Range	
		30---40 Bx Range	
		40---50 Bx Range	
		50---60 Bx Range	
		60---70 Bx Range	
		70---80 Bx Range	
		80---90 Bx Range	

		90---100 Bx Range	
3	Measuring Cylinder	Glass capacity 500 ml	
		I.D -- 5cm	
4	Hydrometer Jar	30 x 5 cm	
5	Hydrometer (Be) range	0----10 Be Range	
		10---20 Be Range	
		20----30 Be Range	
		30----40 Be Range	
6	Measuring Cylinder with spout	Glass boro silicate	
		25 ml	
		50 ml	
		100 ml	
		250 ml	
		500 ml	
		1000 ml	
7	Measuring Cylinder	Glass boro silicate	
8	(stoppered) German Standard	50 ml (in half divisions) Capacity	
9	Vaccum flask	Glass boro silicate capacity 1000 ml complete with filter assembly	
10	Measuring Flask	Glass boro silicate	
		50 ml	
		100 ml	
		250 ml	
		500 ml	
		1000 ml	
11	Kohlrauch flask for polarisatoin	Glass	
		Capacity	

		100 ml	
		200 ml	
12	Water condenser	Spiral type glass condenser boro silicate	
13	Elenmeyer's conical flask	Glass pyrex brand	
		capacity	
		50 ml	
		100 ml	
		250 ml	
14	Distillation flask with side tube	500 ml	
		Glass German Brand	
		Capacity	
		100 ml	
15	Boiling Round bottom flask with lipped neck	500 ml	
		Glass pyrex brand	
		capacity	
		1000 ml	
		2000 ml	
16	Evaporating basin flat bottom with spout	Glass German Brand	
		Capacity	
		45 ml	
		300 ml	
17	Beaker with spout	600 ml	
		1000 ml	
		Jena/Pyrex Glass	
		Capacity	
		50 ml	
		250 ml	
18	Funnel with stem	China Glass	
		5 cm dia	

		10 cm dia		
		15 cm dia		
		20 cm dia		
19	Desiccator schiehler's with perforated dise	Glass Size:		
		15 cm dia		
		20 cm dia		
20	Burette with stop cock	Rota flow tm, wertlab germany Capacity: 50 ml		
21	Auto fill Burette	Werlab Garmany 50 ml		
22	Buritte Mehr's with rubber tube het and pinch cock	Glass 50 ml		
23	Burette stand equipped withdouble clamp, brass	Standard Size		
24	Pipette with one mark	German brand, Glass		
		5 ml		
		10 ml		
		20 ml		
25	Pipette graduated in 1/10 ml---1ml Germany	German brand, Glass		
26	Pipette stand for holding 8-12 pipettes	Metallic base (Special)		
27	Thermometers graduated stem (china)	Hg-filled		
		100 c		
		220 c		
		212 F		
		400 F		
28	Thermometers graduated in 1C	100 C		
29	Crucible tongs with bow	Iron std. size		
30	Retort rings with brass screw	Metallic		
31	Tripod stand	Wrough Iron coated in ZnO		
32	Reagent bottles narrow mouth flat glass stoppered	Glass (White)		
		250 ml		
		500 ml		

		1000 ml		
33	Reagent bottles narrow mouth flat glass stoppered	Amber Colour Glass		
		125 ml		
		250 ml		
34	Dropping bottle (China)	Glass		
35	Test tube-ordinary (England)	10 cmx2 cm		
		15 cmx2.5 cm		
36	Test tube holder with wooden handle	metallic strip type		
37	Test tube stand	For holding 08 tubes approx.		
38	Buritte Brushes	Long size std		
39	Test tube burshes	Std Size		
40	Magnifying glass fitted in steel case	5 cm dia		
		10 cm dia		
41	Crucible porcelain with lid	Berlin porcelain		
		50 ml		
		100 ml		
42	Gooch crucible complete with asbestos	Porcelain capacity 25 ml		
43	Fireclay crueible with lid	Capacity 200-250ml		
44	Platinum wire	Lab grade		
		0.1 mm thickness and 5 cm length, attach to screw clamp for lab test		
45	Porealain basin round bottom with spout	Royal Berline porcelain		
		6 cm dia		
		10 cm dia		
		15 cm dia		
46	Silica crucible Suitable for ash incineration with lid (England)	Transparen t		

47	Alluminium mugs with handle	Capacity 500 ml		
		1000 ml		
48	Bucket with cover	Plastic capacity		
		5 Lit.		
		10 Lit.		
49	Sprit lamp complete with wick holder	Glass container capacity 120 ml		
50	Liabig's condenser glass body (China)	40 cm		
51	Weighing bottles with stopper	40 x 25 mm		
		60 x 39 mm		
52	Watch glass	45 mm		
		75 mm		
		100 mm		
53	Wire gauge iron with asbestor center	15 cm sq.		
54	Asbestos mill board	0.5 cm thick, 15 cm sq.		
55	Pinch cock clip	6 cm long		
56	Cork borer nickled brass with handle for each	06 piece set		
57	Cork presser	Wheal pattern metallic. Std. Size		
58	Filter Paper (wattman)	No. 40 Std. 10 cm dia		
		No. 42 Std. 10 cm dia		
		(Packet of 100 Pieces)		
59	Mortal & Pestle	Porcelain 10 cm dia		
		15 cm dia		
60	Petri dish	Glass 4 cm dia		
		15 cm dia		
61	Spatula	Steel 15 cm long		
62	Ceramic tile glazed on one side	15 cm x 15 cm		

63	Wash bottles with ground stopper	Capacity 500 ml		
64	Glass rods	6 mm dia, weight in pound		
		8 mm dia, weight in pound		
		10 mm dia, weight in pound		
		12 mm dia, weight in pound		
		18 mm dia, weight in pound		
65	Glass tubes	Bore Size:		
		8 mm, weight in pound		
		10 mm, weight in pound		
		12 mm, weight in pound		
		14 mm, weight in pound		
		16 mm, weight in pound		
		18 mm, weight in pound		
66	Rubber tubing	50 Ft length for each bore size		
		7.5 mm		
		10 mm		
		12 mm		
		15 mm		
67	Rubber Cork	Top dia 16		

		mm to 40 mm bottom dia 12 mm to 34 mm		
	Different sizes			
68	Aspirator bottles without stopper and stop cock	Capacity 2 Lit. (China)		
69	Glass pencil	Std. Size		
70	Pair of scissors	4" Size		
		6" Size		
71	Water bath with rings of assorted sizes	Copper, 20 cm dia		
72	Ostwald viscometer	ASTM Standard		
73	PH paper Strip	ASTM Standard (pack of 20) demand in packets		
74	Filter flask	Pyrex brand glass		
		250 ml		
		500 ml		
		1000 ml		
75	Funnel stand for two funnels	Wooden, std Size Glass Capacity		
76	Separating funnel with stop cock (Germany)	Capacity: 100 ml		
		250 ml		
		500 ml		
77	Glass prism for practical purpose	China		
78	Glass slab	China Size: 10cm x 7cm x 1cm (Standard Size)		
79	Glass mirror strips for practical	5 cm x 15 cm		
80	Fiber Glass wool for insulation	1 Kg pack (Packet)		
81	Asbestos powder	10 Kg pack		
82	Cork Sheet	3mm thick 3" x 6"		

83	Pipe vice	Pak made 04" dia, made of drop forged steel jaws borders hinged body		
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Grand Total of Glassware & above Labs. =	12,259,032
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List of CHEMICALS

Sr. No.	Chemicals	Make	Qty Requi red	Unit Price
1	Acetic Acid	Germany/E ngland	15 Litre	800/Lit
2	Acetone	China/Ger many	2.5 Litr	900/2.6 Lit
3	Ammonium Acetate	China/Ger many	1 Kg	1300/kg
4	Ammonium Chloride	China/Ger many	4 Kg	350/kg
5	Ammonium Oxalate	China/Ger many	1 Kg	1700/kg
6	Ammonia Liquid.	China/Ger many	10 Litr	550/2.5 Lit
7	Ammonium Sulphate	China/Ger many	1 Kg	800/kg
8	Ammonium Phosphate	China/Ger many	1/2 Kg	1300/kg
9	Ammonium Sulphocyanite	China/Ger many	1/2 Kg	1400/kg

10	Ammonium Molybedate	China/Germany	1/2 Kg	500/kg
11	Ammonium Hydroxide	China/Germany	2.5 Litr	900/2.5 Lit
12	Ammonium Tri-Chloride	China/Germany	1/2 Kg	3000/kg
13	Ammonium Nitrate	China/Germany	1/2 Kg	400/kg
14	Acetylene Chloride	China/Germany	1/2 liter	3200/lit
15	Alumina	China/Germany	1/2 Kg	1500/kg
16	Bismuth Carbonate	China/Germany	1/2 Kg	1800/kg
17	Bismuth Nitrate	China/Germany	1/2 Kg	1600/Kg
18	Barium Carbonate	China/Germany	1 Litr	700/kg
19	Bromine Liquid	China/Germany	1Litre	500/Lit
20	Benzoic Acid	China/Germany	1 Kg	700/kg
21	Barium chloride	China/Germany	2.5 Litr	800/Lit
22	Benzene	China/Germany	5 Litr	1400/2.5 Lit
23	Calcium carbonate	China/Germany	1/2 Kg	1600/kg
24	Calcium chloride	China/Germany	2.5 Litr	200/Lit
25	Calcium Acetate	China/Germany	1/2 Kg	700/kg
26	Calcium sulphate	China/Germany	1/2 Kg	250/kg
27	Calcium Carbide	Pak	2 Kg	500/kg
28	Copper Carbonate	China/Germany	1 Kg	2200/kg
29	Copper Acetate	Pak	1 Kg	1850/kg
30	Copper Chloride	Pak	1 Kg	200/kg
31	Chromium Nitrate	China/Germany	1/2 Kg	1200/kg
32	Chromium Chloride	China/Germany	1/2 Kg	1900/kg
33	Chromium Carbonate	China/Germany	1/2 Kg	1200/kg
34	Copper Sulphate	China/Germany	1/2 Kg	250/kg
35	Cobalt Sulphate	China/Germany	1/2 Kg	2000/kg

36	Cobalt Nitrate	China/Germany	1/2 Kg	2200/kg
37	Cobalt Chloride	China/Germany	1/2 kg	2150/kg
38	Di-amonium Hydrogen Phosphate	China/Germany	1 Litr	1900/kg
39	Di-methyl Aniline	China/Germany	1 Litr	3600/2.5 lit
40	Di-Phenyl Amine	China/Germany	1 Litr	1700/lit
41	Distilled water	China/Germany	25 Litr	100/Lit
42	Ethanol	China/Germany	10 Litr	750/Lit
43	Ethyl Chloride	China/Germany	1/2 litr	2000/2.5 Lit
44	Erichrom Black T	China/Germany	2 Kg	600/kg
45	EDTA	China/Germany	1 Kg	700/kg
46	Ferrious Sulphate	Pak	1 Kg	250/kg
47	Ferric Chloride	China/Germany	2.5 Litr	500/Lit
48	Glycerin	Pak	30 Litr	200/Lit
49	Hexane	China/Germany	2.5 Litr	600/2.5 Lit
50	Hydrochloric Acid	Pak	5 Litr	800/Lit
51	Hydrogen Per-Oxide	Pak	2.5 Litr	1200/Lit
52	Hydroxyl Amine	China/Germany	1/2 Kg	1500/100mg
53	Iodine	China/Germany	500 gm	1500/500gm
54	Iron Chloride	China/Germany	1 Kg	600/kg
55	Iron Sulfate	China/Germany	1 Kg	500/kg
56	Iron Powder (Fillings)	Pak	1 Kg	200/kg
57	Iso-Propyl Alcohol	China/Germany	1 Litr	700/2.5 Lit
58	Lead Acetate	Pak	500 gm	750/kg
59	Lead Nitrate	Pak	500 gm	1000/kg
60	Manganese Sulfate	China/Germany	1 Kg	750/kg
61	Magnesium Chloride	China/Germany	1 Kg	1000/kg
62	Magnesium Carbonate	China/Germany	1 Kg	1000/kg

63	Mercuric Nitrate	China/Germany	1/2 Kg	800/100gm
64	Mercurious Nitrate	China/Germany	1/2 Kg	800/100gm
65	Mercuric Sulphate	China/Germany	1/2 Kg	800/100gm
66	Methyl Orange	China/Germany	250 gm	300/25gm
67	Methyl Red	China/Germany	250 gm	300/25gm
68	Magnesium Metal (Ribbon)	China/Germany	250 gm	800/25gm
69	Magnese Chloride	China/Germany	1 Kg	1000/kg
70	Magnese Carbonate	China/Germany	1 Kg	750/kg
71	Mohr's Salt	China/Germany	1 Kg	750/kg
72	Methyl Iso-butyl Ketone	China/Germany	1 Litr	2000/Lit
73	Naphthalene	Pak	1 Kg	300/25gm
74	Nitric acid	China/Germany	5 Litr	750/2.5 Lit
75	Nitrobenzene	China/Germany	2 Litr	1000/2 Lit
76	Nickel Chloride	Pak	500 gm	700/Kg
77	Nickel Carbonate	China/Germany	500 gm	500/500gm
78	Nessler's Reagent	China/Germany	250 gm	800/25Lit
79	Oxalic acid	China/Germany	1 Kg	500/kg
80	Paraffin Wax	China/Germany	1 Kg	250/kg
81	Phenolphthalein Dry	China/Germany	250 gm	750/250gm
82	Potassium Chromate	China/Germany	1 Kg	600/kg
83	Potassium Iodide	China/Germany	1 Kg	2500/kg
84	Potassium Hydroxide	U.K	1/2 Kg	3500/500gm
85	Potassium Nitrate	China/Germany	1 Kg	700/kg
86	Potassium Di-Chromate	China/Germany	1 Kg	750/kg
87	Potassium Ferrocyanide	China/Germany	1/2 Kg	750/kg
88	Potassium Ferricyanide	China/Germany	1/2 Kg	750/kg

89	Potassium Sulfo Cyanide	China/Germany	1/2 Kg	1500/kg
90	Potassium Permanganate	China/Germany	1 Kg	500/kg
91	Potassium Fluoride	China/Germany	1 Kg	4000/kg
92	Picric Acid	China/Germany	500 gm	4000/kg
93	Phosphorus Tri-Chloride	China/Germany	500 ml	6000/500gm
94	Silver Nitrate	Pak	1/2 Kg	400/250gm
95	Sodium Acetate	China/Germany	2 Kg	500/kg
96	Sodium Carbonate	China/Germany	2 Kg	400/kg
97	Sodium Chloride	China/Germany	1 Kg	200/kg
98	Sodium Hydroxide	China/Germany	2 Kg	500/kg
99	Sodium Thiosulphate	China/Germany	2 Kg	400/kg
100	Sulphuric acid	Pak	5 Litr	1400/2.5Lit
101	Sodium Bicarbonate	China/Germany	2 Kg	400/kg
102	Sodium Sulphite	China/Germany	1 Kg	400/kg
103	Sodium Sulphide	China/Germany	1 Kg	400/kg
104	Sodium Nitrite	China/Germany	1 Kg	1000/kg
105	Sodium Nitrate	China/Germany	1 Kg	300/kg
106	Sodium Bromide	China/Germany	1 Kg	750/kg
107	Sodium Oxalate	China/Germany	1 Kg	600/kg
108	Sodium Sulphate	China/Germany	1 Kg	3000/kg
109	Sodium Phosphate	China/Germany	1 Kg	500/kg
110	Sodium Metal	China/Germany	500 gm	3000/kg
111	Sodium Citrate	China/Germany	500 gm	750/kg
112	Sodium Potassium Tartarate	China/Germany	500 gm	800/kg
113	Sodium Cobalt Nitrite	China/Germany	250 gm	750/100gm

114	Sodium Di-Chromate	China/Germany	500 gm	600/kg
115	Stannous Chloride	China/Germany	500 gm	1000/500gm
116	Sodium Nitro Ferro Cyanide	China/Germany	250 gm	1000/500gm
117	Starch	Pak	1 Kg	75/kg
118	Tin granulated Metal	Pak	500 gm	750/250gm
119	Tartaric Acid	Pak	500 gm	750/kg
120	Zinc Carbonate	China/Germany	500 gm	1200/kg
121	Zinc Nitrate	China/Germany	500 gm	2500/kg
122	Zinc Acetate	China/Germany	500 gm	2500/ kg

Pharmaceutical Lab.

Sr.#	Item	Quantity (No.)	Unit Cost (Rs.)	Total Cost (Rs.)
Subject : Pht.113				
1.	BUCHNER FILLER	01		
2.	AGITATORS	01		
3.	MIXERS	01		
4.	COLLOIDAL MILLS	01		
5.	HOMOGENIZER	01		
6.	HAMMER MILLS	01		
7.	BALL MILLS	01		
8.	Roller mills	01		
9.	HOBART MIXER	01		
10.	ROTATING MIXER	01		
11.	LAMINAR FLOW HOOD	01		
12.	COMPRESSION MOLDING	10		
13.	COLD COMPRESSION MACHINE	01		
14.	AUTOMATIC MOLDING MACHINE	01		
Subject : PHT.313				
15.	HARDNESS TESTER	10		
16.	VERNIER CALIPERS	10		
17.	FRIABILATOR	01		
18.	USP DISINTEGRATION TEST APPARATUS	01		
19.	USP DISSOLUTION TEST APPARATUS	01		
20.	B.P. DISINTEGRATION TEST APPARATUS FOR CAPSULES	01		
21.	WEIGHING BALANCE	02		

22.	LAL TEST APPARATUS	01		
23.	MICROSCOPE	02		
24.	BROOK'S VISCOMETER	02		
<u>Subject : PHT-333</u>				
25.	ROLLER MILL	01		
26.	HAMMER MILL	01		
27.	BALL MILL	01		
28.	CENTRIFUGAL IMPACT MILL	01		
29.	FLUID ENERGY MILL	01		
30.	TWIN SHELL BLENDER	01		
31.	FLUIDIZED BED GRANULATOR	01		
32.	ROTARY GRANULATOR AND SIFTER	01		
33.	TABLET PRESS MACHINE	02		
34.	FLUIDIZED BED DRYER AND TRAY DRYER	01		
35.	TABLET COMPRESSION MACHINE	01		
36.	BLISTER PACKAGING MACHINE	01		
37.	CONVENTIONAL COATING PANS	02		
38.	STRUNCK IMMERSSED TUBE COATING MACHINE	01		
39.	FLUIDIZED BED COATING MACHINE	01		
40.	HAND OPERATED CAPSULE FILLER	02		
41.	SEMIAUTOMATIC CAPSULE FILLING MACHINE	01		
42.	PARENTERAL FILLING AND SEALING MACHINE	01		
43.	AUTOCLAVE	01		
44.	DRY HEAT STERILIZER	01		
45.	FILTRATION ASSEMBLY	01		
TOTAL				Rs.

CURRICULUM DEVELOPMENT COMMITTEE

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Member