

CHEMICAL TECHNOLOGY SCHEME OF STUDIES

1st Year

Sr.#	Course No.	Subject	T	P	C
1.	Gen 111	Islamiat / Pak Studies	1	0	1
2.	Eng. 112	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	Basic Engineering Drawing & CAD-I	1	6	3
Total			14	21	21

2nd Year

1.	Gen 211	Islamiat / Pakistan Studies	1	0	1
2.	Math 223	Applied Maths-II	3	0	3
3.	Mgm 211	Business Communications	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

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 324(Rev.)	Industrial Chemical Process - II	3	3	4
5.	CHT 335(Rev.)	Chemical Engineering - II	3	6	5
6.	CHT 343	Process Instrumentation & Control	2	3	3
7.	CHT 352	Chemical Technology Practice	0	6	2
8.	CHT 361	Energy Conservation & Environmental Pollution	1	0	1
9.	CHT 372	Industrial Stiochiometry	2	0	2
Total			15	24	23

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اسلامیات / مطالعہ پاکستان

ٹی پی سی
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کل وقت: 20 گھنٹے

GEN III

سہ اول

حصہ اول اسلامیات

حصہ دوم مطالعہ پاکستان

موضوعات حصہ اول اسلامیات

کتاب و سنت

(ا) قرآن مجید

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

- 1.1 تنالوا البر حتی تنفقوا مما تحبون
- 1.2 واعتصموا بحبل اللہ جمیعاً ولا تفرقوا
- 1.3 ولا یجبر منکم شیئاً قوم علی ان لا تعدلوا
- 1.4 ان اللہ یمرکم ان تودوا الامانات الی اهلها
- 1.5 ان اللہ یمر بالعدل والاحسان
- 1.6 ان اصلوہ تنہی عن الفحشاء والمنکر
- 1.7 لقد کان لکم فی رسول اللہ سوة حسنة
- 1.8 ان اکرمکم عند اللہ اتقاکم
- 1.9 وما آتاکم الرسول فخرزو و ما نہی عنہوا نتهوا
- 1.10 ولو فو بالعہد
- 1.11 وما شروہن بالمعروف
- 1.12 یمحق اللہ الربو ویربب الصمدقات
- 1.13 واصبر علی ما اصابک
- 1.14 وقولوا قولا سدیداً
- 1.15 ان الدین عند اللہ السلام

(ب) سنت

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

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- 1- اعمالاً عملاً بالنیات
- 2- اہمیت لایم مکارم الاخلاق
- 3- لایومس احدکم حق یحب الاخیرہ ما یحب لنفسہ
- 4- لمسلم من سلم المسلمون من سبہ المسمون من لسانہ ویدہ
- 5- فی امنت باللہ سلم استفم
- 6- حیر کم خیر کم ذالہ
- 7- سبب المسلم فسوق وقتالہ کفر
- 8- احو من احو المؤمن
- 9- کئی المسلم عسی المسلم حیر لم یبعہ وعمالہ وفرقہ
- 10- ایتہ المنلق ثلاث اذا حدیث کذب واقاوت من عنان واناو فنا خالف

دین اسلام

- 2.1 ہمام کے بنیادی مقصد کی وضاحت اور انسان کی انفریوی و اجتماعی زندگی پر ان کے اثرات
- 1- توحید
- 2- رسالت
- 3- آخرت
- 4- ملاکہ
- 5- آسماق شب
- 7.2 عملوات

- 1- نماز 2- روزہ 3- حج 4- زکوٰۃ
- مدرجہ پنا عملوات کی اہمیت و فضیلت، حکمتیں اور انسان کی انفریوی و معاشرتی زندگی پر ان کے اثرات

مذہبی مقاصد

۱- قرآن مجید

- عمومی مقصد: طالب علم یہ سمجھنے کے قابل ہو کہ اسلام کی تعلیمت کا اصل سرچشمہ قرآن مجید ہے
 خصوصاً مقصد: طالب علم اس قابل ہو جائے گا کہ
- ۱۰ قرآن مجید کی تشریح کر سکے گا
 - ۱۱ قرآن مجید کے نزول کی صورت بیان کر سکے
 - ۱۲ قرآن مجید کی آئی و دینی سورتوں کی پہچان کر سکے
 - ۱۳ منتخب آیات کا ترجمہ و تشریح کر سکے
- عمومی مقصد: یہ سمجھنے کے قابل ہو جائے گا کہ منتخب قرآنی آیات کے ذریعے اسلامی تعلیمت کا مفہوم کیا ہے
- ۱۴ قرآنی آیات کا ترجمہ و تشریح کر سکے
 - ۱۵ قرآنی تعلیمت کی روشنی میں اپنی اور معاشرتی اصلاح کر سکے
- ۲- سعادت

- عمومی مقصد: طالب علم سنت نبوی کی اہمیت اور ضرورت کو اچھی طرح سمجھنے کے قابل ہو جائے گا
 خصوصاً مقصد:
- ۱۶ سنت کی تشریح بیان کر سکے
 - ۱۷ سنت کی اہمیت و ضرورت کی وضاحت کر سکے
 - ۱۸ سنت کی روشنی میں اسوہ حسنہ پر عمل کر سکے
- ۳- منتخب احادیث نبویہ

- عمومی مقصد: احادیث کی روشنی میں اخلاقی اقدار سے سمجھنے حاصل کر سکے
 خصوصاً مقصد: احادیث کا ترجمہ و تشریح کر سکے
 رسالہ: اقدار اخلاقیہ کے اسوہ حسنہ کا اجرا، کاغذ: سدا ہو سکے

دین اسلام
عمومی مقاصد: دین اسلامی کے بنیادی مقاصد اور عبادت کے بارے میں جان سنے اور بیان کر سنے
خصوصی مقاصد
لفظ دین اسلام کے لغوی اور اصطلاحی معنی بیان کر سنے
اسلام کے بنیادی مقاصد کی اہمیت بیان کر سنے
اسلام کے بنیادی مقاصد سے انسان کی اخروی و اجمالی زندگی پر پڑنے والے اثرات بیان کر سنے
عبادت کے لفظی و اصطلاحی معنی بیان کر سنے
عقیدے اور عبادت کا فرق بیان کر سنے
عبادت (نماز، روزہ، حج، زکوٰۃ) کے فوری احکامات اور نسلی زندگی پر ان کی اثرات بیان کر سنے
اسلامی مقاصد و عبادت کے مطابق اپنی زندگی ڈھل کر ایک اچھا مسلمان بن سنے

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انجیر مسلم طلباء کے لئے)

GEN III

نصاب اختلاقیات سال اول
حصہ دوم ملاحظہ پاکستان

ن ن ن
1 0 1
کل وقت - 20 گھنٹے

موضوعات

اختلاقیات کی تعریف اور اہمیت
اختلاقیات کا معیار (آٹون، عقل، العین، کتب)
سندرجہ اہل اخلاقیات کی وضاحت

- ☆ دولت ارضی
- ☆ وقہ داری
- ☆ نظم و ضبط
- ☆ راست گوئی
- ☆ صبر و استقامت
- ☆ جوصلہ مندی
- ☆ وقت کی پابندی
- ☆ سفلگی
- ☆ اعجاز
- ☆ پابندی احرام
- ☆ مصلحت

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نصاب اخلاقیات (سولہ لوز)

تدریسی مقاصد

- عمومی مقاصد: اعلیٰ اخلاق کی وجہ سے اعلیٰ ترقی میں تکل قدر اضافہ کر سکے
- خصوصی مقاصد: طلبہ اس علم سے اپنا تہل 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 داری کی اہمیت بیان کر سکے
 - ☆ وفا داری کی اہمیت بیان کر سکے
 - ☆ لقم و ضبط کی انقلابیت بیان کر سکے
 - ☆ صدق بیان کی ضرورت بیان کر سکے
 - ☆ حوصلہ مندی کے فوائد بیان کر سکتے
 - ☆ رزقیت کی پابندی کے فوائد بیان کر سکتے
 - ☆ صفائی اور بائیں اختیار سے حسن کلر کدی کو بیان کر سکتے
 - ☆ مصلحت کے فوائد بیان کر سکتے

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حصہ دوم	مذاہد پاکستان	نصابہ: سلسلہ لوس (Gen III)	کل وقت 12 گھنٹے
بنا	حسرت نگر: سسٹم قوم میں آذوقہ لکڑی تاریخ مسعودوں میں سیاسی آذوقہ کی اہمیت بحور ضرورت - ڈان، جسران، غلامی کے تعلقات		
بنا	نظریہ پاکستان		
بنا	قیام پاکستان کی اساس (دین اسلام) قیام پاکستان کی فرض، اہمیت نظریہ پاکستان کی وضاحت۔ نظریہ پاکستان اور مردم آہل اور قائد اعظم کے ارشادات کی مدافعتی میں		
بنا	نظریہ پاکستان کا تاریخی پسو		
بنا	محمد بن قاسم کی آمد، محمد یوسف، مولیٰ اور شاہ ولی اللہ کی تباہی خدمات سید احمد شہید کی تحریک مجاہدین		
بنا	تعمیری تحریکیں		
بنا	علی گڑھ - خدمت اعلیٰ (زیوٹر - مدرسہ الامام - سندھ) اسلام آباد کلج (پٹوڑا) انجمن خدمات اسلام آباد (پٹوڑا)		

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مطالعہ پاکستان (حصہ دوم)
درس کا مقصد
حریت فکر:

- عمومی مقصد
- طالب علم یہ جان لے کہ اسلام میں اور مسلمان قوم میں آزادی فکر کی کیا اہمیت ہے
- خصوصی مقاصد
- ۱۴ حریت فکر کا معنی و مفہوم بیان کر سکے
- ۱۵ آزادی فکر کی اہمیت بیان کر سکے
- ۱۶ خصوصاً "اسلام میں آزادی اظہار رائے" کی اہمیت بیان کر سکے
- ۱۷ ذاتی غلامی کے قومی سطح پر نقصانات کے بیان کر سکے
- ۱۸ اسلامی غلامی قومی سطح پر نقصانات بیان کر سکے
- نظریہ پاکستان
- عمومی مقصد:
- نظریہ پاکستان (ذہن اسلام) سے پوری طرح واقفیت ہو جائے
- خصوصی مقاصد:
- ۱۹ نظریہ کی تعریف بیان کر سکے اور اس کی وضاحت کر سکے
- ۲۰ نظریہ پاکستان کی تعریف کر سکے اور اس کا مفہوم بیان کر سکے
- ۲۱ علامہ اقبال اور قائد اعظم کے فرمودات کی روشنی میں نظریہ پاکستان بیان کر سکے
- نظریہ پاکستان کا تاریخی پسو
- عمومی مقصد
- ۲۲ نظریہ پاکستان کے تاریخی پسو سے واقفیت حاصل کر سکے
- خصوصی مقاصد:
- ۲۳ محمد بن قاسم کے بارے میں بیان کر سکے

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

علمی تحریکیں

- ۶۷۔ علم میں مقصد
- ۶۸۔ برصغیر کی علمی تحریکوں سے آگاہی حاصل کر سکتے
- ۶۹۔ خصوصاً مقصد:
- ۷۰۔ ملی گزٹ - ریج ہنڈ - خدمت العلماء خدمت الاسلام، اسلامیہ کالج - انجمن خدیجہ اسلام کے زیر سرپرستی
- ۷۱۔ شعور مسلمانوں میں پیدا کیا اسے بیان کر سکتے
- ۷۲۔ آزادی ہند کے سلسلہ میں تحریک مہادیوں کی خدمات بیان کر سکتے

Eng-112 ENGLISH

Total contact hours

Theory	64	T	P	C
Practical	0	2	0	2

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

COURSE CONTENTS

ENGLISH PAPER "A"

- 1 PROSE/TEXT** **16 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.

4 hours

5. TRANSLATION

6 hours

5.1 Translation from Urdu into English.

For Foreign Students: A paragraph or a dialogue.

RECOMMENDED BOOKS

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

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-113 APPLIED MATHEMATICS

Total contact hours	96	T	P	C
Theory		3	0	3

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

AIMS After completing the course the students will be able to

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

COURSE CONTENTS

1	QUADRATIC EQUATIONS	6 Hrs
1.1	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 i, j, 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 $a \times b$.
- 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 nth term of an A.P.
- 2.3 Explain Arithmetic Mean between two given numbers
- 2.4 Insert n Arithmetic means between two numbers
- 2.5 Derive formulas for summation of an Arithmetic series
- 2.6 Solve problems on Arithmetic Progression and Series

3 UNDERSTAND GEOMETRIC PROGRESSION AND SERIES

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

4 EXPAND AND EXTRACT ROOTS OF A BINOMIAL

- 4.1 State binomial theorem for positive integral index.
- 4.2 Explain binomial coefficients: $(n,0), (n,1), \dots, (n,r), \dots, (n,n)$
- 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, VOLUMEAND WEIGHTS OF SOLIDS.

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

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

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

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

- 12.1 Define a matrix and a determinant.
- 12.2 List types of matrices.
- 12.3 Define transpose, ad joint and inverse of a matrix.
- 12.4 State properties of determinants.
- 12.5 Explain basic concepts.
- 12.6 Explain algebra of matrices.
- 12.7 Solve linear equation by matrices.
- 12.8 Explain the solution of a determinant.
- 12.9 Use Crammers Rule for solving linear equations

PHY-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 centre 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
- 9.14 Laser in medicine

- 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 held 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 centre 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, semi conductors and insulators
 - 19.3 Describe semi conductors 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

- 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

Comp-122 COMPUTER APPLICATIONS

INSTRUCTIONAL OBJECTIVES

- 1. UNDERSTAND ELECTRONIC DATA PROCESSING (EDP).**
 - 1.1 Describe basics of computers.
 - 1.2 Enlist different classification of computers.
 - 1.3 Explain block diagram of a computer system.
 - 1.4 Describe binary number system.
 - 1.5 State the terms used in computers such as BIT, BYTE, RAM, ROM, EROM, EPROM.
 - 1.6 Identify input and output devices.
 - 1.7 Describe secondary storage media.
 - 1.8 Explain processor.
 - 1.9 Name 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).**
 - 2.1 Explain the use of various internal command of DOS.
 - 2.2 Explain the use of various external command of DOS.
 - 2.3 Describe batch files.
 - 2.4 Identify advanced features

- 3. UNDERSTAND BASIC LANGUAGE.**
 - 3.1 Explain high level languages.
 - 3.2 Explain Basic language.
 - 3.3 Describe Rem statement
 - 3.4 Describe assignment statement
 - 3.5 Explain Input statement
 - 3.6 Explain Read-Data statement
 - 3.7 Explain If-Then Statement
 - 3.8 Explain If-then-Else Statement
 - 3.9 Explain 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

T	P	C
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 equipments	
3.3	Standard symbols	
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 Aluminium 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 equipments
 - 3.2.1 Heat transfer equipments
 - 3.2.2 Mass transfer equipments
 - 3.2.3 Auxiliary equipments
- 3.3 Standard symbols for major processing equipments

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 ware 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 CH ₄ , H ₂ O and NH ₃ 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 Boyel'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

- 12.1 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.
- 12.2 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
- 12.3 Know acidity and basicity
 - 12.3.1 Define acidity.
 - 12.3.2 Define basicity
 - 12.3.3 Calculate acidity and basicity

13 SALTS

- 13.1 Understand types of salts
 - 13.1.1 Define salt
 - 13.1.2 Name types of salt
 - 13.1.3 Explain metal salt with examples
 - 13.1.4 Explain acidic salt with examples
 - 13.1.5 Explain basic salt with examples

- 13.1.6 Illustrate double salt with examples
- 13.1.7 Distinguish between double salt and complex salt

13 METALS

- 14.1 Understand metals
 - 14.1.1 Define metals
 - 14.1.2 Give examples of materials
 - 14.1.3 Differentiate metals and non-metals
- 14.2 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
- 14.3 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

- 15.1 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
- 15.2 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
- 15.3 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

- 16.1 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
- 16.2 Understand copper refining and uses of copper
 - 16.2.1 Explain refining of copper

16.2.2 Enlist of copper

17. ALUMINIUM

17.1 Understand extraction of aluminium

17.1.1 List ores of aluminium

17.1.2 Name methods of aluminium extraction

17.1.3 Explain electrolysis of bauxite

17.1.4 Give the uses of aluminium

16 CHROMIUM

18.1 Understand chromium extraction

18.1.1 Enlist chromium ores

18.1.2 Describe chromium extraction

18.1.3 Name alloys of chromium

18.1.4 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 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

MT-143 BASIC ENGINEERING DRAWING & CAD-I

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.
- 10.5 Practice sectioning.

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 oblique drawings of cube with one hole.
38. Isometric and oblique 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 butt joint

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

1. Practice loading CAD software into computer memory.
2. Practice unloading CAD software safely and come to Dos prompt.
3. Practice CAD abbreviations, auto CAD release 12 or 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 its 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

DAE Technology

اسلامیات / مطالعہ پاکستان

GEN 21L

مضب (اسل دو نم)

حصہ اول اسلامیات

حصہ دوم مطالعہ پاکستان

موضوعات

ن ۱ ۱
۱ ۰ ۱
کل وقت: 20 گھنٹے

- 1- سورۃ السونان آیت تا پلہ آیات کا مع ترجمہ
- 2- دن نخبہ مملکت مع زیرہ تفریح
- 3- خیار کم من تعسیم القرآن و علمہ
- 4- لا ایمان لمن لا امانتہ لہ ولا دین لمن لا عمدتہ
- 5- ویاکم واطنن ان اظنن اکرب الحدیث
- 6- من احدث فی امرنا بقاء لیس متہ فہورد
- 7- من حمل علیہ السلاح فلیس منا
- 8- لاولیٰ کفای البیتیم فی الجنۃ
- 9- لا ضرر ولا ضرار فی السلام
- 10- کلکم راع وکلکم راع وکلکم مسؤل عن رعیتہ
- 11- 3- یرۃ طیبہ
- 12- کنی زندگی وارتبہ بختیہ اجرت
- 13- علی زندگیہ موافقتہ مشق مدرسہ (کہ اسباب و نتائج)
- 14- حضور ﷺ بحیثیت
- 15- قطب جمعہ الامام
- 16- معہ کل سرپر کو خاندان
- 17- اسلای معاشرہ
- 18- حکم تعلیم اور اس کے مقصدہ عدس و انصاف امر بالمعروف فی عن المنکر
- 19- 3- کسب طالبہ سچہ الامیت (تعلیمات)
- 20- اسلای ریاست کی تعریف۔ اسلای ریاست کی خصوصیات۔ اسلای حکومت کے فرائض۔ اسلای طرز حکومت

اسلامیات

تدریس مقاصد

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

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

اخلاص نبویہ

☆ عمومی مقصد اخلاص کی روشنی میں اسلامی اخلاقی اقدار (انفرادی و اجتماعی) سے آگاہ ہو سکے

خصوصی مقاصد:

☆ اخلاص کا ترجمہ بیان کر سکے

☆ اخلاص کی تشریح کر سکے

☆ اخلاص کی روشنی میں اسلام کی اخلاقی اقدار کی وضاحت کر سکے

☆ فن اخلاص 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
☆	جہاد کے لفظی و اصطلاحی معنی بیان کر سکے
☆	جہاد کی اہمیت بیان کر سکے
☆	جہاد اور قتل میں فرق بیان کر سکے
☆	جہاد کی مختلف اقسام بیان کر سکے
☆	اقل مسجد کی تعریف کر سکے
	مسجد کی سابقہ حیثیت کو بحال کرنے کے بارہ میں اقدامات کو بیان کر سکے
	اسلامی ریاست
	عمومی مقاصد: 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 قیام کیلئے جدوجہد کر سکے

نصاب مطالعہ پاکستان

آئی بی سی
1 0 1
کل وقت: 12 گھنٹے

سلاہ دوم	
حصہ دوم	
موضوعات	
یہ قانون نظر	☆
تحریک پاکستان	☆
انڈین کانگریس	☆
مسلم لیگ	☆
تفسیر بنگلہ	☆
سینٹریل کمیٹی	☆
تحریک خلافت	☆
سندھ تحریک	☆
جولوزارمی	☆
سورپورٹ	☆
قائمہ اعظم کے چودہ نکات	☆
خلیفہ آلہ آباد	☆
انقلابیت 1938 اور انقلاب برصغیر	☆
قرارداد پاکستان	☆

حصہ دوم

سزاخہ 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 عموماً کو بیان کر سکے

☆ قومی تشخص کو بھل رکھنے سے لئے مسلمان ہند کی مساوی بیان کر سکے

☆ آزادی ہند اور قیام پاکستان علامہ اقبال اور قائد اعظم کی مساوی 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

DAE Technology

(غیر مسلم طلباء کے لئے)

نی ڈی ٹی
J D A
کل وقت: 20 منٹ

نصاب امتحانیت
سال دوم

موضوعات

سائنس، قدر اور اخلاق، سماج، قوم، قوی سطح، شہری سطح، صنعتی اور لوہا کی سطح، ضروریات، درجہ

حقوق و فرائض ☆

قوت بیداشت ☆

قوت ارادی ☆

لگن و جذبہ ☆

وسیع نظری ☆

بے غرضی ☆

مسئلہ دوستی ☆

سائنسی شعور ☆

پاس آڑی ☆

کمال لگن ☆

تعمیرات کو قبول کرنا ☆

شہر شہنشاہی ☆

DAE Technology

نصاب اخلاقیات

سال سوم

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 مطابق مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے

اعلیٰ اخلاقی قدرا میں سے

توبت برداشت۔ قوت ارادی۔ نکتہ جذبہ۔ وسیع النظری۔ بے غرض۔ انسانی دوستی۔ سخاوت۔ شہور۔ پس سزاوی۔

کمال اعلیٰ اور نوازشی کی اہمیت بیان کر سکے

اخلاقیات سے متعلقہ اور کوئی خدمت بہتر طور پر انجام دے سکے

Math 223 APPLIED MATHEMATICS

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 $\sec x, \operatorname{cosec} x, \cot x$.
 - 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.

- 6. 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 f 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.

Mgm-211 BUSINESS COMMUNICATIONS.

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.**
 - 6.1 Identify the different types of reports.
 - 6.2 Determine when to use an informal or formal report presentation.
 - 6.3 Identify the stages of planning a report.
 - 6.4 Identify the parts of a report and choose the parts appropriate for each type of report.
 - 6.5 Draft a report outline.

- 7. DEMONSTRATE READING COMPREHENSION.**
 - 7.1 Identify major reading problems.
 - 7.2 Identify basic reading skills.
 - 7.3 State methods of previewing written material.
 - 7.4 Identify methods of concentration when reading.
 - 7.5 Demonstrate reading comprehension.

- 8. UNDERSTAND THE PRINCIPLES OF GROUP COMMUNICATIONS.**
 - 8.1 State the purpose and characteristics of major types of meeting.
 - 8.2 Explain responsibilities of a meeting/committee.
 - 8.3 Identify problems likely to be faced at meeting and means to overcome these problems.
 - 8.4 Distinguish between content and process at meetings.
 - 8.5 Explain 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.

Mgm-221 BUSINESS MANAGEMENT AND INDUSTRIAL ECONOMICS.

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 it 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 alkanes	
6.	ALKYNES	02
6.1	Definition	
6.2	Preparation	
6.3	General chemical properties of alkanes	
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.	CABOXYLIC 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 an-hydrides.	
	13.3 Chemical properties of acid an-hydrides	
14.	AMIDES	04
	14.1 Definition	
	14.2 Methods of preparations	
	14.3 Chemical properties	
15.	ESTERS	02
	15.1 Definition	
	15.2 Methods of preparations	
	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 proteins.	

RECOMMENDED BOOKS

- 1 Manual 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

CHT 244(Rev.) ORGANIC CHEMISTRY

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 to 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 preoperties 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 mehtods 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 comoounds
- 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
- 18.2 Give classification of carbohydrates
- 18.3 Write structural formula of glucose and fructose
- 18.4 Explain the method of preparation of glucose
- 18.5 Explain the properties of glucose
- 18.6 Explain the method of preparation of fructose
- 18.7 Explain the properties of fructose
- 18.8 Give comparison between glucose and fructose

19. PROTEINS

- 19.1 Define protein
- 19.2 Give classification of proteins
- 19.3 Explain general properties of proteins

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 veiw 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	

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 Liquefied Petroleum Gas (LPG)
- 12.4 Compressed 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 Nostrand Reinhold

INSTRUCTIONAL OBJECTIVES

1. INTRODUCTION

1.1 UNIT 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

1.2 FLOW 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

2.1 water 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

2.2 Ion 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.

2.3 sodium cation exchange

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

2.4 mixed bed resins.

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

2.5 hydrogen 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

- 2.6 soda 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 chlor-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

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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.	
3.	ERRORS IN ANALYSIS	03
	3.1 Personal errors.	
	3.2 Determinate errors.	
	3.3 Indeterminate errors.	
	3.4 Detection of errors.	
4.	ANALYTICAL PROCEDURES	03
	4.1 Weighing of sample.	
	4.2 Volume measurement of sample.	
	4.3 Preparation of sample solution.	
	4.4 Titration.	
	4.5 Precipitation.	
	4.6 Filtration.	
	4.7 Drying	
	4.8 Ignition.	
13	PREPARATION OF STANDARD SOLUTION	03
	5.1 Primary standards, secondary standards.	

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 oxidising 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.	
14	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).	
15	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.

9 REPORTING OF ANALYSIS RESULTS

01

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.

CHT 263 QUANTITATIVE ANALYSES

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.
- 1.5 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 Illustrate measurement of volume using burette, 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.

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 Iodometry and iodimetry.
- 7.6 Explain argentometry.
- 7.7 Solve problems based on $N_1V_1=N_2V_2$
- 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.

CHT 263 QUANTITATIVE ANALYSIS.

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 of 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 ing of 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.
 - Viii Acid industry (H_2SO_4 , HNO_3 , HCl)
 - 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.

CHT 271 SAFETY PRACTICE AND PROCEDURE

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 ackali industry
 - Fertilizers urea, Ammonia Ammonium Nitrate
 - Plastics and Fibre Industry
 - Power plants

2 ACCIDENT COST

- 2.1 Accident cost.
 - 4 0 ious 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 vessab/Roactors
 - 2.1.5 Explain management role of reliance
 - 2.1.6 0Differentiate 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 vasis 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**

- 1.1 chemistry
 - 1.1.1 Define thermo chemistry
 - 1.1.2 Distinguish exothermic and endothermic reactions.
 - 1.1.3 Give examples of exothermic and endothermic 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

- 2.1 thermodynamics
 - 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

- 3.1 solution
 - 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

- 4.1 colloidal 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

- 5.1 Understand 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 photosensitisation
- 5.1.6 Define photosynthesis
- 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 alpha rays, Beta rays, gamma rays
- 7.4 Describe particles of atom like proton, neutron, positron
- 7.5 Explain the method for radioactivity measurement
- 7.6 Define nuclear fission and nuclear fusion
- 7.7 Enlist nuclear fission and nuclear fusion applications
- 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 affect 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 BCl₃
- 9.1.5 Describe reaction between an organic acid and an alcohol
- 9.1.6 Illustrate reaction between hydrogen and Iodine
- 9.1.7 Enlist equilibrium constant applications
- 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 viscosity 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 magnesium (To verify the law of constant composition)	02
10. Preparation of standard solution of alkalies and acids e.g NaOH, KOH, oxalic acid and succinic acid.	04
11. Prepare approximate solution of H ₂ SO ₄ and determine its exact molarity by titrating it against standard N/10 NaOH.	02
12. Determination of surface tension by stalgo meter.	02
- Determination of surface tension of liquid by using torsion balance.	
- Preparation of colloidal solution and study the properties of colloidal solution.	
- Determination of equilibrium constant and rate of reaction (1st degree reaction and 2nd degree reaction).	
- Preparation of Neon signs.	

CHT 293 CHEMICAL ENGINEERING - I.

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OBJECTIVES.

1. Apply the principles of unit operation in chemical engineering.
2. To apply principles of unit operation in the laboratory work.
3. Know the construction and working of chemical process 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 steady state systems

2.1 UNDERSTAND THE FLUID

- 2.1.1 Define fluid
- 2.1.2 Give types of fluid
- 2.1.3 differentiate between newtonian 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 dynamics
- 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 poiseuille equation

2.6 UNDERSTAND BERNOULLI'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 equatoin

2.7 UNDERSTAND FIRCTION LOSSES

- 2.7.1 Enlist different kinds of fiction losses
- 2.7.2 Calculate the head loss due firction in pipes
- 2.7.3 Calculate the head loss due to sudden enlengement
- 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 equipments 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 orifcie meter
- 2.8.4 Explain athe 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 take
- 2.8.7 Explain the construction and working of rotameter
- 2.8.8 Explain the construcion 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 construcion and working of a reciprocating pump (piston pump)
- 3.2.4 Explain the constructon 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 CENTIFUGAL PUMPS

- 3.3.1 Define centifugal pump
- 3.3.2 Give the classification of centifugal pumps
- 3.3.3 Explain the construcion and working of a volute pump
- 3.3.4 Explain consitation in a c.f pump

- 3.3.5 Explain priming of a c. f pump
 - 3.3.6 Explain 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-Hytor
 - 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 effecting overall heat transfer co-efficient
- 5.3.5 Calculate the overall heat transfer co-efficient when film co-efficients 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 transfere 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 constuction 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 tubesevaporator
- 6.1.5 Explain construction and working of long tubes evaporator
- 6.1.6 Explain construction and working of climbing film evoporator
- 6.1.7 Explain consturcion 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 triple 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 noncondensed 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.

اسلامیات / مطالعہ پاکستان	GEN 312	نصاب (سہ سو نو)
101		حصہ اول اسلامیات
کس وقت سے 20 بجے		حصہ دوم مطالعہ پاکستان
		موضوعات
		قرآن مجید
1		سورۃ الفاتحہ۔ ایتہ النہی۔ سورۃ البقرۃ کی تخریج آیات از اسرار الہیہ سے تا آخر سورۃ مہلکات مع ترجمہ و تفسیر
2		بہن منتخب احادیث۔ سو ترجمہ و تفسیر
3		بنی آدم اسلام علی خمس شہادت لہ الا لہ الا لہم اقلیم ائصلو نہ و ایشا ان زکوۃ و حج
4		البت و صوم رمضان
5		الذین انصبتہ
6		المنشاء مومن
7		للمومن علی المؤمن سنت خصی بعدد ما از مرض و تشہدہ لائمات و یحبہ لنا دعا
8		لیس علیہ انقلبہ و لیستہ انا عظمی و فصیحہ لانا غاب او شہد
9		لا یخفن سن خذک
10		لا یفخول الحننہ قاطع
11		ان اللہ حرم عنیکم عقوق المہات و اضاعتہ اعمال
12		لیسر اولاتعسر اولاتنفرا
13		ذوق طعام الا یمان من مرضی باللہ و بالاسلام دین بمجمعیہا
14		لخص الذکر لہ الا اللہ
15		حقوق و فرائض
16		حصن تعلیم بطور فرض۔ والدین اور نوالہ کے حقوق و فرائض۔ ہمدیہ کے حقوق
17		اسلام کی اتالیقی اقدار
18		عبودیت متقابل۔ غمخوار گنہگار۔ ایمانے عمد۔ امنوت۔ ائمہ و قرینی

سہ ماہی سوئم
حصہ اول اسلامیات

تدریس مقاصد

قرآن حکیم

عمومی مقصد: منتخب سورتوں اور آیات کی روشنی میں اسلام کے بنیادی مقاصد اور عبادت بیان کئے
خصوصی مقاصد: طالب علم اس قتل ہو جائے گا کہ
سورۃ الفاتحہ: آیتہ الکرسی۔ سورۃ بقرۃ کی آخری آیات از امن الرسول سے اور سورۃ انفلاق کا ترجمہ و تفسیح 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 پادشاہی اللہ کی ہوگی
- ☆ عبادت اور استعانت 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
- ☆ رسول ملا کہ کتب سلویہ پر ایمان لانا فرض ہے
- ☆ اطاعت حقیقی صرف اللہ کے لیے ہے
- ☆ اسلامی احکامات پر عمل کرنا انسانی بسلا 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

- ۱۶۰ احادیث کی تشریح کر سکے
- ۱۶۱ 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:
- ۱۶۲ والدین کے حقوق و فرائض بیان کر سکے
- ۱۶۳ مسایوں کے حقوق بیان کر سکے
- ۱۶۴ اسلام میں حقوق و فرائض اگلی کی صورت میں اپنے اندر خدمتِ خلق کا جذبہ پیدا کر سکے
- اسلامی اقدار
- عمومی مقصد: طالب علم بن سکے گا کہ تعلیم کا مقصد حسنِ اخلاق سے متصف ہو رہا ہے
- خصوصی مقاصد
- ۱۶۵ اخلاق کے معنی و مفہوم کو بیان کر سکے
- ۱۶۶ اسلام میں حسنِ اخلاق کی اہمیت بیان کر سکے
- ۱۶۷ قرآن و سنت کی روشنی میں صبر و استقلال کی اہمیت بیان کر سکے
- ۱۶۸ اسلام میں عفو و درگزر کی اہمیت بیان کر سکے
- ۱۶۹ ایٹانے عہد کی اہمیت بیان کر سکے
- ۱۷۰ اخوت کے معنی و مفہوم کو بیان کر سکے
- ۱۷۱ اخوتِ اسلامی کی اہمیت بیان کر سکے
- ۱۷۲ اسلام کی اعلیٰ قدر کو اپنا کر مثالی معاشرہ پیدا کر سکے

DAE Technology

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کل وقت: 20 گھنٹے

QEN 311

نصاب (سہل سوئم)
مظاہرہ پاکستان
حصہ دوئم

موضوعات

- ☆ قیام پاکستان
- ☆ پونڈری کمیشن
- ☆ ریڈ کلف ایوارڈ
- ☆ تقسیم بنگلہ و کلکتہ
- ☆ تقسیم پنجاب
- ☆ مسئلہ مہاجرین
- ☆ ریاست کا الحاق
- ☆ ریاست جموں و کشمیر
- ☆ سری پالی کا تنازعہ
- ☆ قرار داد مقاصد
- ☆ علماء کے بائیس نکات
- ☆ 1956-1962 اور 1973 کے دستاویز کی اسلامی دفعات
- ☆ پاکستان کا عمل 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 مقاصد:

- ☆ باؤنڈری کمیشن تشکیل اور اس کے فرائض بیان کر سکے
- ☆ ریڈ کلف اور اس کے ایوارڈ کے بارے میں بیان کر سکے
- ☆ بنگلہ اور گلگت 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
- ☆ سری پانی کے تنازعہ کو بیان کر سکے
- ☆ قرار داد مقاصد کی تفصیلات بیان کر سکے
- ☆ 22 علماء کے متفقہ اسلامی نکلت بیان کر سکے
- ☆ قیام پاکستان کے بعد نفاذ اسلام کی کوششوں کو بیان کر سکے
- ☆ پاکستان کے محل وقوع اور اس کی جغرافیائی اہمیت بیان کر سکے
- ☆ پاکستان میں قدرتی وسائل (تیل- گیس- کوئلہ) کے بارے میں بیان کر سکے

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(غیر مسلم طلباء کے لئے)

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کل وقت: 20

Gen 311

نصاب اخلاقیات	
سال سوئم	
موضوعات	
☆ احساس ذمہ داری	
☆ مثبت زبان	
☆ عدل و انصاف	
☆ قومی خدمت کا جذبہ	
☆ ذکر و نظر کی پاکیزگی	
☆ احرام آدمیت	
☆ شائستگی	
☆ غصہ و درگزر	
☆ بردباری	
☆ خود انحصاری	
☆ اثر و نفوذ	
☆ جامعیت	
☆ اپنی ذات کی معرفت (بذریعہ ہم عمر طلباء۔ اساتذہ۔ اہم شخصیات اور)	

(غیر مسلم طلباء کے لئے)

نصاب اخلاقیات

سل 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 اوارہ 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.**
 - 1.1 Describe brief history of industrial psychology.
 - 1.2 Describe in detail definition of industrial psychology.
 - 1.3 State nature and scope of industrial psychology.

- 2. KNOW LEADERSHIP.**
 - 2.1 Define leadership.
 - 2.2 Describe types of leadership.
 - 2.3 State qualities of a good leader.

- 3. UNDERSTAND MOTIVATION.**
 - 3.1 Define motivation.
 - 3.2 Describe financial and non financial motives.
 - 3.3 Explain conflict of motives.

- 4. KNOW MORALE.**
 - 4.1 State importance of morale.
 - 4.2 Describe development of morale.
 - 4.3 State the method of measurement of morale.

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

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

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

- 8. UNDERSTAND INDUSTRIAL PREJUDICE.**
 - 8.1 Define 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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2	6	4

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, Absorbence. | |
| 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.s	
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

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 REFRACTOMETRY

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 $[\alpha] = 100x$
- 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) Calomel electrode
- (d) Antimony electrode

12 PH-VALVE AND BUFFER SOLUTION

12.1 PH-Valve

12.1.1 Define PH-Valve

Define POH-Valve

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 CuSO₄ 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 PO₄ and SO₄ contents by using Nephelometer.
10. Determination of Manganese in steel by using spectronic 21 (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 324(Rev.) INDUSTRIAL CHEMICAL PROCESS II

T	P	C
3	3	4

OBJECTIVES

1. Understand important manufacturing procedure employed by modern chemical Industries.
2. Use the equipments necessary to carry out chemical reaction on industrial scale.
3. To give knowledge of flow sheet diagram.
4. Understanding local Chemical industry from the viewpoint of statistics of production and location in Pakistan

COURSE CONTENTS**Weeks****1. OILS AND FATS****09**

- 1.1 Vegetable oils. (name origin and uses)
- 1.2 Linseed oil, coconut oil, corn oil, palm oil, Peanut oil, tung oil castor oil sunflower oil, cotton seed oil soybean oil.
- 1.3 Extraction of oils.
- 1.4 Compression method for cotton seed oil.(Introduction only)
- 1.5 Solvent extraction methods for soybean oil/sun flower oil
- 1.6 Flow sheet unit operations involved
- 1.7 Energy requirements by products of solvent extraction their uses.
- 1.8 Processing of vegetable oils
- 1.9 Refining, Bleaching.
- 1.10 Hydrogenation
- 1.11 Deodorization, Vitaminization.
- 1.12 Flow sheet
- 1.13 Unit operations and unit process involved
- 1.14 List of local ghee industries.

2. WAXES, ORIGIN AND USES.**03**

- 2.1 Bees wax, carnauba wax, Paraffin wax , condellilla wax, synthetic wax and their composition.
- 2.2 Uses of waxes.

3. SOAP.**09**

- 3.1 Soap chemical formul. raw materials.
- 3.2 Manufacture of soap by kettle process.
- 3.3 Manufacture of soap and fatty acid by continuous process.
- 3.4 Flow sheets.
- 3.5 Unit operations and unit processes.
- 3.6 By products.
- 3.7 Typical soaps.

3.8	Toilet soap industrial soap.	
3.9	Shaving soap and toilet soap.	
3.10	Medicated soap transparent soap.	
3.11	Soap industries in Pakistan.	
4.	GLYCERIN.	06
4.1	Manufacture of glycerin as by product of soap plant.	
4.2	Flowsheet.	
4.3.	Unit operations and unit process involved.	
4.4	Energy requirements	
4.5	Synthetic Glycerin.	
4.6	Raw materials.	
4.7	Chemical reaction.	
4.8	Manufacture of glycerin by the Hydrolysis of oil/fat.	
4.9	Flow sheet.	
4.10	Unit operations and Unit process.	
4.11	Uses of Glycerin.	
5.	DETERGENT, SURFACTANTS.	09
5.1	Classification of detergent.	
5.2	Anionics, Cationics, Non ionic, Amphoteric.	
5.3	Formulation of Detergents.	
5.4	Builders and Additives.	
5.5	Biodegradability.	
5.6	Manufacture of detergent (ABS)	
5.7	Flow sheet.	
5.8	Unit operations and unit processes.	
5.9	Detergent action.	
5.10	Local brands of Detergents and their comparison.	
6.	PULP AND PAPER INDUSTRY	09
6.1	Raw materials. Preparation of Raw materials.	
6.2	Types of pulps(mechanical, semi chemical, chemical pulp)	
6.3	kraft pulping	
6.4	Flow sheet	
6.5	Unit operations and energy requirements.	
6.6	Recovery of Black liquor (Kraft Pulping).	
6.7	Soda pulping.	
6.8	Sulphite pulping.	
6.9	Flow sheet.	
6.10	Unit operations and energy requirements.	
6.11	Recovery of Black liquor.	
6.12	Comparison of the three pulps.	
6.13	Manufacture of paper.	
6.14	Beating and refining of pulp fillers.	
6.15	Conical refiner of a Jordan engine.	

6.16	Fourdrinier machine for paper manufacture.	
6.17	Cylinder machine for heavy paper/card board manufacture	
6.18	Tissue paper machine.	
7.	SUGAR AND GLUCOSE INDUSTRY	09
7.1	Raw materials.	
7.2	Manufacture of cane sugar.	
7.3	Flow sheet.	
7.4	Unit operations and unit processes.	
7.5	Manufacture of Beet Sugar.	
7.6	Unit operations and unit processes.	
7.7	By products of Sugar industries and their uses.	
7.8	List of Sugar Industries of Pakistan.	
7.9	Glucose manufacturing.	
8.	FERMENTATION INDUSTRIES.	09
8.1	Industrial Alcohol uses.	
8.2	Manufacture of industrial alcohol by fermentation.	
8.3	Flow sheet.	
8.4	Unit operations and unit processes involved.	
8.5	Preparation of Absolute alcohol from industrial alcohol.	
8.6	Preparation of Acetone and Butanol from molasses/corn.	
8.7	Flow sheet unit operations and unit processes.	
8.8	Preparation of citric acid from molasses	
8.9	Bakery products by fermentation.	
9.	SYNTHETIC FIBER.	09
9.1	Classification and Uses.	
9.2	Manufacture of polyester fiber. Flow sheet.	
9.3	Chemical process and unit operations.	
9.4	Manufacture of Nylon-6 fiber. Flow sheet.	
9.5	Unit operations and Unit processes.	
10.	NUCLEAR INDUSTRIES	12
10.1	Introduction, Nuclear reactions (Fusion and Fission)	
10.2	Uranium and thorium fission.	
10.3	Uranium as energy source.	
10.4	Sources and reserves of nuclear fuels in Pakistan	
10.5	Mining and milling of ores.	
10.6	Refining of ore.	
10.7	Flow sheet.	
10.8	Isotopes enrichment.	
10.9	Isotopes and isotope separation.	

- 10.10 Protection from radioactivity.
- 10.11 Waste disposal of nuclear waste.
- 10.12 Explain enrichment techniques of radio-active elements.

11 PAINTS AND VARNISHES

06

- 11.1 Define paint, pigment and varnishes.
- 11.2 Solvents.
- 11.3 Types of pigments and their colours.
- 11.4 Ingredients of different kinds of paints.(Decorative, protective, industrial ,building)
- 11.5 Paint formulation and its manufacture.
- 11.6 Paint industries in Pakistan.

12 TEXTILE CHEMICALS.

06

- 12.1 Chemical dyes and their classification.
- 12.2 Textile chemicals used before spinning.
- 12.3 Textile chemicals used during weaving process.
- 12.4 Chemicals used in Textile industry.

TEXT 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), "Riegeis Handbook of Industrial Chemistry", 10th Ed. Springer/Van Nostrard Reinhold

INSTRUCTIONAL OBJECTIVES.

1. OILS AND FATS.

- 1.1 Define Oils and Fats.
- 1.2 Enlist various types of Oils.
- 1.3 Distinguish between Oils and Fats.
- 1.4 Explain solvent extraction method for cotton seed, and soya-been.
- 1.5 Describe expression method for cotton seed.
- 1.6 Explain refining, Bleaching and hydrogenation.
- 1.7 Name catalyst and explain its validity.
- 1.8 Draw a neat flow sheet diagram for solvent extraction method.

2. WAXES.

- 2.1 Define waxes.
- 2.2 Enlist various types of waxes.
- 2.3 Differentiate between natural and synthetic waxes with examples.
- 2.4 Explain uses of both types of waxes.

3. UNDERSTAND SOAPS

- 3.1 Define Soaps.
- 3.2 Name Raw-materials
- 3.3 Write formula.
- 3.4 Explain continuous process for soap manufacturing.
- 3.5 Draw a neat and labeled diagram of continuous process.
- 3.6 Explain unit processes and operations involved in soap manufacturing.
- 3.7 Describe typical soaps and their By-products.
- 3.8 Explain energy requirements.

4. GLYCERIN.

- 4.1 Define Glycerin.
- 4.2 Name Raw materials.
- 4.3 Differentiate between synthetic and natural glycerin.
- 4.4 Write chemical reaction.
- 4.5 Explain manufacture of glycerin by the hydrolysis of oil and fats.
- 4.6 Draw a neat flow diagram.
- 4.7 Explain unit operation and unit process
- 4.8 Enlist uses.

5. DETERGENTS/SURFACTANTS.

- 5.1 Define detergent.
- 5.2 Identify soaps and detergents.

- 5.3 Explain manufacture of different (Alkyl - Benzene) sulphates.
- 5.4 Draw a neat flow sheet diagram.
- 5.5 Explain detergents action.
- 5.6 Enlist various types of detergents.
- 5.7 Name Builders and additives.
- 5.8 Enlist uses.
- 5.9 Comparison of local brands of detergents by cost and quality.
- 5.10 Formulation of detergents.

6. PULP AND PAPER.

- 6.1 Enlist Raw materials.
- 6.2 Name various types of pulps.
- 6.3 Explain the manufacture of Mechanical pulp, Kraft and chemical pulp, sulphate/sulphite pulp.
- 6.4 Draw flow sheet diagram for each of above types.
- 6.5 Explain manufacture of paper by Jordan engine.
- 6.6 Enlist fillers and sizing elements.
- 6.7 Explain manufacturing methods for heavy paper/car-board and structural boards.

7. SUGAR AND GLUCOSE INDUSTRY.

- 7.1 Name Raw materials.
- 7.2 Explain the manufacture of sugar from cane.
- 7.3 Explain the Unit processes and operations involved in sugar manufacturing.
- 7.4 Explain manufacture of sugar from beet.
- 7.5 Enlist by-products of sugar industry.
- 7.6 Describe the uses of By-products of sugar industry.
- 7.7 Explain the manufacture of glucose from corn.

8. FERMENTATION.

- 8.1 Define fermentation.
- 8.2 Enlist fermenting agents.
- 8.3 Name the products of "Molasses" after fermentation.
- 8.4 Explain the manufacture of industrial alcohol by fermentation.
- 8.5 Describe the manufacture of absolute alcohol from industrial alcohol
- 8.6 Explain the manufacture of acetic acid, citric acid and acetone.
- 8.7 Draw a flow sheet diagram for each one of the above.
- 8.8 Enlist the unit operations and processes involved in the manufacture of acetic acid, citric acid.
- 8.9 Explain the energy requirement for 8.8
- 8.10 Explain the uses of industrial alcohol, acetic and citric acid.

9. SYNTHATIC FIBER.

- 9.1 Define synthetic fiber.

- 9.2 Enlist various types of fiber.
- 9.3 Explain the manufacture of polyester fiber with flow sheet diagram.
- 9.4 Explain the manufacturing procedures of Nylon-6
- 9.5 Draw a neat flow diagram for 9.4
- 9.6 Explain the unit processes and operations involved in nylon-6
- 9.7 Name the uses of polyester.

10. NUCLEAR INDUSTRIES.

- 10.1 Define nuclear and fission reaction.
- 10.2 Enlist various radio active elements.
- 10.3 Explain the characteristic of alpha, beta and gama rays.
- 10.4 Distinguish between nuclear and fission reaction.
- 10.5 Locate the position of nuclear fuels and source in Pakistan.
- 10.6 Describe mining operations of the Uranium ore.
- 10.7 Explain the refining of Uranium ore.
- 10.8 Enlist uses of radio-active elements.
- 10.9 Identify nuclear fuels according to their uses.
- 10.10 Describe isotope separation techniques.
- 10.11 Name protective devices from radio active elements.
- 10.12 Explain the use of waste disposal of nuclear waste.

11 PAINTS AND VARNISHES

- 11.1 Define paint, pigment and varnishes.
- 11.2 Solvents.
- 11.3 Types of pigments and their colours.
- 11.4 Ingredients of different kinds of paints(Decorative, protective, industrial ,building)
- 11.5 Paint formulation and its manufacture.
- 11.6 Paint industries in Pakistan.

12 TEXTILE CHEMICALS.

- 12.1 Chemical dyes and their classification.
- 12.2 Textile chemicals used before spinning.
- 12.3 Textile chemicals used during weaving process.
- 12.4 Chemicals used in Textile industry.

LIST OF PRACTICALS

(One Practical Period Per Week)

1. Determination of Free fatty acids of vegetable oils/Fats.
2. Determination of column index of oil/fats by tento meter.
3. Determination of Acid-value of Oils/Fats.
4. Determination of iodine-value of Oils/Fats.
5. Determination of melting point of Fats. (Ghee)
6. Determination of sponification value of Oil/Fat.
7. Vitamin test for Ghee.
8. Extraction of oil by Soxlet apparatus.
9. Preparation of soyabean oil in the laboratory.
10. Preparation of Stearic Acid in the laboratory.
11. Preparation of Medicated Soap.
12. Preparation of Detergents.
13. Chemicals industries visit.
14. Recycling of waste paper.
15. Fermentation of items used in bakery.
16. Preparation of Shampoo.
17. Preparation of food drinks/squashes etc.
18. Analysis of petroleum products like flash point, cloud point, pour point , calorific value , Reed vapour pressure.

CHT 335(Rev.) CHEMICAL ENGINEERING -II
(UNIT OPERATION-II)

T	P	C
3	6	5

OBJECTIVES

1. To input knowledge to students about various unit operations.
2. To apply principles of unit operations in the laboratory work
3. Chemical production equipment related to these operations.

CONTENTS.

HOURS

- | | |
|--|-----------|
| 1. CRYSTALLIZATION, IMPORTANCE, TYPES OF CRYSTALS, CRYSTAL, FORMS | 12 |
| 1.1 Principle of crystallization. | |
| 1.2 Supersaturation, Nucleation. | |
| 1.3 Miscellaneous crystallization techniques. | |
| 1.4 Classification of crystallization . | |
| 1.5 Crystallization, Agitated batch crystallization. | |
| 1.6 Swenson walker crystallizer. | |
| 1.7 Vacuum crystallizer, vacuum crystallizer with recirculation, crystal crystallizer | |
| 1.8 Crystallizer produces large crystals. | |
| 1.9 Case study : Crystallizer of Sugar Industry. | |
| 2. FILTRATION, CLASSIFICATION OF FILTERS | 09 |
| 2.1 Filter media, filter aids | |
| 2.2 Sand filter, Chamber press | |
| 2.3 Plate and frame press, leaf filter, pressure filter | |
| 2.4 Rotary drum filter | |
| 2.5 Washing of filter cakes | |
| 2.6 Applications of filter. | |
| 3. INTRODUCTION TO DRYING | 09 |
| 3.1 Bound, unbound and free moisture, equilibrium moisture content. | |
| 3.2 Classification of dryers. | |
| 3.3 Compartment and tunnel dryers. | |
| 3.4 Rotary dryer (construction and working) | |
| 3.5 Festoon dryer. | |
| 3.6 Factors affecting rate of drying . | |
| 3.7 Drying rate curve. | |

4.	SIZE REDUCTION	12
4.1	Classification of crushing and grinding machinery	
4.2	Jaw crusher	
4.3	Gyratory crusher	
4.4	Roll crushers	
4.5	Single roll crusher	
4.6	Fine grinders	
4.7	Roller mills	
4.8	Ball and tube mill	
4.9	Ultra fine grinders	
4.10	Closed circuit grinder	
4.11	Construction and working of a sugar cane crusher.	
5.	DISTILLATION	24
5.1	Theory of Distillation.	
5.2	Raoult's Law, Relative volatility.	
5.3	Henry's Law, constant boiling mixtures.	
5.4	Differential distillation.	
5.5	Equilibrium distillation.	
5.6	Rectification and vacuum distillation.	
5.7	Construction of rectifying columns.	
5.8	Sieve plate and packed columns.	
5.9	Bubble cap fractionating columns.	
5.10	Fractionating column calculations.	
5.11	Heat and material balances.	
5.12	Plate to plate calculations.	
5.13	McCabe Thiele method.	
5.14	Types of trays Bubble cap.	
5.15	Sieve trays, flexitrays, disc and daughnut trays.	
5.16	Types of down comers.	
5.17	Towers operating conditions.	
5.18	Pressure vacuum tower top temperature reboiler temperature gradient.	
5.19	Types of feed effect of feed temperature, reflux ratio.	
5.20	Tower operating troubles.	
5.21	Overloading, flooding, entrainment.	
5.22	Coring, weeping, in proper reflux rate.	
5.23	Steam distillation, extractive distillation.	
5.24	Azeotropic distillation, petroleum distillation.	
5.25	Refinery visits.	
6.	EXTRACTION	09
6.1	Extraction, classification of extraction equipments.	
6.2	Oil seed extraction plant.	

6.3	Continuous diffusion batteries.	
6.4	The Dorr s agitator, Dorr thickener.	
6.5	Counter current decantation system.	
6.6	Counter current extraction with filters.	
6.7	Liquid extraction towers.	
6.8	Baffle plate towers spray towers, pulse towers Agitated operation towers.	
6.9	Centrifugal type extractors.	
7.	ABSORPTION	09
7.1	Theory of Gas absorption.	
7.2	Construction and working of Gas absorber.	
7.3	Types and properties of packings.	
7.4	Carbonated water preparation.	
8.	HUMIDITY	12
8.1	Air water vapour contact theory.	
8.2	Humidity, Retative and % age humidity.	
8.3	Humid heat, saturated of humid volume.	
8.4	Dew point, wet bulb temperature.	
8.5	Use of humidity chart.	
8.6	Humidification methods.	
8.7	Construction and operating principles of cooling towers	
8.8	Atmospheric draft cooling towers.	
8.9	Mechanical draft cooling towers.	

TEXT AND REFERENCE BOOKS:

1. Introduction to chemical engineering By Wall.L.Badger & Julins T.Banchero Mc Graw Hill book co New york
2. Chemical Engineering Hand Book By J.H Perry (Editor) Mc Graw Hill Book co. in New York
3. Chemical Engineering by Coulson and Richardson vol 2.

INSTRUCTIONAL OBJECTIVES.

1 CRYSTALLIZATION

- 1.1 Crystallization
 - 1.1.1 Define crystallization.
 - 1.1.2 Give the importance of crystallization.
 - 1.1.3 Enlist the types of crystals.
 - 1.1.4 Give the crystal forms.
 - 1.1.5 Explain the principle of crystallization.
 - 1.1.6 Explain super-saturation.
 - 1.1.7 Explain Nucleation.
 - 1.1.8 Enlist crystallization techniques.
 - 1.1.9 Explain different crystallization techniques.
- 1.2 Crystallizers
 - 1.2.1 Give classification of crystallizers.
 - 1.2.2 Explain construction and working of
 - (a) Tank crystallizer
 - (b) Agitated batch crystallizer
 - (c) Swenson walker crystallizer
 - (d) Vacuum crystallizer
 - (e) Vacuum crystallizer with recirculation
 - (f) Krystal crystallizer
 - (g) Crystallizer to produce large crystal.
- 1.3 Application of Crystallization in sugar industry.

2 FILTRATION

- 2.1 Filtration
 - 2.1.1 Define filtration.
 - 2.1.2 Enlist filter medias.
 - 2.1.3 Define filter aid.
 - 2.1.4 Give examples of filter aid.
- 2.2 Filters
 - 2.2.1 Give classification of filters
 - 2.2.2 Explain construction and working of
 - (a) Sand filter
 - (b) Plate and frame filter
 - (c) Leaf filter
 - (d) Pressure filter
 - (e) Rotary drum filter
 - 2.2.3 Explain the washing of filter cake.
- 2.3 Applications of filtration.

3 DRYING

3.1 Drying

- 3.1.1 define drying
- 3.1.2 Define bound, unbound and free water
- 3.1.3 Explain equilibrium moisture content
- 3.1.4 Explain drying rate
- 3.1.5 Enlist factors affecting rate of drying
- 3.1.6 Draw drying rate curve

3.2 Dryers

- 3.2.1 Define dryer
- 3.2.2. Give the classification of dryers
- 3.2.3 Explain the construction and working of
 - (a) Compartment dryer
 - (b) Tunnel dryer
 - (c) Rotary dryer
 - (d) Festoon dryer

3.3 Applications of drying.

4 SIZE REDUCTION

4.1 Size reduction

- 4.1.1 Define size reduction(crushing and grinding)
- 4.1.2 Give classification of crushing and grinding machinery
- 4.1.3 Differentiate between inter mediate grinding, fine grinding and ultra fine grinding.
- 4.1.4 Explain construction and working of
 - (a) Jaw crusher
 - (b) Gyratory crusher
 - (c) Roll crusher
 - (d) Ball mill
 - (e) Tube mill
- 4.1.5 Explain the construction and working of ultrafine Grinder (pulverizer)
Explain closed circuit grinding

5 DISTILLATION

5.1 Distillation

- 5.1.1 Define distillation
- 5.1.2 Explain theory of distillation
- 5.1.3 Explain Raoults law
- 5.1.4 Explain Henry's law
- 5.1.5 Explain relative volatility

5.2 Types of distillation

- 5.2.1 Enlist types of distillation
- 5.2.2 Define differential distillation
- 5.2.3 Define equilibrium distillation
- 5.2.4 Define rectification
- 5.2.5 Define vacuum distillation
- 5.2.6 Explain steam distillation
- 5.2.7 Explain extractive distillation
- 5.2.8 Explain Azeotropic distillation
- 5.2.9 Give examples of constant boiling mixtures
- 5.2.9 Explain petroleum distillation
- 5.3 Rectifying Columns
 - 5.3.1 Explain the construction and working of
 - (a) Packed column
 - (b) Sieve plate column
 - (c) Bubble cap column
 - 5.3.2 Enlist the types of trays
 - Explain the merits of each type of tray
 - Explain the types of down comers.
- 5.4 Fractionating column calculation
 - 5.4.1 Make heat balance
 - Make material balance
 - Make plate to plate calculations by using Mc Cabe-Thiele method
- 5.5 Tower's operating conditions
 - 5.5.1 Enlist the factors which affect the tower's operating conditions
 - 5.5.2 Explain the effect of pressure and vacuum
 - 5.5.3 Explain the effect of tower top temp
 - 5.5.4 Explain the effect of reboiler temp
 - 5.5.5 Explain the effect of feed temp
 - 5.5.6 Explain the effect of reflux ratio
- 5.6 Tower operating troubles
 - 5.6.1 Explain over loading and flooding
 - 5.6.2 Explain entrainment.
 - 5.6.3 Explain weeping.
 - 5.6.4 Explain the effect of improper reflux rate

6 EXTRACTION

- 6.1 Extraction
 - 6.1.1 Define extraction
 - 6.1.2 Give the examples of solid liquid extraction
 - 6.1.3 Give the examples of liquid-liquid extraction
- 6.2 Extraction equipments

- 6.2.1 Give the classification of extraction equipments
- 6.2.2 Explain the oil seed extraction plant
- 6.2.3 Explain the construction and working of
 - (a) Continuous diffusion batteries.
 - (b) Dorr s agitator
 - (c) Dorr s thickner
- 6.2.4 Explain counter current decantation system
- 6.2.5 Explain counter current extraction with filters
- 6.2.6 Explain the construction and working of liquid liquid extraction towers like:
 - (a) Baffle plate tower
 - (b) Spray tower
 - (c) Pulse tower
 - (d) Agitated extraction tower
- 6.2.7 Explain the construction and working of the centrifuge type extractor

7 **ABSORPTION**

- 7.1 Absorption
 - 7.1.1 Explain theory of gas absorption
 - 7.1.2 Explain the construction and working of gas absorber
 - 7.1.3 Give the types of packing materials
 - 7.1.4 Enlist the properties of packing materials
- 7.2 Carbonated water manufacture.

8 **HUMIDITY**

- 8.1 Humidity
 - 8.1.1 State air-water vapour contact theory
 Define humidity
 Give mathematical form of relative humidity
 Give formula for percentage humidity
 Define humid heat and humid volume
 Explain dew point
 Differentiate between dry bulb and wet bulb temperature
 Use humidity chart to calculate different terms
- 8.2 Humidification methods
 - 8.2.1 Define humidification
 - 8.2.2 Enlist humidification methods
 - 8.2.3 Explain humidification methods
- 8.3 Cooling towers
 - 8.3.1 Enlist types of cooling towers
 - 8.3.2 Explain construction and working of atmospheric draft cooling tower
 - 8.3.3 Explain construction and working of mechanical draft cooling towers

LIST OF PRACTICALS

1. Study the working and construction of bubble cap fractionating column.
2. Separation of a binary mixture by fractional distillation in a bubble cap distillation tower
3. To study the principle of extraction by using solvent extractor
4. Determination of Humidity of air water vapour system by using dew point method
5. To determine the humidity, % age humidity humid heat specific and saturated volume of an air water vapour system by psychometric method
6. To study the Construction and working principle of an air conditioner
7. To study the construction and working principle of an absorption column
8. To study the effect of the rate of distillation
9. The practicals in unit operation should include a considerable amount of installing and dismantling the equipments whichever is feasible
10. Study the effect of temperature, concentration and agitation on crystallization
11. Study the theory and operation of filter press, filtering, washing, cleaning of press, by filtering various industrially important slurries
12. Study the effect of flow rate on the efficiency of a filter press
13. Study the operation of a portable mixer by use of various industrially important materials
14. Determination of house power required and rate of mixing for the mixing of definite quantities, of materials (such as salt and sand) in dry and wet states
15. Determination of the number of revolutions and time required for mixing of two materials per unit weight and calculation of the efficiency of the mixer
16. Determination of rate of drying for a fibrous, and granular material.
17. Study the operation of a sieve shaker through the use of a variety of crushed solids (Alternately, a manual sieve screen analysis way be carried out)
18. Study the operation of a pulverizer by using a variety of materials analyze the efficiency and purpose of the machine by sieve screen analysis
19. Study the operation of various mills by grinding several materials analysis of efficiency and purpose of the machines by sieve screen analysis
20. Study the operation of jaw crusher
21. Determine the horse power required for crushing a definite material e.g red bricks
22. Determine the horse power required for grinding a definite quantity of a material to 100 mesh in a mill. Also calculate the work index for such a grinding operation.
23. Prepare a graph relating particle diameter to time in sample grinder.

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. | INRODUCTION. | 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 |
| 2.1 | Pascal's law. | |
| 2.2 | Bernoulli's theorem. | |
| 2.3 | Hook's law. | |
| 2.4 | Thermoelectric effects. | |
| 2.5 | Wheatstone Bridge circuit | |
| 2.6 | Capacitance, 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 Chicago, Illinois

CHT-343 PROCESS INSTRUMENTATION AND CONTROL

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 Barnacles' 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. TEMPRATURE**
 - 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 TEMPRATURE 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 Practicals.

- 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.

CHT. 352 CHEMICAL TECHNOLOGY PRACTICE.

T	P	C
0	6	2

Total contact hours:

Theory: -	Nil.
Practical	192

OBJECTIVES

1. The students are encourage to demonstrate their practical skill, they have developed
2. A project to a group of students will be allocated which will be completely the co-ordination of industry.
3. A close liaison will be established between the institution and industry to achieve the institutional objectives.
4. Objective No. 3 will help in facilitating the placement of the students in industries.
5. The time allocation will depend on the Project assigned, by the working teacher and the Industrial Management.

CONTENTS:

- 1. INTRODUCTION, SIGNIFICANCE IN INDUSTRIES 30**
 - 1.1 Preparation of flow diagram of typical chemical industries showing process conditions and products at different sections e.g Fertilizers, Sugar, Cement, Petroleum and petrochemicals, acid alkali industries
 - 1.2 Preparation of standard solutions of various normalities of different chemicals.
 - 1.3 Sampling, precipitation, digestion, ignition, filtration and distillation techniques
- 2. VOLUMETRIC ANALYSIS 22**
 - 2.1 Neutralization titration, Redox titration
 - 2.2 Iodometry, Iodimetry and argentometry
- 3. GRAVIMETRIC ANALYSIS 14**
 - 3.1 Use of oven, furnaces, disecators etc.
- 4. DETAILED DESCRIPTION REPORT ABOUT THE FOLLOWING CHEMICAL INDUSTRIES, BY DEPUTING DIFFERENT GROUPS OF STUDENTS (6 NO) AT DIFFERENT SECTIONS OF INDUSTRIAL UNITS. THE STUDENTS WILL GET TRAINING AT THEIR RESPECTIVE SECTIONS ONCE A WEEK. 48 Hrs.**
 - (A) FERTILIZER INDUSTRIES**
Reforming Section

NH₃ Synthesis
Compressor Section
NH₃ Storage
HNO₃ manufacturing unit
Urea plant
Utility section
Laboratory

(B) VEGETABLE GHEE INDUSTRIES

H₂ gas plant
Refining Section
Hardening and Filling Section
Laboratory/lab techniques

(C) SOAP AND SODIUM

Soap and Silicate manufacturing units
Solvent extraction plant

(D) INDUSTRIAL GASES

CO₂ plants
O₂ plants

(E) BEVERAGES

Water Softening and water treatment
Reverse Osmosis Unit
Beverage manufacturing unit
Laboratory

(F) CERAMICS AND BLUE POTTERY

Raw materials and flow diagram

5 LABORATORY TESTS PERTAINING TO DIFFERENT CHEMICAL INDUSTRIES. 24

- 5.1 Water Analysis (Municipal and Boiler water)
- 5.2 Vegetable Ghee analysis
- 5.3 Sugar tests
 - i) Sucrose percentage test using
 - a) Indicator
 - b) Polarimeter
 - ii) Determination of specific gravity by Hydrometer
- 5.4 Ferrous, non ferrous alloys analysis

6. PROCESS CONTROL. 24

6.1 Development of process parameter's indicators and controller for process equipment

7. EQUIPMENT FABRICATION.

30

7.1 Development of process equipment

7.2 Any project of industrial importance with the consultation of concerned teacher/HOD and local industry

REFERENCE BOOKS:

1. Coulson, J. M., Richardson (1999), "Chemical Engineering" Vol-6, Butterworth-Heinemann.
2. Peters Max S, Timmerhaus Klaus D. (1991), "Plant Design and Economics for Chemical Engineers" 4th Ed. McGraw Hill Inc.
3. Ludwig Ernest R. (2002) "Applied Process Design for Chemical and Petrochemical Plants" Vol.1 2, & 3, 3rd Ed. Gulf Publishing Company.
4. Smith Robin (1995), "Chemical Process Design" McGraw Hill Inc.
5. Walas Stanley M. (1999) "Chemical Process Equipment – Selection and Design" Butterworth Heinemann.
6. Wells G. L. Rose L. M.(1986), "The art of Chemical Process Design" Elsevier.
7. Smith, R. (1995), "Chemical Process Design". London: McGraw-Hill.
8. E.L. Cussler and G.D. Moggridge (2001), "Chemical Product Design" Cambridge University Press.
9. Brown T., (2007), "Engineering Economics and Economic Design for Process Engineers CRC Press

CHT 361 ENERGY CONSERVATION & ENVIRONMENTAL POLLUTION

T	P	C
1	0	1

OBJECTIVES

1. Know about energy and energy conservation in industry.
2. Know the uses of basic instruments to measure Energy
3. To apply his knowledge to conserve energy in chemical industries. Calculate energy losses.

CONTENTS.

HOURS

ENERGY CONSERVATION.

- | | | |
|-----|---|-------------------|
| 1. | Introduction to energy & energy conservation, sources of energy | 02 |
| 1.1 | Types of energy | |
| | Heat energy. | Mechanical energy |
| | Potential energy | Kinetic energy |
| | Electrical energy | Chemical energy. |
| 2. | First and 2nd Laws of thermodynamics and application | 02 |
| 3. | Heat recovery in internal combustion engines and steam turbines | 02 |
| 4. | Types of fuels, primary fuels | 02 |
| 4.1 | (solid fuels) Secondary fuels | |
| 4.2 | (liquid fuels) Tertiary fuels | |
| 4.3 | (Gaseous fuels) Incomplete combustion and its effects on energy recovery | |
| 5. | Selection of equipment for process energy recovery such as. Hydraulic Turbines, wheel or runner gas expansion units etc | 01 |
| 6. | Energy Management systems | 02 |
| 6.1 | energy monitoring | |
| 6.2 | Measuring instruments and techniques | |
| 7. | Heat recovery in process plants | 02 |
| 7.1 | Steam generation | |
| 7.2 | Pre-heating boiler's feed water | |
| 7.3 | Application for heat recovery, economics of heat recovery | |
| 8. | Energy recovery in petro-chemical industry | 02 |
| 8.1 | Process and equipments | |
| 8.2 | Steam and electric energy generation | |
| 8.3 | Refrigeration, heat gain. | |
| 9. | Emerging energy saving trends in sugar industry | 01 |

Reference:

1. Process energy conservation by Richard Green & Staff of chemical Engineering
Published by Mc Graw Hill publishing co, New York
2. Energy education for Pakistan ENERCON 86-H Ministry of planning and
development Govt. of Pakistan March 1987
3. Giampaolo A., (2006), “Gas Turbine Handbook; Principles and Practices”, 3rd Edition,
CRC Press.
4. Kveith F and Goswami D.Y., (2007), “Energy Management and Conservation Handbook”,
CRC Press.
5. Kveith F and Goswami D.Y., (2007), “Handbook of Energy Efficiency and Renewable
Energy”, CRC Press.
6. Ganapathy V., (2002), “Industrial Boilers and Heat Recovery steam Generators”, CRC Press.

ENVIRONMENTAL POLLUTION.	HOURS
1. INTRODUCTION.	02
1.1 Definition, types of pollution, atmospheric pollution, land pollution, noise pollution, and waste water pollution.	
2. ATMOSPHERIC POLLUTION.	02
2.1 Definition.	
2.2 Methods of control	
2.3 Its effects on human health.	
3. WATER POLLUTION	02
3.1 Definition, methods of control.	
4. NOISE POLLUTION.	02
4.1 Definition, sources of pollution, sound characteristics, controlling measures.	
5. LAND POLLUTION.	02
5.1 Types, controlling techniques.	
6. POLLUTION CONTROL IN FERTILIZERS.	02
6.1 Ammonia, Urea pollution, biled gases, effect on human health, use of gas masks, controlling techniques.	
7. PAPER AND PULP POLLUTION.	01
7.1 Chemicals used, elimination of poisonous gases, controlling methods.	
8. A. PETROLEUM POLLUTION.	03
B. SUGAR POLLUTION.	
8.1 Poisonous chemicals in petroleum	
8.2 Their effects upon human health.	
8.3 Bleaching chemicals used in sugar industry.	
8.4 Pollution controlling techniques.	

REFERENCES BOOKS.

1. Environmental pollution Atmosphere, Land, Water and Noise by H.M. Dix published by John Wiley and Sons.
2. Pollution control in process industries by S.P. Mahajan Tata Mc Graw Hill publishing company.
3. W. Wesley Eckenfelder, Jr. (2000) "Industrial Water Pollution Control".
4. Bishop Paul L. (2000), "Pollution Prevention: Fundamentals and Practice", McGRAW Hill New York
5. Nicholas P. C., (2001), "Handbook of Pollution Prevention Practices", CRC Press.

CHT 361- ENERGY CONSERVATION & ENVIRONMENTAL POLLUTION.

INSTRUCTIONAL OBJECTIVES.

ENERGY CONSERVATION.

1. UNDERSTAND ENERGY AND ENERGY CONSERVATION.

- 1.1 Define Energy and Energy conservation.
- 1.2 Enlist sources of Energy.
- 1.3 Name various types of Energy.
- 1.4 Explain all types of Energy.
- 1.5 Differentiate different Energy on the basis of their heat contents.

2. UNDERSTAND LAWS OF THERMODYNAMICS.

- 2.1 Define first-Law of thermodynamics.
- 2.2 Define second Law of thermodynamics.
- 2.3 Derive relationships for kinetic and potential Energy.
- 2.4 Prove $K.E = 1/2 MV^2$.
- 2.5 Prove $P.E. = mZ$.
- 2.6 Explain their application in conserving Energy.

3. UNDERSTAND INTERNAL COMBUSTION ENGINES AND TURBINES.

- 3.1 Define internal combustion engines.
- 3.2 Name various types of turbines.
- 3.3 Explain the merits of rotary turbine over reciprocating Engines.
- 3.4 Explain methods of heat recovery from internal combustion Engine and rotary turbines.

4 UNDERSTAND FUELS AND COMBUSTION PROCESS.

- 4.1 Define solid Liquid and gaseous Fuels.
- 4.2 Enlist types of solid Fuels.
- 4.3 Enlist types of Liquid and gaseous Fuels.
- 4.4 Explain merits of gaseous Fuels over solid and Liquid Fuels.
- 4.5 Define combustion.
- 4.6 Explain the methods of heat recovery by the combustion of Liquid and gaseous Fuels.
- 4.7 Calculate waste heat.
- 4.8 Describe an effective and efficient method of heat recovery and its re-cycle.

5. SELECTION OF EQUIPMENT FOR PROCESS ENERGY RECOVERY.

- 5.1 Enlist equipment
- 5.2 Describe working and use of equipment for energy recovery.

6. ENERGY MANAGEMENT SYSTEMS.

- 6.1 Definition
- 6.2 List of types of systems.
- 6.3 Explain different energy management systems.

7 HEAT RECOVERY IN PROCESS PLANTS.

- 7.1 Steam turbine
- 7.2 Gas Expansion unit.
- 7.3 Explain managing energy techniques.
- 7.4 Describe Energy monitoring system.
- 7.5 Name the process variables required for energy measurement and control.
- 7.6 Explain the process variable relevant for energy conservation.

8 PETRO-CHEMICAL PROCESS PLANTS.

- 8.1 Define process plants.
- 8.2 Enlist various process plants such as glass-plastics, petroleum-sugar etc.
- 8.3 Name methods for heat recovery from such plants.
- 8.4 Describe pre-heating system in steam power plant.
- 8.5 Explain the method of steam production.
- 8.6 Describe per-heating system in steam power plant.
- 8.7 Describe method how heats conserved in such a plant.
- 8.8 Explain the use of heat recovered in others as an energy sources.
- 8.9 Explain economic impact, of heat recovery in terms of saving money
- 8.10 Explain the heat recovery system in petrochemical plant.
- 8.11 Describe fractionating column and recovery of heat as waste heat from the vapour-Liquid phase.
- 8.12 Calculate heat recovered mathematically and the amount saved in Pakistani Rupees.
- 8.13 Name the equipment used for heat recovery in the plant.
- 8.14 Describe heat generation system from water, both as a steam power plant and Electricity generation plant.
- 8.15 Explain the use of low pressure and high pressure steam in refrigeration system thought sudden enlargement and T.

9: UNDERSTAND SUGAR MANUFACTURING TRENDS.

- 9.1 Explain cane crushing process
- 9.2 Name the tallest type of sharp knife edge crushers.
- 9.3 Calculate energy used and conserve in the above system

- 9.4 Define evaporation.
- 9.5 Enlist various types of evaporators.
- 9.6 Explain the use of multiple effect evaporator and heat saved.
- 9.7 Calculate the energy saved in terms of money.
- 9.8 Identify between various types of evaporators on the basis of
 - 9.8.1 Heat conserved
 - 9.8.2 Re-use both from cane sugar and beet sugar juice.

POLLUTION

1 POLLUTION.

- 1.1 Define pollution
- 1.2 Enlist types of pollution such as atmospheric pollution land pollution, land pollution, noise and waste water pollution.
- 1.3 Define noise pollution.
- 1.4 Describes its effect upon human health.
- 1.5 Explain damages caused by above types of pollution.
- 1.6 Identify various types of pollution on the basis of their damages caused, effect on environment and human health.
- 1.7 Explain control methods.

2. AIR/ATMOSPHERIC POLLUTION

- 2.1 Define atmospheric pollution
- 2.2 Enlist various types of gases present in atmosphere.
- 2.3 Explain methods to control air pollution.
- 2.4 Explain the effects of atmospheric pollution on human health.
- 2.5 Explain physical and chemical treatment to control.
- 2.6 Explain neutralization and precipitation, oxidation-reduction method to control.

3 WATER POLLUTION

- 3.1 Define water pollution.
- 3.2 Name water pollutants.
- 3.3 Explain the oxidation effect on bacteria's present in water.
- 3.4 Define chemical nutrients.
- 3.5 Explain 10 exchange method to control waste water disposal.
- 3.6 Explain filtration techniques to control and check water affluent in sewage and industrial waste water.

4 NOISE POLLUTION

- 4.1 Define noise pollution.
- 4.2 Name sources of noise pollution.

- 4.3 **Define sound characteristics of high pitch which affects worker health and public health.**
- 4.4 Name units of intensity of sound.
- 4.5 Explain the effect of sound of 80-150 db on human ear.
- 4.6 Explain ear plug system to control.
- 5 LAND POLLUTION.**
- 5.1 Define land pollution.
- 5.2 Enlist types of land pollution.
- 5.3 Explain control methods
- (i) Precipitation
 - (ii) adsorption
 - (iii) Ion exchange
- 6 AMMONIA/UREA MANUFACTURING**
- 6.1 Define ammonia equilibrium.
- 6.2 Define equilibrium Constant
- 6.3 Enlist bleed gases
- 6.4 Explain the effect of gases upon human health
- 6.5 Name quality catalyst
- 6.6 Explain the absorption system of gases.
- 6.7 Explain the use of gas mask on ammonia plant/urea plant
- 6.8 Explain reaction between CO_2 & NH_3
- 6.9 Explain the damage caused by bi-ureate on the plant
- 6.10 Explain how pollution can be controlled by latest stripping techniques.
- 7 PULP AND PAPER MANUFACTURING TECHNIQUES.**
- 7.1 Enlist chemicals used
- 7.1 Explain the toxicity of chemicals
- 7.2 Describe the elimination techniques of SO_2 and NO_2 's by chemical methods
- 7.3 Name method of removal by ordination
- 7.4 Explain the meeting process for the removal of organic compound which produce harmful gases.
- 8 PETROLEUM REFINING
SUGAR MANUFACTURING**
- 8.1 Enlist various obnoxious chemicals present in petroleum
- 8.2 Explain tetraethyl lead use and its effect upon engine and human health
- 8.3 Explain the method of removal of sulphur from gasoline
- 8.4 Explain the use of additives in petroleum product
- 8.5 Explain the formation of alkylates and re-formations to overcome pollution.
- 8.6 Enlist various refining and decolorizing agents
- 8.7 Explain the use of SO_2 in bleaching
- 8.8 Describe method to eliminate sulphur
- 8.9 Name in-organic salt which are problematic for environment
- 8.10 Explain Ion-exchange method to overcome environmental pollution
- 8.11 **Explain method to eliminate formation of CO_2 during burning of baggasse as a fuel.**

NOTE: However it is suggested that the contents may be updated by consulting the expert of ENERCON Islamabad

Recommended Books:

1. Cheremisinoff, (2002) "Handbooks of air pollution prevention and control".
2. W. Wesley Eckenfelder, Jr. (2000) "Industrial Water Pollution Control".
3. Bishop Paul L. (2000), "Pollution Prevention: Fundamentals and Practice", McGRAW Hill New York.
4. Kalliar T. V. (2009), "Elements of Environmental Engineering", CRC Press.
5. Nicholas P. C., (2001), "Handbook of Pollution Prevention Practices", CRC Press.
6. Giampaolo A., (2006), "Gas Turbine Handbook; Principles and Practices", 3rd Edition, CRC Press.
7. Kveith F and Goswami D.Y., (2007), "Energy Management and Conservation Handbook", CRC Press.
8. Kveith F and Goswami D.Y., (2007), "Handbook of Energy Efficiency and Renewable Energy", CRC Press.
9. Ganapathy V., (2002), "Industrial Boilers and Heat Recovery steam Generators", CRC Press.

CHT. 372 INDUSTRIAL STOICHIOMETRY

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HOURS

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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

CHT 372 INDUSTRIAL STOICHIOMETRY

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 yield
- 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

DAE CHEMICAL TECHNOLOGY
REVISED LIST OF EQUIPMENT
DAE CHEMICAL TECHNOLOGY

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

Sr. No.	Items		Qty Required
1	Analytical Balance Electronic Single Pan	Universal compact balance capacity 300gm LCD display power supply battery and main range 0.002 mg Snorex EJ-300 Koria/Taiwan	4
2	Platform Balance	Digital Display capacity 30 kg accuracy 10-15 gm. Koria/Taiwan	2
3	Analytical Balance Electronic Single Pan	Universal compact balance capacity 3000gm LCD display power supply battery and main range 0.1 gm Snorex Koria/Taiwan	1
4	Set of Analytical weights	Nickle chrome coated, standard weights upto 100 gm and fractional weights along with forceps, covered in box	2
5	Brix Hydrometer	Without thermometer Length 25 cm, graduated in 0.5 Brix	
		0---30 Bx Range	6
		30---60 Bx Range	6
		60---90 Bx Range	6
6	Brix Hydrometer	With thermometer Length 25 cm graduated in 0.1 Bx	
		0---10 Bx Range	4
		10---20 Bx Range	4
		20---30 Bx Range	4
		30---40 Bx Range	4
		40---50 Bx Range	4
		50---60 Bx Range	4
		60---70 Bx Range	4
		70---80 Bx Range	4
		80---90 Bx Range	4
		90---100 Bx Range	4
7	Measuring Cylinder	Glass capacity 500 ml I.D -- 5cm	12

8	Hydrometer Jar	30 x 5 cm	12
9	Hydrometer (Be) range	0---10 Be Range	12
		10---20 Be Range	6
		20---30 Be Range	6
		30---40 Be Range	6
10	Measuring Cylinder with spout	Glass boro silicate	
		25 ml	12
		50 ml	12
		100 ml	24
		250 ml	36
		500 ml	24
		1000 ml	6
11	Measuring Cylinder (stoppered) German Standard	Glass boro silicate 50 ml (in half divisions) Capacity	6
12	Vacuum flask	Glass boro silicate capacity 1000 ml complete with filter assembly	6
13	Measuring Flask	Glass boro silicate	
		50 ml	6
		100 ml	12
		250 ml	12
		500 ml	12
		1000 ml	6
14	Measuring flask with special wide neck for the analysis of press mud	Glass pyrex brand capacity 200 ml	4
15	Kohlrausch flask for polarisatoin	Glass Capacity	
		100 ml	6
		200 ml	3
16	Water condenser	Spiral type glass condenser boro silicate	6
17	Elenmeyer's conical flask	Glass pyrex brand capacity	
		50 ml	24
		100 ml	24
		250 ml	12
		500 ml	6
18	Distillation flask with side tube	Glass German Brand Capacity	
		100 ml	6
		500 ml	6

19	Boiling Round bottom flask with lipped neck	Glass pyrex brand capacity	
		500 ml	12
		1000 ml	6
		2000 ml	6
20	Evaporating basin flat bottom with spout	Glass German Brand Capacity	
		45 ml	6
		300 ml	12
		600 ml	6
21	Beaker with spout	Jena/Pyrex Glass Capacity	
		50 ml	24
		250 ml	28
		600 ml	24
		1000 ml	12
22	Funnel with stem	China Glass	
		5 cm dia	12
		10 cm dia	18
		15 cm dia	18
		20 cm dia	6
23	Desiccator schiehler's with perforated disc	Glass Size:	
		15 cm dia	6
		20 cm dia	4
24	Burette with stop cock	Rota flow tm, wertlab germany Capacity: 50 ml	25
25	Auto fill Burette	Werlab Garmany 50 ml	6
26	Buritte Mehr's with rubber tube het and pinch cock	Glass 50 ml	12
27	Burette stand equipped with double clamp, brass	Standard Size	24
28	Pipette with one mark	German brand, Glass	
		5 ml	12
		10 ml	24
		20 ml	12
29	Pipette graduated in 1/10 ml---1ml Germany	German brand, Glass	12
30	Pipette stand for holding 8-12 pipettes	Metallic base (Special)	6
31	Thermometers graduated stem (china)	Hg-filled	
		100 c	24
		220 c	12

		212 F	24
		400 F	12
32	Thermometers graduated in 1C	100 C	12
33	Crucible tongs with bow	Iron std. size	6
34	Crucible tongs, Ni-polished with bow	Iron, Nickle polished. Std. Size	6
35	Retort rings with brass screw	Metallic	12
36	Tripod stand	Wrough Iron coated in ZnO	18
37	Reagent bottles narrow mouth flat glass stoppered	Glass (White)	
		250 ml	96
		500 ml	48
		1000 ml	24
38	Ordinary bottles narrow mouth with stopper	Glass Capacity 3 Lit.	12
39	Reagent bottles narrow mouth flat glass stoppered	Amber Colour Glass	
		125 ml	12
		250 ml	12
40	Droping bottle (China)	Glass	24
41	Test tube-ordinary (England)	10 cmx2 cm	144
		15 cmx2.5 cm	72
42	Test tube holder with wooden handle	metallic strip type	36
43	Test tube stand	For holding 08 tubes approx.	36
44	Buritte Brushes	Long size std	24
45	Test tube burshes	Std Size	18
46	Magnifying glass fitted in steel case	5 cm dia	6
		10 cm dia	2
47	Crucible porcelain with lid	Berlin porcelain	
		50 ml	18
		100 ml	6
48	Gooch crucible complete with asbestos	Porcelain capacity 25 ml	12
49	Fireclay crueible with lid	Capacity 200-250ml	6

50	Platinum wire	Lab grade 0.1 mm thickness and 5 cm length, attach to screw clamp for lab test	6
51	Porcelain basin round bottom with spout	Royal Berlin porcelain	
		6 cm dia	6
		10 cm dia	6
		15 cm dia	6
52	Silica crucible Suitable for ash incineration with lid (England)	Transparent	6
53	Casseroles s.c with handle and lip without lid	Porcelain 25 cm Dia	3
54	Enamelled Basin	45 cm	6
		60 cm	12
55	Enamelled mugs	15 cm x 15 cm	24
56	Enamelled plate shallow	30 cm dia	24
57	Aluminium mugs with handle	Capacity 500 ml	6
		1000 ml	12
58	Bucket with cover	Plastic capacity	
		5 Lit.	12
		10 Lit.	12
59	Spirit lamp complete with wick holder	Glass container capacity 120 ml	18
60	Liabig's condenser glass body (China)	40 cm	8
61	Weighing bottles with stopper	40 x 25 mm	6
		60 x 39 mm	6
62	Watch glass	45 mm	24
		75 mm	24
		100 mm	24
63	Wire gauge iron with asbestos center	15 cm sq.	24
64	Asbestos mill board	0.5 cm thick, 15 cm sq.	12
65	Pinch cock clip	6 cm long	12
66	Cork borer nickled brass with handle for each	06 piece set	6
67	Cork presser	Wheal pattern metallic. Std. Size	2
68	Filter Paper (wattman)	No. 40 Std. 10 cm dia	6
		No. 42 Std. 10 cm dia (Packet of 100 Pieces)	6
69	Mortar & Pestle	Porcelain 10 cm dia	4

		15 cm dia	4
70	Petri dish	Glass 4 cm dia	6
		15 cm dia	4
71	Spatula	Steel 15 cm long	4
72	Ceramic tile glazed on one side	15 cm x 15 cm	12
73	Wash bottles with ground stopper	Capacity 500 ml	24
74	Glass rods	6 mm dia, weight in pound	1
		8 mm dia, weight in pound	1
		10 mm dia, weight in pound	1
		12 mm dia, weight in pound	2
		18 mm dia, weight in pound	2
75	Glass tubes	Bore Size:	
		8 mm, weight in pound	2
		10 mm, weight in pound	2
		12 mm, weight in pound	2
		14 mm, weight in pound	2
		16 mm, weight in pound	2
		18 mm, weight in pound	2
76	Metal tray copper	10 cm x 20 cm x 3 cm	12
77	Metal tray copper with finely perforated bottom	11 cm x 20 cm x 5 cm	6
78	Rubber tubing	20 Ft length for each bore size	
		7.5 mm	1
		10 mm	1
		12 mm	1
		15 mm	1
79	Rubber Cork Different sizes	Top dia 16 mm to 40 mm bottom dia 12 mm to 34 mm	48
80	Aspirator bottles without stopper and stop cock	Capacity 2 Lit. (China)	6
81	Glass pencil	Std. Size	6
82	Pair of scissors	4" Size	3
		6" Size	3
83	Water bath with rings of assorted sizes	Copper, 20 cm dia	6
84	Ostwald viscometer	ASTM Standard	12
85	PH paper Strip	ASTM Standard (pack of 20) demand in packets	48
86	Filter flask	Pyrex brand glass	
		250 ml	24
		500 ml	12
		1000 ml	6

87	Funnel stand for two funnels	Wooden, std Size Glass Capacity	24
88	Separating funnel with stop cock (Germany)	Capacity: 100 ml	4
		250 ml	2
		500 ml	4
89	Glass prism for practical purpose	China	24
90	Glass slab for Physics practical	China Size: 10cm x 7cm x 1cm (Standard Size)	24
91	Glass mirror strips for practical	5 cm x 15 cm	24

HARDWARE ITEMS

1	Pipe cutter (circular blade)	Size 3" dia, China	2
2	Pipe threading dye set (China)	Size 0.5" to 1.25" RACHET, Whale brand type 112 China	2
3	Pipe Fittings Size 3/4"	Union 3/4 inch	12
		Tee 3/4 inch	12
		Elbow 3/4 inch	12
		Reducing Elbow 3/4 inch	12
		Nipple 3/4 inch	12
		Socket 3/4 inch	12
		Stop Cock 3/4 inch	12
		Bend 3/4 inch	12
		Stopper 3/4 inch	12
	Size 1"	Union 1 Inch	12
		Tee 1 Inch	12
		Elbow 1 Inch	12
		Reducing Elbow 1 Inch	12
		Nipple 1 Inch	12
		Socket 1 Inch	12
		Stop Cock 1 Inch	12
		Bend 1 Inch	12
		Stopper 1 Inch	12
	4	Steam traps 3/4" size	Impluse type
Inverted bucket type			2
Thermal expansion type			2
5	Valve (Internally threaded) Size 3/4"	Gate Valve	6
		Globe Valve	6
		Ball Valve	6

		Check Valve	6
		Safety Valve	6
	Size 1"	Gate Valve	6
		Glabe Valve	6
		Ball Valve	6
		Check Valve	6
		Safety Valve	6
6	G.I Pipe (Heavy Wt.)	Size 3/4" in Ft.	40
		Size 1" in Fit.	40
7	Fiber Glass wool for insulatioin	1 Kg pack (Packet)	1
8	Asbestos powder	10 Kg pack	20
9	Cork Sheet	3mm thick 3" x 6"	2
10	Pipe vise	Pak made 04" dia, made of drop forged steel jaws horders hinged body	6
11	Pipe wrench	Bosi, Japan	
		6"	2
		12"	6
		18"	6
12	Screw driver	Germany 07 pcs. Set chrome vanadium with steel headed top.	6
13	Screw Wrench	Alloy steel, Bosi Japan Size 6", 10", 12", 15" (4 Pcs) set.	3
14	Straight peen Hammer	Pak made weight 500 gm with wooden handle	10
		Pak made weight 250 gm with wooden handle	6
15	Plier (3 piece set)	Japan 8" Combination 8" Cutter 6" Long nose	6
16	Socket Set	UK/Japan 5-10 mm size	2
17	Flaring tools set	3/16" to 5/8" mibro brand (China)	2
18	Hand Hacksaw frame	Fix grame made of steel tube elliptical section frome size 300mm	6
19	Misc.		
			Total

List of Equipment & Machinery

Sr. No.	Items	Specification	Approved Cost
			Qty
1	Electric Muffle Furnace with consol system	Capacity 2.6 liter temp. Range-1000°C \pm 5C ^o Control – digital, power – 1500 watt operating voltage 220 V 50 Hz	2
2	A standard photo Electric Colorimeter	Stabilizer Automatic input- 220 V indicator-35UA detector – Celenuim photo cell Filters – Glass filter 420,470,530,620 & 660 um. Cuvette: 12mm Cell (10Pcs) Latest Model. Nippon Japan or Equivalent	2
3	Abbe-Refractometer(Digital)	Builtin thermometer with the main body. Combined iluninator and power source of digital thermometer with refractometer. Refractive index scale = nd 1.300-1.700 Brix scale – 95% (\pm 0.1%)Power selectable /220 volt same as Model 501-DU Nippon, Japan or Equivalent	1
4	Abberrefractometer same as Model 502 Nippon, Japan or equivalent	Range nd 1.3000-1.7000 (\pm 0.0002) Sugar concentration 0.95% (+ 0.5%) same as Model 502 Nippon, Japan or Equivalent	1
5	Soxhlet extraction apparatus	China capacity 250 ml	5
6	Electro – Mantles for soxhlet China	Capacity 250 ml extraction power 3x180 watt Temp. Range – Ambient-300C Control Energy Regulator, 220 V	2
7	Orsat Apparatus for the determination of CO₂, CO, O₂	Fitted in wooden case complete set.	2
8	Centrifuge machine	Power driven speed 3000 rpm 06 tubes with cover	4

9	Water distillation unit (still) capacity 5 lit/hr	Electric Heater emersion rod 2000 watt, steel body, water container with sight glass koria/china with collecting Jug 1 lit capacity (China)	3
10	Humidity and Temperature meter (Hygrometer)	Same as Model TR-202 digitmax or equivalent	5
11	Hot air drying oven	Complete with air regulator & perforated shelves (Germany) or equivalent	4
12	PH meter (Portable)	0.0-14.00 PH Resolution 0.1 PH, Accuracy + 0.1 PH Calibration 1 point Automatic Operating temp, 0-50 Co Power 4x1.5 V DC LCD Display, OAKTON /Eutech. (Malaysia/Japan) or equivalent	5
13	Bomb Calorimeter set	For the testing of fuel as per Model P-6310 Cussons/UK or equivalent	2
14	PH meter/mv meter (Bench Type) with ATC probe integral electrode holder & power adopter	0.0 to 14.00 PH Resolution 0.01 Accuracy \pm 0.01 PH my range \pm 199.9 mv \pm 1999 mv Resolution 0.1mvAccuracy + 0.2 mvTemp Range 0.0 to 100 CoNo of calibration points = up to 3 pointMemory 50 data set power 7 v D.C. using A.C. adopter 220 V A.C. 50/60 HZ (Same as Model cyber scan PH-510 Eutech (Malaysia/Japan) or equivalent	2
15	Micro Scope	Complete with all accessories as Model No. Switt-M-7000 D or equivalent	2
16	Jefco disintegrator	Jefco disintegrator M/C with motor (for the analysis of baggas)	1
17	Membrain filter	Cellulose Aceltate filter pore size 0.45 um	12
18	Cau Juice crusher Motordriven (Lab-grade size)	Rollers 4x10 steel Pak made equipped with 2 HP motor.	1
19	Polarimeter (succarimeter) Digital	Automatic Polarimeter same as Model AP-100 cat # 3261, ATAGO or equivalent	2

20	Vacum Pump	Rocker-300, Rocker	1
21	Refrigeration cycle demonstration model.	Local made, complete with all accessories manually fitted on a horizontal board 6x4 and covered with glass sheet.	1
22	Alcometer	Density meter model DMA-35N Amton paar Austria or equivalent	2
23	Spectro photometer (Digital)	As per model Genesys-6 or equivalent	2
24	Flame photometer complete set including main instrument, an air compressor accessories & spare parts	Digital display linear range = K:K:0.02 mml/l-007 mml/L Na, 1.10 mml/L Repeatability Cvf 2% Linear + 5% EIEC/China or equivalent	2
25	Electroplating demonstration unit	Equipped with 04 both 9x9x6" along with busbar, Emersion Rods, Battery 12 volt DC, Volt mater Am-meter	1
26	Flash point tester	Electric Pensky Marten Flash point apparatus (close cup method)ASTM-D-93 MCU-controlled temperature rise, Automatic ignition self determination of flash point built in LCD screen for real time process display same as model DSY-202 ZChina or equivalent (equipped with all accessories)	2
27	Cloud & pour point test apparatus	ASTM-D-97 consisting of Dewar flask with cover which is equipped with an electrically operated bath stirrer and with four opening for four air jacket support for bath thermometer Accessories 04 Test Jar 10 Spacer ring 04 Stoppers 04 Air Jacket 04 Insulating Disks 04 ASTM thermometer type 5C 01 type 6C A.C supply 230 vol 50 HZ (Italy/Germany) or Equivalent	1

28	Aniline tester U-Tube method (Manual) IP-2	Containing of Electric heated device with electronic power regulator adjustable stirring motor (mounted on the rod of stand) voltage supply for cell illumination support rod plate with centre hole Accessories: U-Tube, u-Tube mounting, stirrer with support, pipette 10 ml. Rubber suction bulb. Power: 220-230 volts 50/60 HZ Thermometer ASTM 34C Range - 25 to 105 Co (0.2Co) lamp Lamp: Lamp for test cell GV. PETROTEST/Germany or Equivalent	1
29	Magnetic stirrer/Hot plate	Max. Speed = 1200 rpm Max. Temp = 450 C With glass ceramic top plate 210 x 21 mm	5
30	Laboratory sieve shaker	Lab Sieve shaker machine with electromegnetical moving, 220 Volt AC containing 0.5 sieves of 8, 10, 14, 18 and 20 mesh. Complete with all accessories. Pak made / China	2
31	Conductivity/TDS meter	Model WAG 9032 WAGTECH/UK or equivalent	1
32	Water Analyzer	Water and waste water sempler [A] Cope/UK or Equivalent	1
33	Water analysis kit complete	Complete unit with all accessories for all analysis of water test	1
34	Solar cell module	Complete demonstration unit with all accessories	1
35	Solar cell training kit.	Training kit with all accessories lab model	1
36	Reverse osmosis plant	Lab unit complete with all accessories	1
37	Gas Compressor Unit	Training module complete with all accessories	1