



DAE CHEMICAL TECHNOLOGY

CURRICULUM



REVISED (AUG, 2024)
Curriculum Section, TEVTA

EXECUTIVE SUMMARY

This curriculum revision of the DAE in Chemical Technology responds strategically to the evolving needs of the chemical industry in Pakistan. The primary goal of this revision was to align the educational outcomes with the dynamic requirements of local industries, ensuring graduates are equipped to contribute effectively to their professional roles. The Pakistani chemical sector faces challenges and opportunities that necessitate a workforce proficient in contemporary practices, especially regarding sustainability and safety. To ensure the curriculum meets current industry standards, a thorough gap analysis was conducted by TEVTA involving stakeholders from academia and the chemical industry. This analysis identified key weaknesses in the existing curriculum, emphasizing the need for a program that imparts both theoretical knowledge and practical application essential for competent technicians.

Significant enhancements include a new course on Engineering Thermodynamics, designed to empower graduates to tackle the increasing demands of the energy sector. Additionally, a course on Entrepreneurship has been introduced to foster innovation and self-employment opportunities within the industry. Recognizing the importance of effective communication, a dedicated Business Communication course aims to enhance students' verbal and written skills for better stakeholder interaction. The Computer Applications course has been overhauled to integrate emerging tools and technologies, ensuring students are familiar with the latest tools to improve operational efficiencies. The curriculum also emphasizes Sustainable Development Goals (SDGs), promoting the adoption of sustainable practices. New tools for personal and process safety have been explicitly introduced, reflecting the industry's growing focus on safety and environmental responsibility.

This revision represents a comprehensive approach to curriculum development, addressing the demands of the local market while emphasizing global trends in safety and sustainability. The inclusion of new experimental activities identified in the gap analysis maintains a practical-to-theoretical balance of 60% practical work and 40% theoretical instruction, ensuring students acquire essential knowledge and develop necessary skills.

In summary, the revised DAE Chemical Technology curriculum is a robust framework designed to cultivate knowledgeable, skilled, and adaptable graduates. It prepares students to meet industry challenges while empowering them to contribute positively to Pakistan's economic growth and sustainable development.

Convener
Curriculum Revision Committee (CRC)
DAE Chemical Technology

August 2024

SCHEME OF STUDIES

1 st Year	Course No.	Subject	T	P	C
1.	Gen 111	Islamiat / Pakistan Studies - I	1	0	1
2.	TTQ 111/ Civic-111	Tarjuma-Tul-Quran/ Civics	1	0	1
3.	Eng. 112	English	2	0	2
4.	Math 113	Applied Maths - I	3	0	3
5.	Phy 113	Applied Physics	2	3	3
6.	Comp 172	Computer Applications	1	3	2
7.	ChT 113	Basic Chemical Technology	2	3	3
8.	ChT 124	General Chemistry	2	6	4
9.	ChT 133	Basic Engineering Drawing	1	6	3
Total			15	21	22

2 nd Year	Course No.	Subject	T	P	C
1.	Gen 201	Islamiat / Pakistan Studies - II	1	0	1
2.	TTQ211/ Civic211	Tarjuma-Tul-Quran/ Civics	1	0	1
3.	Math 223	Applied Maths-II	3	0	3
4.	Mgm 222	Business Communications & Report Writing	1	3	2
5.	ChT 214	Organic Chemistry	2	6	4
6.	ChT 224	Chemical Process Industries - I	3	3	4
7.	ChT 232	Quantitative Analysis	1	3	2
8.	ChT 241	Safety Practices & Procedure	1	0	1
9.	ChT 252	Physical Chemistry	1	3	2
10.	ChT 273	Unit Operations – I	2	3	3
11.	ChT 282	Basic Engineering Thermodynamics	1	3	2
Total			17	24	25

3 rd Year	Course No.	Subject	T	P	C
1.	Gen 301	Islamiat / Pakistan Studies - III	1	0	1
2.	Mgm 351	Business Management & Industrial Economics	1	0	1
3.	Mgm 341	Entrepreneurship	1	0	1
4.	ChT 304	Instrumental Methods of Analysis	2	6	4
5.	ChT 334	Chemical Process Industries - II	3	3	4
6.	ChT 345	Unit Operations - II	3	6	5
7.	ChT 353	Process Instrumentation & Control	2	3	3
8.	ChT 362	Chemical Technology Practice	0	6	2
9.	ChT 371	Energy Conservation & Environmental Pollution	1	0	1
10.	ChT 382	Industrial Stoichiometry	2	0	2
Total			16	24	24

Legend:

- T: Theory hours
- P: Practical hours
- C: Credit hours

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COURSE DETAILS

YEAR - 1

اسلامیات / مطالعہ پاکستان

ٹی پی سی
1 0 1
کل وقت: 20 گھنٹے

GEN III

حصہ اول اسلامیات

حصہ دوم مطالعہ پاکستان

موضوعات حصہ اول اسلامیات

کتاب و سنت

قرآن مجید

1- تفہیم 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 یجر منکم شأن قوم علی ان لا تعدلوا
- 1.4 ان اللہ یمرکم ان تودوا ما نلت الی اہلہا
- 1.5 ان اللہ یمر بالعدل والاحسان
- 1.6 ان الصلوٰۃ تنہی عن الفحشاء والمنکر
- 1.7 لقد کان لکم فی رسول اللہ سۃ حسنہ
- 1.8 ان اکرمکم عند اللہ اتقاکم
- 1.9 وما آتاکم الرسول فخرزو وما نہی عنہوا نتهوا
- 1.10 ولو فو بالعباد
- 1.11 وما شر وہن بالمعروف
- 1.12 یمحق اللہ الربو ویربب الصمدات
- 1.13 واصبر علی ما اصابک
- 1.14 وقولوا لا سدیدنا
- 1.15 ان الدین عند اللہ السلام

(ب) سنت

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

- 1- اعمالاً عملاً بالنیات
- 2- اہمیت لایم مکارم الاخلاق
- 3- لایوم من احدثکم حق یحب الاخیرہ ما یحب لنفسہ
- 4- المسلم من سلم المسلمون من سب المسلمون من لسانہ ویدہ
- 5- فی امننت باللہ سلم استغفر
- 6- حیرکم خیرکم ذالہ
- 7- سبب المسلم فسوق وقتالہ کفر
- 8- المؤمن اخو المؤمن
- 9- کفی المسلم عسی المسلم حر لم یجمعه و مالہ و فرقہ
- 10- ایۃ المنافق ثلاث اذا حدیث کذب و قضا و تمن خائن و اناؤ فنا خلف

دین اسلام

- 2.1 ہنظام کے بنیادی مقصد کی وضاحت اور انسان کی اخروی و دنیاوی زندگی پر ان کے اثرات

- 1- توحید
- 2- رسالت
- 3- آخرت
- 4- ملائکہ
- 5- اسلمی کتب
- 2.2 عبادات

- 1- نماز 2- روزہ 3- حج 4- زکوٰۃ

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

مذہبی مقاصد

۱۔ قرآن مجید

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

۵۱

قرآن مجید کے نزول کی صورت بیان کر سکے

۵۲

قرآن مجید کی آئی دینی سورتوں کی پہچان کر سکے

۵۳

مختار آیات کا ترجمہ و تشریح کر سکے

۵۴

عمومی مقصد: یہ سمجھنے کے قائل ہو جائے گا کہ مختار قرآنی آیات کے ذریعے اسلامی تعلیمت کا مفہوم کیا ہے

قرآنی آیات کا ترجمہ و تشریح کر سکے

۵۵

قرآنی تعلیمت کی روشنی میں اپنی اور معاشرتی اصلاح کر سکے

۵۶

۲۔ حدیث

۵۷

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

حدیث کی تشریف بیان کر سکے

۵۸

حدیث کی اہمیت و ضرورت کی وضاحت کر سکے

۵۹

حدیث کی روشنی میں امور حسنہ پر عمل کر سکے

۶۰

مختار احادیث ترجمہ

۶۱

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

خصوصی مقصد: احادیث کا ترجمہ و تشریح کر سکے

رسول اللہ ﷺ کے اقوال و افعال، احادیث کا ترجمہ و تشریح کر سکے

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

اغیر مسلم طلباء کے لئے

GEN III

نصاب امتلاقیات سال: نول
حصہ دوم: مطالعہ پاکستان

نئی جی کا
1 0 1
کل وقت: 20 گھنٹے

موضوعات

امتلاقیات کی تعریف اور اہمیت
امتلاقیات کا معیار (قانون، عقل، الہی کتب)
مندرجہ اہل اقلیات کی وضاحت

- ☆ دولت داری
- ☆ وقہ داری
- ☆ نظم و ضبط
- ☆ راست گوئی
- ☆ صبر و استقامت
- ☆ حوصلہ مندگی
- ☆ وقت کی پابندی
- ☆ سفلگی
- ☆ اعتماد
- ☆ باہمی احترام
- ☆ مصلحت

نصاب اخلاقیات (اسائنمنٹ)

تدریسی مقاصد

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

خصوصی مقاصد: طالب اس علم سے اس قدر متاثر ہو گا کہ

۱۔ موضوعات کا مطلب بیان کر سکے

۲۔ عملی زندگی سے مثالوں کی نشاندہی کر سکے

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

۴۔ روائت داری کی اہمیت بیان کر سکے

۵۔ وفا داری کی اہمیت بیان کر سکے

۶۔ نظم و ضبط کی فلاحیت بیان کر سکے

۷۔ صدق بیان کی ضرورت بیان کر سکے

۸۔ حوصلہ مندی کے فوائد بیان کر سکے

۹۔ وقت کی پابندی کے فوائد بیان کر سکے

۱۰۔ صفائی اور باہمی اختیار سے حسن نگہداشت کو بیان کر سکے

۱۱۔ مصلحت کے فوائد بیان کر سکے

نصابہ اسلامیات (Green III)
مطالعہ پاکستان (حصہ دوم)
درس کا مقاصد
حریت فکر:

۲۱

۱۶

عمومی مقصد

۱۷

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

حریت فکر کا معنی و مفہوم بیان کر سکے

۱۸

۱۸

آزادی فکر کی اہمیت بیان کر سکے

۱۹

۱۹

خصوصی "اسلام میں آزادی اظہار رائے کی اہمیت بیان کر سکے

۲۰

۲۰

ذاتی غلامی کے قومی سطح پر نقصانات کے بیان کر سکے

۲۱

۲۱

دوسلی غلامی قومی سطح پر نقصانات بیان کر سکے

۲۲

۲۲

نظریہ پاکستان

عمومی مقصد:

نظریہ پاکستان (دین اسلام) سے پوری طرح واقفیت ہو جائے

خصوصی مقاصد:

نظریہ کی تعریف بیان کر سکے اور اس کی وضاحت کر سکے

۲۳

۲۳

نظریہ پاکستان کی تعریف کر سکے اور اس کا مفہوم بیان کر سکے

۲۴

۲۴

علامہ اقبال اور قائد اعظم کے فرمودات کی روشنی میں نظریہ پاکستان بیان کر سکے

۲۵

۲۵

نظریہ پاکستان کا تاریخی پسو

عمومی مقصد

نظریہ پاکستان کے تاریخی پس منظر سے واقفیت حاصل کر سکے

۲۶

۲۶

خصوصی مقاصد:

محمد بن قاسم کے بارے میں بیان کر سکے

۲۷

۲۷

- ۱۶۰ محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکے
- ۱۶۱ محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکے
- ۱۶۲ بیان کر سکے کہ ہندوستان میں ہندو مسلم دو قومی نظریہ کا کھڑا آغاز کیا ہے
- ۱۶۳ مہد لطف خاں کی علمی خدمات بیان کر سکے
- ۱۶۴ شلا دہی اللہ کی علمی خدمات بیان کر سکے
- ۱۶۵ مہد لطف خاں اور شلا دہی اللہ نے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکے

علمی تحریکیں

علمی مقصد

- ۱۶۶ برصغیر کی علمی تحریکوں سے آگاہی حاصل کر سکے
- ۱۶۷ خصوصاً مقصد:
- ۱۶۸ ملی مرکز - راجہ بند - ندوت العلماء مدرستہ السلام، اسلامیہ کالج - انجمن حنیفہ اسلام نے تعلیم کے ذریعہ سیاسی شعور مسلمانوں میں پیدا کیا اسے بیان کر سکے
- ۱۶۹ آزادی ہند کے سلسلہ میں تحریک محمدین کی خدمات بیان کر سکے

TTQ 111 TARJAMA TUL QURAN / CIVIC-111

Theory	32	T	P	C
Practical	0	1	0	1

As per syllabus of BISE from PCTB Book

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. | |
| 5. | TRANSLATION | 4 hours
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-I

Total contact hours		T	P	C
Theory	96	3	0	3

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

AIMS After completing the course the students will be able to

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

COURSE CONTENTS

1	QUADRATIC EQUATIONS	6 Hrs
1.1	Standard Form	
1.2	Solution	
1.3	Nature of roots	
1.4	Sum & Product of roots	
1.5	Formation	
1.6	Problems	
2	ARITHMETIC PROGRESSION AND SERIES	3Hrs
2.1	Sequence	
2.2	Series	
2.3	nth term	
2.4	Sum of the first n terms	
2.5	Means	
2.6	Problems	
3	GEOMETRIC PROGRESSION AND SERIES	3Hrs
3.1	nth term	
3.2	sum of the first n terms	
3.3	Means	
3.4	Infinite Geometric progression	
3.5	Problems	
4	BINOMIAL THEOREM	6 Hrs
4.1	Factorials	
4.2	Binomial Expression	
4.3	Binomial Co-efficient	
4.4	Statement	
4.5	The General Term	
4.6	The Binomial Series.	
4.7	Problems	
5	PARTIAL FRACTIONS	6 Hrs
5.1	Introduction	

5.2	Linear Distinct Factors	Case I	
5.3	Linear Repeated Factors	Case II	
5.4	Quadratic Distinct Factors	Case III	
5.5	Quadratic Repeated Factors	Case IV	
5.6	Problems		
6	FUNDAMENTALS OF TRIGONOMETRY		6 Hrs
6.1	Angles		
6.2	Quadrants		
6.3	Measurements of Angles		
6.4	Relation between Sexagesimal & circular system		
6.5	Relation between Length of a Circular Arc & the Radian Measure of its central Angle		
6.6	Problems		
7	TRIGONOMETRIC FUNCTIONS AND RATIOS		6 Hrs
7.1	trigonometric functions of any angle		
7.2	Signs of trigonometric Functions		
7.3	Trigonometric Ratios of particular Angles		
7.4	Fundamental Identities		
7.5	Problems		
8	GENERAL IDENTITIES		6 Hrs
8.1	The Fundamental Law		
8.2	Deductions		
8.3	Sum & Difference Formulae		
8.4	Double Angle Identities		
8.5	Half Angle Identities		
8.6	Conversion of sum or difference to products		
8.7	Problems		
9	SOLUTION OF TRIANGLES		6 Hrs
9.1	The law of Sines		
9.2	The law of Cosines		
9.3	Measurement of Heights & Distances		
9.4	Problems		
10	MENSURATION OF SOLIDS		30 Hrs
10.1	Review of regular plane figures and Simpson's Rule		
10.2	Prisms		
10.3	Cylinders		
10.4	Pyramids		
10.5	Cones		
10.6	Frusta		
10.7	Spheres		
11	VECTORS		9 Hrs
11.1	Scalars & Vectors		
11.2	Addition & Subtraction		
11.3	The unit Vectors $\mathbf{i}$, $\mathbf{j}$, $\mathbf{k}$		
11.4	Direction Cosines		

- 11.5 Sealer or Dot Product
- 11.6 Deductions
- 11.7 Dot product in terms of orthogonal components
- 11.8 Deductions
- 11.9 Analytic Expression for $a \times b$.
- 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 n th term of an A.P.
- 2.3 Explain Arithmetic Mean between two given numbers
- 2.4 Insert n Arithmetic means between two numbers
- 2.5 Derive formulas for summation of an Arithmetic series
- 2.6 Solve problems on Arithmetic Progression and Series

3 UNDERSTAND GEOMETRIC PROGRESSION AND SERIES

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

4 EXPAND AND EXTRACT ROOTS OF A BINOMIAL

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

5 RESOLVE A SINGLE FRACTION INTO PARTIAL FRACTIONS USING DIFFERENT METHODS.

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

6 UNDERSTAND SYSTEMS OF MEASUREMENT OF ANGLES.

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

7 APPLY BASIC CONCEPTS AND PRINCIPLES OF TRIGONOMETRIC FUNCTIONS

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

8 USE TRIGONOMETRIC IDENTITIES IN SOLVING TECHNOLOGICAL PROBLEMS

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

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

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

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

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

11. USE THE CONCEPT AND PRINCIPLES OF VECTORS IN SOLVING TECHNOLOGICAL PROBLEMS.

- 11.1 Define vector quantity.
- 11.2 Explain addition and subtraction of vector
- 11.3 Illustrate unit vectors i, j, k .
- 11.4 Express a vector in the component form.

- 11.5 Explain magnitude, unit vector, direction cosines of a vector.
- 11.6 Derive analytic expression for dot product and cross product of two vector.
- 11.7 Deduce conditions of perpendicularity and parallelism of two vectors.
- 11.8 Solve problems

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

- 12.1 Define a matrix and a determinant.
- 12.2 List types of matrices.
- 12.3 Define transpose, 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 concepts of physics use these to solve problems in practical situations/technological courses and understand concepts to learn advance physics/technical courses.

COURSE CONTENTS

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

5.7	Resonance	
5.8	Transverse vibration of a stretched string	
6	SOUND.	5 Hours
6.1	Longitudinal waves	
6.2	Intensity, loudness, pitch and quality of sound	
6.3	Units of Intensity, of level and frequency response of ear	
6.4	Interference of sound waves, silence zones, beats	
6.5	Acoustics	
6.6	Doppler effect.	
7	LIGHT.	5 Hours
7.1	Review laws of reflection and refraction.	
7.2	Image formation by mirrors and lenses	
7.3	Optical instruments	
7.4	Wave theory of light	
7.5	Interference, diffraction, polarization of light waves	
7.6	Applications of polarization of light waves	
8	OPTICAL FIBER.	2 Hours
8.1	Optical communication and problems	
8.2	Review total internal reflection and critical angle	
8.3	Structure of optical fiber	
8.4	Fiber material and manufacture	
8.5	Optical fiber - uses.	
9	LASERS.	3 Hours
9.1	Corpuscular theory of light	
9.2	Emission and absorption of light	
9.3	Stimulated absorption and emission of light	
9.4	Laser principle	
9.5	Structure and working of lasers	
9.6	Types of lasers with brief description.	
9.7	Applications (basic concepts)	
9.8	Material processing	
9.9	Laser welding	
9.10	Laser assisted machining	
9.11	Micro machining	
9.12	Drilling, scribing and marking	
9.13	Printing	
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 field around a current carrying conductor	
	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 interaction with matter	
	15.2 Radiation detector	
	15.3 Radiation damage and its effects	
	15.4 Radiation therapy	
	15.5 Radioactive tracers	
	15.6 Application of radiation techniques in archeology, agriculture, chemical industry, polymerization, sterilization, food preservation, gauging and control, radiography	
16	ARTIFICIAL SATELLITES.	2 Hours
	16.1 Review law of gravitation	
	16.2 Escape velocity	
	16.3 Orbital velocity	

16.4	Geosynchronous and geostationary satellites	
16.5	Use of satellites in data communication.	
17	MAGNETIC MATERIALS.	2 Hours
17.1	Magnetism	
17.2	Domains theory	
17.3	Para and ferromagnetism and magnetic materials	
17.4	B.H. curve and hysteresis loop.	
18	SEMI CONDUCTOR MATERIALS.	2 Hours
18.1	Crystalline structure of solids	
18.2	Conductors, semiconductors, insulators	
18.3	P-type and N-type materials	
18.4	P-N junction	
18.5	P-N junction as a diode	
18.6	Photovoltaic cell (solar cell)	

RECOMMENDED BOOKS:

1. Tahir Hussain, Fundamentals of physics Vol-I, II
2. Farid Khawaja, Fundamentals of Physics Vol-I and II
3. Wells and Slusher, Schaum's Series Physics .
4. Nelkon and Oyborn, Advanced Level Practical Physics
5. Mehboob Ilahi Malik and Inam-ul-Haq, Practical Physics
6. Wilson, Lasers - Principles and Applications
7. M. Aslam Khan and M. Akram Sandhu, Experimental Physics Note Book

INSTRUCTIONAL OBJECTIVES

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

- 6.3 Explain units of Intensity level and frequency response of ear
 - 6.4 Explain phenomena of silence zones, beats
 - 6.5 Explain Acoustics of buildings
 - 6.6 Explain Doppler effect giving mathematical expressions and its application
- 7. USE THE CONCEPTS OF GEOMETRICAL OPTICS TO MIRRORS AND LENSES.**
- 7.1 Explain laws of reflection and refraction
 - 7.2 Use mirror formula to solve problems
 - 7.3 Use the concepts of image formation by mirrors and lenses to describe working of optical instruments, e.g. microscopes, telescopes, cameras.
- 7 UNDERSTAND WAVE THEORY OF LIGHT.**
- 7.1 Explain wave theory of light
 - 7.2 Explain phenomena of interference, diffraction, polarization of light waves
 - 7.3 Describe uses of polarization given in the course contents
- 9. UNDERSTAND THE STRUCTURE, WORKING AND USES OF OPTICAL FIBER.**
- 9.1 Explain the structure of the Optical Fiber
 - 9.2 Explain its principle of working
 - 9.3 Describe use of optical fiber in industry and medicine.
- 10. UNDERSTAND THE STRUCTURE, WORKING AND USES OF LASERS.**
- 10.1 Explain the stimulated emission of radiation
 - 10.2 Explain the laser principle
 - 10.3 Describe the structure and working of lasers
 - 10.4 Distinguish between types of lasers
 - 10.5 Describe the applications of lasers in the fields mentioned in the course contents.
- 11. UNDERSTAND CONCEPTS OF HEAT.**
- 11.1 Explain calorimetric and modes of transfer of heat
 - 11.2 Explain Gas laws giving mathematical expressions
 - 11.3 Explain Thermal expansion of solids, liquids and gases
 - 11.4 Distinguish between absolute and relative humidity
 - 11.5 Distinguish between heat of fusion, vaporization
 - 11.6 Explain Law of cooling
 - 11.7 Explain basic concepts of Thermoelectricity
 - 11.8 Describe Thermocouple, giving its principle, structure and working.
- 12. UNDERSTAND LAWS OF THERMODYNAMICS.**
- 12.1 Distinguish between heat energy and internal energy
 - 12.2 Explain first law of thermodynamics giving its applications by defining Isothermal and adiabatic process
 - 12.3 Distinguish between isometric and adiabatic processes
 - 12.4 Explain second law of thermodynamics describing alternate statements
 - 12.4 Distinguish between work of heat engine and refrigerator.

- 13. UNDERSTAND LAWS OF ENERGY DISTRIBUTION AND EMISSION RADIATION.**
- 13.1 Explain modes of transfer of heat
 - 13.2 Explain black body radiation and laws of energy distribution
 - 13.3 Describe Planck's Quantum theory
 - 13.4 Explain photoelectric effects
 - 13.5 Explain production, properties and uses of x-rays
- 14. UNDERSTAND NATURE, TYPES, GENERATION AND SPECTRUM OF ELECTROMAGNETIC WAVES.**
- 14.1 Explain magnetic field due to current and electric field due to changing magnetic flux
 - 14.2 Explain moving fields
 - 14.3 Describe types of electromagnetic waves
 - 14.4 Explain generation of radio waves
 - 14.5 Explain spectrum of electromagnetic waves
- 15. UNDERSTAND THE STRUCTURE OF THE ATOMIC NUCLEUS AND RELEVANT ACTIVITIES.**
- 15.1 Describe the structure of the nucleus
 - 15.2 Explain Radioactivity and Radioactive series
 - 15.3 Explain transmutation of elements
 - 15.4 Distinguish between fission reaction and fusion reaction
 - 15.5 Explain the structure and working of the nuclear reactor
- 16. UNDERSTAND NUCLEAR RADIATIONS THEIR EFFECTS AND USES.**
- 16.1 Describe properties of nuclear radiations and their interaction with matter
 - 16.2 Explain working of radiations detectors
 - 16.3 Explain damaging effects of nuclear radiation
 - 16.4 Explain radiations therapy
 - 16.5 Describe radioactive tracers
- 17. UNDERSTAND TYPES AND USES OF ARTIFICIAL SATELLITES.**
- 17.1 Explain escape velocity
 - 17.2 Explain orbital velocity
 - 17.3 Distinguish between geosynchronous and geostationary satellite
 - 17.4 Describe uses of artificial satellite in data communications
- 18. UNDERSTAND BASIC CONCEPTS AND CLASSIFICATION OF MAGNETIC MATERIALS.**
- 18.1 Explain domains theory of magnetism
 - 18.2 Distinguish between Para, dia and ferromagnetism and magnetic materials
 - 18.3 Distinguish between B and H
 - 18.4 Describe B.H. Curve
 - 18.5 Describe hysteresis loop.
- 19. UNDERSTAND BASIC CONCEPTS OF SEMI-CONDUCTOR MATERIALS AND THEIR USES.**
- 19.1 Explain crystalline structure of solids
 - 19.2 Distinguish between conductors, semiconductors and insulators
 - 19.3 Describe semiconductors giving example with reference to their structure
 - 19.4 Distinguish between P-type and N-type materials
 - 19.5 Explain working of P-N junction as a diode

19.6 Explain working of solar cell

LIST OF PRACTICAL

96 Hours

1. Draw graph representing the functions:
 - a) $Y = mx$ for $m=0, 0.5, 1, 2$
 - b) $Y = X^2$
 - c) $Y = 1/x$
2. Find the volume of a given solid cylinder using vernier calipers.
3. Find the area of cross-section of the given wire using micrometer screw gauge.
4. Prove that force is directly proportional to (a) mass, (b) acceleration, using fletchers' trolley.
5. Verify law of parallelogram of forces using Grave-sands apparatus.
6. Verify law of triangle of forces and Lami's theorem
7. Determine the weight of a given body using
 - a) Law of parallelogram of forces
 - b) Law of triangle of forces
 - c) Lami's theorem
8. Verify law of polygon of forces using Grave-sands apparatus
9. Locate the position and magnitude of resultant of like parallel forces
10. Determine the resultant of two unlike parallel forces
11. Find the weight of a given body using principle of moments
12. Locate the center of gravity of regular and irregular shaped bodies
13. Find Young's Modules of Elasticity of a metallic wire.
14. Verify Hook's Law using helical spring.
15. Study of frequency of stretched string with length
16. Study of variation of frequency of stretched spring with tension
17. Study resonance of air column in resonance tube and find velocity of sound.
18. Find the frequency of the given tuning fork using resonance tube.
19. Find velocity of sound in rod by Kundt's tube.
20. Verify rectilinear propagation of light and study shadow formation
21. Study effects of plane mirror on reflection
22. Compare the reflective indices of given glass slabs
23. Find focal length of concave mirror by locating centre of curvature
24. Find focal length of concave mirror by object and image method
25. Find focal length of concave mirror with converging lens
26. Find reflective index of glass by apparent depth
27. Find reflective index of glass by spectrometer
28. Find focal length of converging lens by plane mirror
29. Find focal length of converging lens by displacement methods
30. Find focal length of diverging lens using converging lens
31. Find focal length of diverging lens using concave mirror
32. Find angular magnification of an astronomical telescope.
33. Find angular magnification of a simple microscope (magnifying glass)
34. Find angular magnification of a compound microscope
35. Study working and structure of camera
36. Study working and structure of sextant
37. Compare the different scales of temperature and verify the conversion formula
38. Determine the specific heat of lead shots.
39. Find the coefficient of linear expansion of a metallic rod.
40. Find the heat of fusion of ice

41. Find the heat of vaporization.
42. Determine relative humidity using hygrometer

Comp-172 COMPUTER APPLICATIONS

Total contact hours

Theory	32	T	P	C
Practical	96	1	3	2

Learning Outcomes

1. Understanding of basics of electronic data
2. Learning of file managers, word processors, spreadsheets, presentation software's
3. Demonstrate the ability to apply application software in an office environment.
4. Use office applications for presentation, report writing, and data entry.

COURSE CONTENTS

Hours

1.	ELECTRONIC DATA PROCESSING (EDP)	06
1.1	Basics of computers	
1.2	Classification of computers	
1.3	Block diagram of a computer system	
1.4	Binary number system	
1.5	BIT, BYTE, KB, MB, GB, TB	
1.6	Input and output devices	
1.7	Secondary storage media details	
1.8	Processors and types	
1.9	Using computer for system software	
1.10	Using computers for application software.	
1.11	Common types of software and their application.	
1.12	CPU, RAM, ROM, Hard disk, USB, Flash drive, CD, DVD, Blue ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound, Cards, Speakers, CMOS battery, Sharing of Printers.	
2.	OPERATION SYSTEM AND APPLICATION SOFTWARE	06
2.1.	System Software, Application Software, Virtualization Software, Utility Software	
2.2.	Msoffice/OpenOffice/ LibreOffice	
2.3.	Working with window, Desktop components, Menu bars, creating shortcut of program.	
2.4.	Installation of Application softwares, Antivirus and Drivers	
3.	INTERNET AND NETWORKING	05
3.1	Basics of Networking WWW, LAN, WAN, Wi-Fi technologies	
3.2	Concept of IP Addresses, DNS, Search Engines, e-mail,	
3.2	Browsing and cyber laws.	
3.3	Distributed system in networking	
3.4	Client side and server side networking	
4.	APPLICATIONS OF OFFICE SOFTWARES	10
4.1	Applications of MS Word software	
4.2	Applications of MS PowerPoint	

- 4.3 Applications of MS Excel
- 4.4 Applications of Google Docs

5. ADVANCED COMPUTER APPLICATIONS

05

- 5.1. Graphic software's such as paint and MS Visio
- 5.2. Introduction to artificial intelligence and machine learning
- 5.3. Introduction to large language models such as ChatGPT

RECOMMENDED BOOKS

- 1. Gottfrid. R. S., (1 May 1986). Schaum's Outline of Programming with BASIC. New York: McGraw-Hill.
- 2. Any Word Processor Latest Release (e.g., Word, Word-Perfect etc).
- 3. Miller. A.R., (1993). The ABC's of DOS 6. Hoboken; Sybex.
- 4. Robbins. J., (1994). Mastering Dos 6.0 & 6.2. BPB Publications.

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,
- 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
- 1.14 CPU, RAM, ROM, Hard disk, USB, Flash drive, CD, DVD, Blue ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound, Cards, Speakers, CMOS battery, Sharing of Printers.

2. OPERATION SYSTEM AND APPLICATION SOFTWARE

- 2.1. System Software, Application Software, Virtualization Software, Utility Software
- 2.2. MS Office/Open Office/ Libre office
- 2.3. Working with window, Desktop components, Menu bars, creating shortcut of program.
- 2.4. Installation of Application software's, Antivirus and Drivers

3. INTERNET AND NETWORKING

- 3.1. Basics of Networking WWW, LAN, WAN, Wi-Fi technologies
- 3.2. Concept of IP Address, DNS, Search Engines, e-mail,
- 3.3. Browsing and cyber laws.
- 3.4. Distributed system in networking
- 3.5. Client side and server-side networking

4. UNDERSTAND MICROSOFT OFFICE PROCESSING SESSION

- 4.1. Describe applications of MS Word
- 4.2 Describe basic and advanced features of MS word
- 4.3. Describe uses of MS PowerPoint
- 4.4 Describe basic and advanced features of MS PowerPoint
- 4.5. Describe uses of MS Excel
- 4.6 Describe basic and advanced features of MS Excel
- 4.7 Describe applications of google docs
- 4.8 Describe procedures to use printer

5. UNDERSTAND ADVANCED COMPUTER APPLICATIONS

- 5.1 Identify graphic software's
- 5.2 Explain the applications of graphic software's
- 5.3 Describe artificial intelligence and machine learning
- 5.4 Describe the applications of artificial intelligence and machine learning
- 5.5 Describe large language models such as ChatGPT

Comp-172 COMPUTER APPLICATIONS

LIST OF PRACTICALS

1. Identify key components of a computer system (keyboard, mouse, CPU, disk drives, disks, monitor, printer) through hands-on exploration.
2. Install system software and explore its features through guided lab sessions.
3. Install and use various application software (e.g., word processors, spreadsheets) to create documents and perform tasks.

Specific activities for MS Word

4. Create a new document and format the text using different fonts, sizes, and colors.
5. Apply bold, italic, and underline styles to specific parts of a text.
6. Insert and format a table, including merging and splitting cells.
7. Use bullet points and numbered lists to organize information.
8. Insert headers, footers, and page numbers into a document.
9. Use the spell check and grammar check features to correct a document.
10. Create and apply different paragraph alignments and line spacing.
11. Insert and format images, shapes, and text boxes into a document.

Specific activities for MS Excel

12. Create a new spreadsheet and enter data into cells.
13. Use basic formulas (e.g., SUM, AVERAGE) to perform calculations on data.
14. Create and format charts (e.g., pie, bar, line) to visually represent data.
15. Insert and format tables, including sorting and filtering data within the table.
16. Print selected areas or the entire spreadsheet, including setting up print titles and page layout.

Specific activities for MS PowerPoint

17. Create a new presentation and add slides with different layouts.
18. Apply themes and design templates to enhance the presentation's appearance.
19. Insert and format text boxes, images, shapes, and charts on slides.
20. Apply transitions between slides and animations to objects on slides.
21. Insert multimedia elements such as audio and video into a presentation.
22. Print slides, handouts, and notes pages in various formats for distribution.

Specific activities for Google Docs

23. Create a database form using form wizard
24. Create and share files/folders in Google drive.
25. Create and share Google docs.
26. Create and share Google sheets.
27. Create and share Google Forms.
28. Create and share Google slides.

ChT-113 BASIC CHEMICAL TECHNOLOGY

Total contact hours

Theory	64	T	P	C
Practical	96	2	3	3

OBJECTIVES:

1. To introduce the students with the basic concepts of fundamental units of measurement and their inter-conversion; 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.
4. The students will be able to perform experiments related to subject in the lab.

CONTENTS

HOURS

1.0	HISTORY AND SCOPE OF CHEMICAL ENGINEERING	06
1.1	History of Chemical Engineering.	
1.2	Introduction to chemical engineering and chemical technology.	
1.3	Scope of Chemical Engineering	
1.4	Emerging Techniques & Technologies in Chemical Engineering & DAE Chemical or Future Trends in Chemical Technology.	
1.5	Classification of Chemical Industries.	
1.6	Chemical Plant Layout and its Sections.	
1.7	Role of Chemical Engineer in industry.	
2.0	CONCEPT OF UNIT OPERATIONS AND UNIT PROCESSES	02
2.1	Introduction of Unit Operations and Unit Processes	
2.2	Define Unit Operations examples i.e. Drying, Absorption, Adsorption, Evaporation, & Screening etc.	
2.3	Define Unit Processes examples i.e. Combustion, Nitration, Halogenation, Sulphonation, Alkylation, Amination etc.	
3.0	FLOW DIAGRAMS, MAJOR EQUIPMENTS AND STANDARD SYMBOLS	12
3.1	Flow diagrams and types	
3.2	Introduction to Heat transfer & List of heat transfer equipments.	
3.3	Introduction to Mass transfer equipments.	
3.4	Introduction to auxiliary equipments and list of auxiliary equipments.	
3.5	Introduction and detail of plant utilities (Plant air, instrument air, fire water, pneumatic air, cooling water, BFW, DMW, De-aeration of water etc.)	
3.6	Major process equipments.	

3.7	Standard symbols.	
4.0	UNITS AND DIMENSIONS	08
4.1	Physical quantities and their classification.	
4.2	Primary quantities units and dimensions.	
4.3	Secondary quantities units and dimensions.	
4.4	System of Measurements.	
4.5	Units and Dimensions.	
4.6	Unit conversion	
4.7	Dimensional and Dimensionless quantities	
4.8	Related Problems	
5.0	REPRESENTATION OF SCIENTIFIC DATA	08
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.	
5.5	Introduction to linear scale.	
5.6	How to select scale according to reading.	
5.7	Introduction with logarithmic graph and logarithmic scale.	
5.8	Introduction with extrapolation & interpolation and difference between them.	
6.0	PIPE AND TUBES	14
6.1	Type of pipes	
6.2	Cast iron pipe, wrought iron pipe, steel pipe Aluminum pipes, plastic pipe, Rubber pipes	
6.3	Pipe standards	
6.4	Pipe fitting	
6.5	Define tube. Introduction with tube standards and BWG.	
6.6	Types of valves	
6.7	Construction and working and application of gate valve, globe valve ball valve, plug cock, needle valve, butterfly valve and check valve.	
6.8	Introduction to corrosion concept and its types. The mitigation techniques and corrosion under insulation.	
6.9	Industrial hose pipe concept, type and industrial uses.	
6.10	Definition of control valve.	
7.0	STEAM TRAPS	06
7.1	Introduction to steam and steam traps	
7.2	Types of steam traps.	
7.3	Troubleshooting and problems 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.	

- 8.4 Heat tracing concept, its types (Electrical and steam heat tracing).
- 8.5 Personal protection type insulation.

REFERENCE BOOKS

- 1 Coulson J. M., Richardson J. f.,(2004) "Chemical Engineering" Vol-6 The English Book Society and Pergamon Press.
- 2 By Salil K. Ghosal, Shyamal K. Sanyal, Siddhartha Datta."Introduction to Chemical Engineering"
© 2004, Published: June 21, 2004.

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
 - Name different systems of measurement.(CGS, MKS,FPS,SI)
 - 4.2.1 Primary quantities (Length, Mass, Time, Temperature)
 - 4.2.2 Secondary quantities (Area, volume, density, velocity, acceleration, force, pressure, work , Power).
- 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, Kinetic Energy, and specific gravity.

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
- 5.4 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

6.0 PIPES AND TUBES

- 6.1 Know the types of pipes
 - Define pipe
 - Define tube
 - Differentiate pipe and tube
 - Define schedule number and BWG
 - Define common material of construction i-e G.I, S.S and PVC
- 6.2 Introduction to pipe fittings
 - 6.2.1 Define pipe fittings
 - 6.2.2 Enlist the different pipe fitting

- 6.2.3 Explain the functions of different pipe fittings used in chemical process industries (bend, elbow, tee, union and closer)
- 6.3 Types of valves
 - 6.3.1 Define valve
 - 6.3.2 Enlist the types of a valves
- 6.4 Understand construction and working of valves
 - 6.4.1 Explain the construction and working of gate valve (rising and non-rising stem), globe valve, ball valve, ~~needle valve~~, ~~butterfly valve~~ NRV and safety valves
 - 6.4.2 Select a proper valve according to need

7 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 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 i-e asbestos, glass wool, refractory bricks, plaster of Paris
 - 8.1.5 Explain the general precautions for handling thermal insulation materials
 - 8.1.6 Explain the use of thermal cladding
- 8.2 Apply the insulation technique for steam pipes and valves
 - 8.2.1 Explain the method of steam pipe insulation (lagging)
- 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. Calculate dimensions of various secondary quantities using standard measurement tools.
2. Determine units of different physical quantities in both metric and imperial systems.
3. Convert measurements from one unit system to another accurately.
4. Draw basic graphs (line, bar, pie charts) based on provided data sets.
5. Read and interpret data from various types of graphs, identifying trends and key information.
6. Measure the diameter and length of pipes using calipers and measuring tapes.
7. Calculate the surface area and cross-sectional area of different objects using geometric formulas.
8. Cut pipes to specified lengths using appropriate pipe-cutting tools.
9. Thread pipes using a pipe threading tool for connections and fittings.
10. Drill holes in pipes at specified locations with precision and safety.
11. Assemble pipes using various fittings (e.g., elbows, tees, couplings) ensuring proper alignment.
12. Install valves in a piping system, ensuring they are properly secured.
13. Apply insulation materials to steam pipelines, understanding their importance.
14. Observe and explain the function of cut models of equipment used in the chemical industry.
15. Document procedures, observations, and results for each laboratory activity in clear reports.

ChT-124 GENERAL CHEMISTRY

Total contact hours

Theory	64	T	P	C
Practical	192	2	6	4

Learning Outcomes

1. To understand the principles of General chemistry.
2. To perform experiments related to general chemistry
3. To develop understanding of the scientific methods as applied to the development of laws of chemistry.
4. To prepare for advance Laboratory Work.

Course Outlines

Hours

1.0	CONCEPT OF CHEMISTRY	02
	1.1 Language of Chemistry	
	1.2 Molecular formula and Empirical formula	
	1.3 Chemical Equation	
2.0	CHEMICAL LAWS	02
	2.1 Law of conservation of mass, Law of constant proportion	
	2.2 Law of Reciprocal proportion, Law of multiple proportion	
3.0	ATOMIC STRUCTURE	04
	3.1 Passage of electricity through electrolyte solution and gases	
	3.2 Rutherford atomic model and its defects	
	3.3 Plank's theory, types of spectrum, and Bohr's theory	
	3.4 Defects in Bohr's theory	
	3.5 Periodic Table	
4.0	CHEMICAL BOND	06
	4.1 Ionic Bond	
	4.2 Covalent bond, types of Covalent Bond, Polar & Non-Polar Bonds	
	4.3 Ionization Potential and Electron Affinity	
	4.4 Electro negativity and Bond Energy	
	4.5 Co-ordinate covalent Bond, Sigma and Pi Bond	
	4.6 Hybridization and structure of CH ₄ , H ₂ O, and NH ₃	
5.0	GASES	06
	5.1 Behavior of gases and Kinetic theory of gases	

	5.2 Boyle's and Charles law and the General Gas Equation with problem-solving	
	5.3 Graham's law of diffusion, Dalton's law of partial pressure, and Gay Lussac law	
	5.4 Behavior of gases like SO ₂ , CH ₄ , N ₂ , H ₂ , O ₂ , and CO ₂ at different temperatures	
6.0	LIQUIDS	04
	6.1 Properties of liquid and viscosity measurement	
	6.2 Surface tension and its measurement	
7.0	SOLIDS	04
	7.1 Preparation and properties of solids	
	7.2 Classification of solids and crystal lattice energy	
8.0	SOLUTIONS	04
	8.1 Types of solutions and units of measurement	
	8.2 Ideal and non-ideal solutions	
9.0	OXIDATION/REDUCTION	04
	9.1 Important oxidizing and reducing agents	
	9.2 Balancing of equations by oxidation number method	
10.0	WATER	04
	10.1 Impurities and causes of water hardness	
	10.2 Hard and soft water, removal of permanent and temporary hardness	
11.0	ALLOYS DEFINITION & CHEMISTRY	02
	11.1 Difference between Alloys and Compounds	
	11.2 Stainless steel composition, properties, and uses	
	11.3 German silver, Bronze, Nichrome, and Amalgam	
	11.4 Bell Metal and Solder	
12.0	ACIDS & BASES	04
	12.1 Concept of acids and bases and their properties	
	12.2 Strong and weak acids and bases with examples	
	12.3 Basicity and acidity	
13.0	SALTS	04
	13.1 Types of salts	

13.2	Salt analysis	
14.0	METALS	04
14.1	Difference between metals and non-metals	
14.2	General methods of purification of ores	
14.3	Lithium metal, its occurrence and uses	
15.0	IRON, ORES, IRON PURIFICATION	04
15.1	Manufacture of pig iron from blast furnace	
15.2	Manufacture of steel and its uses	
16.0	COPPER	02
16.1	Ores extraction of copper	
16.2	Refining and uses of copper	
17.0	ALUMINIUM	02
17.1	Ores, extraction, and uses of aluminium	
18.0	CHROMIUM	02
18.1	Ores, extraction, and uses of chromium	

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-124 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 valence
 - 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 Types of Covalent Bond
 - 4.2.3 Define single bond and give examples
 - 4.2.4 Illustrate double bond and give examples
 - 4.2.5 Describe triple bond and give examples
 - 4.2.6 Describe covalent compounds
 - 4.2.7 Name covalent compounds
 - 4.2.8 Define Polar and Non-Polar Bonds with examples.
- 4.3 Know ionization potential
 - 4.3.1 Define ionization potential
 - 4.3.2 Illustrate electron affinity
 - 4.3.3 Give ionization potential of different atoms
- 4.4 Know electronegativity
 - 4.4.1 Explain electronegativity
 - 4.4.2 Define bond energy
 - 4.4.3 Give example of electronegativity
- 4.5 Understand co-ordinate bond
 - 4.5.1 Describe co-ordinate bond
 - 4.5.2 Understand hybridization
 - 4.5.3 Describe hybridization
- 4.6 Give example of Sigma bond
 - 4.6.1 Distinguish between Sigma and pie bond
 - 4.6.2 Illustrate structure of different hybridized atom

5 GASES

- 5.1 Understand behavior of gases
 - 5.1.1 Explain kinetic theory of gases
 - 5.1.2 Describe temperature effect on gases
- 5.2 Understand gas laws
 - 5.2.1 State Boyle's law
 - 5.2.2 State Charles law
 - 5.2.3 Describe absolute temperature
 - 5.2.4 Derive ideal gas equation

- 5.2.5 Solve problem based on ideal gas equation
- 5.2.6 State Graham's law of diffusion
- 5.2.7 Explain Dalton's law of partial pressure
- 5.2.8 State Gay Lussac's law
- 5.2.9 Solve problems based on Graham's law of diffusion
- 5.2.10 Solve problems based on Gay Lussac's law

6 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.

7 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.

8 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

9 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.
- 10 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.
- 11 ALLOYS DEFINITION & CHEMISTRY**
 - 11.1 Composition of alloys
 - 11.1.1 Define alloys, Difference b/w alloys & compounds.
 - 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
- 12 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

14 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
 - 14.3.3 Lithium metal, its occurrence and uses.

15 IRON, ORES, IRON PURIFICATION

- 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

16 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 aluminum
 - 17.1.1 List ores of aluminum
 - 17.1.2 Name methods of aluminum extraction
 - 17.1.3 Explain electrolysis of bauxite
 - 17.1.4 Give the uses of aluminum

18 CHROMIUM

- 18.1 Understand chromium extraction
 - 18.1.1 Enlist chromium ores
 - 18.1.2 Describe chromium extraction

CHT-124 GENERAL CHEMISTRY

LIST OF PRACTICALS

192 Hrs.

- 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

ChT-133 BASIC ENGINEERING DRAWING

Total contact hours

Theory	32	T	P	C
Practical	192	1	6	3

Learning Outcomes

Students will be able to

1. Understand the fundamentals of engineering & process drawing used in the various fields of industry
2. Use various drawing instruments related to process industry

COURSE CONTENTS

1. USES AND APPLICATIONS OF TECHNICAL DRAWING 2 Hours

- 1.1 Technical drawing and the technician.
- 1.2 Use of technical drawing.
- 1.3 Common drawing types
- 1.4 Application of drawing
- 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 3 Hours

- 3.1 Importance of the alphabet lines.
- 3.2 Common alphabet lines
- 3.3 Uses and correct line weightage of the line.
- 3.4 Application of line

4. LETTERING. 3 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 TECHNIQUES 3 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. PROCESS DIAGRAM SYMBOLS. 3 Hours

- 6.1 Process Instrumentation
- 6.2 Enlist Various Instrument Types
- 6.3 Draw Standard Symbols of Instrumentation
- 6.4 Uses
- 6.5 Draw a Simple Complete P&ID.

7. INTRODUCTION TO PROCESS FLOW EQUIPMENTS DRAWINGS 3 Hours

- 7.1 Process Flow Equipments for Diagrams
- 7.2 Uses
- 7.3 Draw Symbol of Major & Widely Used Process Equipments

8. INTRODUCTION TO PROCESS DRAWINGS 3 Hours

- 8.1 Process Drawings & Process Flow Diagram
- 8.2 Block Diagram
- 8.3 PFD
- 8.4 Uses

9. INTRODUCTION TO PROCESS & INSTRUMENTATION DRAWINGS (P&ID) 3 Hours

- 9.1 Process & Instrumentation Drawings (P&ID)
- 9.2 Uses
- 9.3 Draw a Simple P&ID Diagram

10. DRAWING OF VALVES AND FITTINGS. 3 Hours

- 10.1 Definition of Valve and fittings
- 10.2 Enlist Different Types of Valves and fittings
- 10.3 Draw Standard Symbol of Each Valve and fittings

11. INTRODUCTION TO PROCESS SIMULATION SOFTWARES 4 Hours

- 11.1 Define Process Simulation
- 11.2 Uses
- 11.3 Enlist Some Widely Used Process Simulation Software
- 11.4 Importance

RECOMMENDED BOOKS:

1. Engineering drawing by French Wirk

CHT-133 BASIC ENGINEERING DRAWING

INSTRUCTIONAL OBJECTIVES

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

1.2 Recognizes the different application of Technical drawing

- 1.2.1 Identify commonly used drawing forms
- 1.2.2 Illustrate the different drawing types
- 1.2.3 Differentiate different drawing types
- 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 Define the horizontal, vertical and inclined lines & arcs
- 3.5 Explain the uses of horizontal, vertical and inclined lines & arcs

4. APPLIES THE GOOD LETTERING IN A DRAWING

- 4.1 Describe the importance of lettering in a technical engineering drawing.
- 4.2 Identify the letter style used in technical drawing.

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

- 5.1. Define circle, square, triangle, quadrilaterals)
- 5.2. Explain the use of circle, square, triangle, quadrilaterals in the drawings

6. UNDERSTANDING THE PROCESS DIAGRAM SYMBOLS

- 6.1 Define standard process diagram symbols
- 6.2 Recognize standard process diagram symbols
- 6.4 Draw Symbol of valves, Pump, Compressor, Turbine, Heat exchanger, Heater, Furnace, Reactor, Fin Fan Cooler columns
- 6.6 Define Importance of Process Equipments in Process Drawings

7. UNDERSTANDING THE INSTRUMENTATION SYMBOLS IN PROCESS DIAGRAM.

- 7.1 Definition of Process Instrumentation
- 7.2 Enlist Various Instruments Types like Control Valve, Pressure Transmitter, Flow Transmitter
- 7.3 Draw Standard Symbols of Instrumentation like FT, PT, LT, & Control Valve
- 7.4 Define Process Instrumentation
- 7.5 Uses of Instrumentation in Process Flow Diagrams

8. UNDERSTANDING THE INTRODUCTION TO PROCESS DRAWINGS

- 8.1 Introduction to Process Drawings & Process Flow Diagrams
- 8.2 Introduction to Block Diagram of Various Chemical Process
- 8.3 Define Block Flow Diagram & PFD
- 8.4 Uses of BFD & PFD in Industries
- 8.5 Sketch a Simple Block Flow Diagram of Any Process
- 8.6 Sketch a Simple Process Flow Diagram of Any Chemical process

9. UNDERSTANDING THE INTRODUCTION TO PROCESS & INSTRUMENTATION DRAWINGS (P&ID).

- 9.1 Define Process & Instrumentation Drawings (P&ID)
- 9.2 Write Uses of P&ID in Process Industries
- 9.3 Write Various Characteristics Used in P&ID
- 9.4 Draw a Simple P&ID Diagram
- 9.5 How to Read P&ID Diagram.

10. UNDERSTANDING THE DRAWING OF VALVES.

- 10.1 Definition of Valve
- 10.2 Enlist Different Types of Valves
- 10.3 Describe Uses of Various Types of Valves in Process Industries
- 10.4 Define Gate Valve, Globe Valve, Ball Valve, Butterfly Valve
- 10.5 Draw Standard Symbol of Each Valve

11. UNDERSTANDING THE INTRODUCTION TO PROCESS SIMULATION SOFTWARES

- 11.1 Define Process Simulation
- 11.2 Uses of Process Simulations in Process Industries
- 11.3 Enlist Some Widely Used Process Simulation Softwares
- 11.4 Tutorial on process Flowsheeting

CHT-133 BASIC ENGINEERING DRAWING

LIST OF PRACTICALS

192 Hours

1. Draw lettering at 3mm and 5mm heights.
2. Draw horizontal, vertical, inclined, and intersecting lines using a tee square and set squares.
3. Draw circles, half circles, and radii using a compass.
4. Draw rounded corners and figures inside and outside circles.
5. Draw geometric angles in a plane.
6. Draw various types of triangles in plane geometry.
7. Draw different quadrilaterals in plane geometry.
8. Draw parallel lines, perpendicular lines, and bisect lines and angles in plane geometry.
9. Draw inscribed and circumscribed squares and triangles within circles.
10. Draw tangents to circles both inside and outside the circle.
11. Draw curves of parabolas and hyperbolas.
12. Draw spirals and helix curves.
13. Draw the geometry of a cube.
14. Draw the geometry of cylinders.
15. Draw symbols for various valves.
16. Draw symbols for pumps.
17. Draw symbols for compressors.
18. Draw symbols for turbines.
19. Draw symbols for heat exchangers.
20. Draw symbols for coolers.
21. Draw symbols for heaters.
22. Draw symbols for reactors.
23. Draw symbols for vessels.
24. Draw symbols for columns.
25. Draw a block flow diagram for a chemical process.
26. Draw a process flow diagram for a chemical process.
27. Draw a block flow diagram for a chemical process using computer tools.
28. Draw a process flow diagram for a chemical process using computer tools.

COURSE DETAILS

YEAR - 2

() حضور ﷺ کی بطور سربراہ بیان کر سکے

حضور ﷺ بحیثیت

() خطبہ حجۃ الوداع۔ انسانی حقوق کا اعلامیہ حقوق انسانی پالیسی 2018 کے بارے جان سکے

اسلامی معاشرہ:

عمومی مقاصد: اسلامی معاشرہ کی خصوصیات سے آگاہی حاصل کر سکے

خصوصی مقاصد:

() اسلامی معاشرہ کا معنی و مفہوم 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 اور 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

() لفظ مسجد کی تعریف بیان کر سکے

() مسجد کی سابقہ حیثیت کو بحال کرنے کے بارے میں اقدامات کو مان سکے

() انسانی حقوق کی معاشی اور معاشرتی ترقی میں اہمیت اور کردار 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

حصہ دوم
مطالعہ پاکستان

تدریس مقاصد:

تحریک پاکستان:

عمومی مقاصد:

() قیام پاکستان کے اسباب و تحریک 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 کی اہمیت بیان کر سکے

() ہندوستانی مسلمانوں کی محرومیوں کو بیان کر سکے

() قومی تشخص کو بحال رکھنے کے لیے مسلمانان ہند کی مساعی بیان کر سکے

() آزادی ہند اور قیام پاکستان علامہ اقبال اور قائد اعظم کی مسایام کریں

() قیام پاکستان سے مستقبل اسلامی مملکت کے قیام کے لیے مسلم عوام کی کوششوں کو بیان کر سکے

() مسلم لیگ کے قیام پاکستان کے لیے جدو جہد بیان کر سکے

(غیر مسلم طلباء کے لیے)

ٹی پی سی

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کل وقت 20 گھنٹے

نصاب اخلاقیات

سال دوم

موضوعات:

معاشرتی اقدار بلحاظ ہمسایہ قوم۔ قومی سطح۔ شہری سطح۔ صنعتی اداروں کی سطح۔ ضروریات۔ ورثہ

() حقوق و فرائض

() قوت برداشت

() قوت ارادی

() لگن و جذبہ

() وسیع النظری

() بے غرضی

() انسانی دوستی

() حفاظتی شعور

() پاس آزادی

() کامل آگاہی

() تغیرات کو قبول کرنا

() خود شناسی

() انسانی حقوق کا اعلامیہ حقوق انسانی پالیسی 2018

() انسانی حقوق کا معاشرتی اور معاشی ترقی میں کردار

() حقوق آگاہی، معلومات تک رسائی۔ ملازم پیشہ خواتین کا تحفظ

نصاب اخلاقیات

سال دوم

تدریس مقاصد:

طالب علم اخلاقیات کی اہمیت و ضرورت سے آگاہ 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 معاشرے پر موضوعات کے مطابق اثرات پیدا کرنے کے طریقے بیان کر سکے
- () اعلیٰ اخلاقی اقدار میں سے قوت برداشت، قوت ارادی، لگن و جذبہ، وسیع النظری، بے غرض، انسانی دوستی شعور، پاس آزادی، کامل آگاہی اور خود شناسی کی اہمیت
- () اخلاقیات سے متصف ہو کر قومی خدمت بہتر طور پر انجام دے سکے
- () انسانی حقوق کا اعلامیہ حقوق انسانی کی پالیسی 2018 کے بارے میں جان سکے
- () انسانی حقوق کا معاشرتی اور معاشی ترقی میں اہمیت اور کردار بیان کر سکے
- () حقوق آگاہی معلومات تک رسائی کے قانون کو جان سکے
- () ملازم پیشہ خواتین کا تحفظ کو اخلاقیات کا حصہ تصور کرے

TTQ 211/ CIVIC-211

**TARJAMA TUL QURAN /
Civics**

Theory	32	T	P	C
Practical	0	1	0	1

As per syllabus of BISE from PCTB Book

Math-223 APPLIED MATHEMATICS-II

Total Contact Hours

Theory: 96 Hours

T	P	C
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. Text Book of Math-223 developed by TEVTA Punjab
2. Thomas Finny- Calculus and Analytic Geometry
3. Ghulam Yasin Minhas - Technical Mathematics Vol - II, Ilmi Kitab Khana, Lahore.
4. Prof. Riaz Ali Khan- Polytechnic Mathematic Series Vol I & II, Majeed Sons, Faisalabad
5. Prof. Sana Ullah Bhatti - Calculus and Analytic Geometry, Punjab Text Book Board, Lahore.

INSTRUCTIONAL OBJECTIVES

1. **USE THE CONCEPT OF FUNCTIONS AND THEIR LIMITS IN SOLVING SIMPLE PROBLEMS.**
 - 1.1 Define a function.
 - 1.2 List all type of functions.
 - 1.3 Explain the concept of limit and limit of a function.
 - 1.4 Explain fundamental theorems on limits.
 - 1.5 Derive some important limits.
 - 1.6 solve problems on limits.
2. **UNDERSTAND THE CONCEPT OF DIFFERENTIAL COEFFICIENT**
 - 2.1 Derive mathematical expression for a differential coefficient.
 - 2.2 Explain geometrical interpretation of differential coefficient.
 - 2.3 Differentiate a constant, a constant associated with a variable and the sum of finite number of functions.
 - 2.4 Solve related problems.
3. **USE RULES OF DIFFERENTIATION TO SOLVE PROBLEMS OF ALGEBRAIC FUNCTIONS.**
 - 3.1 Differentiate ab-initio x^n and $(ax+b)^n$.
 - 3.2 Derive product, quotient and chain rules.
 - 3.3 Find derivatives of implicit functions and explicit functions.
 - 3.4 Differentiate parametric forms, functions w.r.t another function and by rationalization.
 - 3.5 Solve problems using these formulas.
4. **USE RULES OF DIFFERENTIATION TO SOLVE PROBLEMS INVOLVING TRIGONOMETRIC FUNCTIONS.**
 - 4.1 Differentiate from first principle $\sin x, \cos x, \tan x$.
 - 4.2 Derive formula Derivatives of $\sec x, \csc x, \cot x$.
 - 4.3 Find differential coefficients of inverse trigonometric functions
 - 4.3 Solve problems based on these formulas.
5. **USE RULES OF DIFFERENTIATION TO LOGARITHMIC AND EXPONENTIAL FUNCTIONS.**
 - 5.1 Derive formulas for differential coefficient of Logarithmic and exponential functions.
 - 5.2 Solve problems using these formulas.
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-222 BUSINESS COMMUNICATION & REPORT WRITING

Total Contact Hours:	128	T	P	C
Theory (Hours):	32	1	3	2
Practical (Hours):	96			

Aims

- To develop an understanding of business communication process and mediums
- To learn about basic communication practices
- To develop effective writing and speaking techniques for communication
- To introduce students to effective employment related communication

COURSE CONTENTS

1. TECHNIQUES FOR EFFECTIVE COMMUNICATION	2 Hours
1.1 Identifying audience	
1.2 Establishing purpose	
1.3 Formulating message	
1.4 Selecting style and tone	
1.5 Writing process	
1.6 Communicating in the electronic office	
2. BASIC WRITING PRACTICES	4Hours
2.1 Types and functions of paragraphs	
2.2 Topic sentence	
2.3 Appearance and patterns	
2.4 How to make Sentences: construction and punctuation	
2.5 Active and passive voice	
2.6 Parallelism	
2.7 Context; modifiers; pronoun reference	
2.8 How to Use Proper Words: Spelling, Right meaning	
2.9 Eliminating unnecessary words: Jargon and slang	
3. TYPES OF BUSINESS CORRESPONDENCE	8Hours
3.1 Memorandums	
3.2 Agendas and Minutes of Meeting	
3.3 Emails	
3.4Business Letters: General Correspondence	
o Letters of Inquiry	
o Customer relations letters	
o Letters of instruction	
4. PRESENTATIONS TECHNIQUES	4Hours
4.1 Effective speaking and listening	
4.2 Briefings	
4.3 Formal Presentations	
5. REPORT WRITING	6Hours
5.1 Report Process and Research Methods	
5.2 Planning	

- 5.3 Pre-writing
 - Collecting Information & Documenting Sources
 - Preparing Structure
 - Conducting Interviews
 - Summarizing Materials
- 5.4 Report Structure
- 5.5 Table of Contents
- 5.6 Front Matter
 - Objectives
 - Scope of Work
 - Statement of Problem
 - Abbreviations
- 5.7 Executive Summary
- 5.8 Introduction
- 5.9 Report Body
- 5.10 Conclusion & Recommendations
- 5.11 Back Matter
 - Annexes, Appendixes, Glossary of Terms
- 5.12 Drafting
- 5.13 Revising
- 5.14 Managing data and using graphics

6. GOOD REPORT WRITING TECHNIQUES

2 Hours

- 6.1 Organization of facts/data
- 6.2 Accuracy of information
- 6.3 Style of writing
- 6.4 Vocabulary & grammar
- 6.5 Presentation

7. FORMAL COMMUNICATIONS RELATED TO EMPLOYMENT

6 Hours

- 7.1 Cover Letters
- 7.2 Resume Writing
- 7.3 How to make a Curriculum Vitae (CV)
- 7.4 Methods Job Search
- 7.5 Interviewing techniques

RECOMMENDED BOOKS

1. Essentials of Business Communication: Mary Ellen Guffey & Dana Loewy (2012)
2. Business Communication, Amy Newman and Scot Ober (2012)
3. Report writing skills training course. How to write a report and executive summary, And plan, design and present. Margaret Greenhall (2010)

INSTRUCTIONAL OBJECTIVES

- 1. UNDERSTAND AND ACQUIRE THE TECHNIQUES FOR EFFECTIVE COMMUNICATION**
 - 1.1 Understand the relevance of Identifying audience for effective communication
 - 1.2 Understand the relevance of establishing purpose for effective communication
 - 1.3 Understand the method to formulate the message
 - 1.4 Identify how to select the style and tone
 - 1.5 Describe effective writing process
 - 1.6 Describe the communication through electronic media
- 2. UNDERSTAND THE BASIC WRITING PRACTICES**
 - 2.1 Understand the types and purpose of writing paragraphs (topic sentence, appearance and patterns,
 - 2.2 Understand the construction of a sentence (punctuation, active and passive voice, parallelism, Context; modifiers; pronoun reference)
 - 2.3 Understand the importance of using proper words (spelling, words with appropriate meaning, eliminating unnecessary words, avoiding use of jargon and slangs)
- 3. KNOW ABOUT THE VARIOUS TYPES OF BUSINESS CORRESPONDENCE**
 - 3.1 Learn writing memorandums (Parts & composition of a memorandum and text)
 - 3.2 Learn writing an agenda (Parts & composition and text)
 - 3.3 Learn arranging a meeting and writing minutes of meeting (requirements of a meeting, parts & composition and text of minutes)
 - 3.4 Learn writing emails
 - 3.5 Learn composing different types of business letters (general correspondence, letters of inquiry, customer relations letters, and letters of instruction)
- 4. UNDERSTAND AND ACQUIRE THE BASIC PRESENTATIONS TECHNIQUES**
 - 4.1 Learn effective speaking and listening techniques
 - 4.2 Understand how to give briefings (in a meeting)
 - 4.3 Learn techniques of giving formal presentations
- 5. KNOW ABOUT EFFECTIVE REPORT WRITING SKILLS**
 - 5.1 Understand the reporting process and methods
 - 5.1.1 Understand how to plan a report
 - 5.1.2 Understand the procedure before beginning actual writing (Collecting information & documenting sources, preparing structure, conducting interviews and summarizing materials)
 - 5.1.3 Describing the report structure (table of contents, front matter- objective, scope of work, statement of problem, abbreviations, executive summary, introduction, report body and conclusion & recommendations, back matter- annexes, appendices and glossary)
 - 5.1.4 Learn how to draft a report
 - 5.1.5 Understand the revision process
 - 5.1.6 Understand the representation of data and using graphics
- 6. UNDERSTAND GOOD REPORT WRITING TECHNIQUES**

- 6.1 Describe the organization of facts/data
- 6.2 Understand the importance of accuracy of information
- 6.3 Understand the importance style of writing
- 6.4 Understand the proper use of vocabulary & grammar
- 6.5 Understand good report presentation

7. KNOW ABOUT THE FORMAL COMMUNICATIONS RELATED TO EMPLOYMENT

- 7.1 Learn writing cover letters
- 7.2 Learn making resume
- 7.3 Learn making a Curriculum Vitae (CV)
- 7.4 Understand different mediums of job search
- 7.5 Acquire important interviewing skills

LIST OF PRACTICAL

(96 hours)

1. Introduction of each of the class participants. Written & Oral
2. Demonstrate basic language skills (i.e., Grammar, Spellings, capitalization, sentence structure, etc.)
3. Practice exercises for “Writing Business Letters”
4. Practice Exercise: Standard Business Communication/Letters
5. Practice Exercise: Email& Business Letters
6. Practice Exercise: Writing a Memorandum
7. Practice Exercise: Arranging a meeting, writing Agenda /Minutes .
8. Select Interesting Topics: For individual presentations with PowerPoint slides
9. Select interesting topics: For group presentation with PowerPoint slides
10. Assign topic to individual students for writing short reports
11. Assign topics to groups of students for submitting a technical report
12. Writing CVs along with a cover letter
13. Class Group Project: Practice interviewing skills

ChT-214 ORGANIC CHEMISTRY

ORGANIC CHEMISTRY	T	P	C
Th.=64 Hours; Pract.=192 Hours	2	6	4

OBJECTIVES

1. To understand the basic principles of organic chemistry.
2. To perform experiments related to Organic Chemistry
3. Apply basic principle of organic chemistry in the laboratory work.

1 INTRODUCTION TO ORGANIC CHEMISTRY 08

- 1.1 Source of Organic Compounds and Applications
- 1.2 Classification of Organic Compounds with General Formula and Functional Groups
- 1.3 Difference between Organic and Inorganic Chemistry
- 1.4 Types of Organic Reactions
- 1.5 Isomerism and its types
- 1.6 Hydrocarbons - Definition and Classification with Examples and General Formula
- 1.7 Homologous Series
- 1.8 Nomenclature of Organic Compounds According to IUPAC System

2 ALKANES, ALKENES & ALKYNES 06

- 2.1 Definition of Alkanes
- 2.2 Preparation of Alkanes
- 2.3 Physical and Chemical Properties of Alkanes
- 2.4 Definition of Alkenes
- 2.5 Preparation of Alkenes
- 2.6 Physical and Chemical Properties of Alkenes
- 2.7 Definition of Alkynes
- 2.8 Preparation of Alkynes
- 2.9 Physical and Chemical Properties of Alkynes

3 ALKYL HALIDES & ORGANOMETALLIC COMPOUNDS 04

- 3.1 Definition of Alkyl Halide
- 3.2 Classification of Alkyl Halide
- 3.3 Methods of Preparation of Alkyl Halide
- 3.4 Physical and Chemical Properties of RX
- 3.5 Definition of Organometallic Compounds

	3.6 Preparation of RMgX (Grignard Reagent)	
	3.7 Physical and Chemical Properties of RMgX	
4	ALCOHOLS	04
	4.1 Definition of Alcohol	
	4.2 Classification of Alcohol	
	4.3 Preparation of Alcohol	
	4.4 Physical and Chemical Properties of Alcohol	
	4.5 Use of Alcohols	
5	ETHERS	02
	5.1 Definition of Ethers	
	5.2 Preparation of Ether	
	5.3 Physical and Chemical Properties of Ether	
6	ALDEHYDES	04
	6.1 Definition of Aldehydes	
	6.2 Preparation of Aldehydes	
	6.3 Physical and Chemical Properties of Aldehydes	
7	KETONES	02
	7.1 Definition of Ketones	
	7.2 Preparation of Ketones	
	7.3 Physical and Chemical Properties of Ketones	
8	CARBOXYLIC ACIDS	04
	8.1 Definition of Carboxylic Acids	
	8.2 Classification of Carboxylic Acids	
	8.3 Preparation of Carboxylic Acids	
	8.4 Physical and Chemical Properties of Carboxylic Acids	
	8.5 Enlist Derivatives of Carboxylic Acid	
9	AMIDES	04
	9.1 Definition of Amide	
	9.2 Methods of Preparation of Amide	
	9.3 Physical and Chemical Properties of Amide	
10	ESTERS	02
	10.1 Definition of Esters	

	10.2 Methods of Preparation of Esters	
	10.3 Physical and Chemical Properties of Esters	
11	AMINES	04
	11.1 Definition of Amines	
	11.2 Methods of Preparation of Primary Amines	
	11.3 Physical and Chemical Properties of Amines	
12	AROMATIC HYDROCARBONS & BENZENE	02
	12.1 Definition of Aromatic Hydrocarbons	
	12.2 Classification of Aromatic Hydrocarbons	
	12.3 Methods of Preparation of Benzene	
	12.4 Physical and Chemical Properties of Benzene	
13	PHENOLS	04
	13.1 Definition of Phenol	
	13.2 Preparation of Phenol	
	13.3 Physical and Chemical Properties of Phenols	
14	CARBOHYDRATES & ENZYMES	
	14.1 Classification of Carbohydrates	
	14.2 Preparation of Glucose	
	14.3 Physical and Chemical Properties of Glucose	
	14.4 Physical and Chemical Properties of Fructose	
	14.5 Comparison between glucose and fructose	
	14.6 Enzymes, its types & Applications	
15	AMINO ACIDS & PROTEINS	02
	15.1 Definition of Amino Acid	
	15.2 General Formula of Amino Acid	
	15.3 Definition of Proteins	
	15.4 Classification of Proteins	
	15.5 Chemical composition, Molecular Shape of Proteins	
	15.6 Physical and Chemical Properties of Proteins	
16	SYNTHETIC POLYMERS & RUBBER	03
	16.1 Definition of Polymer, Rubber and Polymerization	
	16.2 Classification of Polymers	

16.3 Addition Polymers
16.4 Condensation Polymers

17 BIO FUELS

03

17.1 Definition of Bio Fuels
17.2 Classification of Bio Fuels
17.3 Properties of Bio Fuels
17.4 Industrial Use of Bio Fuels

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

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 in 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
- 1.3 Types of Organic Reactions
 - 1.3.1 Understand the types of organic reactions
 - 1.3.2 Enlist the types of organic reactions
 - 1.3.3 Explain substitution reaction
 - 1.3.4 Explain addition reaction
 - 1.3.5 Explain elimination reaction
 - 1.3.6 Explain rearrangement reaction
 - 1.3.7 Give examples of different types of reaction
- 1.4 Isomerism
 - 1.4.1 Understand isomerism
 - 1.4.2 Define isomerism
 - 1.4.3 Give types of isomerism in organic compounds
 - 1.4.4 Explain different isomeric forms
 - 1.4.5 Give examples of different isomeric forms
- 1.5 Understand the Hydrocarbons
 - 1.5.1 Define hydrocarbon
 - 1.5.2 Give classification of hydrocarbons
 - 1.5.3 Write general formula for hydrocarbons
 - 1.5.4 Explain homologous series
- 1.6 Understand the Nomenclature of organic compounds
 - 1.6.1 Explain conventional method of naming organic compounds
 - 1.6.2 Explain IUPAC system for naming organic compounds
 - 1.6.3 Write names of organic compounds according to IUPAC system

2 ALKANES, ALKENES & ALKYNES

- 2.1 Understand the concept of alkanes
 - 2.1.1 Define alkanes

- 2.1.2 Write general formula for alkanes and alkyl radicals
 - 2.1.3 Name alkanes and alkyl radicals
 - 2.1.4 Explain general methods of preparation of alkanes
 - 2.1.5 Explain general properties of alkanes
- 2.2 Understand the concept of alkenes
 - 2.2.1 Define alkenes
 - 2.2.2 Name alkenes
 - 2.2.3 Explain general methods of preparation of alkenes
 - 2.2.4 Enlist the uses of ether
- 2.3 Understand the concept of alkynes
 - 2.3.1 Define alkynes
 - 2.3.2 Enlist different types of alkynes
 - 2.3.3 Explain the methods of preparation of acetylene
 - 2.3.4 Explain the properties of acetylene
 - 2.3.5 Give the uses of C_2H_2
- 3 **ALKYL HALIDES & ORGANOMETALLIC COMPOUNDS**
 - 3.1 Understand the concept of alkyl halides
 - 3.1.1 Define alkyl halide
 - 3.1.2 Give the type of alkyl halides
 - 3.1.3 Name different alkyl halides
 - 3.1.4 Explain general methods of preparation of alkyl halides
 - 3.1.5 Explain general properties of alkyl halides
 - 3.1.6 Enlist uses of alkyl halides
 - 3.2 Understand the concept of organometallic compounds
 - 3.2.1 Define organometallic compounds
 - 3.2.2 Explain the methods of preparation of Grignard Reagent (R-Mg-X)
 - 3.2.3 Explain the properties of R-Mg-X
- 4 **ALCOHOLS**
 - 4.1 Define alcohol
 - 4.2 Give classification of alcohols
 - 4.3 Explain general methods of preparation of alcohols
 - 4.4 Explain general properties of alcohols
 - 4.5 Explain the methods of preparation of ethyl alcohol
 - 4.6 Enlist the uses of ethyl alcohol
 - 4.7 Uses of Alcohols.
- 5 **ETHERS**
 - 5.1 Define ether

- 5.2 Give general formula of ethers
- 5.3 Explain general methods of preparation of ethers
- 5.4 Explain general properties of ethers.

6 **ALDEHYDES**

- 6.1 Define aldehyde
- 6.2 Name different aldehydes
- 6.3 Explain general methods of preparation of aldehydes
- 6.4 Explain general properties of aldehydes
- 6.5 Enlist the uses of aldehydes

7 **KETONES**

- 7.1 Define ketone
- 7.2 Name different ketones
- 7.3 Explain methods of preparation of acetone
- 7.4 Explain the properties of acetone
- 7.5 Enlist the uses of acetone

8 **CARBOXYLIC ACIDS**

- 8.1 Name different carboxylic acids
- 8.2 Give the types of carboxylic acids
- 8.3 Explain the general methods of preparation of mono carboxylic acids
- 8.4 Explain the properties of mono carboxylic acids
- 8.5 Enlist the uses of carboxylic acids
- 8.6 Enlist derivatives of Carboxylic Acids

9 **AMIDES**

- 9.1 Understand the concept of acid chlorides
 - 9.1.1 Define acid chlorides
 - 9.1.2 Name acid chlorides
 - 9.1.3 Explain general methods of preparation of acid chlorides
 - 9.1.4 Explain general properties of acid chlorides
- 9.2 Understand the concept of acid anhydride
 - 9.2.1 Define acid anhydride
 - 9.2.2 Name acid anhydride
 - 9.2.3 Give general methods of preparation of acetic anhydride
 - 9.2.4 Give properties of acetic anhydride
 - 9.2.5 Enlist the uses of acetic anhydride
- 9.3 Understand the concept of acid amide
 - 9.3.1 Define acid amide

- 9.3.2 Name acid amides
- 9.3.3 Explain general methods of preparation of acid amides
- 9.3.4 Explain the properties of acid amides

10 **ESTERS**

- 10.1 Define esters
- 10.2 Name esters
- 10.3 Give general methods of preparation of esters
- 10.4 Explain the properties of esters
- 10.5 Enlist the uses of esters

11 **AMINES**

- 11.1 Define amine
- 11.2 Classify amines
- 11.3 Name different types of amines
- 11.4 Explain the method of preparation of primary amines
- 11.5 Explain the method of preparation of secondary amines
- 11.6 Explain the method of preparation of tertiary amines
- 11.7 Explain the general properties of amines

12 **AROMATIC HYDROCARBONS & BENZENE**

- 12.1 Define aromatic hydrocarbons
- 12.2 Differentiate between open chain (aliphatic) and close chain (aromatic) compounds
- 12.3 Give classification of aromatic compounds
- 12.4 Explain the nomenclature of aromatic compounds
- 12.5 Explain the methods of preparation of benzene
- 12.6 Explain the properties of benzene

13 **PHENOLS**

- 13.1 Define phenol
- 13.2 Explain the nomenclature of phenol
- 13.3 Explain general methods of preparation of phenol
- 13.4 Explain general properties of phenol

14 **CARBOHYDRATES & ENZYMES**

- 14.1 Define carbohydrate
- 14.2 Give classification of carbohydrates
- 14.3 Write structural formula of glucose and fructose
- 14.4 Explain the method of preparation of glucose
- 14.5 Explain the properties of glucose

- 14.6 Explain the method of preparation of fructose
- 14.7 Explain the properties of fructose
- 14.8 Give comparison between glucose and fructose
- 14.9 Describe briefly enzymes, its types & applications

15 AMINO ACIDS & PROTEINS

- 15.1 Define protein
- 15.2 Give classification of proteins
- 15.3 Explain general properties of proteins

16 SYNTHETIC POLYMERS & RUBBER

- 16.1 Define polymers, rubber, and polymerization
- 16.2 Classify polymers
- 16.3 Explain addition polymers
- 16.4 Explain condensation polymers

17 BIOFUELS

- 17.1 Define biofuels
- 17.2 Classify biofuels
- 17.3 Explain the properties of biofuels
- 17.4 Explain the industrial use of biofuels

ChT 214 ORGANIC CHEMISTRY.

LIST OF PRACTICALS.

192 Hrs.

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 Ethylene 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 Acetaldehyde.
15. Preparation and properties of methyl orange.
16. Preparation of aqueous formic acid.
17. Preparation of Acetic Anhydride.
18. Preparation of Acetyl chloride.
19. Preparation of Ethyl Amine
20. Preparation of ethyl 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.
29. Formation of Pallets of biomass.

ChT-224 CHEMICAL PROCESS INDUSTRIES –I

Total contact hours	T	P	C
Th. Hrs.= 96, Pract. Hrs. = 96	3	3	4

Learning outcomes

Students will be able to:

1. Understand important manufacturing process employed by chemical Industries.
2. Describe equipment's necessary to carry out chemical process on industrial scale.
3. Explain process flow sheet diagram.
4. Understand local Chemical industry from the view point of statistics of production and location in Pakistan
5. Perform experiments related to Chemical Process Industries –I

Course Contents	Hours
(Part A)	
1 INTRODUCTION (INDUSTRIAL CHEMICAL PROCESS)	05
1. Unit operation and unit process, examples	
2. Batch process, continuous process	
3. Flowcharts	
2 WATER CONDITIONING	13
1. Introduction to soft water, hard water, causes of water hardness	
2. Softening, purification, and clarification	
3. Ion-Exchange method	
4. Sodium cation exchange process	
5. Mixed bed resins	
6. Hydrogen cation exchange process	
7. De-aeration of water and its importance	
8. Demineralization of water	
9. Desalting/Desalination of water	
10. Reverse Osmosis	
11. Boiler feed water	
12. Industrial waste water	
13. Mineral water preparation	
3 CHLOR ALKALI INDUSTRIES	13
1. Introduction	
2. Manufacture of Soda ash, Raw material, Treatment of raw materials	
3. Flow chart of Soda ash process	
4. Unit operations and unit processes of soda ash	
5. Manufacture of Sodium Bicarbonate	

	6. Flow sheet, unit operations and processes of sodium bicarbonate 7. Uses of Sodium carbonate and Sodium bicarbonate 8. Manufacture of caustic soda by electrolysis of NaCl, Pretreatment of NaCl solution 9. Diaphragm cell method 10. Membrane cell method 11. Comparison of the three cell methods 12. Unit operations and processes of caustic soda 13. By-products of caustic soda manufacture and Uses of chlorine and Hydrogen 14. Manufacture of bleaching Powder 15. Manufacture of Calcium hypochlorite, uses, unit operation and processes 16. Manufacture of Sodium hypochlorite, uses, unit operation and processes 17. Manufacturing of HCl as the by-product of chloro-alkali industry 18. Unit operations and unit processes involved in Manufacturing of HCl 19. Uses of HCl 20. Describe PVC manufacturing process 21. Enlist names of Chloro Alkali manufacturing plants in Pakistan	
4	SULPHURIC ACID	04
	1. Formula uses and importance in industrial developments 2. Raw materials 3. Sulphuric acid manufacturing by contact process and its flow sheet 4. Unit operations and unit processes of contact process 5. Treatment of vent gas of contact process 6. Energy Requirements	
5	AMMONIA	07
	1. Ammonia, uses, economics 2. Manufacture of Ammonia from Natural gas 3. Steam-Natural gas reforming, primary reforming, secondary reforming 4. Shift conversion 5. CO ₂ absorption and separation 6. Removal of Carbon monoxide 7. Compression of N ₂ and H ₂ 8. Ammonia synthesis, Ammonia converter 9. Flow chart 10. Unit operations and unit processes 11. Liquefaction of Ammonia 12. Storage of Ammonia 13. Manufacture of Nitric Acid from Ammonia, flow sheet 14. Unit operations and unit processes, uses 15. Draw Process Flow Chart of Ammonia manufacturing Unit 16. Draw Process Flow Chart of Nitric Acid Production unit 17. Describe Purge gas recovery unit to recover Ammonia	
6	AMMONIUM NITRATE AND AMMONIUM SULFATE	06
	1. Define Fertilizer, Uses of fertilizer, classification of fertilizer	

2. Describe Nitrogenous Fertilizers:
Ammonium Nitrate
Ammonium Sulfate
3. Unit operation and process of each fertilizer
4. Uses of Each fertilizer
5. Ammonium Nitrate storage

(Part - B)

7	UREA 1. Formula, uses, Raw material 2. Flow sheet 3. Manufacturing process of Urea 4. Unit operations and unit processes 5. Prilling Tower and Prilling of Urea 6. Urea product bagging, handling and storage 7. Uses of Urea	04
8	PHOSPHATE FERTILIZER 1. Describe Phosphorous Fertilizers: Single super phosphate Triple super phosphate 2. Describe Mixed Fertilizers: Mono Ammonium phosphate Di-ammonium phosphate 3. Processing of phosphate rock 4. Unit operation and process of each fertilizer 5. Uses of Each fertilizer	08
9	PORTLAND CEMENT 1. Port land cement 2. Raw materials 3. Manufacture method, Dry process 4. Flow sheet (Dry process) 5. Unit operations and unit processes 6. Kiln (living and heating zones) reactions 7. Setting and Hardening of cement 8. Different types of cement 9. Uses of cement 10. Enlist names of cement manufacturing plants in Pakistan	11
10	LIME 1. Lime, formula, uses 2. Calcination of limestone, unit operations and unit processes 3. Slaked lime manufacturing	05
11	GYPSUM 1. Gypsum Formula, uses, processing of Rock	05

2. Preparation of plaster of Paris from gypsum, chemical reactions
3. Uses of plaster of Paris
4. Hardening of plaster
5. Sources of Gypsum in Pakistan

12 PETROLEUM INDUSTRY

15

1. Introduction to Petroleum and its constituents
2. Natural gas
3. Liquefied Petroleum Gas (LPG)
4. Compressed Natural Gas (CNG)
5. Products of refining
6. Conversion process, cracking or pyrolysis
7. Reforming, catalytic reforming
8. Polymerization
9. Alkylation
10. Isomerization
11. Re-Liquefied Natural Gas (RLNG)
12. Amine Treating unit (DEA, MDEA etc)
13. Merox process for LPG & Kerosene sweetening
14. Asphalt air blowing oil
15. Blending operation
16. Gantry
17. Storage Tank/ Tank farm Area
18. Brief explanation of petroleum refinery process
19. Enlist names petroleum refineries in Pakistan

RECOMMENDED BOOK

1. George, T.A., (1997). Shreve's Chemical Process Industries. New York: McGraw-Hill.
2. Heaton, A., (1994). The Chemical Industry. New York : Blackie Academic & Professional
3. Iqbal, H., (1992). Chemical Industry in Pakistan. Karachi: Industrial Research Service.
4. Pandey, G.N., (2000). A Textbook of Chemical Technology. Vikas Publishing House (Pvt) Limited.
5. Othmer, K., (1999). Encyclopedia of Chemical Technology. Wiley Inter Science Publishers.
6. Prospects of Chemical Industry in Pakistan: Expert Advisory Cell, Ministry of Industries and Production.
7. Jacob, A.M., Michiel, M., Annelies, V.D., (2007). Chemical Process Technology. John Wiley & Sons, Ltd.
8. Kent, J.A., (2003). Riegel Handbook of Industrial Chemistry. Springer/Van Nostrand Reinhold
9. James, H.G., Handwerk G.E., (2005). Petroleum Refining: Technology and Economics. Taylor & Francis Group.
10. Jones, D.S.J., (1995). Elements of Petroleum Processing. John Wiley & Sons.

INSTRUCTIONAL OBJECTIVES

1. INTRODUCTION

1.1 UNIT PROCESS

- 1.1.1 Define unit process
- 1.1.2 Give examples of unit 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& Utilities

2.1 Water conditioning

- 2.1.1 Types of raw water
- 2.1.2 Enlist impurities of water.
- 2.1.3 Name salts responsible for water hardness
- 2.1.4 Give water softening methods.
- 2.1.5 Explain water purification
- 2.1.6 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 de-aeration of water.

- 2.6.1 Define term de-aeration
- 2.6.2 Give the importance of de-aeration for boiler water

- 2.6.3 Explain de-aeration methods.
- 2.7 demineralization and de-salting
 - 2.7.1. Explain Desalination of water
 - 2.7.2. Enlist minerals in water
 - 2.7.3. Describe demineralization
 - 2.7.4. Explain de-salting.
 - 2.7.5. Mineral water preparation.
- 2.8. Reverse Osmosis
 - 2.8.1 Explain Reverse Osmosis. Also give its advantages.
 - 2.8.2 Flow chart of RO plant
 - 2.8.3 Pre-Treatment of RO Plant
- 2.9. Boiler feed water
 - 2.9.1 Define boiler and its types
 - 2.9.2 Describe Boiler Feed Water.
 - 2.9.3 Enlist boiler problems.
 - 2.9.4 Describe formation and nature of scale in boiler feed water.
 - 2.9.5 Explain method for treatment of scale in boiler.
 - 2.9.6 Describe boiler corrosion, its causes and prevention.
- 2.10. Industrial waste water
 - 2.10.1 Describe Waste water Treatment.
 - 2.10.2 Explain different methods for waste water treatment.

3. CHLOR-ALKALI 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 membrane cell
 - 3.5.9 Draw flow sheet for the manufacture of caustic soda by membrane cell
 - 3.5.10 Name unit operations for the manufacture of caustic soda by membrane cell
 - 3.5.11 Describe nit process for manufacture of caustic soda by mercury cell
 - 3.5.12 Give the comparison of the three cells used for caustic soda manufacture.
 - 3.5.13 Give the byproducts of caustic soda manufacture.
 - 3.5.14 Illustrate uses of chlorine
 - 3.5.15 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 Hydrogen per oxide
 - 3.8.1 Explain manufacturing process of Hydrogen per oxide
 - 3.8.2 Draw flow sheet for the manufacture of Hydrogen peroxide
 - 3.8.3 Enlist unit operations forHydrogen peroxide
 - 3.8.4 Enlist uses of Hydrogen peroxide
- 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
- 3.9.7. Enlist commercial grades of Hydrochloric acid
- 3.10 Explain construction and working of membrane cell also Draw its diagram

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.
 - 4.1.12 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.
 - 4.1.17. What is difference between contact process and double contact process?
 - 4.1.18. Safety precautions and Handling for sulfuric acid
 - 4.1.19. Enlist names of Sulfuric manufacturing plants in Pakistan

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.
 - 5.1.15 Describe unit process of Ammonia convertor
 - 5.1.16 Draw process 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 Purge gas recovery unit to recover Ammonia
- 5.1.20 Describe storage of liquid ammonia
- 5.1.21 Name the method used for the manufacture of nitric acid from ammonia.
- 5.1.22 Draw process flow sheet for manufacture of nitric acid from ammonia
- 5.1.23 Explain unit operation 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.
 - 6.1.7. Introduction to fertilizer, Describe the benefits of using fertilizers.
 - 6.1.8. Give the classification of fertilizers
 - 6.1.9. Difference between synthetic and organic fertilizers
 - 6.1.10. Describe Nitrogenous fertilizers
 - 6.1.11. Enlist important nitrogenous fertilizers
 - 6.1.12. Enlist names of fertilizer manufacturing companies in Pakistan

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
 - 7.1.7 Urea product bagging, handling and storage

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
- 8.1.9. Describe Phosphorus fertilizers
- 8.1.10. Enlist important Phosphorus fertilizers
- 8.1.11. . Explain the manufacturing process of Single superphosphate & Triple superphosphate and also Draw flow sheet diagram
- 8.1.12. Unit operations and Unit process & uses of SSP & TSP fertilizer
- 8.1.13. Describe Mixed fertilizers
- 8.1.14. Enlist important mixed fertilizers

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
 - 9.1.15. Disadvantages of impurities of raw material
 - 9.1.16. Define fluxes and mineralizers with examples
 - 9.1.17. What are auxiliary components with examples
 - 9.1.18. Enlist dust collecting equipment's in cement industry
 - 9.1.19. Explain Electrostatic precipitator
 - 9.1.20. Enlist names of cement manufacturing plants in Pakistan

10. LIME

- 10.1.1. Lime processing
- 10.1.2. Write formula for lime
- 10.1.3. Enlist uses of lime
- 10.1.4. Enlist unit operation involved in lime processing
- 10.1.5. 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
 - 11.1.6. Sources of Gypsum in Pakistan

12. PETROLEUM INDUSTRY

- 12.1 petroleum industry
 - 12.1.1. Define petroleum
 - 12.1.2. Enlist constituents of petroleum
 - 12.1.3. Give composition of natural gas
 - 12.1.4. Describe unit operations and unit processes for processing of natural gas
 - 12.1.5. 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
 - 12.2.4. Enlist the uses of L.P.G
- 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
- 12.5. Natural Gas
 - 12.5.1. Draw flow diagram for purification of natural gas
 - 12.5.2. Enlist unit operations and unit processes for processing of natural gas
 - 12.5.3. Define sweet and sour natural gas
 - 12.5.4. What is dry natural gas and wet natural gas
- 12.6. Define alkylation
- 12.7. What is RLNG, write short note on it
- 12.8. Amine Treating unit (DEA, MDEA etc)
- 12.9. Merox process for LPG & Kerosene sweetening
- 12.10. Asphalt air blowing oil
- 12.11. Petroleum products blending operation
- 12.12. Gantry Operation
- 12.13. Storage Tank/ Tank farm Area
- 12.14. Brief explanation of petroleum refinery process
- 12.15. Enlist names petroleum refineries in Pakistan

LIST OF PRACTICALS.

96 Hrs.

1. Detection of soft and hard water.
2. Determination of hardness of water.
3. Demineralization of water.
4. Preparation of Distilled water
5. PH value determination.
6. Analysis of mineral water
7. Determination of dissolved oxygen in water.
8. Determination of iron contents in water.
9. Determination of total chlorides in water.
10. Determination silica in water
11. Determination of H₂S in water
12. Determination magnesium content in water
13. Determination of conductivity of water
14. Determination of phosphate in water
15. Determination of carbonates in water.
16. Determination of bi-carbonates in water.
17. Determination of calcium contents in water.
18. Determination of sulphates contents in water.
19. Preparation of lime by the calcination of lime stone
20. Preparation of plaster of Paris from gypsum.
21. . Purification by crystallization.
22. Flue gases analysis (NO_x, SO_x, CO, Particulate matter
23. Analysis of petroleum products like flash point, cloud point, pour point, calorific value, Reed vapor pressure.
24. Animations of Process industries

ChT-232 QUANTITATIVE ANALYSIS

Quantitative Analysis

T	P	C
1	3	2

LEARNING OUTCOMES

1. To understand the importance of Analytical Chemistry in industrial scale and in daily life as well.
2. To perform experiments related to quantitative analysis.
3. Understand the various types of analysis techniques and procedures involved at laboratory and industrial scale.
4. To prepare sample and make analysis using various laboratory tools.
5. To report the analysis results.

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1 INTRODUCTION TO ANALYTICAL CHEMISTRY 02

- 1.1 Definition and its importance in daily life and industrial importance
- 1.2 Types of analysis: Qualitative, Quantitative, Volumetric, Gravimetric
- 1.3 Instrumental methods of analysis, conventional methods of analysis
- 1.4 Introduction to SDS (Safety Data Sheet) and PPE (Personnel Protective Equipment)

2 SAMPLING 02

- 2.1 Sampling techniques for liquid, solid, and gas samples
- 2.2 Types of Sampling
- 2.3 Storage of Sample
- 2.4 Handling of Flammable Liquids
- 2.5 Handling of Hazardous Materials
- 2.6 Safety Precaution for Sampling
- 2.7 Identification and Tagging of Samples

3 ERROR IN ANALYSIS 02

- 3.1 Types of Error
- 3.2 Elimination of Error
- 3.3 Personal Errors
- 3.4 Determinate Errors
- 3.5 Indeterminate Errors
- 3.6 Detection of Errors
- 3.7 Definition of Precision & Accuracy

4	ANALYTICAL PROCEDURES	03
	4.1 Types of Volumetric & Gravimetric Apparatus	
	4.2 Weighing of Sample	
	4.3 Volume measurement of Sample	
	4.4 Preparation of Sample Solution	
	4.5 Titration	
	4.6 Precipitation	
	4.7 Filtration	
	4.8 Drying	
	4.9 Ignition	
	4.10 Distillation	
	4.11 International Testing Standard Methods	
5	PREPARATION OF STANDARD SOLUTIONS	03
	5.1 Primary Standards, Secondary Standards	
	5.2 Standard Solutions	
	5.3 Characteristics of Standard Solution	
	5.4 Methods of Expression of Concentration	
	5.5 Equivalent Weight, Molecular Weight	
	5.6 Calculation of Equivalent Weight of Acids	
	5.7 Calculation of Equivalent Weight of Bases	
	5.8 Calculation of Equivalent Weight of Oxidizing Compounds	
	5.9 Calculation of Equivalent Weight of Reducing Compounds	
	5.10 Normal Solution and Normality	
	5.11 Molar Solution and Molarity	
	5.12 Molal Solution and Molality	
	5.13 Preparation of Solutions of Different Normalities	
	5.14 Preparation of Solution of Different Molalities	
	5.15 Definition of BOMIO	
	5.16 Definition of API GRAVITY	
6	PREPARATION OF INDICATORS	03
	6.1 Internal Indicator	
	6.2 External Indicator	
	6.3 Universal Indicator	
	6.4 Behavior of Different Indicators in Acidic and Basic Solutions	
	6.5 Preparation of Indicator Solution	
	(Phenolphthalein, Methyl Orange, Methyl Red, Methyl Blue, Litmus Solution, Starch Solution, Phenyl Amine)	

7	VOLUMETRIC ANALYSIS	08
	7.1 Types of Volumetric Analysis (on the basis of reagent used)	
	7.2 Acidimetry - Alkalimetry	
	7.3 Acid-Base Titration	
	7.4 Redox-Titration	
	7.5 Iodometry	
	7.6 Iodimetry	
	7.7 Argentometry	
	7.8 Apparatus for Volumetric Analysis	
	7.9 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	01
	9.1 Percentage Report Making/Writing	
	9.2 Definition of Gram per Liter	
	9.3 Definition of Parts per Million (PPM)	
	9.4 Definition of Parts per Billion (PPB)	

RECOMMENDED BOOKS

1. Samuel H. Maron & Jerome B. Lando. (1974), "Fundamentals of Physical Chemistry" MecomillanPublishing 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.

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 ENRORS 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 STANDRAD 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 morality

6 INDICATOR

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

7 VOLUMETRIC ANALYSIS

- 7.1 Define volumetric analysis.
- 7.2 Enlist type of reagent based volumetric analysis.
- 7.3 Describe acidimetry, alkalyimetry.
- 7.4 Explain redox titrations.
- 7.5 Distinguish Iodoimetry and iodimetry.
- 7.6 Explain argentometry.
- 7.7 Solve problems based on $N_1V_1=N_2V_2$
- 7.8 Solve problems based on

$$\text{Amount/liter} = \text{Normality} \times \text{Equivalent weight}.$$

8 GRAVIMETRIC ANALYSIS

- 8.1 Define gravimetric analysis.
- 8.2 Describe gravimetric analysis apparatus.
- 8.3 Calculate free water content.
- 8.4 Calculate water of crystallization.
- 8.5 Explain desiccator.
- 8.6 Enlist desiccants.
- 8.7 Determine magnesium from given sample.
- 8.8 Determine calcium from given sample.

- 8.9 Determine silica from given sample.
- 8.10 Cement analysis

9 REPORTING OF ANALYSIS RESULTS

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

LIST OF PRACTICALS.

1. Calibration of
 - i. Burette
 - ii. Measuring cylinder.
 - iii. Measuring flask
 - iv. Pipette.
2. Weighing practice on analytical balance.
3. Weighing practice on digital balance.
4. Preparation of N/10 solution of primary standard Na_2CO_3 , Oxalic Acid)
- 5 Calculation method for preparation of N/10 (approximate) solution of secondary standard (NaOH , H_2SO_4).
6. Determination of normality of approximately prepared solution by titrating against some standard solution. HCl , H_2SO_4 and Nowlt solution
7. Preparation of indicator solution.
 - i. Phenolphthalein solution.
 - ii. Methyl orange solution.
 - iii. Litmus solution.
- iv. Starch solution.
- v. Diphenyl amine.
8. Determination of equivalent weight if an organic acid (oxalic acid)
9. Determination of acetic acid in vinegar.
10. Determination of alkaline value of soda ash.
11. Determination of percentage of NaOH and Na_2CO_3 in the mixture of two bases.
12. Preparation of (approx.) M/20 KMnO_4 solution.
13. Standardizing the M/20 KMnO_4 solution
14. Determination of iron contents in iron wire.
15. Determination of Fe^{+2} and Fe^{+3} in the iron salt.
16. Redox titration using external indicator.
17. Redox titration using internal indicator.
18. Standardization of 0.1 N iodine solution with $\text{Na}_2\text{S}_2\text{O}_3$ sol.
19. Standardization of $\text{Ba}_2\text{S}_2\text{O}_3$ solution versus a known iodine sol.
20. Determination of antimony in antimony salt.
21. Determination of chlorine in soluble salt by volhards method.
22. Estimation of chloride in a given sample of NaCl by AgNO_3 by using moters methods.
23. Gravimetric determination of free water (moisture contents) and combined water (water crystallization)
24. 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-241 SAFETY PRACTICE AND PROCEDURE

Total Contact Hours	T	P	C
Theory: 32 Hours	1	0	1

Learning Outcomes:

Students will be able to:

1. To understand safety and its importance in industry
2. To understand PPEs and training of employees
3. To analyze and report incident
4. To understand process and environment safety

COURSE CONTENTS

1. INTRODUCTION TO SAFETY AND ITS PLACE IN INDUSTRY	03
1.2 Safety in chemical industry	
1.3 Philosophy of accidents.	
1.4 Define Work Permit	
1.5 Introduction to Process Safety	
1.6 Hazards Identification and Risk Analysis	
2. PERSONAL PROTECTION EQUIPMENTS	06
2.1. What is PPE	
2.2. Types of PPEs	
2.3. Description and detail of PPEs usage	
2.4. Safety Equipment at Plant Site	
2.5. Safety Suit Purpose & Usage	
2.6. Fire Suppression System	
3. EMPLOYEES TRAINING	06
3.1. Training of employees and its importance.	
3.2. Importance of training.	
3.3. Introduction of international safety courses.	
3.4. What is Permit to work?	
4. ACCIDENT INVESTIGATION RECORD AND REPORT	06
4.1. Accident Investigation terminology and maintain record of reports.	
4.2. Sample of Incident Report	
4.3. Six Significant Disasters	
5. INDUSTRIAL NOISE AND CONTROL	02
5.1 Industrial noise and control.	
6. PROCESS AND ENVIRONMENT SAFETY	06
6.1 Basic requirement for safe handling and storage of waste	
6.2 What is Equipment Safety	
6.4 Hand over and Documentation of process equipment's	

6.5 What is Process Safety Management System and briefly explain its elements

6.6 What are Safety Critical Switches on Process Safety Equipment's

6.7 What is a Fire Station & How it Works?

6.8 What is an Emergency Response Plan (ERP) in Process Industries?

6.9 What is technical safety and Loss prevention?

7. FIRE PREVENTION HAZARDS

03

7.1 Fire hazards and prevention.

7.2 Enlist types

7.3 Firefighting equipment's

BOOKS RECOMMENDED.

1. Heinrich, H. W. (Herbert William), 1886-1962. Industrial Accident Prevention; a Scientific Approach. New York ; London :McGraw-Hill book company, inc., 2007.
2. Heinrich, H. W., Industrial Accident Prevention: A Safety Management Approach - January 1, 1980

INSTRUCTIONAL OBJECTIVES

1 INTRODUCTION TO SAFETY AND ITS PLACE IN INDUSTRY

- 1.1 Safety in chemical industry
 - 1.1.1 What is safety?
 - 1.1.2 Importance of safety.
 - 1.1.3 Handling of chemicals
- 1.2 Philosophy of accidents
 - 1.2.1 Define accident
 - 1.2.2 Enlist various types of accidents.
 - 1.2.3 Name remedial/prevention measures.
 - 1.2.4 Explain preventive measures in chemical industries, like Petroleum, paints, paper and board printing industries, Food processing, Vegetable oils and Ghee, Acid and alkali industry, Fertilizers, Cement, Pharmaceuticals, Plastics and Fiber Industry, Power plants
- 1.3 Define Work Permit
 - 1.3.1 Types of work permits
- 1.4 Introduction to Process Safety
- 1.5 What is Hazards Identification and Risk Analysis?

2 PERSONAL PROTECTION EQUIPMENTS

- 2.1 What is PPE
- 2.2 Types of PPEs (Hand Safety, Eye Safety, Head safety, Face Safety, Foot safety, Ear safety)
- 2.3 Description and detail of PPEs usage
- 2.4 Safety Equipment at Plant Site (Smoke, fire, Gas Flame & Hydrocarbon Leakage Detector, eye shower face shower and emergency booth)
- 2.5 Safety Suit Purpose & Usage
- 2.6 Fire Suppression System (Sprinkler System, Deluge Valves, Fire Hydrants & Monitors, Fire Blankets, Foam Trolley, Fire Water Pumps, Water Canon and Dehydrator Systems)

3 EMPLOYEES TRAINING

- 3.1 Training of employees
 - 3.1.1 Define training.
 - 3.1.2 Supervisor training.
 - 3.1.3 Importance of training.
 - 3.1.4 First aid training
- 3.2 Introduction of international safety courses
 - 3.2.1 NEBOSH, IOSH, ISO9001, 45001, 14001 for health safety environment and quality (HSE), CPR Training
- 3.3 What is Permit to work?
 - 3.3.1 Types of Work Permit
 - 3.3.2 Hot Cold

3.3.3 Electrical Excavation.

3.3.4 Confined

3.3.5 Instrument

3.3.6 Radiography.

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 Sample of Incident Report

4.2 Six Significant Disasters: 1. Flixborough, 2. Bhopal, 3. Piper Alpha, 4. BP Well Blowout- Gulf of Mexico, 5. BP Refinery Explosion, Texas City, 2005, 6. Chernobyl Disaster

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 noise standards.

5.1.6 Describe medical view point on noise and its control.

6 PROCESS AND ENVIRONMENT SAFETY

6.1 Basic requirement for safe handling and storage of waste

6.2 What is Equipment Safety

6.2.1 Enlist Equipment Safety

6.2.2 What is LOTOTO, Cabin LOTOTO, LOTOTO Box and Procedure?

6.2.3 Isolation of process equipment's

6.3 Hand over and Documentation of process equipment's

6.4 What is Process Safety Management System and briefly explain its elements

6.5 What are Safety Critical Switches on Process Safety Equipment's

6.6 What is Fire Station & How it Works?

6.7 What is Emergency Response Plan (ERP) in Process Industries?

6.8 What is technical safety and loss prevention?

7 FIRE PREVENTION HAZARDS

7.1 Fire hazards and prevention.

7.1.1 Define fire hazards and Fire Triangle

7.2.2 Enlist types of fires in a chemical Industry.

- 7.2.3 Name firefighting and extinguishing equipments.
- 7.2.4 Explain origin of the fire.
- 7.2.5 Explain method of fire prevention.
- 7.2.6 Explain the uses of fire extinguish and the chemicals it contains.
- 7.2.7 Describe the use of chemicals to avoid accidents due to fire.

ChT-252 PHYSICAL CHEMISTRY

Physical Chemistry	T	P	C
	1	3	2

LEARNING OUTCOMES

1. Understand scientific methods as applied to the development of the laws of chemistry and physics.
2. Perform experiments related to physical chemistry.

No. COURSE CONTENTS

Hours

1 THERMOCHEMISTRY	06
1.1 Define Physical Chemistry.	
1.2 Introduction & Definition of Thermochemistry.	
1.3 Exothermic and Endothermic Reaction.	
1.4 Heat of Reaction.	
1.5 Factor Affecting Heat of Reaction.	
1.6 Heat of Formation.	
1.7 Heat of Combustion.	
1.8 Application of Heat of Combustion.	
1.9 Heat of Neutralization.	
1.10 Hess's law of Constant Heat Summation.	
2 SOLUTION & COLLOIDAL STATE	06
2.1 Definition of Solution and Types of Solutions.	
2.2 Concentration.	
2.3 Normality, Normal Solution.	
2.4 Molarity, Molar Solution, Molality.	
2.5 Percentage Composition.	
2.6 Properties of Solution.	
2.7 Definition of Solubility.	
2.8 Effect of Temperature and Pressure on Solubility.	
2.9 Elevation of Boiling Point and its Applications.	
2.10 Depression of Freezing Point and its Applications.	
2.11 Definition and Preparation of Colloidal Solutions.	
2.12 Properties of Colloidal Solutions.	
2.13 Application of Colloidal Chemistry in Industry.	
2.14 Emulsion and Emulsifier.	
3 PHOTO-CHEMISTRY	06

No. COURSE CONTENTS**Hours**

- 3.1 Definition of Photochemistry.
- 3.2 Photochemical Reactions.
- 3.3 Sources of Photochemical Reaction.
- 3.4 Laws of Photochemistry.
- 3.5 Measurement of Intensity of Radiation.
- 3.6 Phosphorescence.
- 3.7 Application of Photochemistry.

4 ELECTROCHEMISTRY**06**

- 4.1 Definition of Electrochemistry.
- 4.2 Electrolytes and Electrolysis.
- 4.3 Electrolytes and Ohm's Law.
- 4.4 Conductivity of Electrolytes.
- 4.5 Faraday's Law of Electrolytes.
- 4.6 Effect of Dilution on Conductivity.
- 4.7 Measurement of Conductivity.

5 CHEMICAL KINETICS**04**

- 5.1 Velocity of a Chemical Reaction.
- 5.2 Reaction Rate and Velocity Constant.
- 5.3 Factors Which Affect Reaction Rate.
- 5.4 Law of Mass Action.
- 5.5 Introduction to Arrhenius Equation.
- 5.6 Catalysts & its Purpose.

6 CHEMICAL EQUILIBRIUM**04**

- 6.1 Definition of Chemical Equilibrium.
- 6.2 Equilibrium Mixtures and Measurement of Equilibrium Constant.
- 6.3 Hydrolysis of Bicarbonates.
- 6.4 Effect of Temperature, Pressure, Concentration, and Catalyst on Reactions equilibrium.

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. THERMO CHEMISTRY

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

2 SOLUTION & COLLIDAL STATE

- 2.1 solution
 - 2.1.1 Define solution
 - 2.1.2 Give examples of types of solution
 - 2.1.3 Define concentration
 - 2.1.4 Explain normality
 - 2.1.5 Describe molarity
 - 2.1.6 Explain percentage composition
 - 2.1.7 Illustrate properties of solution
 - 2.1.8 Define solubility
 - 2.1.9 Describe effect of temperature and pressure on solubility
 - 2.1.10 Explain elevation of boiling point
 - 2.1.11 Enlist elevation of boiling point application
 - 2.1.12 Explain depression of freezing point
 - 2.1.13 Enlist depression of freezing point applications
- 2.2 colloidal state
 - 2.2.1 Explain colloidal state
 - 2.2.2 Prepare different colloidal solutions
 - 2.2.3 Describe properties of colloidal solutions
 - 2.2.4 Enlist colloidal chemistry application in industry

3 PHOTO CHEMISTRY

- 3.1 Understand photo chemistry
 - 3.1.1 Enlist sources of photo chemical radiations
 - 3.1.2 Describe photo chemical reactions
 - 3.1.3 State different laws of photo chemistry
 - 3.1.4 Enlist different instruments used to measure intensity of radiations
 - 3.1.5 Describe photos sensitization
 - 3.1.6 Define photo synthesis
 - 3.1.7 Define luminescence
 - 3.1.8 Explain briefly fluorescence
 - 3.1.9 Define phosphorescence
 - 3.1.10 Enlist applications of photo chemistry

4 UNDERSTAND ELECTRO CHEMISTRY

- 4.1 Describe electrolytes
- 4.2 State ohm's law
- 4.3 Describe conductivity of electrolytes
- 4.4 State faraday's laws of electrolysis
- 4.5 Explain effect of dilution on conductivity
- 4.6 Enlist instruments used to measure the conductivity

5 UNDERSTAND CHEMICAL KINETICS

- 5.1 Calculate velocity of chemical kinetics
- 5.2 Explain reaction rate
- 5.3 Describe velocity constant
- 5.4 Enlist factors which effect reaction rate
- 5.5 Catalyst & its Purpose

6 UNDERSTAND CHEMICAL EQUILIBRIUM

- 6.1 State law of mass action
- 6.2 Define equilibrium mixtures
- 6.3 Measure equilibrium constant
- 6.4 Explain hydrolysis
- 6.5 Describe reaction between on organic acid and an alcohol
- 6.6 Illustrate reaction between hydrogen and Iodine
- 6.7 Enlist equilibrium constant application
- 6.8 Describe effect of temperature, pressure on equilibrium constant

CHT 252 PHYSICAL CHEMISTRY.

LIST OF PRACTICALS.

96 Hrs.

1. To weigh the chemicals on an analytical balance (use of sensitive analytical balance)
2. To determine the melting point of a given organic compounds.
3. To determine the boiling point of a given liquid.
4. Determine the specific gravity of the given liquid.
5. Determine the viscosity by viscometer (Ostwald's viscometer)
6. Determine of solubility of common salt at room temperature.
7. To separate the mixture by sublimation.
8. To obtain alcohol from a mixture of alcohol and water by distillation.
9. To determine the equivalent weight of magnesium (To verify the law of constant composition)
10. Preparation of standard solution of alkalis and acids e.g NaOH, KOH, oxalic acid and succinic acid.
11. Prepare approximate solution of H_2SO_4 and determine its exact normality by titrating it against standard N/10 NaOH.
12. Determination of surface tension by stalgo meter.
- 13 Determination of surface tension of liquid by using torsion balance.
- 14 Preparation of colloidal solution and study the properties of colloidal solution.
- 15 Determination of equilibrium constant and rate of reaction (1^{st} degree reaction and 2^{nd} degree reaction).
- 16 Preparation of Neon signs.

ChT-273 UNIT OPERATIONS - I

T	P	C
2	3	3

LEARNING OUTCOMES.

1. Apply the principles of unit operation in Chemical technology.
2. To apply principles of unit operation in the laboratory work.
3. Know the construction, working and applications of different chemical equipment being used in different industrial operations.

No.	COURSE CONTENTS	Hours
1	INTRODUCTION TO UNIT OPERATIONS 1.1 Define unit operation & unit process with examples 1.2 Enlist major unit operations involved in the process industry 1.3 Understand the basic laws used in chemical engineering 1.4 Differentiate between steady state and unsteady state system	02
2	INTRODUCTION TO FLUID FLOW 2.1 Define fluid and enlist various types of fluids 2.2 Define various properties related to fluids 2.3 Fluids statics, fluid dynamics 2.4 Mechanism of fluids flow 2.5 Reynold's number, the significance of Reynold's number	10
3	FLUID FLOW PRINCIPLES 3.1 Viscosity, units of viscosity 3.2 Bernoulli's theorem 3.3 Fluids Head and friction losses 3.4 Friction in pipes, sudden enlargement and contraction losses in fittings 3.5 Introduce volumetric flow rate and mass flow rate 3.6 Types of viscosity: Kinematic viscosity, Dynamic viscosity	06
4	PUMPS 4.1 Definition of pump 4.2 Application of pumps in the process industry 4.3 Pump's terminology: capacity, velocity head, suction heads, net positive suction Head, cavitation 4.4 Types of pumps 4.5 Centrifugal pumps: types, construction, and working 4.6 Impeller and types of impellers used in centrifugal pump	12

No.	COURSE CONTENTS	Hours
	4.7 Multistage centrifugal pump 4.8 Series and Parallel arrangement of Pumps 4.9 Construction and working of rotary pumps 4.10 Construction and operation of reciprocating pumps: Piston pumps 4.11 Plunger Pump, Simplex type, their construction and working principles 4.12 Concept of prime mover 4.13 Pump characteristic curves 4.14 SOP of pump start-up and shut off 4.15 Troubleshooting of pumps	
5	COMPRESSORS & BLOWERS	06
	5.1 Define compressor & enlist its types 5.2 Application of compressors and blowers in the process industry 5.3 Difference between compressors, fans, and blowers 5.4 Define Surging 5.5 Compressor characteristic curves 5.6 Single stage and multistage compressors	
6	CENTRIFUGATION	03
	6.1 Definition of centrifuge 6.2 Classification of centrifuges 6.3 Explain construction and working of top-driven batch type centrifuge 6.4 Explain construction and working of under-driven batch type centrifuge	
7	FILTRATION	13
	7.1 Filter media, filter aids 7.2 Sand filter, Chamber press 7.3 Plate and frame press, leaf filter, pressure filter 7.4 Rotary drum filter 7.5 Washing of filter cakes 7.6 Applications of filter 7.7 Back washing of filter	
8	SIZE REDUCTION	12
	8.1 Classification of crushing and grinding machinery 8.2 Jaw crusher 8.3 Gyratory crusher 8.4 Roll crushers 8.5 Single roll crusher	

No.	COURSE CONTENTS	Hours
	8.6 Fine grinders	
	8.7 Roller mills	
	8.8 Ball and tube mill	
	8.9 Methods or ways of size reduction	
	8.10 Laws of size reduction	
	8.11 Closed circuit grinder	

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 UNDERSTAND THE BASIC OF CHEMICAL TECHNOLOGY

- 1.1 Define unit operation and unit process
- 1.2 Give examples of unit operations.
- 1.3 Give examples of unit processes.
- 1.4 Explain the basic laws (law of material and energy balance) of chemical energy.
- 1.5 Differentiate between steady state and non-steady state systems.

2 UNDERSTAND THE FLUID & ITS TYPES

- 2.1 Define fluid.
- 2.2 Give types of fluid.
- 2.3 Differentiate between Newtonian and non-Newtonian fluids.
- 2.4 Give examples of the two types of fluids.
- 2.5 Define fluid statics
- 2.6 Develop a relationship to calculate the pressure exerted by the liquid column.

3. UNDERSTAND THE MEASUREMENT OF FLUID

- 3.1 Define manometer
- 3.2 Give the types of manometers
- 3.3 Explain the construction and working of simple manometer (u-tube manometer)
- 3.4 Explain the construction and working of differential Manometer.
- 3.5 Explain the construction and working of inclined tube Manometer.
- 3.6 Calculate pressure drop from manometer readings
- 3.7 Define fluid dynamics.
- 3.8 Explain the mechanism of fluid flow by Reynold experiment.
- 3.9 Differentiate between laminar flow and turbulent flow.
- 3.10 Explain Reynold's number.
- 3.11 Differentiate between point velocity, maximum velocity and mean velocity of the flowing.
- 3.12 Define viscosity.
- 3.13 Explain the units of viscosity.
- 3.14 Calculate the viscosity of fluids by using Hagen Poiseuille equation

4 UNDERSTAND BERNOULLI'S THEOREM

- 4.1 Explain Bernoulli's theorem
- 4.2 Develop a mathematical equation for Bernoulli's theorem
- 4.3 Explain fluid heads
- 4.4 Calculate the H.P of the pump required to pump the liquid from station A & B , by using Bernoulli's equation.

5 UNDERSTAND FRICTION LOSSES

- 5.1 Enlist different kinds of friction losses
- 5.2 Calculate the head loss due friction in pipes
- 5.3 Calculate the head loss due to sudden enlargement.
- 5.4 Calculate the head loss due to sudden contraction.
- 5.5 Explain the losses in fittings in terms of equivalent pipe length

- 6 UNDERSTAND THE MEASUREMENT OF DISCHARGE OF FLUIDS**
- 6.1 Enlist the equipment's used for the measurement of flow rate of fluids.
 - 6.2 Explain the construction and working of Orifice meter.
 - 6.3 Explain the methods of installation of an Orifice meter.
 - 6.4 Explain the construction and working of Venturi meter.
 - 6.5 Give a comparison between orifice meter and Venturi meter.
 - 6.6 Explain the construction and working of pilot tube.
 - 6.7 Explain the construction and working of Rotameter.
 - 6.8 Explain the construction and working of weirs.
- 7 UNDERSTAND THE TERMINOLOGY OF PUMPS**
- 7.1 Define pump.
 - 7.2 Define pump capacity.
 - 7.3 Explain suction head.
 - 7.4 Explain net positive suction head.
 - 7.5 Explain discharge head.
 - 7.6 Explain velocity head.
 - 7.7 Explain pump efficiency.
- 8. UNDERSTAND THE TYPES OF POSITIVE DISPLACEMENT PUMPS**
- 8.1 Define positive displacement pump.
 - 8.2 Explain the classification of positive displacement pumps.
 - 8.3 Explain the construction and working of a reciprocating pump (piston pump).
 - 8.4 Explain the construction and working of a plunger pump.
 - 8.5 Explain the construction and working of diaphragm pump.
 - 8.6 Explain the construction and working of a gear pump.
 - 8.7 Explain the construction and working of cycloidal pump.
- 9. UNDERSTAND THE CONSTRUCTION AND WORKING OF DIFFERENT TYPES OF CENTIFUGAL PUMPS**
- 9.1 Define centrifugal pump
 - 9.2 Give the classification of centrifugal pumps
 - 9.3 Explain the construction and working of a volute pump
 - 9.4 Explain construction in a c.f pump.
 - 9.5 Explain the priming of a c. f pump.
 - 9.6 Explain the thrust in a c. f pump.
 - 9.7 Explain the construction of a turbine pump.
- 10 UNDERSTAND THE SELECTION METHOD OF A PUMP**
- 10.1 Enlist the factors that are to be considered in the selection of a pump.
 - 10.2 Give a comparison between centrifugal and reciprocating pump.
 - 10.3 Enlist the pump losses.
- 11. UNDERSTAND THE COMPRESSORS & BLOWERS**
- 11.1 Define blower.
 - 11.2 Explain the construction and working of cycloidal blower.
 - 11.3 Explain the construction and working of Nash Hytor.
 - 11.4 Explain the construction and working of Centrifugal blower.
- 12 UNDERSTAND THE COMPRESSAS**

- 12.1 Define compressor.
- 12.2 Enlist the factors one should consider while selecting a compressor.

13 CENTRIFUGATION

- 13.1 Define centrifugation
- 13.2 Classification of centrifugation.
- 13.3 Explain construction and working of Top driven Batch type centrifuge.
- 13.4 Explain construction and working of Under Driven Batch type centrifuge

14 FILTRATION

- 14.1 Filtration
 - 14.1.1 Define filtration.
 - 14.1.2. Enlist filter Medias.
 - 14.1.3 Define filter aid.
 - 14.1.4 Give examples of filter aid.
- 14.2 Filters
 - 14.2.1 Give classification of filters
 - 14.2.2 Explain construction and working of
 - (a) Sand filter
 - (b) Plate and frame filter
 - (c) Leaf filter
 - (d) Pressure filter
 - (e) Rotary drum filter
 - 14.2.3 Explain the washing of filter cake.
- 14.3 Applications of filtration.

15 SIZE REDUCTION

- 15.1 Size reduction
 - 15.1.1 Define size reduction (crushing and grinding)
 - 15.1.2 Give classification of crushing and grinding machinery
 - 15.1.3 Differentiate between inter mediate grinding, fine grinding and ultra-fine grinding.
 - 15.1.4 Explain construction and working of
 - (a) Jaw crusher
 - (b) Gyratory crusher
 - (c) Roll crusher
 - (d) Ball mill
 - (e) Tube mill
 - 15.1.5 Explain the construction and working of ultrafine Grinder (Pulverize)
Explain closed circuit grinding

LIST OF PRACTICALS.

96 Hrs.

FLUID MECHANICS

1. Introduction to the unit operation laboratory.
2. Calibrate a storage tank to obtain weight and volume relationship per unit height and study important values used in the chemical industry.
3. Calculation of flow rate of fluid flowing through a specific pipe size.
4. Calculation of Reynolds number and specify the types of flow using Reynolds apparatus.
5. Determine the relationship between head loss due to fluid friction and velocity of water through different bore size pipes.
6. Determine the head loss associated with the flow of water through standard fittings used in plumbing installations.
7. Calculate the head loss across the orifice meter.
8. Calculation of pressure drop across the venturi meter.
9. Study the operating characteristics and performance of a centrifugal pump. Dismantle and assemble the centrifugal pump.

PARTICLE TECHNOLOGY

10. Study the operation of a centrifuge.
11. Study the theory and operation of filter press, including filtering, washing, and 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 using various industrially important materials.
14. Determine the number of revolutions and time required for mixing two materials per unit weight and calculate the efficiency of the mixer.
15. Study the operation of a sieve shaker using a variety of crushed solids (or conduct a manual sieve screen analysis).
16. Study the operation of a pulverizer using a variety of materials, analyze the efficiency and purpose of the machine through sieve screen analysis.
17. Study the operation of various mills by grinding several materials and analyze the efficiency and purpose of the machines by sieve screen analysis.
18. Study the operation of a jaw crusher.
19. Determine the horsepower required for crushing a definite material, e.g., red bricks.
20. Determine the horsepower required for grinding a definite quantity of a material to 100 mesh in a mill and calculate the work index for that grinding operation.

ChT-282 BASIC ENGINEERING THERMODYNAMICS

Total Contact Hours

Theory	32	T	P	C
Practical	96	1	3	2

Learning Outcomes: The students will be able to:-

1. Define basic terminologies of engineering thermodynamics.
2. Describe the basic concepts and laws of thermodynamics and their applications in the process industry.
3. Perform energy balance for open and closed systems based on the first law of thermodynamics.
4. Describe thermodynamic processes involved in the fluid motive machinery and thermodynamic cycles for power generation, refrigeration, and liquefaction.
5. Perform various experiments related to engineering thermodynamics

No. COURSE CONTENTS		Hours
1 INTRODUCTION AND BASIC TERMINOLOGIES		3 Hrs
1.1 Thermodynamic definition		
1.2 History of thermodynamics		
1.3 Definition of energy, its forms, and its units in C.G.S, M.K.S, and F.P.S systems		
1.4 Definition of temperature, internal energy, enthalpy, and entropy		
1.5 Definition of heat, and work and difference between the two		
1.6 Examples of thermodynamics in daily life and engineering applications		
2 BASIC CONCEPTS OF THERMODYNAMICS		3 Hrs
2.1 Concept of system and surrounding		
2.2 Open, closed, and isolated systems		
2.3 Steady state, unsteady state, and equilibrium processes		
2.4 Mechanisms of energy transfer to or from a system		
2.5 Introduction of thermodynamic processes including Isobaric, Isochoric, Isothermal, and Adiabatic processes		
3 THERMODYNAMIC LAWS AND ENERGY BALANCE		6 Hrs
3.1 First Law of thermodynamics and its applications		
3.2 Specific heat at constant pressure and volume		
3.5 Second law of thermodynamics and its applications		
3.6 Third law of thermodynamics		
4 VAPOR POWER CYCLES		8 Hrs

No.	COURSE CONTENTS	Hours
	4.1 Concept of steam, subcooled liquid, saturated liquid and vapors, and superheated steam 4.2 Different pressure levels of steam used in the industry 4.3 Concept of steam quality, dry steam, and wet steam, steam sources, vacuum 4.4 Basic components of the steam cycle 4.5 Components and functioning of a steam turbine 4.6 Concepts of efficiency of power cycle 4.7 Applications of steam cycle in the power industry	
5	GAS POWER CYCLES	5 Hrs
	5.1 Introduction of a gas turbine 5.2 Components and functioning of a gas turbine 5.3 Industrial applications of gas turbine cycle 5.4 Components of the gas power cycle 5.7 Combined cycle (Gas turbine and Rankine cycle)	
6	REFRIGERATION CYCLE	7 Hrs
	6.1 Joule–Thomson effect and throttling process 6.2 Refrigerant and its selection 6.3 Components of refrigeration cycle 6.4 Chillers and its components 6.5 Liquefaction process	

RECOMMENDED REFERENCE BOOKS

1. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. B. (2014). Fundamentals of engineering thermodynamics. John Wiley & Sons.
2. Cengel, Yunus A., Boles, Michael A. (2015). Thermodynamics: an engineering approach (8th ed). New York: McGraw-Hill Book

INSTRUCTIONAL OBJECTIVES

1 INTRODUCTION AND BASIC TERMINOLOGIES

- 1.1 Define thermodynamics
- 1.2 Briefly elaborate the history of thermodynamics
- 1.3 Enlist and define various forms of energy, power, and its units (CGS, MKS, FPS, SI)
- 1.4 Define the terms: temperature, internal energy, enthalpy, and entropy
- 1.5 Define the terms heat and work
- 1.6 Differentiate between heat and various forms of work such as compression/expansion work and shaft work
- 1.7 Provide at least 5 examples of thermodynamics applications in daily life and in the industry

2 BASIC CONCEPTS OF THERMODYNAMICS

- 2.1 Explain the concept of system, surrounding, and boundaries in the context of thermodynamics
- 2.2 Explain open, closed, and isolated systems with examples
- 2.3 Define steady state, unsteady state, and equilibrium processes with examples
- 2.4 Explain the mechanism of energy transfer between system and surrounding using simple examples
- 2.5 Define Isobaric, Isochoric, Isothermal, and Adiabatic processes with examples

3 THERMODYNAMIC LAWS

- 3.1 Define and explain the First Law of thermodynamics and its applications
- 3.2 Define specific heat at constant pressure and volume. Enlist units
- 3.3 Define the Second Law of thermodynamics and its applications
- 3.4 Define the Third Law of thermodynamics

4 VAPOR POWER CYCLES

- 4.1 Define steam, subcooled liquid, saturated liquid and vapors, and superheated steam
- 4.2 Explain low-pressure steam, medium-pressure steam, and high-pressure steam
- 4.3 Define steam quality, dry steam, wet steam, and supercritical steam
- 4.4 Define and enlist sources of steam generation
- 4.5 Explain the concept of vacuum
- 4.6 What are the basic components of the steam cycle?
- 4.7 Explain various components of a steam turbine and its operation
- 4.8 Define efficiency of a power cycle
- 4.9 Enlist various applications of steam cycle in the power industry

5 GAS POWER CYCLE

- 5.1 What is a gas turbine?
- 5.2 Enlist various components of a gas turbine and its operation
- 5.3 What are the different components of a gas power cycle?
- 5.4 Explain the purpose and applications of a gas power cycle
- 5.5 Explain basic components and functions of a combined cycle power plant (Gas turbine and Steam cycle)

6 REFRIGERATION CYCLE & LIQUEFACTION

- 6.1 Define Joule–Thomson effect and throttling process with common examples
- 6.2 Define refrigerant, enlist common refrigerants, and their selection process
- 6.3 What are the different components of a refrigeration cycle?
- 6.4 Define chillers and their various components
- 6.5 Applications of refrigeration and chillers in industry
- 6.6 Define liquefaction and its industrial applications

CHT- 282 BASIC ENGINEERING THERMODYNAMICS

LIST OF PRACTICAL

1. Demonstration of isothermal, isochoric, adiabatic, and isobaric process
2. Study Perform experiment energy transfer processes of daily life example and take basic measurements.
3. Perform experiment to determine electrical equivalent of heat
4. Determine specific heat of liquid water using calorimetric technique (method of mixtures)
5. Perform experiment to determine the relationship between steam temperature and pressure
6. Demonstrate the operation of a steam boiler
7. Demonstration of basic steam cycle used for power generation
8. Demonstration of refrigeration cycle
9. Visit of Power plant
10. Industrial Visits of Boiler units and / or Chillers.

COURSE DETAILS

YEAR - 3

خصوصی مقاصد:

- () احادیث کا ترجمہ بیان کر سکے
 - () احادیث کی تشریح کر سکے
 - () معاشرتی اور انفرادی زندگی میں احادیث سے رہنمائی حاصل کر سکے
- حقوق و فرائض:

عمومی مقاصد:

- () اسلامی معاشرے کا ایک اچھا فرد بن سکے

خصوصی مقاصد:

- () والدین کے حقوق و فرائض بیان کر سکے
- () ہمسائیوں کے حقوق بیان کر سکے
- () بچوں کے حقوق بیان کر سکے
- () عورتوں کے حقوق کی پاسداری کر سکے
- () بزرگ شہریوں کے حقوق کا خیال رکھ سکے
- () محنت حضرات کے حقوق جان سکے اور ان کے حقوق کی پاسداری کر کے انہیں معاشرے کا ایک مفید فرد بنایا جاسکے
- () اسلام میں حقوق و فرائض کی آگاہی کی صورت میں اپنے اندر خدمت خلق کا جذبہ پیدا کر سکے

اسلامی اقدار:

عمومی مقاصد:

- () طالب علم جان سکے گا کہ تعلیم کا مقصد حسن اخلاق سے متصف ہونا ہے

خصوصی مقاصد:

- () اخلاق کے معنی و مفہوم کو بیان کر سکے
- () اسلام میں حسن و اخلاق کی اہمیت بیان کر سکے
- () قرآن و سنت کی روشنی میں صبر و استقامت کی اہمیت بیان کر سکے
- () ایقانے عہد کی اہمیت بیان کر سکے
- () اخوت کے معنی و مفہوم بیان کر سکے
- () اخوت اسلامی کی اہمیت بیان کر سکے

() اسلام کی اعلیٰ اقدار کو اپنا کر مثالی معاشرہ پیدا کر سکے

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کل وقت 20 گھنٹے

غیر مسلم طلباء کے لیے
GEN301

نصاب اخلاقیات
سال سوئم

موضوعات:

- () احساس ذمہ داری
- () مثبت ذہن
- () عدل و انصاف
- () قومی خدمت کا جذبہ
- () ذکر و نظر کی پاکیزگی
- () احترام آدمیت
- () شائستگی
- () عفو و درگزر
- () بردباری
- () خود انحصاری
- () اثر و نفوذ
- () جامعیت
- () اپنی ذات کی معرفت (بذریعہ ہم عمر طلباء، اساتذہ، اہم شخصیات)
- () بچوں کے حقوق
- () عورتوں کے حقوق
- () بزرگ شہریوں کے حقوق
- () منہج حضرات کے حقوق

غیر مسلم طلباء کے لیے
نصاب اخلاقیات (سال سوئم)

تدریس مقاصد:

عمومی مقاصد:

- () 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 سکے کہ
- () موضوعات کا مطلب بیان کر سکے
- () عملی زندگی سے مثالوں کی نشاندہی کر سکے
- () موضوعات کی اہمیت بیان کر سکے
- () اپنی شخصیت اور معاشرے پر موضوعات کے مطابق اثرات پیدا کرنے کے طریقے بیان کر سکے
- () مثبت ذہن کے ساتھ کام کر سکے
- () عدل و انصاف سے ادارہ میں، دفتر میں بہتر ماحول پیدا کر سکے
- () ماحول کو اخلاقی طور پر پاکیزہ بنائے
- () کارکنوں کی بہتر طور پر دل جوئی کر سکے
- () کارکردگی میں اضافہ کر سکے
- () باہمی احترام کی برکات سے استفادہ کر سکے
- () بچوں کے حقوق بیان کر سکے
- () عورتوں کے حقوق کی پاسداری کر سکے
- () بزرگ شہریوں کے حقوق کا خیال رکھ سکے
- () محنت حضرات کے حقوق جان سکے اور ان کے حقوق کی پاسداری کر کے انہیں معاشرے کا ایک مفید فرد بنایا جاسکے

Mgm-351 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 | 1 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 | 2 Hour |
| 2.1 Utility | |
| 2.2 Income | |
| 2.3 Wealth | |
| 2.4 Saving | |
| 2.5 Investment | |
| 2.6 Value. | |
| 2.7 Pay Back Period | |
| 2.8 Tax | |
| 2.9 Return on Investment | |
| 2.10 Operation Cost | |
| 2.11 Capital Cost | |
| 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. | |
| 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.	
8.4	Islamic Economic System	
8.5	Effect of stock exchange in industries production.	
10.	BANK.	2 Hour
10.1	Definition	
10.2	Functions of a commercial bank.	
10.3	Central bank and its functions.	
11.	MEANS OF TRANSACTIONS	2 Hour
11.1	Definition	
11.2	Characteristics and kinds of cheque.	
11.3	Dishonor of cheque.	
11.4	Debit Card	
11.5	Credit Card	
12.	FINANCIAL INSTITUTIONS	3 Hours
12.1	IMF	
12.2	IDBP	
12.3	PIDC	
12.4	World Bank	
12.5	ADB	
12.6	JICA	
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.	
14.3	Introduction to E-Commerce	
14.4	Business to Business (B2B)	
14.5	Business to Consumer (B2C)	
14.6	Consumer to Consumer (C2C)	
15.	MANAGEMENT	2 Hour
15.1	Meaning and concept	
15.2	Functions of management	
15.3	Levels of management	
16.	ADVERTISEMENT	2 Hours
16.1	The concept, benefits and draw-backs.	

16.2 Principal media used in business world.

17. ECONOMY OF PAKISTAN

2 Hour

17.1 Introduction

17.2 Economic problems and remedies.

17.3 Case study of relevant industry

BOOKS RECOMMENDED

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

INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND THE IMPORTANCE OF ECONOMICS.

- 1.1 State definition of economics given by Adam Smith, Alfred Marshall and Professor Robins.
- 1.2 Explain nature and scope of economics.
- 1.3 Describe importance of study of economics for technicians.

2. UNDERSTAND BASIC TERMS USED IN ECONOMICS.

- 2.1 Define basic terms, utility, income, wealth, saving, investment and value.
- 2.2 Explain the basic terms with examples
- 2.3 Explain Pay Back Period, Tax, Return on Investment, Operation Cost, and Capital Cost.

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.

7. UNDERSTAND SCALE OF PRODUCTION.

- 7.1 Explain scale of production and its determination.
- 7.2 Describe large scale production and its merits.
- 7.3 Explain small scale of production and its advantages and disadvantages.

8. UNDERSTAND DIFFERENT ECONOMIC SYSTEMS.

- 8.1 Describe free economic system and its characteristics.
- 8.2 Explain centrally planned economic system, its merits and demerits.
- 8.3 State mixed economic system and its features.
- 8.4 Explain Effect of Stock Exchange of Industries Production.

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.
- 10.4 Islamic Economic System
- 11. UNDERSTAND MEANS OF TRANSACTIONS.**
 - 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.
 - 11.5 Debit Card and Credit Card
- 12. UNDERSTAND FINANCIAL INSTITUTIONS.**
 - 12.1 Explain IMF and its objectives.
 - 12.2 Explain organizational set up and objectives of IDBP.
 - 12.3 Explain organizational set up and objectives of PIDC.
 - 12.4 Explain organizational set up and objectives of World Bank.
 - 12.5 Explain organizational set up and objectives of ADP.
 - 12.6 Explain organizational set up and objectives of JECA.
- 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.
 - 14.3 Introduction of E-Commerce
 - 14.4 Business to Business
 - 14.5 Business to Consumer
 - 14.6 Consumer to Consumer
- 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 the 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.
 - 17.4 Case Studies of relevant industries

Mgm-341 ENTREPRENEURSHIP

T	P	C
1	0	1

Learning Outcomes:

Students will be able to:

1. Understand the role of entrepreneurs in economic development.
2. Understand business steps and business opportunities
3. Understand registration of business
4. Discuss a comprehensive business plan.

COURSE CONTENTS	Hours
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1	INTRODUCTION TO ENTREPRENEURSHIP	04
	1.1 Introduction to entrepreneurship	
	1.2 Qualities of an entrepreneur	
2	ENTREPRENEURSHIP FOR TECHNOLOGISTS	04
	2.1 Overview of the industry	
	2.2 Opportunities for DAE professionals	
	2.3 Expertise and adaptability as an entrepreneur	
3	ENTREPRENEURSHIP PROCESS OR STEPS	04
	3.1 Business plan	
	3.2 Financial projections	
	3.3 Customer discovery	
	3.4 Customer development	
4	BUSINESS OPPORTUNITIES	04
	4.1 Production businesses	
	4.2 Specialty businesses	
	4.3 Service businesses	
5	QUALITY CONTROL	02
	5.1 Concept and advantages	
	5.2 Methods	
6	BUSINESS REGISTRATION PROCESS IN PAKISTAN	04
	6.1 Registration process	
	6.2 Legal formalities	
	6.3 Importance of registration	
7	STUDY OF PRE-FEASIBILITIES	04
	7.1 Pre-feasibilities	

8.1 Development of a comprehensive business plan

Recommended Books

1. Burns, P., Hurst, J.D., (1996). Small Business and Entrepreneurship. Red Globe Press
2. Blank, S., (2013). The Four Steps to the Epiphany
3. Osterwalder, A., Pigneur, Y., (2010). Business Model Generation. John Wiley and Sons
4. Singh ,P.N., (1986). Developing Entrepreneurship for Economic Growth. New Delhi: Vikas publications.
5. Drucker, P.F., (2006). Innovation and Entrepreneurship. Harper Business
6. Miner, J.B., (1996).The 4 Routes to Entrepreneurial Success. Berrett-Koehler Publishers
7. Pre-Feasibility Study of different businesses by Small and Medium Enterprises Development Authority (SMEDA), Ministry of Industries and Production, Government of Palistan.

INSTRUCTIONAL OBJECTIVES

1. Introduction to entrepreneurship

- 1.1 Definition and Scope of Entrepreneurship
- 1.2 Importance of Entrepreneurship in Economic Development
- 1.3 What is entrepreneurship and who is an entrepreneur
- 1.4 Pros and Cons of an entrepreneurship
- 1.5 Skills and characteristics of an entrepreneur

2. Entrepreneurship for Technologists

- 2.1 Overview of the Industry
- 2.2 Role of DAE Professionals in Business
- 2.3 Technical Expertise and Innovation
- 2.4 Adaptability to Technological Changes

3. Entrepreneurship Process or steps

- 3.1 Components of a Business Plan
- 3.2 Importance of Goal Setting and Strategy
- 3.3 Developing Financial Projections
- 3.4 Customer Understanding
- 3.5 Market Knowledge
- 3.6 Customer Validation

4. Business Opportunities

- 4.1 Production and Manufacturing Ventures
- 4.2 Specialty and Niche Markets
 - a. Opportunities in Service Sector

5. Quality Control

- 5.1 Define quality control
- 5.2 State the advantages of quality control
- 5.3 Explain methods of quality control

6. Business registration Process in Pakistan

- 6.1 Introduction to Business Registration
- 6.2 Significance of Legal Registration
- 6.3 Legal Structures for Businesses in Pakistan
- 6.4 Importance of Compliance

7. Study of Pre-feasibilities

Study of SMEDA (Small and Medium Enterprises Development Authority, Govt. of Pakistan) pre-feasibilities

8 Entrepreneurship projects

8.1 Application of the entrepreneurship knowledge to develop business idea considering the following aspects:

- a) Idea and its potential
- b) Potential customers
- c) Financial plan
- d) Marketing Plan
- e) Comparison of Your Idea with Competitors

ChT-304 INSTRUMENTAL METHODS OF ANALYSIS

Instrumental Methods of Analysis	T	P	C
	2	6	4

LEARNING OUTCOMES:

1. To understand construction and working mechanism of instruments used for analytical purposes.
2. To understand the principles/properties of light for analytical purposes.
3. Handsome working experience of different analytical equipment's.
4. To understand the applications of various instruments used in industry and laboratory scale.

No.	COURSE CONTENTS	Hours
1	INTRODUCTION	04
	1.1 Introduction to IMA, Types of IMA, its Merits and Demerits	
	1.2 Light and its Properties	
	1.3 Radiant Energy. Reflection, Refraction, Absorbance	
	1.4 Light Waves Transmittance and their Energy	
	1.5 Trazar Cooling Tower System and its Industrial Application	
2	COLORIMETRY	06
	2.1 Fundamental Laws of Colorimetry	
	2.2 Beer-Lambert's Law	
	2.3 Photo Emissive Tube Construction and Working	
	2.4 Photometer	
	2.5 Industrial Application of Photometers	
	2.6 Single Beam Photometer: Construction and Working	
	2.7 Double Beam Photometer: Construction and Working	
	2.8 Beer-Lambert's Law Applied to Photoelectric Colorimetry	
3	FLUORESCENCE AND PHOTOLUMINESCENCE	04
	3.1 Fluorescence Methods for Fluorescence Development	
	3.2 Filter Fluorimeter	
	3.3 Construction, Operating Parts, and Working of Fluorimeter	
4	TURBIDIMETRY & NEPHELOMETRY	04
	4.1 Applications	
	4.2 Nephelometer: Construction and Working	
	4.3 Turbidimeter: Construction and Working	
	4.4 COD and BOD Techniques	

No.	COURSE CONTENTS	Hours
5	SPECTROPHOTOMETRY	08
	5.1 Spectrum of Light, Visible Spectra	
	5.2 Ultraviolet Spectra	
	5.3 Absorption and Emission Spectra	
	5.4 Molecular Spectra, Origin of Spectra	
	5.5 Spectrophotometer: Construction and Working	
	5.6 Ultraviolet Spectrophotometer: Construction and Working	
	5.7 Infrared Spectrophotometer: Construction and Working	
	5.8 Applications of Spectrophotometer	
6	FLAME PHOTOMETRY	04
	6.1 Definition and Application	
	6.2 Flame Photometer: Parts and Working	
	6.3 Flow Meter, Atomizer Burner, Optical System	
	6.4 Photo-sensitive Detector, Recording Equipment	
	6.5 Commercial Flame Photometer: Construction and Working	
7	REFRACTIVE INDEX & REFRACTOMETRY	04
	7.1 Effect of Temperature	
	7.2 Applications	
	7.3 Refractometer: Construction and Working	
	7.4 ABBE's Refractometer: Construction and Working	
8	POLARIMETRY	04
	8.1 Optical Active Material, Optical Activity	
	8.2 Plane Polarized Light	
	8.3 Levo-rotatory and Dextro-rotatory Substances	
	8.4 Calculation of Optical Rotation and Specific Rotation	
	8.5 Polarimeter: Construction and Working	
	8.6 Applications of Polarimetry	
9	GAS CHROMATOGRAPHY	04
	9.1 Definition and Principle of Gas Chromatography	
	9.2 Study of Gas Chromatography Instrument	
10	POTENTIOMETRY	04
	10.1 Define Potentiometry, Electrode Potential, and EMF	
	10.2 Formula for EMF of a Cell	
	10.3 Indicating and Reference Electrodes	
	10.4 Hydrogen and Glass Electrodes: Construction and Working	
	10.5 Applications of Potentiometry	
11	PH VALUE & POH VALUE	08

No.	COURSE CONTENTS	Hours
	11.1 Applications of pH Measurement	
	11.2 pH Meter: Construction and Working	
	11.3 Buffer Solution: Properties and Buffer Capacity	
	11.4 Preparation of Standard Buffer Solutions	
	11.5 Measurement and Determination of pH Value	
12	ELECTROLYSIS APPLICATIONS	06
	12.1 Equipment for Electrolysis	
	12.2 Reactions at Anode and Cathode	
	12.3 Faraday's Laws of Electrolysis	
13	CONDUCTIVITY & CONDUCTOMETRY	04
	13.1 Conductivity Cell, Cell Constant, and Conductivity Bridge	
	13.2 Specific and Equivalent Conductance, Molar Conductivity	
	13.3 Applications of Conductometry	

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.
 - 1.1.5 Trazar cooling tower system & its applications
- 1.2 Understand light
 - 1.2.1 Define light
 - 1.2.2 Enlist different properties of light
 - 2.1.3 Explain different properties of light
- 1.3 Understand radiant energy
 - 1.3.1 Define radiant energy
 - 1.3.2 Give different units for the measurement of wave length
 - 1.3.3 Calculate radiant energy by using the formula $E=hc$

2 COLORIMETRY

- 2.1 Understand colorimetry
 - 2.1.1 Define colorimetry
 - 2.1.2 Define transmittance and absorbance
 - Enlist photometric laws
 - Define Bouguer's law
 - Define Beer's law
- 2.2 Understand photo electric colorimetry
 - 2.2.1 Define photo electric colorimetry
 - 2.2.2 Enlist different photo detectors
 - 2.2.3 Explain the construction and working of photo tube/cell.
- 2.3 Understand photo meter
 - 2.3.1 Define photometer
 - 2.3.2 Explain the working of single beam photometer
 - 2.3.3 Explain the working of double beam photometer
 - 2.3.4 Give comparison of the two photometers
 - 2.3.5 Calculate the concentration of sample solution from photometer readings by using Borger-Beer's law equation

3 PHOTO LUMINESCENCE

- 3.1 Photo Luminescence
 - 3.1.1 Define photo luminescence
 - 3.1.2 Give examples of photo luminescence
 - 3.1.3 Differentiate between Fluorescence and luminescence.
 - 3.1.4 Explain the methods of making Fluorescence spectrum
 - 3.1.5 Develop a relationship between Fluorescence intensity and concentration
- 3.2 Fluorescence
 - 3.2.1 Define Fluorescence.

- 3.2.2 Draw working diagram of filter Fluorescence.
- 3.2.3 Draw working diagram of spectro Fluorescence.
- 3.2.4 Explain the function of operating parts of Fluorescence.

4 TURBIDIMETRY AND NEPHLOMETRY

- 4.1 Understand turbidimetry and Nephelometry
 - 4.1.1 Define turbidimetry
 - 4.1.2 Define Nephelometry
 - 4.1.3 Give industrial applications of turbidimetry
 - 4.1.4 Explain the construction and working of turbidimeter
 - 4.1.5 Explain the construction and working of Nephelometer
 - 4.1.6 COD & BOD Technique

5 SPECTRO PHOTOMETRY

- 5.1 Understand spectro photometry
 - 5.1.1 Define spectrophotometry
 - 5.1.2 Define dispersion of light
 - 5.1.3 Explain spectrum of light
 - 5.1.4 Explain visible spectra UV-spectra IR-spectra
 - 5.1.5 Explain Absorption spectra, emission spectra, molecular spectra and origin of spectra
- 5.2 Understand spectro photometer
 - 5.2.1 Enlist essential parts of spectro photometer
 - 5.2.2 Draw working diagram of spectro-photometer
 - 5.2.3 Explain the working of spectro-photometer
 - 5.2.4 Explain construction and working of UV-spectro photometer
 - 5.2.5 Explain construction and working of IR-spectro photometer
 - 5.2.6 Application of spectro photometry.

6 FLAME PHOTOMETRY

- 6.1 Understand flame photometry
 - 6.1.1 Define flame photometry
 - 6.1.2 Give applications of flame photometry
 - 6.1.3 Enlist essential parts of flame photometer.
 - 6.1.4 Explain construction and working of a commercial flame photometer

7 REFRACTOMETRY

- 7.1 Refractometry
 - 7.1.1 Explain refraction of light
 - 7.1.2 Explain refractive index
 - 7.1.3 Explain the effect of temperature on refractive index
 - 7.1.4 Define refractometry
 - 7.1.5 Give applications of refractometry
 - 7.1.6 Explain the construction and working of Abbe's refractometer
 - 7.1.7 Explain the construction and working of fisher s refractometer

8 POLARIMETRY

- 9.1 Polarimetry
 - 8.1.1 Define plane polarized light
 - 8.1.2 Define optical active material and optical activity

- 8.1.3 Define levo rotatory material and dextro rotatory material
- 8.1.4 Give examples of optical active materials
- 8.1.5 Calculate specific rotation by using the formula $[\alpha] = 100\alpha$
- 8.1.6 Draw working diagram of polarimeter
- 8.1.7 Enlist parts of a polarimeter
- 8.1.8 Explain the function of different parts of polarimeter
- 8.1.9 Applications of polarimetry.

9 GAS CHROMATOGRAPHY

- 9.1 Gas chromatography
 - 9.1.1 Define gas chromatography
 - 9.1.2 Explain principle of gas chromatography
 - 9.1.3 Draw working diagram of gas.
 - 9.1.4 Chromatograph.
 - 9.1.5 Enlist essential parts of gas chromatograph.
 - 9.1.6 Enlist different detectors used
 - 9.1.7 Explain the construction and working of detectors
 - (a) Conductivity detector
 - (b) Thermal conductivity detector
 - (c) Flame ignition detector
 - (d) Density box detector

10 POTENTIOMETRY

- 10.1 Potentiometry
 - 10.1.1 Define Potentiometry
 - 10.1.2 Explain electrode potential
 - 10.1.3 Explain e.m.f. of a cell
 - 10.1.4 Calculate e.m.f. of a cell
- 10.2 Differentiate between indicating electrode and reference electrode
 - 10.2.1 Enlist different reference electrodes
 - 10.2.2 Explain the construction and working of
 - (a) Hydrogen electrode
 - (b) Glass electrode
 - (c) Calomal electrode
 - (d) Antimony electrode

11 PH-VALUE AND BUFFER SOLUTION

- 11.1 PH-Valve
 - 11.1.1 Define PH-Valve
 - 11.1.2 Define POH-Volve
 - 11.1.3 Enlist applications of PH-measurement
- 11.2 Buffer solution
 - 11.2.1 Define Buffer solution
 - 11.2.2 Give properties of Buffer solution
 - 11.2.3 Explain Buffer capacity Buffering valve
 - 11.2.4 Explain dilution valve
 - 11.2.5 Explain the preparation of standard Buffer solution
- 11.3 Measurement of PH-Value
 - 11.3.1 Explain colorimetric determination of PH-Valve
 - (a) PH-paper method
 - (b) Indicator method

(c) Pocket comparator method

11.3.2 Explain the construction and working of direct reading PH-meter.

12

ELECTROLYSIS

- 12.1 Define Electrolyte
- 12.2 Define Electrolysis
- 12.3 Give applications of electrolysis
- 12.4 Draw a sketch to show the essential parts of Electrolytic analyzer
- 12.5 Explain the reaction at anode
- 12.6 Explain the reaction at cathode
- 12.7 Explain the procedure of separation of metals by electrolysis
- 12.8 Explain Faradays laws of electrolysis
- 12.8 Calculate the amount of material deposited by electrolysis(1st law based)
- 12.10 Calculate the chemical equivalent of given material by electrolytic method(2nd law based)

13

CONDUCTOMETRY

- 13.1 Define Resistance and conductivity
- 13.2 Define specific resistance
- 13.3 Define specific conductance equivalent conductance and molecular conductance
- 13.4 Give the units of resistance and conductance
- 13.5 Explain the construction of conductivity cell
- 13.6 Calculate cell constant
- 13.7 Explain the construction and working of conductivity bridge
- 13.8 Describe the measurement of conductivity and its applications.

CHT 304 INSTRUMENTAL METHODS OF ANALYSIS.

LIST OF PRACTICALS.

192 Hrs.

1. Study of reflection, refraction, dispersion of light./
2. Determination of Ammonia in water by Nessler reagent in colorimetry.
3. Determination of chlorine in water by visual colorimeter.
4. Determination of concentration of CuSO_4 sample by visual colorimeter.
5. Determination the absorbance of transmittance for different concentration of colored solution by spectrophotometer.
6. Study the effect of wave length on the absorption of light by colored solution.
7. Draw a concentration and absorption curve for colored solutions.
8. Colorimetric determination of Nickel with Dimethyloxime (Nephelometry).
9. Determination of PO_4 and SO_4 contents by using Nephelometer./
10. Determination of Manganese in steel by using spectrophotometer 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.
 - i. Pocket comparator method.
 - ii. PH meter (Direct reading).
 - iii. COD and BOD Test
 - iv. Water TDS Test
19. Perform plating of a protective metal by electroplating techniques.
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.

ChT-334 CHEMICAL PROCESS INDUSTRIES-II

T	P	C
3	3	4

LEARNING OUTCOMES

Students will be able to:

1. Understand important manufacturing process employed by chemical Industries.
2. Describe equipment's necessary to carry out chemical process on industrial scale.
3. Explain process flow sheet diagram.
4. Understand local Chemical industry from the view point of statistics of production and location in Pakistan
5. Perform experiments related to Advance Chemical Process Industries

Course Contents Hours

(Part A)

1.	OILS AND FATS	09
1.1.	Vegetable oils. (name origin and uses)	
1.2.	Lin seed 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 / Cotton seed oil	
1.6.	Flow sheet unit operations involved Solvent extraction methods	
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, Unit operations and unit process involved	
1.13.	List of important ghee industries in Pakistan	
2.	GLASS AND CERAMICS	03
2.1.	Glass and ceramics types	
2.2.	Glass manufacturing	
2.3.	Uses	
3.	SOAP	09
3.1.	Soap chemical formula, 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 diagram.	
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.	Enlist Soap industries in Pakistan.	
4.	PHARMACEUTICAL INDUSTRIES	07
4.1.	Important pharmaceutical industries in Pakistan	
4.2.	Sections of pharmaceutical industry	
4.3.	Manufacture of glycerin as by spent lye	
4.4.	Flow sheet, Unit operations and unit process involved.	
4.5.	Uses of Glycerin.	
5.	DETERGENT, SURFACTANTS	10
5.1.	Classification of surfactant (Anionics, Cationics, Nonionic, Amphoteric)	
5.2.	Formulation of Detergents.	
5.3.	Builders and Additives.	
5.4.	Biodegradability of surfactant	
5.5.	Manufacture of detergent (ABS)	
5.6.	Flow sheet, Unit operations and unit processes.	
5.7.	Washing action of soap & detergent	
6.	PULP AND PAPER INDUSTRY	10
6.1.	Raw materials. Preparation of Raw materials.	
6.2.	Types of pulps (mechanical, chemical pulp)	
6.3.	Kraft pulping/sulphate pulping	
6.4.	Flow sheet, Unit operations and energy requirements.	
6.5.	Recovery of Black liquor from Kraft Pulping	
6.6.	Soda pulping.	
6.7.	Sulphite pulping.	
6.8.	Flow sheet, Unit operations and energy requirements.	
6.9.	Recovery of Black liquor.	
6.10.	Comparison of the three pulps.	
6.11.	Manufacture of paper.	
6.12.	Beating, refining and filling of pulp	
6.13.	Conical refiner of a Jordan engine.	
6.14.	Fourdrinier machine for paper manufacture.	
6.15.	Cylinder machine for heavy paper / card board manufacture	
6.16.	Tissue paper machine.	
6.17.	Uses	

(Part B)

7.	SUGAR AND GLUCOSE INDUSTRY	09
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7.1.	Raw materials.	
7.2.	Manufacture of cane sugar.	
7.3.	Flow sheet, Unit operations and unit processes.	
7.4.	Manufacture of Beet Sugar.	
7.5.	Flow sheet, Unit operations and unit processes.	
7.6.	By products of Sugar industries and their uses.	
7.7.	Glucose manufacturing.	
7.8.	Enlist important Sugar Industries in Pakistan.	
8.	FOOD INDUSTRIES	09
8.1.	Important food industries in Pakistan	
8.2.	Industrial Alcohol uses.	
8.3.	Manufacture of industrial alcohol by fermentation.	
8.4.	Flow sheet, Unit operations and unit processes involved.	
8.5.	Preparation of Absolute alcohol from industrial alcohol.	
8.6.	Preparation of Acetone and Butanol from molasses	
8.7.	Flow sheet unit operations and unit processes.	
8.8.	Preparation of citric acid and acetic acid from molasses	
8.9.	Flow sheet unit operations and unit processes.	
8.10.	Milk processing and Milk Powder production	
9.	SYNTHETIC FIBER	09
9.1.	Classification, general properties and Uses.	
9.2.	Manufacture of polyester fiber.	
9.3.	Flow sheet, Unit operations and Unit processes.	
9.4.	Manufacture of Nylon-6 fiber from benzene	
9.5.	Flow sheet, Unit operations and Unit processes.	
10.	NUCLEAR INDUSTRIES	11
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/separation techniques of isotopes	
10.9.	Protection from radio activity.	
10.10.	Disposal of nuclear waste.	
10.11.	Explain enrichment techniques of radio-active element	
11.	PAINTS AND VARNISHES	05
11.1.	Define paint, pigment and varnishes.	
11.2.	Solvents.	
11.3.	Types of pigments and their colors.	
11.4.	Constituents of paints	
11.5.	Paint formulation and its manufacture.	

11.6. Paint industries in Pakistan.

12. TEXTILE INDUSTRIES

05

- 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 industries

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. GLASS AND CERAMICS.

- 2.1. Define glass
- 2.2. Enlist types of glass
- 2.3. Explain manufacturing process of Borosilicate glass
- 2.4. Enlist Unit operation and process involved in manufacturing process of Borosilicate glass
- 2.5. Industrial application of glass
- 2.6. Define ceramics
- 2.7. Enlist classification of ceramics
- 2.8. Enlist uses of ceramics

3. 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.
- 3.9 Soap with moisturizing cream

4. PHARMACEUTICAL INDUSTRIES.

- 4.1 Define Pharmacy
- 4.2 Importance of pharmaceutical industry
- 4.3 Enlist pharmaceutical industry in Pakistan
- 4.4 scope
- 4.5 Define Glycerin.
- 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. FOOD INDUSTRIES.

- 8.1 Importance, scope and list of food industries
- 8.2 Define fermentation.
- 8.3 Enlist fermenting agents.
- 8.4 Name the products of "Molasses" after fermentation.
- 8.5 Explain the manufacture of industrial alcohol by fermentation.
- 8.6 Describe the manufacture of absolute alcohol from industrial alcohol
- 8.7 Explain the manufacture of acetic acid, citric acid and acetone.
- 8.8 Draw a flow sheet diagram for each one of the above.
- 8.9 Enlist the unit operations and processes involved in the manufacture of acetic acid, citric acid.
- 8.10 Explain the energy requirement for food industry
- 8.11 Explain the uses of industrial alcohol, acetic and citric acid.
- 8.12 Processing of juice by fermentation.
- 8.13 Description of milk processing steps
- 8.14 Production of powdered milk

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.
- 9.8 PTA and other types of polyester raw materials

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.
- 11.7 Enlist the characteristics of good paint
- 11.8 Enlist Types of paints
- 11.9 Enlist uses of different type of paints
- 11.10 Enlist the characteristics of good varnish
- 11.11 Enlist ingredients of varnish
- 11.12 Types of vanish
- 11.13 Enlist important 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.
- 12.5 Enlist unit operation process involved in textile industry.
- 12.5 Process of dyes.
- 12.6 Textile waste treatment.

LIST OF PRACTICALS

96 HRS.

(One Practical Period Per Week)

1. Determination of Free fatty acids of vegetable oils/Fats.
2. Determination of column index of oil/fats by tintometer.
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 saponification value of Oil/Fat.
7. Vitamin test for Ghee.
8. Determination of oil and grease
9. Extraction of oil by Soxhlet apparatus.
10. Preparation of soyabean oil in the laboratory.
11. Preparation of Medicated Soap.
12. Preparation of Shampoo.
13. Preparation of Detergents.
14. Recycling of waste paper.
15. Fermentation of items used in bakery.
16. Preparation of food drinks/squashes etc.
17. Preparation of Stearic Acid in the laboratory.
18. Animations of Process industries
19. Determination of milk adulteration
20. Chemicals industries visit to observe manufacturing process.

ChT-345 UNIT OPERATIONS-II

T	P	C
3	6	5

LEARNING OUTCOMES

1. Recall the fundamental principles and terminology related to various industrial processes such as crystallization, centrifugation, filtration, drying, size reduction, distillation, extraction, absorption, and humidity control
2. Explain the principles of crystallization including super-saturation, nucleation, and the classification of crystallization techniques.
3. Describe the construction, working principles, and applications of major industrial equipment such as centrifuges, filters, dryers, crushers, distillation columns, extractors, absorbers, and cooling towers.
4. Perform experiments related to Unit Operation – II course content.
5. To apply principles of unit operations in the laboratory work
6. Chemical production equipment related to these operations.

No.	COURSE OUTLINE	HOURS
1.	INTRODUCTION TO HEAT TRANSFER	12
	1.1 Modes of Heat Transfer, Fourier Law	
	1.2 Thermal Conductivity, Pipe Insulation	
	1.3 Film Coefficient	
	1.4 Factors Affecting Heat Transfer Coefficient	
	1.5 Introduction of Latent Heat and Sensible Heat and the Difference Between Them	
	1.6 Heat Exchanger	
	1.7 Classification of Heat Exchange Equipment	
	1.8 Double Pipe Heat Exchanger, Shell and Tube Heat Exchanger	
	1.9 Floating Head Heat Exchangers	
	1.10 Plate and Frame Heat Exchangers	
2.	EVAPORATION	10
	2.1 Basic Principles of Evaporation	
	2.2 Types of Evaporators	
	2.3 Construction and Operation of	
	i) Short Tube Evaporator	
	ii) Long Tube Vertical Evaporator	
	2.4 Forced Circulation Upward Flow (Climbing Film) Evaporator	
	2.5 Construction and Working of Falling Film Evaporators	
	2.6 Evaporator Accessories	
	2.7 Multiple Evaporators	

No.	COURSE OUTLINE	HOURS
	2.8 Principle Economy and Capacity 2.9 Effect of Boiling Point Elevation 2.10 Methods of Feeding 2.11 Removal of Non-Condensed Gases 2.12 Removal of Condensates, Salt Removal 2.13 Define Condenser & Enlist Its Types 2.14 Steam Ejector & Its Use in Evaporation	
3.	EVAPORATOR PROBLEMS	4
	3.1 Scale Formation and Its Removal 3.2 Steam Table and Their Use, Choice of Steam Pressure 3.3 Troubleshooting in the Operations of Evaporators, Remedies 3.4 Define Fouling / Scaling and Understand Their Types 3.5 Types of Steam Used in Process Industry and Their Properties from Steam Table 3.6 Types of Steam Condensate	
4.	CHEMICAL REACTORS	4
	4.1 Types of Reactors 4.2 Introduction to Continuous Stirred Tank Reactor (CSTR) 4.3 Introduction to Plug Flow Reactor (PFR) 4.4 Applications of CSTR and PFR in Chemical Industry	
5.	CRYSTALLIZATION	10
	5.1 Principle of Crystallization 5.2 Super-saturation, Nucleation 5.3 Miscellaneous Crystallization Techniques 5.4 Classification of Crystallization 5.5 Crystallization, Agitated Batch Crystallization 5.6 Swenson Walker Crystallizer 5.7 Vacuum Crystallizer, Vacuum Crystallizer with Recirculation, Crystal Crystallizer 5.8 Crystallizer Produces Large Crystals 5.9 Product Movement and Handling (PMH)	
6.	DRYING	9
	6.1 Bound, Unbound and Free Moisture, Equilibrium Moisture Content 6.2 Classification of Dryers 6.3 Compartment and Tunnel Dryers	

No.	COURSE OUTLINE	HOURS
	6.4 Rotary Dryer (Construction and Working)	
	6.5 Festoon Dryer	
	6.6 Factors Affecting Rate of Drying	
7.	DISTILLATION	18
	7.1 Theory of Distillation	
	7.2 Raoult's Law, Relative Volatility	
	7.3 Henry's Law, Constant Boiling Mixtures	
	7.4 Differential Distillation	
	7.5 Equilibrium Distillation	
	7.6 Rectification and Vacuum Distillation	
	7.7 Bubble Cap Fractionating Columns	
	7.8 Fractionating Column Calculations	
	7.9 Types of Trays: Bubble Cap	
	7.10 Sieve Trays, Flexitrays, Disc and Doughnut Trays	
	7.11 Types of Downcomers	
	7.12 Towers Operating Conditions	
	7.13 Types of Feed, Effect of Feed Temperature, Reflux Ratio	
	7.14 Tower Operating Troubles	
	7.15 Overloading, Flooding, Entrainment	
	7.16 Coring, Weeping, Improper Reflux Rate	
	7.17 Steam Distillation, Extractive Distillation	
	7.18 Azeotropic Distillation, Petroleum Distillation	
	7.19 Refinery Visits	
8.	EXTRACTION	9
	8.1 Extraction, Classification of Extraction Equipments	
	8.2 Continuous Diffusion Batteries	
	8.3 The Dorr's Agitator, Dorr Thickener	
	8.4 Counter Current Decantation System	
	8.5 Counter Current Extraction with Filters	
	8.6 Liquid Extraction Towers	
	8.7 Baffle Plate Towers, Spray Towers, Pulse Towers, Agitated Operation Towers	
9.	ABSORPTION	9
	9.1 Definition and Types of Absorption	
	9.2 Theory of Gas Absorption	
	9.3 Construction and Working of Gas Absorber	
	9.4 Types and Properties of Packings	

No.	COURSE OUTLINE	HOURS
10.	HUMIDITY	12
	10.1 Introduction, Construction and Working of Air Fin Fan Cooler (AFC)	
	10.2 Humidity, Relative and Percentage Humidity	
	10.3 Humid Heat, Saturated of Humid Volume	
	10.4 Dew Point, Wet Bulb Temperature	
	10.5 Use of Humidity Chart	
	10.6 Humidification Methods	
	10.7 Construction and Operating Principles of Cooling Towers	
	10.8 Atmospheric Draft Cooling Towers	
	10.9 Mechanical Draft Cooling Towers	

TEXT AND REFERENCE BOOKS:

1. Badger, W. L., & Banchero, J. T. (2021). *Introduction to chemical engineering* (3rd ed.). McGraw-Hill Education.
2. Perry, J. H. (Ed.). (2023). *Chemical engineering handbook* (9th ed.). McGraw-Hill Education.
3. Coulson, J. M., & Richardson, J. F. (2017). *Chemical engineering, volume 2: Particle technology and separation processes* (5th ed.). Elsevier.

INSTRUCTIONAL OBJECTIVES.

1. UNDERSTAND MODES OF HEAT TRANSFER

- 1.1. Define heat.
- 1.2. Enlist modes of heat transfer.
- 1.3. Explain conduction.
- 1.4. Explain convection.
- 1.5. Explain radiation.
- 1.6. Give examples of the three modes of heat transfer.

2. MAKE CALCULATIONS RELATED TO CONDUCTION

- 2.1. State Fourier's law of heat conduction.
- 2.2. Give mathematical form of Fourier's law.
- 2.3. Explain thermal conductivity.
- 2.4. Give units of thermal conductivity.
- 2.5. Explain the effect of thermal conductivity.
- 2.6. Develop a formula to calculate heat flow through compound resistance in flat wall.
- 2.7. Develop a formula to calculate heat flow through cylindrical wall.
- 2.8. Calculate heat loss through a flat furnace wall.
- 2.9. Calculate heat loss through a cylindrical furnace wall.
- 2.10. Calculate the thickness of the insulation layer on a hot pipe

3. MAKE CALCULATIONS RELATED TO CONVECTION

- 3.1. State Newton's law of heat convection
- 3.2. Explain film coefficients
- 3.3. Give the factors affecting overall heat transfer co-efficient

4. UNDERSTAND TEMPERATURE DROP IN FLOWING FLUIDS

- 4.1. Differentiate between co-current flow and counter-current flow
- 4.2. Calculate temperature in parallel flow
- 4.3. Calculate temperature drop in counter-current flows
- 4.4. Calculate mean temperature difference
- 4.5. Calculate log mean temperature difference

5. MAKE CALCULATIONS RELATED TO THE CONDUCTION

- 5.1. State Stefan Boltzmann's law of heat radiation
- 5.2. Explain the black body.
- 5.3. Explain the grey body.
- 5.4. Calculate the heat transfer by radiation.

6. UNDERSTAND HEAT TRANSFER EQUIPMENT

- 6.1. Define heater.
- 6.2. Define heat exchanger.
- 6.3. Give the classification of heat exchangers.
- 6.4. Explain the construction and working of the pipe heat exchanger.
- 6.5. Explain the construction and working of a tubular (shell and tube) heat exchanger.

- 6.6. Explain the construction and working of the floating head heat exchanger.
- 6.7. Explain the finned tube's heater.

7. UNDERSTAND DIFFERENT TYPES OF EVAPORATORS

- 7.1. Define evaporation
- 7.2. Enlist types of evaporators
- 7.3. Explain the construction and working of the horizontal tube evaporator
- 7.4. Explain the construction and working of the short tube evaporator.
- 7.5. Explain the construction and working of long tubes evaporator
- 7.6. Explain the construction and working of the climbing film evaporator.
- 7.7. Explain the construction and working of the falling film evaporator.

8. UNDERSTAND EVAPORATOR ACCESSORIES

- 8.1. Define evaporator accessories
- 8.2. Enlist evaporator accessories
- 8.3. Enlist different types of condensers
- 8.4. Explain the working of a contact condenser
- 8.5. Explain the construction and working of a steam ejector
- 8.6. Explain the construction and working of an entrainment separator

9. UNDERSTAND MULTIPLE EFFECT EVAPORATOR

- 9.1. Explain the basic principle of multiple-effect evaporation
- 9.2. Explain the construction and working of a triple effect evaporator
- 9.3. Enlist the methods of feeding
- 9.4. Explain the forward feeding method
- 9.5. Explain the backward feeding method
- 9.6. Explain the mixed feeding method
- 9.7. Explain the economy and capacity of a multiple-effect evaporator

10. MAKE CALCULATIONS RELATED TO EVAPORATOR

- 10.1. Explain the use of steam table
- 10.2. Calculate the amount of steam required for evaporating a given feed to a desired concentration in a single-effect evaporator

11. UNDERSTAND THE PROBLEMS OF EVAPORATORS

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

12. CHEMICAL REACTORS

- 12.1. Define types of chemical reactors.
- 12.2. Explain the CSTR operation principles.
- 12.3. Describe the PFR characteristics.
- 12.4. Compare CSTR and PFR functionalities.
- 12.5. Identify applications of CSTR in industry.
- 12.6. Identify applications of PFR in industry.
- 12.7. Summarize advantages of CSTR and PFR.
- 12.8. Recognize key differences between CSTR and PFR.

13. CRYSTALLIZATION

- 13.1. Crystallization
- 13.2. Define crystallization.
- 13.3. Give the importance of crystallization.
- 13.4. Enlist the types of crystals.
- 13.5. Give the crystal forms.
- 13.6. Explain the principle of crystallization.
- 13.7. Explain super-saturation.
- 13.8. Explain Nucleation.
- 13.9. Enlist crystallization techniques.
- 13.10. Explain different crystallization techniques.
 - 13.10.1. Crystallizers
 - 13.10.2. Give classification of crystallizers.
 - 13.10.3. Explain construction and working of
 - 13.10.4. Tank crystallizer
 - 13.10.5. Agitated batch crystallizer
 - 13.10.6. Swenson walker crystallizer
 - 13.10.7. Vacuum crystallizer
 - 13.10.8. Vacuum crystallizer with recirculation
 - 13.10.9. Krystal crystallizer
 - 13.10.10. Crystallizer to produce large crystal.
- 13.11. Application of Crystallization in sugar industry.

14. DRYING

- 14.1. Drying
- 14.2. Define drying
- 14.3. Define bound, unbound and free water
- 14.4. Explain equilibrium moisture content
- 14.5. Explain drying rate
- 14.6. Enlist factors affecting rate of drying
- 14.7. Draw drying rate curve
- 14.8. Dryers
- 14.9. Define dryer
- 14.10. Give the classification of dryers
- 14.11. Explain the construction and working of
 - 14.11.1. Compartment dryer
 - 14.11.2. Tunnel dryer
 - 14.11.3. Rotary dryer
 - 14.11.4. Festoon dryer
- 14.12. Applications of drying.

15. DISTILLATION

- 15.1. Distillation
 - 15.1.1. Define distillation
 - 15.1.2. Explain theory of distillation
 - 15.1.3. Explain Raoults law
 - 15.1.4. Explain Henry's law
 - 15.1.5. Explain relative volatility
- 15.2. Types of distillation
 - 15.2.1. Enlist types of distillation
 - 15.2.2. Define differential distillation

- 15.2.3. Define equilibrium distillation
- 15.2.4. Define rectification
- 15.2.5. Define vacuum distillation
- 15.2.6. Explain steam distillation
- 15.2.7. Explain extractive distillation
- 15.2.8. Explain Azeotropic distillation
- 15.3. Give examples of constant boiling mixtures
- 15.4. Explain petroleum distillation
- 15.5. Rectifying Columns
- 15.6. Explain the construction and working of
 - 15.6.1. Packed column
 - 15.6.2. Sieve plate column
 - 15.6.3. Bubble cap column
- 15.7. Enlist the types of trays
 - 15.7.1. Explain the merits of each type of tray
 - 15.7.2. Explain the types of down comers.
- 15.8. Fractionating column calculation
- 15.9. Make heat balance
- 15.10. Make material balance
- 15.11. Make plate to plate calculations by using Mc Cabe-Thiele method
- 15.12. Tower's operating conditions
 - 15.12.1. Enlist the factors which affect the tower's operating conditions
 - 15.12.2. Explain the effect of pressure and vacuum
 - 15.12.3. Explain the effect of tower top temp
 - 15.12.4. Explain the effect of reboiler temp
 - 15.12.5. Explain the effect of feed temp
 - 15.12.6. Explain the effect of reflux ratio
- 15.13. Tower operating troubles
 - 15.13.1. Explain over loading and flooding
 - 15.13.2. Explain entrainment.
 - 15.13.3. Explain weeping.
 - 15.13.4. Explain the effect of improper reflux rate

16. EXTRACTION

- 16.1. Extraction
 - 16.1.1. Define extraction
 - 16.1.2. Give the examples of solid liquid extraction
 - 16.1.3. Give the examples of liquid-liquid extraction
- 16.2. Extraction equipment's
 - 16.2.1. Give the classification of extraction equipment's
 - 16.2.2. Explain the oil seed extraction plant
 - 16.2.3. Explain the construction and working of
 - 16.2.4. Continuous diffusion batteries.
 - 16.2.5. Dorr s agitator
 - 16.2.6. Dorr s thickener
 - 16.2.7. Explain counter current decantation system
 - 16.2.8. Explain counter current extraction with filters
 - 16.2.9. Explain the construction and working of liquid-liquid extraction towers like:
 - 16.2.10. Baffle plate tower

- 16.2.11. Spray tower
 - 16.2.12. Pulse tower
 - 16.2.13. Agitated extraction tower
- 16.3. Explain the construction and working of the centrifuge type extractor
- 17. ABSORPTION**
 - 17.1. Absorption
 - 17.2. Explain theory of gas absorption
 - 17.3. Explain the construction and working of gas absorber
 - 17.4. Give the types of packing materials
 - 17.5. Enlist the properties of packing materials
 - 17.6. Carbonated water manufacture.
- 18. HUMIDITY**
 - 18.1. Humidity
 - 18.1.1. State air-water vapour contact theory
 - 18.1.2. Define humidity
 - 18.1.3. Give mathematical form of relative humidity
 - 18.1.4. Give formula for percentage humidity
 - 18.1.5. Define humid heat and humid volume
 - 18.1.6. Explain dew point
 - 18.1.7. Differentiate between dry bulb and wet bulb
 - 18.1.8. Temperature
 - 18.1.9. Use humidity chart to calculate different terms
 - 18.2. Humidification methods
 - 18.2.1. Define humidification
 - 18.2.2. Enlist humidification methods
 - 18.2.3. Explain humidification methods
- 19. COOLING TOWERS**
 - 19.1. Enlist types of cooling towers
 - 19.2. Explain construction and working of atmospheric draft cooling tower
 - 19.3. Explain construction and working of mechanical draft cooling towers.

LIST OF PRACTICALS

192 Hrs.

HEAT TRANSFER

1. Measure the temperature difference across an insulated pipe to calculate heat loss.
2. Determine the thermal conductivity of common materials using an apparatus (e.g., rods in boiling water).
3. Calculation of log mean temperature difference (LMTD) using heat exchanger for co current and counter current flow
4. Observe the rate of cooling of water in open air and calculate the heat transfer rate.
5. Conduct an experiment to compare heat transfer by conduction, convection, and radiation using three setups (e.g., metal rod, water, and hot plate).
6. Investigate the effect of surface area on heat transfer by measuring temperature changes on objects with different shapes in hot water.
7. Determine the heat losses from a steam pipe and observe the effect of lagging
8. Study the temperature change in a water bath to observe convective heat transfer.
9. Calculate the heat loss from a hot plate by measuring temperature over time.
10. Compare the efficiency of different types of insulators by wrapping hot water containers and measuring heat loss.
11. Conduct an experiment to observe the boiling point elevation of water by adding salt.
12. Measure the rate of evaporation of water in open air and discuss factors affecting evaporation.
13. Determination of rate of drying for a fibrous, and granular material

REACTION ENGINEERING

14. Mix vinegar and baking soda and measure the gas produced to observe reaction kinetics.
15. Conduct an acid-base titration to observe the endpoint and calculate the concentration of an unknown solution.
16. Observe the effect of temperature on the rate of a reaction using colored solutions (e.g., food dye and bleach).
17. Observe the crystallization of sugar from a saturated solution over time.
18. Study the effect of temperature, concentration and agitation on crystallization

MASS TRANSFER

19. Set up a extraction experiment using coffee grounds and hot water to observe solubility.
20. Measure the humidity of air using a hygrometer (e.g., wet and dry bulb thermometer).
21. Conduct an experiment on the drying rate of different materials using a oven or dehydrator.
22. Study the construction and working principle of an absorption column
23. Study the working and construction of bubble cap fractionating column
24. Separation of a binary mixture by fractional distillation in a bubble cap distillation tower
25. Perform a distillation of a saltwater solution to observe phase separation.
26. Study the absorption of CO₂ by water in a closed container and measure the pH change.
27. Determine the effect of temperature on the solubility of sugar in water by preparing solutions at different temperatures.
28. Study the principle of extraction by using solvent extractor
29. Investigate the effects of agitation on the extraction process by using a setup with varying stirring speeds.
30. Observe the difference in humidity levels in a closed container with and without a wet sponge

ChT-353 PROCESS INSTRUMENTATION AND CONTROL.

T	P	C
2	3	3

OBJECTIVES:-

- 1 Demonstrate understanding of temperature, pressure, flow sensors, and transducers.
- 2 Explain the mechanisms of various control instruments utilized in different chemical industries.
- 3 Describe the function and operation of control instruments used to manage diverse process variables.
- 4 Gain insight into the operations conducted within the control room of a chemical plant.

No.	COURSE OUTLINE	HOURS
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- | | | |
|-----------|--|-----------|
| 1. | INTRODUCTION | 04 |
| | 1.1 Importance of Process Instrumentation in Chemical Industry | |
| | 1.2 How Measurements Are Made | |
| | 1.3 Introduction to Important Process Variables | |
| | 1.4 Temperature, Pressure, Flow, and Level | |
| 2. | BASIC PRINCIPLES INVOLVED IN PROCESS INSTRUMENTATION | 06 |
| | 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 | 08 |
| | 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 | |
| | 3.10 PT-100 Temperature Element | |
| 4. | PRESSURE MEASURING INSTRUMENTS | 10 |
| | 4.1 U-tube Manometer | |
| | 4.2 Inclined Manometer | |

No.	COURSE OUTLINE	HOURS
	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	10
	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 5.9 Coriolis Flow Meter 5.10 Turbine Flow Meter	
6.	LIQUID LEVEL MEASURING INSTRUMENTS	08
	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	

No.	COURSE OUTLINE	HOURS
7.	CONTROL VALVES	10
	7.1 Control Valves	
	7.2 Types of Control Valves	
	7.3 Plant Air	
	7.4 Instrument Air	
	7.5 Control Valve Air Opening Table	
	7.6 Troubleshooting in Control Valves	
	7.7 Control Loops	
8.	CONTROL ROOM OF A CHEMICAL PLANT	08
	8.1 Parameter for Control in a Plant	
	8.2 Flow Controller Indicators	
	8.3 Level Indicator Controller	
	8.4 Temperature Indicator Controller	
	8.5 Pressure Indicator Controller	
	8.6 P.L.C.	
	8.7 Industrial Applications of P.L.C	
	8.8 SCADA System	
	8.9 Industrial Applications of SCADA System	
	8.10 DCS System	
	8.11 Types of DCS	
	8.12 Parameters of DCS	
	8.13 Troubleshooting of DCS	
	8.14 Role of DAE Chemical Graduate in DCS / Control Room	

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

INSTRUCTIONAL OBJECTIVES:

1. INTRODUCTION

- 1.1 Define the Importance of Process Instrumentation & Control in Chemical Industry.
- 1.2 Define How Measurements Are Made.
- 1.3 Introduction to Important Process Variables.
- 1.4 Define Temperature.
- 1.5 Define Pressure.
- 1.6 Define Flow.
- 1.7 Define Level.

2. PRINCIPLES INVOLVED IN PROCESS INSTRUMENTATION

- 2.1 Define Pascal's Law.
- 2.2 Explain Bernoulli's Theorem.
- 2.3 Define Hook's Law.
- 2.4 Define Thermoelectric Effects.
- 2.5 What is Wheatstone Bridge Circuit?
- 2.6 Give an Industrial Example of Wheatstone Bridge Circuit.
- 2.7 Define Capacitance.
- 2.8 Define Resistance.
- 2.9 Define Inductance.

3. TEMPERATURE MEASURING INSTRUMENTS

- 3.1 Define Temperature.
- 3.2 Define Thermometers.
- 3.3 Explain Liquid-filled Thermometer.
- 3.4 Explain Hg-filled Thermometer.
- 3.5 Explain Bi-metallic Thermometers.
- 3.6 Explain Pressure Spring Thermometers.
- 3.7 Define Resistance Thermometers.
- 3.8 Define Thermocouples.
- 3.9 Enlist Types of Thermocouples.
- 3.10 Define Temperature Transmitter.
- 3.11 Enlist Types of Temperature Transmitters Used in Process Plants.
- 3.12 Differentiate Between Pneumatic & Electronic Temperature Transmitters.
- 3.13 Define Pyrometers (Optical Radiation).
- 3.14 Write Industrial Applications of Pyrometers.
- 3.15 Define PT-100 Temperature Element.

4. PRESSURE MEASURING INSTRUMENTS

- 4.1 Define Manometer.

- 4.2 Enlist Types of Manometer.
- 4.3 Define U-tube Manometer.
- 4.4 Define Inclined Manometer.
- 4.5 Define Well Type Manometer.
- 4.6 Define Inverted Bell Type Manometer.
- 4.7 What is Bourdon Tube Gauge?
- 4.8 Define Spiral Gauge.
- 4.9 Define Helix.
- 4.10 Define Bellows.
- 4.11 What are Pressure Transmitters?
- 4.12 Enlist Different Types of Pressure Transmitters Used in Industries.
- 4.13 Define Pneumatic Pressure Transmitters.
- 4.14 What is a Transducer?
- 4.15 Explain Various Types of Transducers.
- 4.16 Define Electrical Transducer.
- 4.17 Define Mechanical Transducer.
- 4.18 Define the Pirani Gauge.
- 4.19 What are Load Cells?
- 4.20 Define Differential Pressure Transmitter (DPT).

5. FLOW MEASURING INSTRUMENTS

- 5.1 Understanding Flow Measurement.
- 5.2 Enlist Various Types of Flow Measurement Techniques.
- 5.3 Define Head Meters.
- 5.4 Define Orifice Meter.
- 5.5 Define Venturi Meter.
- 5.6 What are Flow Nozzles?
- 5.7 Define Variable Area Meters (Rota Meters).
- 5.8 Define Magnetic Flow Meters.
- 5.9 Explain Open Channel Flow Measuring Instruments.
- 5.10 Explain Advanced Flow Measurement Instruments or Devices Used in Industries & Plants.
- 5.11 What is a Transducer & Flow Sensor Devices?
- 5.12 What is a Coriolis Flow Meter?
- 5.13 Define Turbine Flow Meter.

6. LIQUID LEVEL MEASURING INSTRUMENTS

- 6.1 What is Level Measurement?
- 6.2 What are Direct Liquid Level Measuring Instruments?
- 6.3 Enlist Various Types of Liquid Level Measurement Instruments.
- 6.4 Define Bob and Tape.
- 6.5 Define Sight Glass.

- 6.6 Define Floats.
- 6.7 Explain Probe Type Level Detector.
- 6.8 What are Indirect Liquid Level Measuring Instruments?
- 6.9 Define Pressure Gauge.
- 6.10 Define Purge or Bubbler Systems.
- 7. CONTROL VALVES**
 - 7.1 Define Control Valves.
 - 7.2 Enlist Various Types of Control Valves.
 - 7.3 Explain Control Valve Air Opening Table.
 - 7.4 Troubleshooting in Control Valves.
 - 7.5 What is Plant Air?
 - 7.6 What is Instrument Air?
 - 7.7 Define Control Loops.
- 8. CONTROL ROOM OF A CHEMICAL PLANT**
 - 8.1 What is a Control Room in Industries & Plants?
 - 8.2 What Parameters are Controlled in a Process Plant Control Room?
 - 8.3 Explain the Importance of Control Room for Continuous Process Plants.
 - 8.4 Define Flow Controller Indicators.
 - 8.5 Define Level Indicator Controller.
 - 8.6 Define Temperature Indicator Controller.
 - 8.7 Define Pressure Indicator Controller.
 - 8.8 What is P.L.C.?
 - 8.9 Enlist Industrial Applications of P.L.C.
 - 8.10 What is SCADA System?
 - 8.11 Explain Industrial Applications of SCADA System.
 - 8.12 What is DCS System?
 - 8.13 Explain Different Types of DCS Systems Used in Process Plants.
 - 8.14 What Troubleshooting Occurred at DCS?
 - 8.15 Role of DAE Chemical Graduate in DCS / Control Room.

List OF PRACTICALS :**96 Hrs.**

1. Illustrate the relationship between applied force and deformation using spring-loaded pressure gauges.
2. Build a Wheatstone Bridge circuit to measure unknown resistances accurately.
3. Compare and contrast different types of thermometers for temperature measurement.
4. Calibrate thermocouples and demonstrate their use in temperature measurement.
5. Use a Bourdon tube pressure gauge to measure pressures of compressed air or liquids in a closed system.
6. Construct and use a U-tube manometer to measure pressures in a pipe or closed vessel.
7. Demonstrate the operation of head meters: orifice, Venturi, and flow nozzles.
8. Use a rotameter to measure the flow rate of water or air through a tube at different valve settings.
9. Measure the flow rate through an orifice plate by calculating the pressure difference across the orifice using a manometer.
10. Build a simple float switch to detect and measure the level of water in a tank.
11. Use a simple capacitive sensor to measure the level of liquid in a container.
12. Organize an industrial visit for practical demonstration of various instrumentation and control equipment and learn about the control room

ChT-362 CHEMICAL TECHNOLOGY PRACTICE.

T	P	C
0	6	2

Total contact hours:

Theory: -	Nil.
Practical	192

OBJECTIVES

1. The students are encouraging 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.

No.	COURSE OUTLINE	HOURS
1.	INTRODUCTION, SIGNIFICANCE IN INDUSTRIES	20
	1.1 Preparation of standard solutions of various normalities of different chemicals.	
2.	VOLUMETRIC ANALYSIS	20
	2.1 Neutralization titration, Redox titration.	
3.	GRAVIMETRIC ANALYSIS	20
	3.1 Use of oven, furnaces, desiccators, etc.	
4.	DETAILED DESCRIPTION REPORT ABOUT THE FOLLOWING CHEMICAL INDUSTRIES	54
	(A) FERTILIZER INDUSTRIES	
	Reforming Section	
	NH ₃ Synthesis	
	Compressor Section	
	NH ₃ Storage	
	HNO ₃ Manufacturing Unit	
	Urea Plant	
	Utility Section	
	Laboratory	
	(B) VEGETABLE GHEE INDUSTRIES	
	H ₂ Gas Plant	
	Refining Section	
	Hardening and Filling Section	
	Laboratory/Lab Techniques	

No.	COURSE OUTLINE	HOURS
	(C) SOAP AND SODIUM Soap and Silicate Manufacturing Units Solvent Extraction Plant	
	(D) INDUSTRIAL GASES CO ₂ Plants O ₂ 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 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, Nonferrous Alloys Analysis 5.5 Specify the Chemicals for Preparation of Standard Solution	28
6.	PROCESS CONTROL 6.1 Development of Process Parameter Indicators and Controllers for Process Equipment. 6.2 Draw Chart PID (Process Instruments Diagram) of Any Process.	25
7.	EQUIPMENT FABRICATION 7.1 Development of Process Equipment 7.2 Any Project of Industrial Importance with the Consultation of Concerned Teacher/HOD and Local Industry. 7.3 Project and Its Report	25

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-371 ENERGY CONSERVATION & ENVIRONMENTAL POLLUTION

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Learning Outcomes

1. Understand energy and energy conservation in industry.
2. To apply his knowledge to conserving energy in chemical industries.
3. Understand pollution, its damage and methods to control.
4. To apply his knowledge to protect the environment.

PART-A: ENERGY CONSERVATION.

No.	COURSE OUTLINE	HOURS
1.	INTRODUCTION TO ENERGY & ENERGY CONSERVATION, SOURCES OF ENERGY	
	1. Introduction to Energy & Energy Conservation, Sources of Energy	03
	1.1 Types of Energy	
	1.2 Sources of Energy	
	1.3 Energy Conservation	
2.	TYPES OF FUELS	02
	2.1 Primary Fuels	
	2.2 Secondary Fuels	
	2.3 Tertiary Fuels	
	2.4 Gaseous Fuels: Incomplete Combustion and Its Effects on Energy Recovery	
3.	SELECTION OF EQUIPMENT FOR PROCESS ENERGY RECOVERY	03
	3.1 Various equipment used for the energy recovery from the process	
4.	ENERGY MANAGEMENT SYSTEMS	02
	4.1 Energy Monitoring	
	4.2 Measuring Instruments and Techniques	
	4.3 Best practices used in the process industry for energy conservation	
5.	HEAT RECOVERY IN PROCESS PLANTS	06
	5.1 Steam Generation	
	5.2 Pre-heating Boiler's Feed Water	
	5.3 Application for Heat Recovery: Economics of Heat Recovery	

PART-B: ENVIRONMENTAL POLLUTION.

No.	COURSE OUTLINE	HOURS
1.	INTRODUCTION	02

No.	COURSE OUTLINE	HOURS
	1.1 Definition, Types of Pollution: Atmospheric Pollution, Land Pollution, Noise Pollution, and Wastewater Pollution	
	1.2 Concept of Sustainability and Sustainable Development Goals	
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, and Damages	
4.	NOISE POLLUTION	02
	4.1 Definition, Sources of Pollution, Controlling Measures, and Its Effects on Human Health	
5.	LAND POLLUTION	02
	5.1 Types, Controlling Techniques, and Damages	
6.	POLLUTION CONTROL	06
	6.1 Latest Stripping Techniques, Elimination Techniques of SO ₂ and NO ₂ , Removal of Organic Compounds, Removal of Sulfur, Precipitation, Adsorption, and Ion-Exchange to Eliminate Formation of CO ₂	

REFERENCES BOOKS.

1. Greene, R., (1982). Process energy conservation. New York : Mc Graw Hill publishing co.
2. Govt. of Pakistan., (1987). Energy education for Pakistan ENERCON 86-H Ministry of planning and development.
3. Giampaolo A., (2006). Gas Turbine Handbook; Principles and Practices. CRC Press.
4. Kveith, F., Goswami, D.Y., (2007). Energy Management and Conservation Handbook. CRC Press.
5. Kveith, F., 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.
7. Dix, H.M., (1981). Environmental pollution Atmosphere, Land, Water and Noise John Wiley and Sons.
8. Mahajan, S.P., (1985). Pollution control in process industries. Tata Mc Graw Hill publishing company.
9. Eckenfelder, W.W. Jr., (2000). Industrial Water Pollution Control. McGraw-Hill higher education
10. Paul, L.B., (2000). Pollution Prevention: Fundamentals and Practice. New York: McGRAW Hill
11. Nicholas, P. C., (2001). Handbook of Pollution Prevention Practices. CRC Press.

CHT 371- ENERGY CONSERVATION & ENVIRONMENTAL POLLUTION.

INSTRUCTIONAL OBJECTIVES.

ENERGY CONSERVATION.

1. INTRODUCTION TO ENERGY, ENERGY CONSERVATION AND SOURCES OF ENERGY

- 1.1 Define Energy and Energy conservation.
- 1.2 Explain all types of Energy
- 1.3 Enlist sources of Energy; -
 - Heat energy
 - Potential energy
 - Electrical energy
 - Solar energy
 - Wind energy
 - Mechanical energy
 - Kinetic energy
 - Chemical energy
 - Hydral energy
 - Geo-Thermal Energy
- 1.4 explain importance of energy conservations
- 1.5 explain common practices of energy conservations

2 UNDERSTAND FUELS AND COMBUSTION PROCESS.

- 2.1 Define solid Liquid and gaseous Fuels.
- 2.2 Enlist types of solid Fuels.
- 2.3 Enlist types of Liquid and gaseous Fuels.
- 2.4 Explain merits of gaseous Fuels, solid and Liquid Fuels.
- 2.5 Define combustion.
- 2.6 Explain the methods of heat recovery by the combustion of Liquid and gaseous Fuels.

3. SELECTION OF EQUIPMENT FOR PROCESS ENERGY RECOVERY.

- 3.1 Enlist Energy Measuring equipment, Energy recovery equipment,
- 3.2 Define Energy recovery equipment, such as Pre-Heater, Economizer, Waste heat boiler, Heat recovery steam generator, Reboiler, Heat Exchanger, evaporator, condenser, steam trap.
- 3.2 Describe working and use of equipment for energy recovery.

4. ENERGY MANAGEMENT SYSTEMS.

- 4.1 Definition
- 4.2 Core components of EMS: monitoring/metering, data analysis, control/automation and Reporting/Insights
- 4.3 Benefits of implementation of EMS: cost savings, environmental sustainability, enhance efficiency, competitiveness.

5. HEAT RECOVERY IN PROCESS PLANTS.

- 5.1 Define process plants.
- 5.2 Enlist various process plants such as glass-plastics, petroleum-sugar etc.
- 5.3 Name methods for heat recovery from such plants.
- 5.4 Describe pre-heating system in steam power plant.
- 5.5 Explain the method of steam production.
- 5.6 Describe per-heating system in steam power plant.
- 5.7 Describe method how heats conserved in such a plant.
- 5.8 Explain the use of heat recovered in others as energy sources.

- 5.9 Explain economic impact, of heat recovery in terms of saving money
- 5.10 Explain the use of multiple effect evaporator and heat saved.
- 5.11 Calculate the energy saved in terms of money.

ENVIRONMENTAL POLLUTION

1 POLLUTION.

- 1.1 Define pollution
- 1.2 Enlist types of pollution such as atmospheric pollution, water pollution, noise pollution and land pollution.
- 1.3 Define sustainability and sustainable development goals (SDGs)
- 1.4 What is role of sustainable development in chemical industry

2. AIR/ATMOSPHERIC POLLUTION

- 2.1 Define atmospheric pollution
- 2.2 Enlist various types of gases present in atmosphere.
- 2.3 Explain methods and equipment for air pollution control.
- 2.4 Explain the damages of atmospheric pollution.

3 WATER POLLUTION

- 3.1 Define water pollution.
- 3.2 Name various water pollutants.
- 3.3 Explain methods and equipment for water pollution control.
- 3.4 Explain the damages of water pollution

4 NOISE POLLUTION

- 4.1 Define noise pollution.
- 4.2 Name sources of noise pollution.
- 4.3 Explain methods and equipment for noise pollution control.
- 4.4 Explain the damages of water pollution.

5 LAND POLLUTION.

- 5.1 Define land pollution.
- 5.2 Enlist types of land pollution.
- 5.3 Explain methods and equipment for land pollution control.
- 5.4 Explain the damages of land pollution

6 POLLUTION CONTROL

- 6.1 Explain how pollution can be controlled by the latest stripping techniques.
- 6.2 Describe the elimination techniques of SO₂ and NO₂'s by chemical methods
- 6.3 Explain the meeting process for the removal of organic compounds which produce harmful gases.
- 6.4 Explain the method of removal of sulfur from gasoline
- 6.5 Explain precipitation, adsorption and Ion-exchange method to overcome environmental pollution
- 6.6 Explain method to eliminate formation of CO₂ during burning of bagasse as a fuel.

ChT-382 INDUSTRIAL STOICHIOMETRY

T	P	C
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COURSE CONTENTS.

HOURS

LEARNING OUTCOMES:-

1. Identify the key units and dimensions in both the English and metric systems, and list basic gas laws such as Boyle's law and Charles's law.
2. Define fundamental terms such as limiting reactant, excess reactant, and mole percent for chemical reactions and gas mixtures.
3. Explain how to convert units between the English and metric systems, and demonstrate calculations based on unit conversions.

COURSE OUTLINE

1.	UNITS AND DIMENSIONS	04
1.1	Definition	
1.2	Conversion of units in English/metric system	
1.3	Calculation based on unit conversion	
2.	BEHAVIOUR OF GAS	12
2.1	Ideal gas laws	
2.2	Boyl's law	
2.3	Charles's law	
2.4	Gas equation	
2.5	Absolute Temperature	
2.6	Absolute Zero	
2.7	Absolute temperature scales	
2.8	Standard conditions	
2.9	Value of gas constant 'R' in different systems	
2.10	Calculation based on gas equation	
2.11	Dalton's law of partial pressure	
2.12	Effects of temperature on gas density	
2.13	Avogadro's number	
2.14	Mole fraction and percent	
2.15	Pressure fraction and percent	
2.16	Mass fraction and percent	
2.17	Volume fraction and percent	
2.18	Mole percent and percent	
2.19	Prove Mole percent = volume percent = pressure percent	
2.20	Calculation based on percentage and fractions for gaseous mixtures	
3.	CHEMICAL EQUATION	10
3.1	Limiting reactant	
3.2	Excess reactant	
3.3	Theoretically required amount of reactant	
3.4	Percent excess of reactant	

3.5	Degree of completion of reaction	
3.6	Percent conversion of reactant	
3.7	Percent yield	
4.	MATERIAL BALANCE	18
4.1	Law of material balance	
4.2	Steps involved in making material balance calculation	
4.3	Tie component	
4.4	Material balance without chemical change	
4.5	Material balance involving chemical change	
5.	ENERGY BALANCE	10
5.1	Energy unit	
5.2	Law of Energy Balance	
5.3	Specific heat at constant volume	
5.4	Specific heat at constant pressure	
5.5	Sensible heat & Latent heat	
5.6	Enthalpy	
6.	THERMO CHEMISTRY	10
6.1	Heat of Reaction	
6.2	Heat of Formation	
6.3	Heat of Combustion	

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- 382 INDUSTRIAL STOICHIOMETRY

INSTRUCTIONAL OBJECTIVES.

1 UNIT AND DIMENSION

- 1.1 Understand unit and dimension
- 1.2 Explain unit and dimension
- 1.3 Enumerate the system of units
- 1.4 Define English system, metric system and S.I system
- 1.5 Explain derived units

2 BEHAVIOUR OF GAS

- 2.1 Understand behavior of gases
- 2.2 Explain facts and observation about gases
- 2.3 Enlist the gas laws
- 2.4 Define ideal gas law
- 2.5 State Boyle's law
- 2.6 State Charles's law
- 2.7 Derive general gas equation
- 2.8 Describe Absolute temperature
- 2.9 Define Absolute Zero
- 2.10 Define Absolute temperature scale
- 2.11 Define the standard conditions of temp pressure (STP or NTP)
- 2.12 Calculate value of R in different system
- 2.13 Solve problems based on gas equation
- 2.14 Effects of temperature on gas density
- 2.15 Explain Dalton's law of partial pressure
- 2.16 Describe Avogadro's number
- 2.17 Explain mole fraction and percent
- 2.18 Illustrate pressure fraction, mass fraction, volume fraction
- 2.19 Prove mole percent=volume percent=pressure percent
- 2.20 Solve problems of gaseous mixture based on %age and fraction

3 CHEMICAL EQUATION

- 3.1 Understand chemical equation
- 3.2 Define limiting reactant
- 3.3 Define excess reactant
- 3.4 Calculate theoretical required amount of reactant
- 3.5 Calculate excess of reactant
- 3.6 Define degree of competition reaction
- 3.7 Describe percent conversion of reaction
- 3.8 Describe percent field
- 3.9 Solve problems based on chemical equation

4 MATERIAL BALANCE

- 4.1 Understand material balance
- 4.2 Enlist the steps involved in making material balance calculation
- 4.3 Define the components
- 4.4 Calculate material balance without chemical change
- 4.5 Calculate material balance involving chemical change

5 ENERGY BALANCE

- 5.1 Understand energy balance
- 5.2 Define energy unit
- 5.3 State law of energy balance
- 5.4 Calculation of specific heat at constant volume and constant pressure
- 5.5 Define Sensible heat & latent heat
- 5.6 Explain enthalpy

6 THERMO CHEMISTRY

- 6.1 Understand thermo chemistry
- 6.2 Define heat of reaction, heat of formation and heat of combustion
- 6.3 State Hess's law of heat summation
- 6.4 Calculate heat of combustion of gases/ fuels

RELEVANT QUALIFICATIONS OF TEACHER / INSTRUCTOR

For Technical Subjects

- i) MSc. / Ph.D degree in disciplines related to Chemical / Petro-Chemical / Polymer (for instructor)
- ii.) B.Sc. Engg. /BS technology degree in Chemical / Petro-Chemical / Polymer with minimum of 1 years Industrial/ Teaching experience in the related field (for instructor)
- iii) DAE in Chemical /Chemical with specialization in sugar/ Petro-Chemical / Polymer with 6-years' Industrial/ Teaching experience in the related field (for junior instructor)

For Subjects pertaining to Humanities / Related Studies /Management/ IT

- i) MA degree in English/ Islamiyat / Pst. with 2 years of teaching experience
- ii) M.Sc degree in IT / Computer Sciences or BE in Computer Engineering with 2-years of teaching experience OR DAE CIT
- iii) M.Sc degree in Mathematics with 2-years of teaching experience
- iv) M.Sc degree in Physics and Chemistry with 2-years of teaching experience
- v) MBA degree with 2-years of teaching experience

POTENTIAL EMPLOYABILITY & JOB OCCUPATIONS

Job Occupations/ Designations

DAE holders in Chemical Technology can pursue various roles, including Process Technicians, Plant Operators, Chemical Plant Supervisors, Refinery Operators, Pipeline Technicians, Production Assistants, Quality Control Assistants, Lab Technicians, Water Treatment Plant Operators, Environmental Technicians, Wastewater Technicians, Production Operators, Dyeing Technicians, Chemical Process Assistants, Safety Technicians, HSE Assistants, and Quality Assurance Technicians.

Sectors/ Areas:-

These roles are spread across industries like chemical processing, ghee, oil and gas, pharmaceuticals, water treatment, food and beverage, sugar, textiles, cement, paints and coatings, fertilizers, alternative energy, plastics, and polymers, with a focus on operating, maintaining, and troubleshooting equipment, as well as ensuring product quality and safety standards.

DETAIL OF CURRICULUM REVIEW COMMITTEE

S. No.	Name & Designation	Qualification	Role
1	Engr. Dr. Asif Nadeem Tabish, Associate Professor Department of Chemical Engineering UET Lahore (New Campus)	PhD Chem. Engg.	Convener
2	Engr. Muhammad Imran Asgar, Chief Instructor / Principal GCT Kamalia	M.Sc Chem. Engg	Member
3	Engr. Muhammad Adnan Faheem, Instructor GCT Multan.	B.Sc Chem. Engg.	Member
4	Dr. Engr. Hafiz Tariq Mahmood Assistant Professor Department of Chemical, Petroleum & Petrochemical, MCUT DG Khan	PhD Chem. Engg.	Member
5	Engr. Suleman Ali Lecturer MNS UET, Multan.	M.Sc Chem. Engg.	Member
6	Mr. Muhammad Hamza Naveed Assistant Technologist Refinery Operations PARCO	DAE Chemical, B-Tech. (Chem.)	Member