



DAE CHEMICAL TECHNOLOGY

(WITH SPECIALIZATION IN SUGAR)

CURRICULUM



REVISED (JUNE 2026)
Curriculum Section, TEVTA

EXECUTIVE SUMMARY

The revised curriculum of DAE Chemical Technology (with Specialization in Sugar), February 2026 has been developed in response to the evolving technological, industrial, and sustainability needs of Pakistan's sugar sector. Sugar remains one of the largest agro-based industries in the country, contributing significantly to employment generation, rural economy, bioenergy production, and allied chemical industries. In view of increasing demands for energy efficiency, environmental compliance, digital transformation, and product quality enhancement, the need for a specialized and modernized technical workforce has become imperative. This revision therefore aims to prepare diploma holders with focused technical competence, digital literacy, and industry-relevant skills tailored specifically to the sugar industry.

The baseline framework for this revision is the DAE Chemical Technology (Revised 2024) curriculum. The specialization has been structured to remain fully aligned with the parent curriculum in terms of academic structure, credit distribution, and competency standards, while introducing targeted enhancements relevant to sugar processing, quality assurance, sustainability, and energy management. This ensures coherence with national technical education standards while strengthening sector-specific expertise.

A major reform in this revision is the comprehensive overhaul of the previous Computer Applications course. It has been replaced with "Introduction to Computing and Applications," which significantly expands the digital competency of students. In addition to foundational tools such as MS Word, Excel, and PowerPoint, the revised course introduces Python programming for basic automation and data handling. Furthermore, recognizing the rapid transformation driven by artificial intelligence, the curriculum now includes practical exposure to Generative AI tools and Large Language Models (LLMs). Students are trained to responsibly utilize AI technologies for generating text, images, audio, and simple video content. This integration reflects the realities of the modern industrial and technological environment, where digital tools and AI-driven decision support systems are increasingly embedded in operations, quality monitoring, documentation, and process optimization.

To strengthen specialization depth, four sugar specific courses have been introduced and refined: Sugar Technology-I, Sugar Technology-II, Quality Control in Sugar Industry, and Energy Conservation & Waste Management. The Quality Control course places specific emphasis on product standards, laboratory analysis, process monitoring, and compliance with industrial quality

benchmarks to enhance competitiveness of Pakistani sugar products. The course Energy Conservation & Environmental Pollution from the baseline curriculum has been revised and expanded into Energy Conservation & Waste Management, with increased credit weightage. This modification reflects the pressing need for sustainable production practices, efficient resource utilization, waste minimization, and environmental stewardship within sugar mills. Besides, more emphasis on the practical in Quantitative Analysis course has been exerted considering the breadth and depth of the course and need in the sugar industry. The revised structure supports alignment with national sustainability goals and global best practices.

Overall, this revision represents a forward-looking, industry-responsive curriculum that balances technical fundamentals with specialization depth, digital transformation, sustainability, and quality assurance. It maintains alignment with the parent DAE Chemical Technology framework while equipping graduates with the competencies required to contribute effectively to Pakistan's sugar industry and its sustainable development.

Convener
Curriculum Revision Committee (CRC)
DAE Chemical Technology (with Sp. in
Sugar)

SCHEME OF STUDIES

DAE Chemical Technology (with Specialization in Sugar), Revised March 2026

1st 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-131	Introduction to Computing and Applications	0	3	1
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
10.	ST-123	Sugar Technology-I	2	3	3
Total			16	24	24

2nd Year	Course No.	Subject	T	P	C
1.	Gen-201	Islamiat / Pakistan Studies – II	1	0	1
2.	TTQ-211/ Civic-211	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-213	Quantitative Analysis	1	6	3
6.	CHT-224	Chemical Process Industries - I	3	3	4
7.	CHT-241	Safety Practices & Procedures	1	0	1
8.	CHT-252	Physical Chemistry	1	3	2
9.	CHT-273	Unit Operations – I	2	3	3
10.	ChT-282	Basic Engineering Thermodynamics	1	3	2
11.	ST- 212	Quality Control in Sugar Industry	1	3	2
Total			16	24	24

3rd 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.	ChT-304	Instrumental Methods of Analysis	2	6	4
4.	ChT-334	Chemical Process Industries – II	3	3	4
5.	ST-343	Sugar Technology-II	2	3	3
6.	ChT 353	Process Instrumentation & Control	2	3	3
7.	ChT-362	Chemical Technology Practice	0	6	2
8.	ST-363	Energy Conservation & Waste Management	2	3	3
9.	Mgm-341	Entrepreneurship	1	0	1
10.	ChT-382	Industrial Stoichiometry	2	0	2
Total			16	24	24

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COURSE DETAILS

YEAR - 1

GEN-111 ISLAMIAT / PAKISTAN STUDIES – I

نی پی سی 1 0 1 کل وقت: 20 گھنٹے	اسلامیات / مطالعہ پاکستان GEN III سہل اول	حصہ اول اسلامیات حصہ دوم مطالعہ پاکستان موضوعات حصہ اول اسلامیات کتاب و سنت
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(ا) قرآن مجید

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

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

(ب) سنت

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

- 1- انما لا اعمال بالنیات
 - 2- اہمیت لایم مکارم الاخلاق
 - 3- لایوم من احدکم حق یحب الاخیرہ ما یحب لنفسہ
 - 4- المسلم من سلم المسلمون من سبہ المسلمون من لسانہ ویدہ
 - 5- فی امنت باللہ سلم استقم
 - 6- حیر کم خیر کم ذالہ
 - 7- سبب المسلم فسوق وقتالہ کفر
 - 8- لعم من احوالمومن
 - 9- کل المسلم عسی المسلم حر لم یبعہ و مالہ وفرقہ
 - 10- ایۃ المنلق ثلاث اذا حدیث کذب و قاتل و تمن خان و اناؤ فنا خلف
- دین اسلام

2.1 بنیاد کے بنیادی مقصد کی وضاحت اور انسان کی اخروی و اوقائی زندگی پر ان کے اثرات

- 1- توحید
- 2- رسالت
- 3- آخرت
- 4- ملاکہ
- 5- اسلاف کتب

2.2 عبادات

1- نماز 2- روزہ 3- حج 4- زکوٰۃ

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

تدریسی مقاصد

۱۔ قرآن مجید

- عمومی مقصد: طالب علم یہ سمجھنے کے قابل ہو کہ اسلام کی تعلیمت کا اصل سرچشمہ قرآن مجید ہے
 خصوصی مقصد: طالب علم اس قابل ہو جائے گا کہ
- ۱۔ قرآن مجید کی تعریف کر سکے
 - ۲۔ قرآن مجید کے نزول کی صورت بیان کر سکے
 - ۳۔ قرآن مجید کی آئی وائی سورتوں کی پہچان کر سکے
 - ۴۔ منتخب آیات کا ترجمہ و تشریح کر سکے
- عمومی مقصد: یہ سمجھنے کے قابل ہو جائے گا کہ منتخب قرآنی آیات کے ذریعے اسلامی تعلیمات کا مفہوم کیا ہے
 قرآنی آیات کا ترجمہ و تشریح کر سکے
- ۱۔ قرآنی تعلیمت کی روشنی میں اپنی اور معاشرتی اصلاح کر سکے

۲۔ سنت

- عمومی مقصد: طالب علم سنت نبوی کی اہمیت اور ضرورت کو اچھی طرح سمجھنے کے قابل ہو جائے گا
 خصوصی مقصد:
- ۱۔ سنت کی تعریف بیان کر سکے
 - ۲۔ سنت کی اہمیت و ضرورت کی وضاحت کر سکے
 - ۳۔ سنت کی روشنی میں اسوہ حسنہ پر عمل کر سکے
- ۳۔ منتخب احادیث پر عمل

- عمومی مقصد: احادیث کی روشنی میں اخلاقی اقدار سے سکھای حاصل کر سکے
 خصوصی مقصد: احادیث کا ترجمہ و تشریح کر سکے
 رسول اللہ ﷺ کے اسوہ حسنہ کا، پیرو، کا مفہوم سمجھ سکے

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

انجیر مسلم طلباء کے لئے

GEN III

نصاب امتلاقیات سائنس نول

حصہ دوم مطالعہ پاکستان

کے بی کے

1 0 1

کل وقت - 20 گھنٹے

موضوعات

املاقیات کی تعریف اور اہمیت

املاقیات کا معیار (کاؤن: شکل، الجی: تپ)

مندرجہ ذیل اظہار کی وضاحت

☆ دولت، ارش

☆ وقہ داری

☆ نظم و ضبط

☆ راست گوئی

☆ صبر و استقامت

☆ حوصلہ مندی

☆ وقت کی پابندی

☆ صفائی

☆ اعتماد

☆ باہمی احترام

☆ مصلحت

نصاب اخلاقیات (اسلن لائن)

تدریسی مقاصد

عمومی مقاصد: اعلیٰ اخلاق کی وجہ سے ملکی ترقی میں کمال قدر حصہ کر سکے

خصوصی مقاصد: طالب اس علم سے اس تہل ہو گا کہ

- ۱۶ موضوعات کا مطلب بیان کر سکے
- ۱۷ عملی زندگی سے مشابہت کی نشاندہی کر سکے
- ۱۸ اپنی شخصیت اور معاشرے پر موضوعات کے مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے
- ۱۹ وراثت داری کی اہمیت بیان کر سکے
- ۲۰ وفا داری کی اہمیت بیان کر سکے
- ۲۱ لقم و ضبط کی افلاہیت بیان کر سکے
- ۲۲ صدق بیان کی ضرورت بیان کر سکے
- ۲۳ حوصلہ مندی کے فوائد بیان کر سکے
- ۲۴ وقت کی پابندی کے فوائد بیان کر سکے
- ۲۵ صفائی اور باہمی اختیار سے حسن کلر کوگی کو بیان کر سکے
- ۲۶ مصلحت کے فوائد بیان کر سکے

نصاب: اسلن لائن (Gen III)

حصہ دوم مباحثہ پاکستان کل وقت 2 گھنٹے

موضوعات

- ۱۷ حصہ دوم: مسلمان قوم میں آزادی فکر کی تاریخ مسلمانوں میں سیاسی آزادی کی اہمیت اور ضرورت - ذاتی و جسمانی غلامی کے تعلقات
- ۱۸ نظریہ پاکستان
- ۱۹ قیام پاکستان کی اساس (دین اسلام) قیام پاکستان کی غرض، غایت نظریہ پاکستان کی وضاحت - نظریہ پاکستان اور مردم
- ۲۰ اقبل اور قائد اعظم کے ارشادات کی مدد سے
- ۲۱ نظریہ پاکستان کا تاریخی پسو
- ۲۲ محمد بن قاسم کی آمد، مجدد مملکت علی اور شہد المی اللہ کی تباہی عدالت سید احمد شہید کی تحریک کلہرین
- ۲۳ قیامی تحریک
- ۲۴ علی گڑھ - تحریک اصلاح - (پروفیسر - مدرسہ لکھنؤ) - (مدرسہ) اسلامیہ کلہرین (پروفیسر) - (مدرسہ) اسلامیہ کلہرین (پروفیسر) - (مدرسہ) اسلامیہ کلہرین (پروفیسر)

مطالعہ پاکستان (حصہ دوم)

مدرسہ مقاصد

حریت فکر:

عمومی مقصد

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

خصوصی مقاصد

۱۵۱ حریت فکر کا معنی و مفہوم بیان کر سکے

۱۵۲ آزادی فکر کی اہمیت بیان کر سکے

۱۵۳ خصوصاً "اسلام میں آزادی" اظہار رائے کی اہمیت بیان کر سکے

۱۵۴ ذہنی غلامی کے قومی سطح پر نقصانات کے بیان کر سکے

۱۵۵ بدسلکی غلامی قومی سطح پر نقصانات بیان کر سکے

نظریہ پاکستان

عمومی مقصد:

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

خصوصی مقاصد:

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

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

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

نظریہ پاکستان کا تاریخی پسو

عمومی مقصد

۱۵۹ نظریہ پاکستان کے تاریخی پس منظر سے واقفیت حاصل کر سکے

خصوصی مقاصد:

۱۶۰ محمد بن قاسم کے بارے میں بیان کر سکے

- ۶۵ محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکے
- ۶۶ محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکے
- ۶۷ بیان کر سکے کہ ہندوستان میں ہندو مسلم دو قومی نظریہ کا کنٹھ آغاز کیا ہے
- ۶۸ محمد لطف خاں کی ملی خدمات بیان کر سکے
- ۶۹ شہد ولی اللہ کی علمی خدمات بیان کر سکے
- ۷۰ محمد لطف خاں اور شہد ولی اللہ نے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکے

علمی تحریکیں

علمی مقصد

- ۷۱ ہر عصر کی علمی تحریکوں سے آگاہی حاصل کر سکے
- ۷۲ خصوصاً مقصد:
- ۷۳ ملی مرکز - دیوبند - تحریک العلماء و مدرستہ السلام، اسلامیہ کالج - انجمن حنیفہ اسلام کے تعلیم کے ذریعہ سیاسی شعور مسلمانوں میں پیدا کیا اسے بیان کر سکے
- ۷۴ 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/ PECTA 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 |
| 5.1 | Translation from Urdu into English. | 6 hours |
| | For Foreign Students: A paragraph or a dialogue. | |

RECOMMENDED BOOKS

1. Technical English developed by Mr. Zia Sarwar, Mr. Habib-ur –Rehman, Evaluated by Mr.Zafar Iqbal Khokhar, Mr. Zahid 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

Theory 96

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

5 RESOLVE A SINGLE 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, adjoint and inverse of a matrix.
- 12.4 State properties of determinants.
- 12.5 Explain basic concepts.
- 12.6 Explain algebra of matrices.
- 12.7 Solve linear equation by matrices.
- 12.8 Explain the solution of a determinant.
- 12.9 Use Crammer's Rule for solving linear equations

Phy-113 APPLIED PHYSICS

Total contact hours

Theory	64	T	P	C
Practical	96	2	3	3

AIMS: The students will be able to understand the fundamental principles and 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 center of curvature
24. Find focal length of concave mirror by object and image method
25. Find focal length of concave mirror with converging lens
26. Find 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-131 INTRODUCTION TO COMPUTING AND APPLICATIONS

Total contact hours

Theory	0	T	P	C
Practical	96	0	3	1

Learning Outcomes

1. Explain basic computer hardware and software concepts and perform essential system and application-level tasks.
2. Create, edit, and manage documents, spreadsheets, and presentations using MS Word, Excel, and PowerPoint for professional communication.
3. Write and execute basic Python programs using variables, control structures, functions, data structures, and file handling.
4. Generate and interpret digital content using Generative AI tools, including text, images, audio, and simple videos.
5. Apply computing, programming, and AI skills to solve practical tasks relevant to office, academic, and digital environments

LIST OF PRACTICALS

1. Computer hardware and software (6 hours)

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.

2 MS Word (12 hours)

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 and use document default structure styles.
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.

3 MS Excel (12 hours)

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.

4 MS PowerPoint (12 hours)

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.
- 5 Python Basics (36 hours)**
 23. Write a simple Python program to display "Hello, World!" on the screen.
 24. Perform basic arithmetic operations (addition, subtraction, multiplication, division) using Python.
 25. Use variables and data types (integer, float, string, Boolean) in Python programs.
 26. Write a program to take user input and display the result.
 27. Apply conditional statements (if, if-else, elif) to solve simple problems.
 28. Use loops (for, while) to perform repeated operations.
 29. Work with lists and dictionaries (create, access, update elements).
 30. Write a program using functions (define, call, return values).
 31. Perform file handling in Python (create, read, write text files).
 32. Create simple data visualizations (bar chart, line chart) using matplotlib.
- 6 Generative Artificial Intelligence (AI) Basics (18 hours)**
 33. Explore the Generative AI and Large Language Models (LLMs): concepts, applications
 34. Use a Large Language Model (LLM) for text generation by creating summaries, stories, or explanations.
 35. Generate images from text prompts using an AI image generation tool.
 36. Generate short audio clips from text using a text-to-speech AI tool.
 37. Generate simple AI-based videos from text prompts using an online video generation tool.
 38. Develop a Python program for a sugar technology application using a generative AI tool and submit the source code, generated outputs in the form of a report.

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 equipment.	
3.3	Introduction to Mass transfer equipment.	
3.4	Introduction to auxiliary equipment and list of auxiliary equipment.	
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 equipment.	

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 equipment
 - 3.2.1 Heat transfer equipment
 - 3.2.2 Mass transfer equipment
 - 3.2.3 Auxiliary equipment
- 3.3 Standard symbols for major processing equipment

4.0 UNITS AND DIMENSIONS

- 4.1 Physical quantities and their classification

- 4.1.1 Define primary quantity and secondary quantity
 - 4.1.2 Give examples of primary quantities and secondary quantities
- 4.2 System of Measurements
 - 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 aluminum	
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 Equipment for Diagrams
- 7.2 Uses
- 7.3 Draw Symbol of Major & Widely Used Process Equipment

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 Equipment 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 Software
- 11.4 Tutorial on process Flow sheeting

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.

ST-123 SUGAR TECHNOLOGY-I

Total contact hours	T	P	C
Th. Hrs.= 64, Pract. Hrs. = 96	2	3	3

Learning outcomes

Students will be able to:

1. Define and explain key concepts and terminologies related to sugar industry.
2. Explain unit operations and processes involved in the sugar industry.
3. Explain the principles of crystallization including super-saturation, nucleation, and the classification of crystallization techniques.
4. Perform experiments related to Sugar Technology-I.

No.	COURSE OUTLINE	HOURS
1.	Introduction to Carbohydrates	08
	1.1 Glucose	
	1.2 Sucrose, Fructose	
	1.3 Sources of Sugars (Milk sugar, cane sugar, beet sugar, fruit sugar)	
	1.4 Extraction from sources	
	1.4.1 Cane sugar	
	1.4.2 Chemistry of cane sugar	
	1.4.3 Inversion of sugar, destruction of reducing sugar, types of inversion	
	1.4.4 Beet roots (introduction, growth and extraction)	
	1.5 Importance of Carbohydrates	
2.	Composition of cane sugar	12
	2.1 Water – free and bound, fiber, pith	
	2.2 Sucrose and other sweeteners (Glucose, fructose & raffinose)	
	2.3 Salts (Calcium, Potassium, Magnesium, Iron, Sodium, Chloride)	
	2.4 Organic acids (citric acid, silicic acid, aconitic acid, oxalic acid, maleic acid, Glycine, alanine, leucine)	
	2.5 Organic non sugars (proteins, starch, gums, waxes, lipids colloids)	
	2.6 Inorganic non sugars (Sulphate, carbonate, silica, phosphate, colloids)	
	2.7 Coloring matters (Chlorophyll, anthocyanin, xanthophyll, carotene, tannin)	
	2.8 Composition of sugar beet juice	
	2.9 Composition in different forms of cane sugar:	
	2.9.1 Raw sugar	
	2.9.2 Brown sugar	
	2.9.3 Refined sugar	

No.	COURSE OUTLINE	HOURS
3.	Analysis of sugar	10
	3.1 Physical properties of sucrose	
	3.1.1 Solubility	
	3.1.2 Structure	
	3.1.3 Optical rotation	
	3.1.4 Specific rotation	
	3.1.5 Refractive index	
	3.1.6 Density / specific gravity	
	3.1.7 Melting point	
	3.2 Chemical properties of sucrose	
	3.2.1 Action of heat on sucrose solution	
	3.2.2 Action of dilute acids on sucrose solutions	
	3.2.3 Action of concentrated acids on sucrose solutions	
	3.2.4 Action of yeast and enzymes on sucrose solutions	
	3.2.5 Action of bacteria on sucrose solutions	
	3.2.6 Action of milk of lime on sucrose solutions	
	3.3 Derivation and analysis of sucrose	
	3.4 Crystal Properties in analysis of sugar	
	3.5 Relationship between brix and POL	
	3.6 Explain Boiling and freezing point	
	3.7 Hygroscopicity	
	3.8 Effects of PH on sucrose stability	
	3.9 Environmental and biological reaction on sucrose solution	
	3.10 Hydrolysis of sucrose and decomposition of sucrose	
4.	Sugar Industry of Pakistan	06
	4.1 Status of worldwide sugar production	
	4.2 Sugar industry of Pakistan	
	4.3 Plant location and capacity	
	4.4 Future demand	
5.	Production from sugar cane	12
	5.1 Block flow diagram	
	5.2 Process flow diagram/chart	
	5.3 Description of process flow diagram	
	5.4 By products and wastes	
	5.5 Energy requirements of sugar industry	
	5.6 Production of sugar from beet roots (flow diagrams)	
	5.7 Refining and polishing	
6.	Major Unit Operations	16
	6.1 Cane handling	

No.	COURSE OUTLINE	HOURS
	6.2 Cane Preparation	
	6.3 Cane feeding	
	6.4 Juice extraction and bagasse separation	
	6.5 Screening	
	6.6 Cane juice clarification	
	6.7 Juice settling	
	6.8 Juice concentration (Evaporation)	
	6.9 Sugar crystallization	
	6.9.1 Grain Crystallization and refining crystallization	
	6.10 Centrifugation	
	6.11 Melting of raw sugar	
	6.12 Refining of raw sugar	
	6.13 Drying of sugar	
	6.14 Deep bed/pressure filtration	
	6.15 Grading of sugar	
	6.16 Packing of sugar	

BOOKS RECOMMENDED:

1. Shreve's Chemical Process Industries, George T. Austin (based on the original work by R. Norris Shreve), McGraw-Hill, **5th Edition**, 1984.
2. Kent and Riegel's Handbook of Industrial Chemistry and Biotechnology, James A. Kent, Springer, **11th Edition**, 2007.
3. The Organic Chemistry of Sugars, Daniel E. Levy and Péter Fügedi, Taylor & Francis (CRC Press), **1st Edition**, 2006.
4. Sugar Technology-I approved by academic wing TEVTA Lahore.

ST-123 SUGAR TECHNOLOGY-I

INSTRUCTIONAL OBJECTIVES

1. UNDERSTANDING INTRODUCTION TO CARBOHYDRATES

- 1.1 Define glucose.
- 1.2 Differentiate between sucrose and fructose.
- 1.3 Identify the major sources of sugars including milk sugar, cane sugar, beet sugar, and fruit sugar.
- 1.4 Explain the methods of sugar extraction from natural sources.
 - 1.4.1 Describe the extraction process of cane sugar.
 - 1.4.2 Explain the chemistry of cane sugar.
 - 1.4.3 Explain the inversion of sugar, destruction of reducing sugars, and the types of sugar inversion.
 - 1.4.4 Describe the introduction, growth, and extraction of sugar from beet roots.
- 1.5 Explain the nutritional and industrial importance of carbohydrates.

2. UNDERSTANDING THE COMPOSITION OF CANE SUGAR

- 2.1 Describe the free water, bound water, fiber, and pith present in sugarcane.
- 2.2 Identify the sucrose and other sweeteners present in sugarcane.
- 2.3 Explain the role of salts present in sugarcane.
- 2.4 Describe the organic acids present in sugarcane.
- 2.5 Explain the organic non-sugars present in sugarcane.
- 2.6 Explain the inorganic non-sugars present in sugarcane.
- 2.7 Identify the coloring matter present in sugarcane.
- 2.8 Describe the composition of sugar beet juice.
- 2.9 Compare the composition of different forms of cane sugar.
 - 2.9.1 Describe the composition and characteristics of raw sugar.
 - 2.9.2 Describe the composition and characteristics of brown sugar.
 - 2.9.3 Describe the composition and characteristics of refined sugar.

3. UNDERSTANDING THE ANALYSIS OF SUGAR

- 3.1 Describe the physical properties of sucrose.
 - 3.1.1 Explain the solubility of sucrose.
 - 3.1.2 Describe the molecular structure of sucrose.
 - 3.1.3 Explain the optical rotation of sucrose.
 - 3.1.4 Explain the specific rotation of sucrose.
 - 3.1.5 Describe the refractive index of sucrose.
 - 3.1.6 Explain the density and specific gravity of sucrose.
 - 3.1.7 Determine the melting point of sucrose.
- 3.2 Describe the chemical properties of sucrose.
 - 3.2.1 Explain the effect of heat on sucrose solutions.
 - 3.2.2 Explain the action of dilute acids on sucrose solutions.
 - 3.2.3 Explain the action of concentrated acids on sucrose solutions.
 - 3.2.4 Explain the action of yeast and enzymes on sucrose solutions.
 - 3.2.5 Explain the action of bacteria on sucrose solutions.
 - 3.2.6 Explain the action of milk of lime on sucrose solutions.
- 3.3 Explain the derivation and analytical methods of sucrose.
- 3.4 Describe the crystal properties used in sugar analysis.
- 3.5 Explain the relationship between °Brix and POL.

- 3.6 Explain the boiling and freezing points of sucrose solutions.
- 3.7 Explain the hygroscopic nature of sugar.
- 3.8 Describe the effect of pH on sucrose stability.
- 3.9 Explain the environmental and biological reactions affecting sucrose solutions.
- 3.10 Explain the hydrolysis and decomposition of sucrose.

4. UNDERSTANDING THE SUGAR INDUSTRY OF PAKISTAN

- 4.1 Describe the status of worldwide sugar production.
- 4.2 Explain the current status of the sugar industry in Pakistan.
- 4.3 Describe the factors influencing sugar plant location and production capacity.
- 4.4 Explain the future demand and growth prospects of the sugar industry.

5. UNDERSTANDING SUGAR PRODUCTION FROM SUGARCANE

- 5.1 Interpret the block flow diagram of a sugar manufacturing process.
- 5.2 Interpret the process flow diagram of a sugar manufacturing plant.
- 5.3 Explain the process flow diagram of sugar production.
- 5.4 Identify the by-products and wastes generated during sugar production.
- 5.5 Describe the energy requirements of the sugar industry.
- 5.6 Explain the process of sugar production from beet roots using flow diagrams.
- 5.7 Describe the refining and polishing of sugar.

6. UNDERSTANDING THE MAJOR UNIT OPERATIONS OF THE SUGAR INDUSTRY

- 6.1 Describe the cane handling operation.
- 6.2 Explain the methods of cane preparation.
- 6.3 Describe the cane feeding operation.
- 6.4 Explain the process of juice extraction and bagasse separation.
- 6.5 Describe the screening operation used in sugar processing.
- 6.6 Explain the process of cane juice clarification.
- 6.7 Describe the juice settling process.
- 6.8 Explain the concentration of juice by evaporation.
- 6.9 Explain the process of sugar crystallization.
- 6.9.1 Differentiate between grain crystallization and refining crystallization.
- 6.10 Explain the centrifugation process in sugar manufacturing.
- 6.11 Describe the melting process of raw sugar.
- 6.12 Explain the refining process of raw sugar.
- 6.13 Describe the drying process of sugar.
- 6.14 Explain the deep bed and pressure filtration processes.
- 6.15 Describe the grading of sugar based on quality specifications.
- 6.16 Explain the packing methods used for finished sugar.

ST-123 SUGAR TECHNOLOGY-I

LIST OF PRACTICALS.

96 Hrs.

1. Draw the process flow diagram of a sugar manufacturing process using a hand sketch and submit the completed process flow diagram.
2. Extract sugarcane juice using crushing rolls and report the average yield.
3. Determine the solubility of sugar at room temperature and submit a report of the measured solubility.
4. Determine the melting point of sugar and report the measured melting temperature.
5. Develop a model of a sugar plant and submit the completed plant model with its description.
6. Determine the variation in juice content between freshly cut sugarcane and 8-day-old sugarcane and submit a comparative analysis report.
7. Determine the boiling point of sugar cane juice and report the average measured value
8. Determine the variation in juice pH with time and temperature and submit a report of the observed pH changes.
9. Control the pH of sugarcane juice using milk of lime and report the final stabilized pH value.
10. Determine the grain size distribution of sugar using a sieve shaker and submit the particle size analysis report.
11. Determine the sucrose content of sugarcane juice using specific gravity measurements and report the calculated sucrose concentration.
12. Determine the sucrose content of sugarcane juice using a polarimeter and submit the measured sucrose content report.
13. Determine the °Brix of sugarcane juice using a refractometer and report the measured °Brix value.
14. Determine the moisture content of sugar cane juice using air dryer oven and report the moisture content
15. Determine the sugar cane juice concentration at different moisture content level and report the relationship between concentration and moisture content
16. Visit a sugar industry to observe sugar manufacturing operations and submit an industrial visit report summarizing the observations.

COURSE DETAILS

YEAR - 2

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1 0 1
کل وقت 20 گھنٹے:

GEN201

اسلامیات / مطالعہ پاکستان

نصاب سال دوم

حصہ اول اسلامیات

حصہ دوم مطالعہ پاکستان

موضوعات:

- 1- سورۃ المومنون ایک تا گیارہ آیات کا ترجمہ مع تشریح
- 2- دس منتخب احادیث مع ترجمہ و تشریح
 - () خیر کم من تعلم القرآن و علمہ
 - () لا ایمان لمن لا امانتہ له ولا دین لا من لا اعہد له
 - () و یا کم و الظن ان الظن اکرب الحدیث
 - () من احدث فی امرنا هذا ما لیس منه فہورد
 - () من حمل علینا السلاح فلیس منا
 - () انا و کافل الیتیم فی الجنہ
 - () لا ضرور ولا ضرار فی السلام
 - () کلکم راع و کلکم راع و کلکم مسول عن رعیتہ
- 3- سیرۃ طیبہ
 - () مکی زندگی - ولادت - بعثت - ہجرت
 - () مدنی زندگی - مواخات - میثاق مدینہ - فتح مکہ (سبب و نتائج)
- 4- حضور ﷺ بحیثیت
 - () خطبہ حجۃ الوداع - انسانی حقوق کا اعلامیہ / حقوق انسانی پالیسی 2018
 - () معلم کامل - سربراہ خاندان
- 5- اسلامی معاشرہ
 - () نظام تعلیم اور اس کے مقاصد - عدل و انصاف - امر بالمعروف - نہی عن المنکر - انسانی حقوق کا معاشرتی اور معاشی ترقی میں کردار
 - () جہاد - کسب حلال - مسجد (اہمیت و فضیلت)
- 6- اسلامی ریاست کی تعریف - اسلامی ریاست کی خصوصیات - اسلامی حکومت کے فرائض - اسلامی طرز حکومت -

() 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

- () اسلامی ریاست کے اغراض و مقاصد بیان کر سکے
- () اسلامی ریاست کے قیام کی لیے جدوجہد کر سکے
- () حقوق آگاہی / معلومات تک رسائی کا قانون جان سکے
- () ملازمت پیشہ خواتین کے حقوق کا تحفظ جان سکے اور
- () معاشرے میں خواتین کے حقوق کا تحفظ یقینی بنائے

نصاب مطالعہ پاکستان

ٹی پی سی
1 0 1
کل وقت 12 گھنٹے

سال دوم
حصہ دوم

موضوعات:

- () دو قومی نظریہ
- () تحریک پاکستان
- () انڈین کانگریس
- () مسلم لیگ
- () تقسیم بنگال
- () میٹھا لکھنؤ
- () تحریک خلافت
- () سندھو تحریک
- () تجاویز دہلی
- () نہرو رپورٹ
- () قائد اعظم کے چودہ نکات
- () خطبہ آلہ آباد
- () انتخابات 1938 اور انتقال اقتدار
- () قرارداد پاکستان

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

1 0 1

کل وقت 20 گھنٹے

نصاب اختیارات

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 و 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 / PECTA 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 $\operatorname{cosec} x$, $\sec x$, $\cot x$. | |
| 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 center
- 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	
3.4 Business 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

MGM-222 BUSINESS COMMUNICATION & REPORT WRITING

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

ST-212 QUALITY CONTROL IN SUGAR INDUSTRY

Total contact hours	T	P	C
Th. Hrs.= 32, Pract. Hrs. = 96	1	3	2

Learning outcomes

Students will be able to:

1. Demonstrate basic understanding of Quality Control in Sugar Industry.
2. Perform experiments related to Quality Control in Sugar Industry.

No.	COURSE OUTLINE	HOURS
1.	Introduction to Quality Control	4
	1.1 General concept of quality.	
	1.2 Quality of sugar cane, cane sugar and beet sugar.	
	1.3 Significance of raw sugar quality from refiners' point of view.	
	1.4 Role of basic 4 M's in producing quality products.	
2.	Influence of cane processing on sugar quality	6
	2.1 Influence of cane preparation on juice extraction and composition.	
	2.2 Effect of milling operation on the extraction and quality of Juice	
	2.3 Mill sanitation and its effects on the quality of cane juice.	
	2.4 Influence of filtration on cane juice quality	
	2.5 Influence clarifying agents on quality of clarified juice	
	2.6 Impact of pH and temperature control during liming on quality of clarified juice	
	2.7 Impact of flashing in clarification.	
	2.8 Impact of coagulation and decolorizing agents on the quality precipitate and clarified juice	
	2.9 Effect of crystallization of sucrose on quality of raw and refined sugar.	
3.	Significance of sampling, recording and reporting method	4
	3.1 Factors which determine the sampling procedure.	
	3.2 Purpose for which the inspection is made.	
	3.3 Nature of the testing methods.	
	3.4 Nature of the testing lots being sampled.	
4.	Quality control and standardization of sugar	6
	4.1 Role of ICUMSA in standardization of the quality of sugar.	
	4.2 Specification of various sugar products	
	4.3 Role of Codex Alimentarius for sugar import /export	
	4.4 Impact of color on sugar quality.	
	4.5 Effect of moisture contents of sugar on its storage or shelf life	
5.	Good manufacturing practices	4

No.	COURSE OUTLINE	HOURS
	5.1 Relationship between the quality of food and sanitation. 5.2 Impact of good manufacturing practices on quality of food. 5.3 Impact of contaminated raw material on food quality. 5.4 Influence of contaminated equipment on quality of food 5.5 Effect of unhealthy persons suffering from contagious diseases on the quality and safety of food. 5.6 Role of aseptic processing on the quality assurance aspect of processed food. 5.7 Role of sanitary design equipment on the quality of the product. 5.8 Impact of personal hygiene on the quality of the product. 5.9 Effect of contaminated water used in process foods. 5.10 Proper disposal of left over samples.	
6.	Establishment of ISO -9001-2008,FSSC-ISO-22000:2005	4
	6.1 System of quality purchase 6.2 Application of process control. 6.3 Role of inspection and testing. 6.4 Influence of document control. 6.5 Internal quality auditing. 6.6 Impact of training and servicing. 6.7 Responsibility of the management.	
7.	Need for quality control department	4
	7.1 Organization of quality control Department. 7.2 Responsibilities of quality control Manager. 7.3 Functions of quality control department. 7.4 Significance of training on the efficiency of the worker. 7.5 Influence of latest instrument on the quality of product. 7.6 Impact of poor quality raw material on the quality of final product. 7.7 Concept of total quality management.	

Books Recommended.

1. Hand book of Cane Sugar Technology , Mathur, R,B,L Oxford and IBH Publishing Co Pvt , Ltd, New Delhi.
2. Mechanism of crushing cane by Murray C.K and J.E Holt.
3. Hand book of Cane Sugar Technology by Hugot. E Elsevier Publishing Co. U.S.A.
4. Modern Milling of sugar cane by Maxwell, F. Norman Rodgers, London.

ST-212 Quality Control in Sugar Industry

INSTRUCTIONAL OBJECTIVES

No.	COURSE OUTLINE
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1.	INTRODUCTION TO QUALITY CONTROL
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|--|---|
| | <ul style="list-style-type: none">1.1 Describe General concept of quality.1.2 Define Quality of sugar cane/sugar beet.1.3 Significance of raw sugar quality from refiners' point of view.1.4 Explain Role of basic 4 MS in producing quality products. |
|--|---|

2.	CANE PROCESSING UNIT OPERATIONS
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- | | |
|--|--|
| | <ul style="list-style-type: none">2.1 Describe Influence of cane preparation on juice extraction and composition.2.2 Explain Effect of milling operation on the extraction and quality of Juice2.3 Explain Mill sanitation and its effects on the quality of cane juice.2.4 Explain Influence of improper filtration on cane juice quality2.5 Explain Influence of poor quality of clarifying agents on quality of clarified juice2.6 What Impact of improper pH and temperature control during liming on quality of clarified juice2.7 Explain impact of proper flashing in clarification.2.8 Describe Impact of coagulation and decolorizing agents on the quality precipitate and clarified juice2.9 Explain Effect of improper crystallization of sucrose on quality of raw and refined sugar. |
|--|--|

3.	SIGNIFICANCE OF SAMPLING, RECORDING AND REPORTING METHOD
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- | | |
|--|--|
| | <ul style="list-style-type: none">3.1 Describe which determine the sampling procedure.3.2 What Purpose for which the inspection is made.3.3 Enlist Nature of the testing methods.3.4 Define Nature of the testing lots being sampled. |
|--|--|

4.	QUALITY CONTROL AND STANDARDIZATION OF SUGAR
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- | | |
|--|--|
| | <ul style="list-style-type: none">4.1 Describe Role of ICUMSA in standardization the quality of sugar.4.2 Explain Specification of refined and direct consumption white sugars.4.3 What Role of Codex Alimentarius for sugar import /export4.4 Describe Impact of color on sugar quality.4.5 Define Standards for raw sugar.4.6 Explain Grades of refined sugar.4.7 Describe Effect of moisture % of sugar on its storage or shelf life4.8 Explain Importance of ash contention on sugar quality.4.9 Describe Keeping quality standard of sugar. |
|--|--|

5.	GOOD MANUFACTURING PRACTICES – HASSAP
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- | | |
|--|--|
| | <ul style="list-style-type: none">5.1 Explain Relationship between the quality of food and sanitation. |
|--|--|

No. COURSE OUTLINE

- 5.2 Explain Impact of good manufacturing practices on quality of food.
- 5.3 Explain Impact of contaminated raw material on food quality.
- 5.4 Explain Influence of contaminated equipment on quality of food
- 5.5 Describe Effect of unhealthy persons suffering from contagious diseases on the quality and safety of food.
- 5.6 Explain Role of aseptic processing on the quality assurance aspect of processed food.
- 5.7 Explain Role of sanitary design equipment on the quality of the product.
- 5.8 Explain Impact of personal hygiene on the quality of the product.
- 5.9 Explain Effect of contaminated water used in process foods.
- 5.10 Define Proper disposal of left over samples.

6. ESTABLISHMENT OF ISO -9001-2008,FSSC-ISO-22000:2005

- 6.1 Define System of quality purchase
- 6.2 Enlist Application of process control.
- 6.3 Explain Role of inspection and testing.
- 6.4 Explain Influence of document control.
- 6.5 Explain Internal quality auditing.
- 6.6 Explain Impact of training and servicing.
- 6.7 Explain Responsibility of the management.

7. NEED FOR QUALITY CONTROL DEPARTMENT

- 7.1 Define Organization of quality control Department.
- 7.2 Explain Responsibilities of quality control Manager.
- 7.3 Define Functions of quality control department.
- 7.4 Significance of training on the efficiency of the worker.
- 7.5 Explain Influence of latest instrument on the quality of product.
- 7.6 What Impact of poor quality raw material on the quality of final product.
- 7.7 Describe Concept of total quality management.

LIST OF PRACTICALS

96 HRS.

- 1 Calibrate laboratory equipment used for sugar quality analysis and submit a calibration record for the equipment.
- 2 Determine the purity of raw and refined sugar and report the calculated purity.
- 3 Determine the color of raw and refined sugar and report the observed color value.
- 4 Determine the ash content of sugar by the incineration method and submit a report of the measured ash content.
- 5 Determine the ash content of sugar by the conductometric method and submit a report comparing the measured ash content.
- 6 Determine the safety factor (shelf life) of raw sugar using the prescribed formula and report the calculated safety factor.

$$\text{Safety Factor (SF)} = \frac{\text{Moisture (\% w/w)}}{100 - \text{Pol (\%)}}$$

- 7 Determine the dilution factor of a sugar solution using the prescribed formula and report the calculated dilution factor.

$$\text{Dilution factor} = \frac{\text{water content}}{\text{Non - pol oxides}} 100$$

- 8 Perform the microbiological analysis of raw and refined sugar and submit a report of the microbiological examination results.
- 9 Examine yeast, mold, and bacteria in sugar using the direct microscopic examination method and report the identified microorganisms.
- 10 Test sugar samples for pathogenic bacteria according to the AOAC method and submit a report of the test results.
- 11 Analyze liquid sugar for mesophilic bacteria using the membrane filtration method adopted by ICUMSA and report the bacterial count.
- 12 Perform the bacteriological analysis of refinery sweet water and submit a report of the bacteriological quality.
- 13 Determine the polarization of raw sugar for quality evaluation and report the measured polarization value.
- 14 Determine the moisture content of raw sugar for quality evaluation and report the measured moisture content.
- 15 Determine the total ash content of raw sugar and report the measured ash content.
- 16 Determine the starch content of raw sugar and report the measured starch content.
- 17 Determine the invert sugar content of raw sugar and report the measured invert sugar content.
- 18 Determine the colloidal content of raw sugar and submit a report of the measured colloidal content and its effect on refining properties.

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 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	04
5	AMMONIA 1. Ammonia, uses, economics 2. Manufacture of Ammonia from Natural gas 3. Steam-Natural gas reforming, primary reforming, secondary reforming 4. Shift conversion 5. CO₂ absorption and separation 6. Removal of Carbon monoxide 7. Compression of N₂ and H₂ 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	07
6	AMMONIUM NITRATE AND AMMONIUM SULFATE 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	06

4. Uses of Each fertilizer
5. Ammonium Nitrate storage

(Part - B)

7	UREA	04
	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	
8	PHOSPHATE FERTILIZER	08
	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	
9	PORTLAND CEMENT	11
	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	
10	LIME	05
	1. Lime, formula, uses	
	2. Calcination of limestone, unit operations and unit processes	
	3. Slaked lime manufacturing	
11	GYPSUM	05
	1. Gypsum Formula, uses, processing of Rock	
	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 Reinhol
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 nit process
 - 1.1.3 Distinguish unit operation and unit process
 - 1.1.4 Explain continuous process with examples.
 - 1.1.5 Explain batch process with examples
- 1.2 FLOW CHARTS
 - 1.2.1 Name types of flow charts.
 - 1.2.2 Distinguish between block diagram and symbolic diagram.
 - 1.2.3 Read different flow charts.

2. WATER CONDITIONING& 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 for Hydrogen 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

- 1.1.1. Lime processing
- 1.1.2. Write formula for lime
- 1.1.3. Enlist uses of lime
- 1.1.4. Enlist unit operation involved in lime processing
- 1.1.5. 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-213 QUANTITATIVE ANALYSIS

Total contact hours	T	P	C
Th. Hrs.= 32, Pract. Hrs. = 192	1	6	3

Learning Outcomes

1. Explain the importance of Analytical Chemistry in industrial scale and in daily life as well.
2. Explain various types of analysis techniques and procedures involved at laboratory and industrial scale.
3. Prepare sample and make analysis using various laboratory tools.
4. Perform experiments related to quantitative analysis.
5. Report the analysis results.

No.	COURSE OUTLINE	HOURS
1	INTRODUCTION TO ANALYTICAL CHEMISTRY	2
	1.1 Definition and its importance in daily life and Industrial importance.	
	1.2 Types of analysis, Qualitative analysis, Quantitative analysis, Volumetric analysis, Gravimetric analysis.	
	1.3 Conventional Method of Analysis	
	1.4 Instrumental methods of analysis	
	1.5 Merits & Demerits of Instrumental methods of analysis	
2	SAMPLING	2
	2.1 Sampling techniques for liquid, solid and gas samples.	
	2.2 Storage of sample.	
	2.3 Types of Sampling.	
	2.4 Safety Precaution for Sampling.	
3	ERROR IN ANALYSIS	4
	3.1 Types of Error.	
	3.2 Elimination of Error.	
	3.3 Personal Errors.	
	3.4 Determinate Errors.	
	3.5 Indeterminate Errors.	
	3.6 Precision & Accuracy	
4	ANALYTICAL PROCEDURES	6
	4.1 weighing of sample.	
	4.2 Volume measurement of sample.	

No.	COURSE OUTLINE	HOURS
	4.3 Preparation of sample solution. 4.4 Titration. 4.5 Precipitation. 4.6 Filtration. 4.7 Drying 4.8 Ignition 4.9 Distillation 4.10 International Testing Standard Methods	
5	PREPARATION OF STANDARD SOLUTIONS	6
	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 API GRAVITY	
6	PREPARATION OF INDICATORS	4
	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	4

No.	COURSE OUTLINE	HOURS
	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	2
	8.1 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 analysis of cement.	
9	REPORTING OF ANALYSIS RESULTS	2
	9.1 Percentage.	
	9.2 Gram per liter.	
	9.3 Parts per million (PPM)	
	9.4 Parts per billion (PPM)	

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.

CHT 213 QUANTITATIVE ANALYSIS

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.
- 1.7 Describe Merits & Demerits of 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.
- 2.5 Enlist Safety Precaution for Sampling.

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.
- 3.6 Define Precision & Accuracy

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
- 4.10 Define Distillation

4.11 Describe International Testing Standard Methods

4 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

5 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).

6 VOLUINETERIC 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
Amount/liter = Normality x Equivalent weight.

7 GRAVIMETERIC 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 Cement analysis

8 REPORTING OF ANALYSIS RESULTS

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

CHT 213 QUANTITATIVE ANALYSIS.

LIST OF PRACTICALS.

192 Hours

- 1 Calibrate volumetric glassware and report findings:
 - i. Burette
 - ii. Measuring cylinder
 - iii. Measuring flask
 - iv. Pipette
- 2 Perform accurate mass measurement using an analytical balance.
- 3 Perform mass measurement using a digital balance.
- 4 Prepare a 0.1 N solution of primary standards (Na_2CO_3 and oxalic acid).
- 5 Apply calculation methods to prepare approximately 0.1 N secondary standard solutions (NaOH and H_2SO_4).
- 6 Determine the normality of approximately prepared solutions by titration against standard acids and bases (HCl , H_2SO_4 , NaOH).
- 7 Prepare phenolphthalein indicator solution.
- 8 Prepare methyl orange indicator solution.
- 9 Prepare litmus indicator solution.
- 10 Prepare starch indicator solution.
- 11 Prepare diphenylamine indicator solution.
- 12 Determine the equivalent weight of oxalic acid.
- 13 Determine the concentration of acetic acid in vinegar.
- 14 Determine the alkalinity of soda ash.
- 15 Determine the percentage composition of NaOH and Na_2CO_3 in a binary mixture.
- 16 Prepare approximately M/20 KMnO_4 solution.
- 17 Standardize the M/20 KMnO_4 solution.
- 18 Determine the iron content in an iron wire sample.
- 19 Determine Fe^{2+} and Fe^{3+} ions in an iron salt sample.
- 20 Perform redox titration using an external indicator.
- 21 Perform redox titration using an internal indicator.
- 22 Standardize 0.1 N iodine solution using sodium thiosulfate.
- 23 Standardize sodium thiosulfate solution against a standard iodine solution.
- 24 Determine the antimony content in an antimony salt sample.
- 25 Determine chlorine content in a soluble salt using Volhard's method.
- 26 Estimate chloride content in NaCl using AgNO_3 by Mohr's method.
- 27 Perform gravimetric determination of free moisture and water of crystallization.
- 28 Determine the percentage loss on ignition in cement.
- 29 Determine the percentage of total silica in cement.
- 30 Determine the percentage of insoluble residue in cement.
- 31 Determine the percentage of moisture content in cement.
- 32 Determine the percentage of calcium content in cement.
- 33 Determine the percentage of magnesium content in cement.

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 incidents
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 equipment.
- 7.2.4 Explain origin of the fire.
- 7.2.5 Explain method of fire prevention.
- 7.2.6 Explain the uses of fire extinguishers 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
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1 THERMOCHEMISTRY	06
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- 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
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- 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
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- 3.1 Definition of Photochemistry.

No.	COURSE CONTENTS	Hours
	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 applications
 - 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, Dynamitic 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 8.6 Fine grinders	

No.	COURSE CONTENTS	Hours
	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

COURSE CONTENTS

- | | | |
|-----------|--|---------------|
| 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 | 08 Hrs |
| 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 the 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 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 first Law of thermodynamics and its applications
- 3.2 Define specific heat at constant pressure and volume. Enlist units.
- 3.3 Define second law of thermodynamics and its applications
- 3.4 Define 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, and wet steam, super critical steam
- 4.4 Define & enlist sources of steam generation
- 4.5 Explain the concept of vacuum
- 4.6 What are basic components of the steam cycle?
- 4.7 Explain various components of 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 gas Power cycle.
- 5.5 Explain basic components and function 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 different components of a refrigeration cycle?
- 6.4 Define Chillers and its various components
- 6.5 Applications of refrigerator & of 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

Gen-301 ISLAMIAT / PAKISTAN STUDIES - III

اسلامیات رمطالعہ پاکستان

GEN 301

ٹی پی سی

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کل وقت 20 گھنٹے

نصاب سال سوئم

حصہ اول اسلامیات

حصہ دوم مطالعہ پاکستان

موضوعات:

1۔ قرآن مجید:

سورۃ الفاتحہ، آیت الکرسی، سورۃ البقرہ کی آخری آیات از امن الرسول ﷺ تا آخر اور سورۃ اخلاق مع ترجمہ و تشریح

2۔ دس منتخب احادیث کا ترجمہ (تشریح)

() بنی الاسلام علی خمس شہادت انا لا اله الا الله للمراقلم الصلوٰۃ و ایما الزکوٰۃ و حج البيت و صوم

رمضان

() الدین النصیحتہ

() المنشاء موتمن

() للمومن علی المومن سنت خصال یعود ماذا مرض و تڑھده اذا مات و یحبیه اذا دعا

() لیسلم علیہ اذا لقیہ و لیثمتہ اذا عطس و فصیحلہ اذا غاب او شہد

() لا تخن من خانک

() لا یدخل الجنة قاتع

() ان الله حرم علیکم عقوق المہات و اضاعتہ المال

() لیسر او لا تعسر او لا تنفر

() ذاق طعم الايمان من مرضی باللہ و با الا سلام دینا بمحمد نبیا

() افضل الذکر لا اله الا الله

3۔ حقوق و فرائض:

حصول تعلیم بطور فرض، والدین اور اولاد کے حقوق و فرائض، ہمسایہ کے حقوق، بچوں کے حقوق، عورتوں کے حقوق، بزرگ

شہریوں کے حقوق، محنت افراد کے حقوق۔

4۔ اسلام کی اخلاقی اقدار:

صبر و استقامت، غفور و درگزر، ایفائے عہد، اخوت، ایثار و قربانی۔

سال سوئم

حصہ اول اسلامیات

تدریس مقاصد

قرآن حکیم:

عمومی مقاصد: منتخب سورتوں اور آیات کی روشنی میں اسلام کے بنیادی مقاصد اور عبادات جان سکے
خصوصی مقاصد: طالب علم اس قابل ہو جائے گا کہ۔

سورۃ الفاتحہ، آیت لکڑی، سورۃ بقرہ کی آخری آیات ازمن الرسول سے اور سورۃ اخلاق کا ترجمہ و تشریح کر سکے
طالب علم درج ذیل کا مفہوم بیان کر سکے

() رب العالمین صرف اللہ تعالیٰ ہے

() اللہ رحم کرنے والا ہے

() قیامت کے دن بادشاہی اللہ کی ہوگی

() عبادات اور استغاثت کا حقدار صرف اللہ ہے

() طالب علم درج ذیل کا مفہوم بیان کر سکے

() اللہ پاک ہر عیب سے پاک ہے

() اللہ کے اسمائے حسنہ حق اور قیوم ہیں

() تمام انبیاء پر ایمان لانا ضروری ہے

() رسول، ملائکہ، کتب، سماویہ، پر ایمان لانا فرض ہے

() اطاعت حقیقی صرف اللہ کے لیے ہے

() اسلامی احکامات پر عمل کرنا مسانی بساط میں ہے

() کفر کو اللہ کی مدد کے بغیر شکست نہیں دی جاسکتی

() اللہ ایک ہے

() اللہ کسی کا محتاج نہیں نہ اس کا کوئی شریک ہے

منتخب احادیث:

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

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

نصاب (سال سوئم)

GEN 301

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کل وقت 12 گھنٹے

مطالعہ پاکستان

حصہ دوم

موضوعات:

- () قیام پاکستان
- () باؤنڈری کمیشن
- () ریڈ کلف ایوارڈ
- () تقسیم بنگال
- () تقسیم پنجاب
- () مسئلہ مہاجرین
- () ریاست کا الحاق
- () ریاست جموں کشمیر
- () نہری پانی کا تنازعہ
- () قرارداد پاکستان
- () علماء کے بائیس نکات
- () 1956-1962 اور 1973 کے دساتیر کی اسلامی / انسانی حقوق کی دفعات (8 تا 28)۔
- () اقلیتوں کے حقوق۔ دیگر محروم طبقات کے حقوق
- () پاکستان کا محل وقوع اور اسکی جغرافیائی اہمیت۔ GSP+ کا تعارف اور عملی طریقہ کار
- () قدرتی وسائل (تیل، گیس، کوئلہ)

مطالعہ پاکستان (حصہ دوم)

قیام پاکستان

تدریس مقاصد:

عمومی مقاصد:

() قیام پاکستان کے بعد درپیش مسائل سے آگاہی حاصل کرے اور بیان کرے

خصوصی مقاصد:

() باؤنڈری کمیشن تشکیل اور اس کے فرائض بیان کر سکے

() ریڈ کلف اور اس کے ایوارڈ کے بارے میں بیان کر سکے

() بنگال اور کلکتہ کی تقسیم کی وجوہات بیان کر سکے

() پنجاب کی تقسیم کی تفصیل بیان کر سکے

() مہاجرین کی آمد سے جو مسائل پیدا ہوئے انہیں بیان کر سکے

() ریاستوں کے الحاق کے بارے میں تفصیل بیان کر سکے

() ریاست جموں کشمیر کے بارے میں بیان کر سکے

() نہری پانی کے تنازعہ کو بیان کر سکے

() قرارداد مقاصد کی تفصیلات بیان کر سکے

() 22 علماء کے مستفقہ اسلامی نکات بیان کر سکے

() 1973 کے آئین میں انسانی حقوق کی دفعات (28-8)۔ اقلیتوں کے حقوق اور دیگر محروم طبقات کے حقوق کے بارے میں

جان سکے

() قیام پاکستان کے بعد نفاذ اسلام کی کوششوں کو بیان کر سکے

() پاکستان کے محل وقوع اور اس کی جغرافیائی اہمیت بیان کر سکے اور GSP+ کے تعارف اور عملی طریقہ کار بیان کر سکے

() پاکستان میں قدرتی وسائل (تیل، گیس، کوئلہ) کے بارے میں بیان 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
- () محنت حضرات کے حقوق

غیر مسلم طلباء کے لیے
نصاب اخلاقیات (سال سوئم)

مذریس 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

Total Contact Hours

Theory	32	T	P	C
Practical	0	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
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	ENTREPRENEURSHIP PROJECTS	06
	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 Pakistan.

Mgm – 341 Entrepreneurship

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
- 4.3 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 optically 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 $[\alpha] = 100 \times$
- 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.

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 CuSO₄ 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 PO₄ and SO₄ 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
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/cor-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 gamma 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 colors.
- 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 varnish
- 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.

ST-343 SUGAR TECHNOLOGY-II

Total contact hours	T	P	C
Th. Hrs.= 64, Pract. Hrs. = 96	2	3	3

Learning outcomes

Students will be able to:

1. Recall the fundamental principles and terminology related to sugar industry unit operations.
2. Explain each process involved in the sugar industry emphasizing understanding of process and Information about the cost estimation of sugar plant.
3. Explain the principles of crystallization including super-saturation, nucleation, and the classification of crystallization techniques.
4. Describe the construction, working principles, and applications of major industrial equipment such as Heat Exchangers, Boilers, distillation columns, extractors, absorbers, Evaporators and cooling towers.
5. Perform experiments related to Sugar Technology-II.

No.	COURSE OUTLINE	HOURS
1.	VAPORIZATION	12
	1.1 Vapor Pressure	
	1.2 Vaporization	
	1.3 Effect of pressure on boiling point.	
	1.4 Boiling point under vacuum.	
	1.5 Impact of area available for heat transfer.	
2.	Heat Exchangers in Sugar industry.	18
	2.1 Types of heat exchangers used in sugar industry.	
	2.2 Cooling Towers and their types.	
	2.3 Multiple effect evaporation.	
	2.4 Boiler plant of sugar industry	
3.	Distillery	16
	3.1 Fermentation.	
	3.2 Enlist fermenting agents.	
	3.3 Name the products of "Molasses" after fermentation.	
	3.4 Industrial alcohol by fermentation.	
	3.5 Uses of Alcohol	
4.	Cost analysis of sugar plant.	8
	4.1 Fixed capital Investment	
	4.2 Operating Capital	

No.	COURSE OUTLINE	HOURS
	4.3 Overhead cost	
	4.4 Profit	
	4.5 Cost Index	
	4.6 Direct material cost	
	4.7 Direct labor cost	
6.	Absorption & Extraction	10
	6.1 Definition and types of absorption.	
	6.2 Extraction, classification of extraction equipment.	

ST-343 SUGAR TECHNOLOG-II

Instructional Objectives:

No.	COURSE OUTLINE
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	VAPORIZATION
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1.	
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- | | |
|--|---------------------------------------|
| | 1.1 Define Vapor Pressure |
| | 1.2 Define Vaporization |
| | 1.3 Enlist Types of Vaporization |
| | 1.4 Describe Evaporation |
| | 1.5 Define Boiling |
| | 1.6 Effect of Pressure on Boiling |
| | 1.7 Modes of Heat Transfer. |
| | 1.8 Define Conduction. |
| | 1.10 Define Convection. |
| | 1.11 Define Radiation. |
| | 1.12 Factors Affecting on the Boiling |

2.	Heat Exchangers
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- | | |
|--|---|
| | 2.1 Define heat exchanger. |
| | 2.2 Explain efficiency of heat exchanger |
| | 2.3 Enlist types of heat exchangers used in sugar industry. |
| | 2.4 Define Cooling Towers |
| | 2.5 Types of Cooling Tower |
| | 2.6 Describe parts of Cooling Tower |
| | 2.7 Define Evaporator |
| | 2.8 Describe the Multi Effect Evaporator |
| | 2.8.1 Enlist the methods of feeding |
| | 2.8.2 Explain the forward feeding method |
| | 2.8.3 Explain the backward feeding method |
| | 2.8.4 Explain the mixed feeding method |
| | 2.8.5 Explain the parallel feeding method |
| | 2.9 Define Boiler |
| | 2.10 Enlist Types of Boilers |
| | 2.10.1 Explain Water Tube Boiler |
| | 2.10.2 Explain the Fire Tube Boiler |

3.	Distillery
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- | | |
|--|---|
| | 3.1 Define fermentation. |
| | 3.2 Enlist fermenting agents. |
| | 3.3 Enlist the products of "Molasses" after fermentation. |

No. COURSE OUTLINE

- 3.4 Explain the manufacture of industrial alcohol by fermentation.
- 3.5 Draw a flow sheet diagram of manufacture of industrial alcohol by fermentation
- 3.6 Enlist Uses of Alcohol

4. Separation Processes

- 4.1 Define Absorption
- 4.2 Enlist types of Absorption
- 4.3 Effect of temperature on absorption
- 4.4 Effect of pressure on absorption
- 4.5 Define Adsorption
- 4.6 Types of Adsorption
- 4.7 Define extraction
- 4.8 Enlist types of extraction
- 4.8.1 Explain solid-Liquid Extraction and Leaching
- 4.8.2 Explain liquid-Liquid Extraction

5. Economics of sugar plant.

- 5.1 Define fixed capital
- 5.2 Define running capital
- 5.3 Define overhead cost
- 5.4 Define Profit
- 5.6 Define direct material cost
- 5.7 Define direct labor cost

Books Recommended.

1. Hand book of Cane Sugar Technology , Mathur, R,B,L Oxford and IBH Publishing Co Pvt , Ltd.
2. Mechanism of crushing cane by Murray C.K and J.E Holt.
3. Analytical Methods used in sugar refining. Plews, R.W Elsevier Publishing Co. U.S.A
4. API manual of relevant unit operation & processes

LIST OF PRACTICALS

96 HRS.

1. Extract sugar from sugarcane using the hot water maceration method and report the extraction efficiency.
2. Determine the boiling point of sugar juice at different concentrations and submit a report on the effect of concentration on boiling temperature.
3. Demonstrate the formation of boiler scale and its chemical removal methods and submit a report on the observations and treatment methods.
4. Determine the composition and properties of molasses by measuring its sugar concentration using the °Brix method and report the analytical results.
5. Estimate the basic production cost of sugar from sugarcane using the given economic data and submit the cost analysis report.
6. Determine the purity of ethanol using specific gravity measurements with a hydrometer and report the calculated ethanol purity.
7. Determine the moisture content of sugar crystals using the oven drying method and report the measured moisture content.
8. Examine the structure and morphology of sugar crystals using a microscope and submit a report of the microscopic observations.
9. Study the effect of evaporation on the concentration of sugar juice and report the observed changes in sugar concentration.
10. Demonstrate the fermentation of a sugar solution using baker's yeast and report the observed gas formation and fermentation results.
11. Compare the modes of heat transfer through simple demonstrations and submit a report describing conduction, convection, and radiation.
12. Observe the major unit operations and processes of a sugar manufacturing plant during an Industrial visit or training session and submit an industrial visit report summarizing the observations.

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
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	
	4.3 Well Type Manometer	

No.	COURSE OUTLINE	HOURS
	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	
7.	CONTROL VALVES	10
	7.1 Control Valves	

No.	COURSE OUTLINE	HOURS
	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.

CHT 353 PROCESS INSTRUMENTATION AND CONTROL

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
0 **P**
6 **C**
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

ST-363 ENERGY CONSERVATION AND WASTE MANAGEMENT

Total contact hours	T	P	C
Th. Hrs.= 64, Pract. Hrs. = 96	2	3	3

Learning outcomes

1. Define basic concepts of energy, fuels, waste, by-products, and pollution.
2. Describe sources of energy and types of industrial waste, particularly in the sugar industry.
3. Explain principles of energy conservation and heat recovery used in process industries.
4. Explain basic methods of waste treatment and pollution control in industrial operations.
5. Perform laboratory experiments related to energy measurement, combustion analysis, and basic waste treatment techniques.

No.	COURSE OUTLINE	HOURS
1.	INTRODUCTION TO ENERGY & ENERGY CONSERVATION 1.1 Types of Energy 1.2 Sources of Energy 1.3 Energy Consumption in Process Industries 1.4 Importance of Energy Conservation 1.5 Basic Energy Saving Techniques 1.6 Energy, Environment, and Sustainability	06
2.	FUELS AND COMBUSTION 2.1 Classification of Fuels 2.2 Calorific Value and Fuel Efficiency 2.3 Combustion Reactions and Air-Fuel Ratio 2.4 Incomplete Combustion and Energy Losses	06
3.	ENERGY MANAGEMENT SYSTEMS 3.1 Energy Audit, Energy Monitoring, and Measuring Instruments 3.2 Boiler and Furnace Efficiency 3.3 Steam System Losses 3.4 Energy Saving Practices in Industry	06
4.	HEAT RECOVERY IN PROCESS PLANTS 4.1 Waste Heat Recovery Systems 4.2 Economizers and Air Preheaters 4.3 Heat Exchangers 4.4 Pre-heating of Boiler Feed Water 4.5 Economics of Heat Recovery	08
5.	ENERGY CONSERVATION IN SUGAR INDUSTRY 5.1 Steam Generation and Distribution 5.2 Efficient Use of Bagasse as Fuel 5.3 Cogeneration of Power	06

5.4 Reduction of Heat Losses	
5.5 Energy Saving Opportunities in Sugar Mills	
6. INTRODUCTION TO INDUSTRIAL WASTE & BY-PRODUCTS	05
6.1 Definition of Waste	
6.2 Definition of By-Product	
6.3 Sources of Industrial Waste	
6.4 Economic Importance of By-Products	
6.5 Overview of Sugar Industry Waste	
7. TYPES OF WASTE IN SUGAR INDUSTRY	06
7.1 Solid Waste (Bagasse, Press Mud, Boiler Ash)	
7.2 Liquid Waste (Effluent, Condensate, Cooling Water)	
7.3 Gaseous Waste (Flue Gas, CO ₂ , SO ₂ , NO _x)	
7.4 Characteristics of Industrial Waste	
8. POLLUTION AND ENVIRONMENTAL PROTECTION	05
8.1 Types of Pollution	
8.1.1 Air Pollution	
8.1.2 Water Pollution	
8.1.3 Soil Pollution	
8.2 Impact of pollution on the environment	
9. WASTE CHARACTERIZATION, MANAGEMENT & TREATMENT	10
9.1 Characteristics of Liquid Waste	
9.2 Biological Oxygen Demand (B.O.D)	
9.3 Chemical Oxygen Demand (C.O.D)	
9.4 Dissolved Oxygen (D.O)	
9.5 Physical, Chemical and Biological Treatment Methods	
9.6 Air Pollutants Characterization	
9.6 Air Pollution Control Equipment (Cyclone, Scrubber, Absorber)	
9.7 Control of CO ₂ in Bagasse Combustion	
10. WASTE TO ENERGY CONVERSION	06
10.1 Agricultural and Sugar Industry Solid Waste Characterization	
10.2 Solid Fuel Pellets and Briquettes	
10.3 Utilization of Bagasse for Power Generation	
10.4 Conversion of Molasses into Ethanol	
10.5 Conversion of Solid fuel to syngas	

Books Recommended.

1. Rao, S., Parulekar, B.B., (2010). Energy Technology: Non-Conventional, Renewable and Conventional. Khanna Publishers.
2. Sharma, S.P., (2012). Energy Management and Conservation. Khanna Publishers.
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. Composition, Properties and Uses of Molasses and Related products. Baker , B.P. United Molasses Trading Co. Ltd , London.

INSTRUCTIONAL OBJECTIVES.

No. COURSE OUTLINE

1. INTRODUCTION TO ENERGY & ENERGY CONSERVATION

- 1.1 Define energy.
- 1.2 Enlist different types of energy.
- 1.3 Define renewable and non-renewable energy sources.
- 1.4 Enlist major sources of energy used in process industries.
- 1.5 Describe energy consumption in chemical industries.
- 1.6 State the importance of energy conservation.
- 1.7 Enlist basic energy saving techniques used in industry.
- 1.8 Describe sustainability and sustainable use of energy

2. FUELS AND COMBUSTION

- 2.1 Define fuel.
- 2.2 Classify fuels into solid, liquid and gaseous fuels.
- 2.3 Define calorific value.
- 2.4 Differentiate between higher and lower calorific value.
- 2.5 Define combustion.
- 2.6 Explain air-fuel ratio.
- 2.7 Describe complete and incomplete combustion.
- 2.8 State the causes of energy losses during combustion.

3. ENERGY MANAGEMENT SYSTEMS

- 3.1 Define energy management.
- 3.2 Describe the purpose of energy monitoring.
- 3.3 Describe Energy Audit
- 3.4 Enlist instruments used for measuring energy consumption.
- 3.5 Define boiler efficiency.
- 3.6 Define furnace efficiency.
- 3.7 Describe losses in steam systems.
- 3.8 State common energy saving practices used in industry.

4. HEAT RECOVERY IN PROCESS PLANTS

- 4.1 Define waste heat recovery.
- 4.2 Enlist types of waste heat recovery systems.
- 4.3 Describe the working of economizers.
- 4.4 Describe the function of air preheaters.
- 4.5 Define heat exchanger.
- 4.6 State applications of heat exchangers in process plants.
- 4.7 Explain the purpose of pre-heating boiler feed water.
- 4.8 State the economic benefits of heat recovery.

5. ENERGY CONSERVATION IN SUGAR INDUSTRY

- 5.1 Describe steam generation in sugar industry.
- 5.2 Explain steam distribution system.
- 5.3 Describe the use of bagasse as fuel.
- 5.4 Define cogeneration of power.
- 5.5 State methods to reduce heat losses in sugar mills.

5.6 Enlist energy saving opportunities in sugar industry.

6. INTRODUCTION TO INDUSTRIAL WASTE & BY-PRODUCTS

- 6.1 Define waste.
- 6.2 Define by-product.
- 6.3 Enlist sources of industrial waste.
- 6.4 Describe economic importance of by-products.
- 6.5 Enlist major wastes produced in sugar industry.

7. TYPES OF WASTE IN SUGAR INDUSTRY

- 7.1 Enlist solid wastes produced in sugar industry.
- 7.2 Describe bagasse and its characteristics.
- 7.3 Describe press mud and boiler ash.
- 7.4 Enlist liquid wastes generated in sugar mills.
- 7.5 Enlist gaseous wastes produced during combustion.
- 7.6 Describe characteristics of industrial waste.

8. POLLUTION AND ENVIRONMENTAL PROTECTION

- 8.1 Define pollution.
- 8.2 Enlist types of pollution.
- 8.3 Define air pollution.
- 8.4 Define water pollution.
- 8.5 Define soil pollution.
- 8.6 State the impact of pollution on environment.

9. WASTE CHARACTERIZATION, MANAGEMENT & TREATMENT

- 9.1 Describe characteristics of liquid waste.
- 9.2 Define Biological Oxygen Demand (B.O.D).
- 9.3 Define Chemical Oxygen Demand (C.O.D).
- 9.4 Define Dissolved Oxygen (D.O).
- 9.5 Enlist physical methods of wastewater treatment.
- 9.6 Enlist chemical methods of wastewater treatment.
- 9.7 Enlist biological methods of wastewater treatment.
- 9.8 Describe the importance of wastewater treatment before disposal.
- 9.9 Enlist air pollution control equipment used in industry.
- 9.10 Describe the working of cyclone separator.
- 9.11 Describe the function of scrubber.
- 9.12 Describe the function of Absorbers
- 9.13 Explain methods to control CO₂ during bagasse combustion.

10. WASTE TO ENERGY CONVERSION

- 10.1 Describe Agricultural Residue
- 10.2 Enlist and define key characteristics of Solid Waste (Proximate and Ultimate Analysis)
- 10.3 Describe Energy densification of solid fuels
- 10.4 Describe process of Fuel pellets and briquettes preparation
- 10.5 Describe utilization of bagasse for power generation.
- 10.6 Describe conversion of molasses into ethanol.
- 10.7 Describe syngas production from solid fuels via gasification

LIST OF PRACTICALS

96 HRS.

1. Determine the calorific value of a given fuel using a bomb calorimeter.
2. Analyze flue gas composition using Orsat apparatus to assess combustion efficiency.
3. Determine the ash content in bagasse to evaluate fuel quality.
4. Determine the moisture content in bagasse and explain its effect on energy output.
5. Measure the pH of boiler water to assess its suitability for steam generation.
6. Determine total dissolved solids (TDS) in boiler water to understand scaling tendency.
7. Calculate boiler efficiency using given operational data.
8. Detect and estimate traces of sugar in wastewater from sugar industry.
9. Analyze condensate for the presence of sugar using alpha-naphthol test.
10. Determine the pH of industrial wastewater samples.
11. Determine the Biological Oxygen Demand (B.O.D) of wastewater.
12. Determine the Chemical Oxygen Demand (C.O.D) of wastewater.
13. Determine the Dissolved Oxygen (D.O) content of water samples.
14. Determine total suspended solids (TSS) in wastewater samples.
15. Prepare Fuel Pellets and Briquettes using agricultural residue and solid waste
16. Visit an industry and observe the processes of energy conservation and waste management in sugar plant during an Industrial visit and submit report summarizing the observations.

ChT-382 INDUSTRIAL STOICHIOMETRY

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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 year 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 (with Specialization In Sugar) 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	Dr. Zohaib Atiq Khan, Assistant Professor Department of Chemical Engineering UET Lahore (New Campus)	PhD Chem. Engg.	Member
3	Mr. Muhammad Usman, Sr. Deputy Chief Chemist. Hunza Sugar Mills Limited Jhang.	B.Sc Chem. Engg	Member
4	Engr. Muhammad Sajid Mustafa CEO, Sajid Chemical Ltd.	B.Sc Chem. Engg	Member
5	Engr. Muhammad Imran Asgar, Chief Instructor / Principal GCT Jhang	M.Sc Chem. Engg	Member
6	Engr. Muhammad Imran Instructor, GCT Kamalia	M.Sc Chem. Engg	Member
7	Engr. Mudassar Ali Instructor GCT, Kamalia	M.Sc Chem. Engg	Member