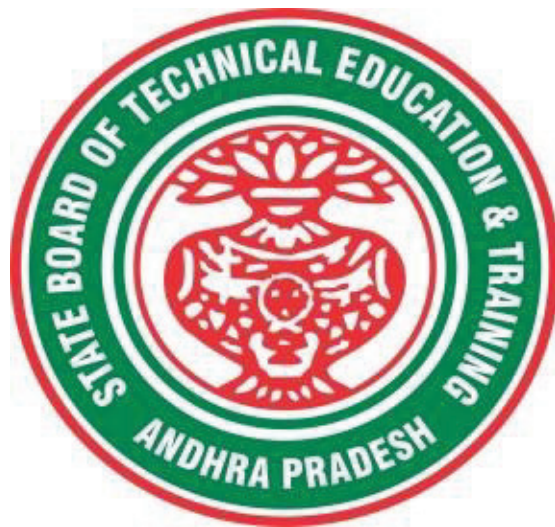


# **CURRICULUM - 2023**

## **C -23**

### **DIPLOMA IN CHEMICAL ENGINEERING (OIL TECHNOLOGY)**



**STATE BOARD OF TECHNICAL EDUCATION & TRAINING  
ANDHRA PRADESH**

**DIPLOMA IN CHEMICAL ENGINEERING(OIL TECHNOLOGY)  
CURRICULUM- 2023 (C-23)**

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## PREAMBLE

Technical Education is a key driver of economic development and plays a crucial role in providing individuals with the skills and knowledge necessary to thrive in the workplace. As technological advancements continue to reshape industries and create new opportunities, it is critical that technical education curricula remain relevant and up-to-date.

The curriculum has been designed with this in mind, with a focus on practical skills, critical thinking, and problem-solving. We believe that these skills are essential for success in both academic and professional spheres. The revamping of the technical education curriculum is made with collaborative effort from educators, industry experts, policymakers, and students.

At the heart of the curriculum, is the belief that the technical education should be **student-centered**, empowering learners to take ownership of their learning and pursue their passions. We aim to create a learning environment that is safe, supportive, and nurturing, where every student has the opportunity to reach their fullest potential. We acknowledge that learning is a lifelong journey, and our curriculum is designed to provide a solid foundation for continued growth and development. We hope that our students will not only leave with a diploma but with employability and passion for learning.

The State Board of Technical Education and Training, (SBTET) AP, has been offering Diploma programmes to meet the above said aspirations of the stake holders: industries, students, academia, parents and the society at large. **The Curriculum should be flexible, adaptable, and responsive to the changing needs of the industry and society.** As such, it has been the practice of SBTET, A.P., to keep the curriculum abreast with the advances in technology through systematic and scientific analysis of current curriculum and bring out an updated revised version at regular intervals.

The design of Curriculum C-23 was started in the month of January - 2023. Feedback was collected from all stake holders: Students, Lecturers, Senior Lecturers, Head of Sections and Principals for all programmes for this purpose. Accordingly, a workshop was convened on 15<sup>th</sup> February 2023 by Smt. C. Naga Rani, I.A.S, Director of Technical Education & Chairperson, SBTET, AP to discuss on revamping of C-20 curriculum to meet the needs of industries and for improvement of placements.

The meeting was attended by Sri. Saurab Gaur, I.A.S, Principal Secretary, Skill Development & Training, Smt. Lavanya Veni, I.A.S, Director, Employment & Training. Thirteen Representatives from Industries and Fourteen Academicians from Higher Level Institutions and officials of ITI, Skill Development, CTE&SBTET attended the workshop.

Smt. C Naga Rani, I.A.S., Commissioner of Technical Education while addressing in the workshop, emphasized the necessity of industrial training and on-hand experience, that the students need to undergo to support the industries and the Gaps in the Curriculum need to be fixed to make the students passionate to work in the industry in order to support economy of the country.

The committees of each branch consisting of experts from Industries, Higher Level Institutions and Faculty of Polytechnics are informed to study the possibility of incorporating the following aspects while preparation of the curriculum so as to improve employability.

- **To bring out industry oriented Diploma Engineers.**
- **Internet of Things (IoT) for all branches**
- **Theoretical & Practical subjects 50: 50 Ratio**
- **Industry 4.0 concepts.**
- **5G Technology.**
- **Critical Thinking (Quantitative Aptitude, Data Interpretation, Quantitative reasoning etc) to face the written tests conducted by the industries during placements.**
- **Dynamic, Student centric to suit the needs of the industry.**

In continuation, series of workshops with subject experts followed in the subsequent weeks for thorough perusal for preparation of draft curriculum. Also, the suggestions received from representatives from various industries, academic experts from higher level institutions, subject experts from Polytechnics, have been recorded, validated for incorporation into the **Curriculum C-23**. Finally, the draft curriculum was sent to academicians of higher-level institutions, industrial experts for Vetting.

The design of new Curricula C-23 for different diploma programmes has thus been finalised with the active participation of the members of the faculty teaching in the Polytechnics of Andhra Pradesh, and duly reviewed by Expert Committee constituted of academicians and representatives from industries. Thus, the primary objective of the curriculum change is to produce employable diploma holders in the country by correlating the growing needs of the industries with relevant academic input.

The outcome-based approach as given by NBA guidelines has been followed throughout the design of this curriculum and designed to meet the requirements of NBA Accreditation, too.

**The Revised Curriculum i.e., Curriculum-2023 (C-23) is approved by 45<sup>th</sup> Academic Committee of SBTET, A.P for its implementation with effect from Academic Year 2023-24. Also, the SBTET, A.P under the aegis of the Department of Technical Education, Andhra Pradesh in it's 62<sup>nd</sup> Board Meeting held on 13-07-2023 (vide item no: 17) Approved to update the Polytechnic Curriculum C-23 with effect from the academic year 2023-2024 onwards after revamping the present C-20 curriculum, to meet the latest industrial technological developments including Industry 4.0 concepts.**

## 2. HIGHLIGHTS OF CURRICULUM C-23

The following Courses / Topics are incorporated in this curriculum C-23 as per the suggestions received from industrial Experts, Faculty of Higher-Level Institutions and Polytechnics to improve the Employability Skills of the Polytechnic Students.

- Modern materials of construction for various process equipment and storage vessels
- 2D Modelling, 3D Modelling, and Python tools in CAD lab for simulation of 'Fluid Mechanics' and 'Heat Transfer' operations
- A new course 'Industrial Hazards and Safety' which enlightens value added services like PSM, MSDS and HAZOP
- New Technology trends in the waste water Management in Chemical and allied process Industries
- Advanced digital sensors for concentration, temperature, pressure, flow and level in process analytical instrumentation
- IOT and IIOT fundamentals and applications in Instrumentation and Process Control
- Current trends and next generation of edible oil technology and challenges in vegetable oils, fats, toilet soap production
- Industry oriented fatty acids separation and analysis by advanced GC, HPLC, and TLC Techniques
- Activity based Teaching – Learning Process in each semester

## 3. ACKNOWLEDGEMENTS

The Members of the working group are grateful to Smt C. Naga Rani I.A.S., Commissioner of Technical Education & Chairman of SBTET, for continuous guidance and valuable inputs during process of revising, modifying and updating the Curriculum C-20 to Curriculum C-23.

We are grateful to Sri. S. Suresh Kumar, I.A.S, Principal Secretary, Skills Development & Training for his valuable suggestions to bring the revamped curriculum C-23 in to a final form to meet latest Industry 4.0 concepts.

We are grateful to Sri. Saurab Gaur, I.A.S, former Principal Secretary, Skills Development & Training who actively participated in the Industry-Academia workshop conducted on 15<sup>th</sup> February, 2023 and offered valuable suggestions and insights into the learning needs and preferences so that the curriculum is engaging, inclusive, and effective.

It is pertinent to acknowledge the support of the following in the making of Curriculum C-23. A series of workshops in different phases were conducted by SBTET, AP,

Guntur involving faculty from Polytechnics, Premier Engineering Colleges & representatives from various Industries and Dr. C. R. Nagendra Rao, Professor & Head, NITTTR-ECV to analyse the Previous C-20 Curriculum and in designing of C-23 Curriculum, is highly appreciated and gratefully acknowledged.

We also extend our sincere thanks to Sri. V. Padma Rao, Joint Director of Technical Education, Sri K.V. RamanaBabu, Secretary, SBTE&T, Andhra Pradesh, Sri K. VijayaBhaskar, Deputy Director (Academic) , Andhra Pradesh, officials of Directorate of Technical Education and the State Board of Technical Education, Andhra Pradesh and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

#### **4. RULES AND REGULATIONS OF C-23 CURRICULUM**

##### **4.1 Duration and pattern of the courses**

All the Diploma programs run at various institutions are of AICTE approved 3 years or 3½ years duration of academic instruction. All the Diploma courses are run on year wise pattern in the first year, and the remaining two or two & half years are run in the semester pattern. In respect of few courses like Diploma in Bio-Medical course, the training will be in the seventh semester. **Run-through system is adopted for all the Diploma Courses, subject to eligibility conditions.**

##### **4.2 Procedure for Admission into the Diploma Courses:**

Selection of candidates is governed by the Rules and Regulations laid down in this regard from time to time.

- a) Candidates who wish to seek admission in any of the Diploma courses will have to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET) conducted by the State Board of Technical Education and Training, Andhra Pradesh, Vijayawada. Only the candidates satisfying the following requirements will be eligible to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET).
  - a. The candidates seeking admission should have appeared for S.S.C examination, conducted by the Board of Secondary Education, Andhra Pradesh or equivalent examination thereto, at the time of applying for the Common Entrance Test for admissions into Polytechnics (POLYCET). In case of candidates whose results of their Qualifying Examinations is pending, their selection shall be subject to production of proof of their passing the qualifying examination in one attempt or compartmentally at the time of admission.
  - b. Admissions are made based on the merit obtained in the Common Entrance Test (POLYCET) and the reservation rules stipulated by the Government of Andhra Pradesh from time to time.
  - c. For admission into the following Diploma Courses for which entry qualification is 10+2, candidates need not appear for POLYCET. A separate notification will be issued for admission into these courses.
    - i). D.HMCT ii).D. Pharmacy

##### **4.3 Medium of Instruction**

The medium of instruction and examination shall be English.

##### **4.4 Permanent Identification Number (PIN)**

A cumulative / academic record is to be maintained of the Marks secured in sessional work and end examination of each year for determining the eligibility for promotion etc., A Permanent Identification Number (PIN) will be allotted to each admitted candidate to maintain academic records.

#### **4.5 Number of Working Days Per Semester / Year:**

- a) The Academic year for all the Courses shall be in accordance with the Academic Calendar.
- b) The Working days in a week shall be from Monday to Saturday
- c) There shall be 7 periods of 50 minutes duration each on all working days.
- d) The minimum number of working days for each semester / year shall be 90 / 180 days excluding examination days. If this prescribed minimum is not achieved due to any reason, special arrangements shall be made to conduct classes to complete the syllabus.

#### **4.6 Eligibility (Attendance to Appear for the End Examination)**

- a) A candidate shall be permitted to appear for the end examination in all subjects, if he or she has attended a minimum of 75% of working days during the year/Semester.
- b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or 1st year may be granted on medical grounds.
- c) A stipulated fee shall be payable towards condonation for shortage of attendance.
- d) Candidates having less than 65% attendance shall be detained.
- e) Students whose shortage of attendance is not condoned in any semester / 1<sup>st</sup> year and not paid the condonation fee in time are not eligible to take their end examination of that class and their admissions shall stand cancelled. They may seek re-admission for that semester / 1<sup>st</sup> year when offered in the next subsequent academic semester/year.

#### **For INDUSTRIAL TRAINING:**

- i) During Industrial Training the candidate shall put in a minimum of 90% attendance.
- ii) If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training at his own expenses.

#### **4.7 Readmission**

Readmission shall be granted to eligible candidates by the respective Principal/ Regional Joint Director.

- a) (i) Within 15 days after commencement of class work in any semester (Except Industrial Training).
- (ii) For Industrial Training: before commencement of the Industrial training.
- b) Within 30 days after commencement of class work in any year (including D. Pharmacy course or first year course in Engineering and Non-Engineering Diploma streams). Otherwise, such cases shall not be considered for readmission

for that semester / year and are advised to seek readmission in the next subsequent eligible academic year.

- c) The percentage of attendance of the readmitted candidates shall be calculated from the first day of beginning of the regular class work for that year / Semester, as officially announced by CTE/SBTET but not from the day on which he/she has actually reported to the class work.

#### 4.8 Scheme of Evaluation

##### a) First Year

**Theory Courses:** Each Course carries Maximum marks of 80 with an end examination of 3 hours duration, along with internal assessment for Maximum of 20 marks. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

**Laboratory Courses:** There shall be 40/20 Marks for internal assessment i.e. sessional marks for each practical Course with an end examination of 3 hours duration carrying 60/30 marks. However, there are no minimum marks prescribed for sessional.

##### b) III, IV, V, VI and VII Semesters:

**Theory Courses:** End semester evaluation shall be of 3 hours duration and for a maximum of 80 marks.

**Laboratory Courses:** Each Course carry 60/30 marks of 3hours duration 40/20 sessional marks.

#### 4.9 Internal Assessment Scheme

- a) **Theory Courses:** Internal assessment shall be conducted for awarding Sessional marks on the dates specified. **Three-unit tests shall be conducted for I year students and two Unit Tests for semesters. The details are presented below.**

S. No.	Type of Assessment	Weightage Assigned
(i)	Testing of knowledge through mid-examination for year/sem as (Mid-1+Mid-2+Mid3) or (Mid-1 + Mid-2)	40
(ii)	Assignments	5
(iii)	<i>Dynamic Learning activities : Project Work/ Seminar/Tech-fest/Group Discussion, Quizzes etc./Extra-curricular activities/NSS/NCC/ IPSGM/Cleaning &amp; Greening of Campus etc.</i>	5
TOTAL		50

Internal Assessment shall be of 90 minutes duration and for a maximum of 40 marks for each test.

At least one assignment should be completed for each unit which carries 10 marks. The total assignment marks should be reduced to 5.

The dynamic learning activity is to be conducted which carries 10 marks. The total marks should be reduced to 5.

The total 50 marks assigned to internal assignment is to be scaled down to 20 marks.

**b) Practical Courses:**

**(i) Drawing Courses:**

The award of Sessional marks for internal Assessment shall be as given in the following table:

<b>Distribution of Marks for the Internal Assessment Marks</b>			
<b>First Year (Total:40 Marks)</b>		<b>Semesters (Total:40 Marks)</b>	
Max:20 Marks	Max:20 Marks	Max:20 Marks	Max:20 Marks
From the Average of THREE Unit Tests.	From the Average of Assessment of Regular Class work Exercises.	From the Average of TWO Unit Tests.	From the Average of Assessment of Regular Class work Exercises.

- For first year engineering drawing each unit test will be conducted for a duration of 2 hours with maximum marks of 40.
- (Part - A: 4 questions x 5 marks = 20 Marks; Part -B: 2 questions x 10 marks = 20 marks).
- For the semester drawing examinations, Two Unit tests shall be conducted as per the Board End Examination Question Paper Pattern.
- All Drawing exercises are to be filed in serial order and secured for further scrutiny by a competent authority

**(ii) Laboratory Courses:**

- (a) Student's performance in Laboratories / Workshop shall be assessed during the year/ semester of study for 40 marks in each practical Course.
- (b) Evaluation for Laboratory Courses, other than Drawing courses:
  - i. Instruction (teaching) in laboratory courses (except for the course on Drawing) here after shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in SBTET website.
  - ii. Internal assessment for Laboratory shall be done on the basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in AP, SBTET website.
  - iii. Question paper for End semester Evaluation shall also be task/s based and shall be prepared and distributed by SBTET as done in case of theory courses be prepared as per SBTET rules in vogue.
- c) Internal assessment in Labs / workshops / Survey field work etc., during the course of study shall be done and sessional marks shall be awarded by the concerned Teacher.

- d) For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective Head of Section preferably choosing a qualified person from in the order of preference.
- i) Nearby Industry
  - ii) Govt / Semi Govt organization like R & B, PWD, PR, Railways, BSNL, APSRTC, APSEB etc.
  - iii) Govt / University Engg College.
  - iv) HoD/Senior Lecture ( Selection Grade-II) from the Govt.Polytechnic
- Internal examiner shall be the person concerned with internal assessment as in (c) above. The end examination shall be held along with all theory papers in respect of drawing.
- e) Question Paper for Practicals: Question paper should cover ( the experiments / exercise prescribed to test various) skills like handling, manipulating, testing, trouble shooting, repair, assembling and dismantling etc., from more than one experiment / exercise
- f) Records pertaining to internal assessment marks of both theory and practical Courses are to be maintained for official inspection.
- g) In case of Diploma programs having Industrial Training, Internal Assessment and Summative Evaluation, shall be done as illustrated in the following table:

Assessment no	Upon completion of	By	Based on	Max Marks
1	12 weeks	1.The faculty concerned (Guide) and 2. Training in charge (Mentor) of the industry	Learning outcomes as given in the scheme of assessment ,for Industrial Training	120
2	22 weeks			120
3. Final summative Evaluation	24 week	1.The faculty member concerned, 2.HoD concerned and 3.An external examiner	1.Demonstration of any one of the skills listed in learning outcomes	30
			2.Training Report	20
			3.Viva Voce	10
<b>TOTAL</b>				<b>300</b>

- h) Each staff member including Head of Section shall be assigned a batch of students 10 to 15 for making assessment during industrial training.

#### 4.10 Minimum Pass Marks

a) Theory Examination:

For passing a theory Course, a candidate has to secure a minimum of 35% in end examination and a combined minimum of 35% of both Sessional and end examination marks put together.

**b) Practical Examination:**

For passing a practical Course, a candidate has to secure a minimum of 50% in end examination and a combined minimum of 50% of both sessional and practical end examination marks put together. In case of D.C.C.P., the pass mark for typewriting and short hand is 45% in the end examination. There are no sessional marks for typewriting and Shorthand Courses of D.C.C.P course.

**C) Industrial Training:**

- I. Monitoring: Similar to project work each teacher may be assigned a batch of 10-15 students irrespective of the placement of the students to facilitate effective monitoring of students learning during industrial training.
- II. Assessment: The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks. And also student has to secure 50% marks in final summative assessment at institution level.
- III. **In-Plant Industrial Training for 3-Year Diploma (C-23) Courses is scheduled as per the Academic Calendar of the SBTET every year.**

**4.11. Provision for Improvement**

Improvement is allowed only after he / she has completed all the Courses from First Year to Final semester of the Diploma.

- a) Improvement is allowed in any 4 (Four) Courses of the Diploma.
- b) The student can avail of this improvement chance **ONLY ONCE**, that too within the succeeding two examinations after the completion of Diploma. However, the duration including Improvement examination shall not exceed **FIVE** years from the year of first admission.
- c) No improvement is allowed in Practical / Lab Courses or Project work or Industrial Training assessment. However, improvement in drawing Course(s) is allowed.
- d) If improvement is not achieved, the marks obtained in previous Examinations hold good.
- e) Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
- f) Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
- g) All the candidates who wish to appear for improvement of performance shall deposit the original Marks Memos of all the years / Semesters and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised Memorandum of marks and Original Diploma Certificate will be issued, else the submitted originals will be returned.

**4.12. Rules of Promotion From 1<sup>ST</sup> YEAR TO 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> Semesters:**

**A) For Diploma Courses of 3 Years duration**

- i). A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds up to 10%) and pay the examination fee.
- ii) A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training, AP from time to time before commencement of 3rd semester.

A candidate is eligible to appear for the 3rd semester examination if he/she puts the required percentage of attendance in the 3rd semester and pays the examination fee.

- iii) A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training AP from time to time before commencement of 4th semester. A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester and pays the examination fee.

- iv) A candidate shall be promoted to 5<sup>th</sup> semester provided he / she puts the required percentage of attendance in the 4<sup>th</sup> semester and pays the examination fee. A candidate, who could not pay the 4<sup>th</sup> semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5<sup>th</sup> semester.

A candidate is eligible to appear for the 5<sup>th</sup> semester examination if he/she puts the required percentage of attendance in the 5<sup>th</sup> semester and pays the examination fee.

- v) A candidate shall be sent to Industrial training / VI semester provided he/she puts in the required percentage of attendance in the 5<sup>th</sup> semester and pay the examination fee/ promotion fee as prescribed by SBTET. A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-voce) puts the required percentage of attendance, i.e., 90% in 6th semester Industrial Training.

**For IVC & ITI Lateral Entry students:**

- i.) A candidate shall be permitted to appear for Third Semester examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds up to 10%) and pay the examination fee for Third semester.
- ii) A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training AP from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4<sup>th</sup> semester examination if he/she puts the required percentage of attendance in the 4<sup>th</sup> semester and pays the examination fee.

- ii) A candidate shall be promoted to 5<sup>th</sup> semester provided he / she puts the required percentage of attendance in the 4<sup>th</sup> semester and pays the examination fee. A candidate, who could not pay the 4<sup>th</sup> semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5<sup>th</sup> semester.

A candidate is eligible to appear for the 5<sup>th</sup> semester examination if he/she puts the required percentage of attendance in the 5<sup>th</sup> semester and pays the examination fee.

- iii) A candidate shall be sent to Industrial training / VI semester provided he/she puts in the required percentage of attendance in the 5<sup>th</sup> semester and pay the examination fee/ promotion fee as prescribed by SBTET.

A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-voce) puts the required percentage of attendance, i.e., 90% in 6<sup>th</sup> semester Industrial Training and pays the examination fee.

**B) For Diploma Courses of 3 ½ Years duration (MET/ CH/ CHPP/ CHPC/ CHOT/ TT):**

- i. A candidate shall be permitted to appear for 1<sup>st</sup> year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.
- ii. A candidate shall be promoted to 3<sup>rd</sup> semester if he/she puts the required percentage of attendance in the 1<sup>st</sup> year and pays the examination fee. A candidate who could not pay the 1<sup>st</sup> year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3<sup>rd</sup> semester.
- iii. A candidate shall be promoted to 4<sup>th</sup> semester provided he/she puts the required percentage of attendance in the 3<sup>rd</sup> semester and pay the examination fee. A candidate, who could not pay the 3<sup>rd</sup> semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4<sup>th</sup> semester.

A candidate is eligible to appear for the 4<sup>th</sup> semester exam if he/she puts the required percentage of attendance in the 4<sup>th</sup> semester

**For IVC & ITI Lateral Entry students:**

- a) Puts the required percentage of attendance in the 4<sup>th</sup> semester
- iv. A candidate shall be promoted to 5<sup>th</sup> semester industrial training provided he / she puts the required percentage of attendance in the 4<sup>th</sup> semester and pays the examination fee. A candidate, who could not pay the 4<sup>th</sup> semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5<sup>th</sup> semester.
- v. Promotion from 5<sup>th</sup> to 6<sup>th</sup> semester is automatic (i.e., from 1<sup>st</sup> spell of Industrial Training to 2<sup>nd</sup> spell) provided he/she puts the required percentage of attendance, which in this case ie.,90 % of attendance and attends for the VIVA-VOCE examination at the end of training.

- vi. A candidate shall be promoted to 7th semester provided he / she puts the required percentage of attendance in the 6th semester and pays the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 7th semester.
- vii. A candidate shall be promoted to 7th semester of the course provided he/she has successfully completed both the spells of Industrial Training.  
A candidate is eligible to appear for 7th semester examination if he/she
  - a) Puts in the required percentage of attendance in the 7th semester

**For IVC & ITI Lateral Entry students:**

- a) Puts in the required percentage of attendance in the 7th semester .

**C) For Diploma Courses of 3 ½ Years duration (BM):**

The same rules which are applicable for conventional courses also apply for this course. The industrial training in respect of this course is restricted to one semester (6 months) after the 6<sup>th</sup> semester (3 years) of the course.

- i. A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.
- ii. A candidate shall be promoted to 3<sup>rd</sup> semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3<sup>rd</sup> semester.
- iii. A candidate shall be promoted to 4<sup>th</sup> semester provided he/she puts the required percentage of attendance in the 3<sup>rd</sup> semester and pay the examination fee. A candidate who could not pay the 3<sup>rd</sup> semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4<sup>th</sup> semester.  
A candidate is eligible to appear for the 4<sup>th</sup> semester examination if he/she
  - a) Puts in the required percentage of attendance in the 4<sup>th</sup> semester

**For IVC & ITI Lateral Entry Students:**

- A candidate is eligible to appear for the 4<sup>th</sup> semester examination if he/she puts the required percentage of attendance in the 4<sup>th</sup> semester
- iv. A candidate shall be promoted to 5<sup>th</sup> semester provided he / she puts the required percentage of attendance in the 4<sup>th</sup> semester and pays the examination fee. A candidate, who could not pay the 4<sup>th</sup> semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5<sup>th</sup> semester.  
A candidate is eligible to appear for the 5<sup>th</sup> semester exam if he/she
    - a) Puts in the required percentage of attendance in the 5<sup>th</sup> semester.

**For IVC & ITI Lateral Entry students:**

- a) Puts in the required percentage of attendance in the 5<sup>th</sup> semester.
- v. A candidate shall be promoted to 6<sup>th</sup> semester provided he/she puts in the required percentage of attendance in the 5<sup>th</sup> semester and pays the examination fee.  
A candidate who could not pay the 5<sup>th</sup> semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 6<sup>th</sup> semester.  
A candidate is eligible to appear for 6<sup>th</sup> semester examination
- a) Puts in the required percentage of attendance in 6<sup>th</sup> semester

**IVC & ITI Lateral Entry students:**

- a) Puts in the required percentage of attendance in 6<sup>th</sup> semester.
- vi. A candidate shall be promoted to 7<sup>th</sup> semester provided he/she puts in the required percentage of attendance in 6<sup>th</sup> semester and pay the examination fee. A candidate, who could not pay the 6<sup>th</sup> semester examination fee, has to pay the promotion fee prescribed by SBTET from time to time before commencement of the 7<sup>th</sup> semester (Industrial Training).  
A candidate is eligible to appear for 7<sup>th</sup> semester Industrial Training assessment (Seminar/Viva-voce) if he/she
- a) Puts in the required percentage of attendance, i.e., 90% in 7<sup>th</sup> semester Industrial Training.

**For IVC & ITI Lateral Entry students:**

- a) Puts in the required percentage of attendance, i.e., 90% in 7<sup>th</sup> semester Industrial Training.

**4.13. Students Performance Evaluation**

Successful candidates shall be awarded the Diploma under the following divisions of pass.

- a) First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.
- b) First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.
- c) Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.
  - i. The Weightage of marks for various year/Semesters which are taken for computing overall aggregate shall be 25% of I year marks + 100% of 3<sup>rd</sup> and subsequent Semesters.
  - ii. In respect IVC & ITI Lateral Entry candidates who are admitted directly into diploma course at the 3<sup>rd</sup> semester (i.e., second year) level the aggregate of (100%) marks secured at the 3<sup>rd</sup> and subsequent semesters of study shall be taken into consideration for determining the overall percentage of marks secured by the candidates for award of class/division.
- d) Second Class shall be awarded to all students, who fail to complete the Diploma in the regular 3 years/ 3 ½ years and four subsequent examinations from the year of first admission.

**4.14. EXAMINATION FEE SCHEDULE:**

The examination fee should be as per the notification issued by State Board of Technical Education and Training, AP from time to time.

**4.15. Structure of Examination Question Paper:**

**I. Formative assessment (Internal examination)**

**a) For theory Courses:**

Three-unit tests for first year and two-unit tests for semesters shall be conducted with a duration of 90 minutes for each test for maximum marks of 40. It consists of part A and Part B.

**Part A** contains five questions and carries 16 marks. Among these five questions first question consists of four objective items like one word or phrase answer/filling-in the blanks/true or false etc with one mark for each question. The other four questions are short answer questions and carry three marks each.

**Part B** carries 24 marks and consists of three questions with internal choice ie., Either/Or type , and each question carries 8 marks.

The sum of marks of 3 tests for I year and 2 tests for semesters including assignments and Dynamic learning activities (50 marks) shall be reduced to 20 marks in each Course for arriving at final sessional marks.

**b) For drawing Courses:**

**For I year:**

Three-unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted for first year. It consists of part A and Part B.

Part A consists four questions for maximum marks of 16 and each question carries four marks (4×4 marks=16 marks).

Part B carries maximum marks of 24 and consists of five questions while the student shall answer any three questions out of these five questions. Each question in this part carries a maximum mark of 8, (3×8 marks=24 marks).

The sum of marks obtained in 3-unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20 marks are awarded by the Course teacher based on the student's performance during regular class exercise.

**For semester:**Two-unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted. The sum of marks obtained in 2-unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20 marks are awarded by the Course teacher based on the student's performance during regular class exercise.

**c) For Laboratory /workshop:** 50% of total marks for the Course shall be awarded based on continuous assessment of the student in laboratory/workshop classes and the remaining 50% shall be based on the sum of the marks obtained by the students in two tests.

## II. Summative assessment (End examination)

The question paper for theory examination is patterned in such a manner that the Weightage of periods/marks allotted for each of the topics for a particular Course be considered. End Examination paper is of 3 hours duration.

a) **Each theory paper consists of Section 'A' and 'B'**

**Section 'A' with Max marks of 30**, contains 10 short answer questions. All questions are to be answered and each carry 3 marks, i.e.,  $10 \times 3 = 30$ .

**Section 'B' with Max marks of 50** contains 8 essay type questions. Only 5 questions are to be answered and each carry 10 marks, i.e., Max. Marks:  $5 \times 10 = 50$ .

**Thus, the total marks for theory examination shall be: 80.**

b) **For Engineering Drawing Course (107) consist of section 'A' and section 'B'.**

**Section 'A' with max marks of 20**, contains four (4) questions. All questions in section 'A' are to be answered to the scale and each carries 5 marks, i.e.  $4 \times 5 = 20$ .

**Section 'B' with max marks of 40**, contains six (6) questions. The student shall answer any four (4) questions out of the above six questions and each question carries 10 Marks, i.e.,  $4 \times 10 = 40$ .

c) **Practical Examinations**

For Workshop practice and Laboratory Examinations, Each student has to pick up a question paper distributed by Lottery System.

Max. Marks for an experiment / exercise : 50

Max. Marks for VIVA-VOCE : 10

Total Max. Marks : 60

In case of practical examinations with 50 marks, the marks shall be distributed as

Max. Marks for an experiment / exercise : 25

Max. Marks for VIVA-VOCE : 05

Total Max. Marks : 30

In case of any change in the pattern of question paper, the same shall be informed sufficiently in advance to the candidates.

d) **Note: Evaluation for Laboratory Courses, other than Drawing courses:**

- I. Instruction (teaching) in laboratory courses (except for the course on Drawing) hereafter shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP and posted in its website.
- II. Internal assessment for Laboratory shall be done on basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP and posted in its website.
- III. Question paper for End semester Evaluation shall be prepared as per SBTET rules in vogue.

**4.16. ISSUE OF MEMORONDUM OF MARKS**

All candidates who appear for the end examination will be issued memorandum of marks without any payment of fee. However candidates who lose the original memorandum of marks have to pay the prescribed fee to the Secretary, State Board of Technical Education and Training, A.P. for each duplicate memo from time to time.

**4.17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA PROGRAMMES:**

Maximum period for completion of the diploma courses is twice the duration of the course from the date of First admission (includes the period of detention and discontinuation of studies by student etc) failing which they will have to forfeit the claim for qualifying for the award of Diploma (They will not be permitted to appear for examinations after that date). This rule applies for all Diploma courses of 3 years and 3 ½ years of engineering and non-engineering courses.

**4.18. ELIGIBILITY FOR AWARD OF DIPLOMA**

A candidate is eligible for award of Diploma Certificate if he / she fulfil the following academic regulations.

- i. He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.
- ii. He / she have completed all the Courses.

Students who fail to fulfil all the academic requirements for the award of the Diploma within 6 / 7 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

**For IVC & ITI Lateral Entry students:**

- i. He / She pursued a course of study for not less than 2 / 2 ½ academic years & not more than 4 / 5 academic years.
- ii. He / she has completed all the Courses.

Students who fail to fulfil all the academic requirements for the award of the Diploma within 4 / 5 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

**4.19. ISSUE OF PHOTO COPY OF VALUED ANSWER SCRIPT, RECOUNTING & REVERIFICATION:**

**A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS**

- I. A candidate desirous of applying for Photo copy of valued answer script/s should apply within prescribed date from the date of the declaration of the result.
- II. Photo copies of valued answer scripts will be issued to all theory Courses and Drawing Course(s).
- III. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.
- IV. No application can be entertained from third parties.

**B) FOR RE-COUNTING(RC) and RE-VERIFICATION(RV) OF THE VALUED ANSWER SCRIPT**

- i. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.
- ii. Re-verification of valued answer script shall be done for all theory Courses' and Drawing Course(s).
- iii. The Re-verification committee constituted by the Secretary, SBTETAP with Course experts shall re-verify the answer scripts.

**I. RE-COUNTING**

The Officer of SBTET will verify the marks posted and recount them in the already valued answer script. The variations if any will be recorded separately, without making any changes on the already valued answer script. The marks awarded in the original answer script are maintained (hidden).

**II. RE-VERIFICATION**

- (i) The Committee has to verify the intactness and genuineness of the answer script(s) placed for Re-verification.
- (ii) Initially single member shall carry out the re-verification.
- (iii) On re-verification by single member, if the variation is less than 12% of maximum marks, and if there is no change in the STATUS in the result of the candidate, such cases will not be referred to the next level i.e., for 2-Tier evaluation.
- (iv) On re-verification by a single member, if the variation is more than 12% of maximum marks, it will be referred to 2-Tier evaluation.
- (v) If the 2-Tier evaluation confirms variation in marks as more than 12% of maximum marks, the variation is considered as follows:
  - a) If the candidate has already passed and obtains more than 12% of the maximum marks on Re-verification, then the variation is considered.
  - b) If the candidate is failed and obtains more than 12% of the maximum marks on Re-verification and secured pass marks on re-verification, then the status of the candidate changes to PASS.
  - c) If a candidate is failed and obtains more than 12% of the maximum marks on Re-verification and if the marks secured on re-verification are still less than the minimum pass marks, the status of the candidate remain FAIL only.
- (vii) After Re-verification of valued answer script the same or change if any therein on Re-verification, will be communicated to the candidate.
- (viii) On Re-verification of Valued Answer Script if the candidate's marks are revised, the fee paid by the candidate will be refunded or else the candidate has to forfeit the fee amount.

**Note:** No request for Photo copies/ Recounting /Re-verification of valued answer script would be entertained from a candidate who is reported to have resorted to Malpractice in that examination.

**4.20. Mal Practice Cases:**

If any candidate resorts to Mal Practice during examinations, he / she shall be booked and the Punishment shall be awarded as per SBTETAP rules and regulations in vogue.

**4.21. Discrepancies/ Pleas:**

Any Discrepancy /Pleas regarding results etc., shall be represented to the SBTETAP within one month from the date of issue of results. Thereafter, no such cases shall be entertained in any manner.

**4.22. Issue of Duplicate Diploma**

If a candidate loses his/her original Diploma Certificate and desires a duplicate to be issued he/she should produce written evidence to this effect. He / she may obtain a duplicate from the Secretary, State Board of Technical Education and Training, A.P., on payment of prescribed fee and on production of an affidavit signed before a First Class Magistrate (Judicial) and non-traceable certificate from the Department of Police. In case of damage of original Diploma Certificate, he / she may obtain a duplicate certificate by surrendering the original damaged certificate on payment of prescribed fee to the State Board of Technical Education and Training, A.P.

In case the candidate cannot collect the original Diploma within 1 year from the date of issue of the certificate, the candidate has to pay the penalty prescribed by the SBTET AP from time to time.

**4.23. Issue of Migration Certificate and Transcripts:**

The Board on payment of prescribed fee will issue these certificates for the candidates who intend to prosecute Higher Studies in India or Abroad.

**4.24.General**

- i. The Board may change or amend the academic rules and regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students, for whom it is intended, with effect from the dates notified by the competent authority.
- ii. All legal matters pertaining to the State Board of Technical Education and Training, AP are within the jurisdiction of Mangalagiri.
- iii. In case of any ambiguity in the interpretation of the above rules, the decision of the Secretary, SBTET, A.P is final.

**VISION**

To become world class Institute in the field of Chemical Engineering with specializations to produce skilled workforce suitable to Chemical and allied industries.

**MISSION**

To provide skill oriented trained through industrial interaction suited for Chemical and allied industries. To inculcate energy and environmental aspects. To achieve high student performance and organizational learning by continuously upgrading technical knowledge and enhancing professional as well as teaching and training skills of faculty. To forge mutually beneficial relation with Government organizations Chemical and allied industry alumni and society at large.

**Vision of Department of Chemical Engineering (Oil Technology)**

To empower the Diploma students of Chemical Engineering (Oil Technology) to be technically adept, innovative, self-motivated and responsible Indian citizen possessing human values and contribute significantly towards high quality skill in technical education.

**MISSION of Department of Chemical Engineering (Oil Technology)**

M1

Mission is to provide Diploma students who are capable to take pivotal role in wide aspects of Chemical Engineering and (Oil Technology).

M2

The students are able to understand basic concepts underlie in Chemical Engineering and Oil Technology and able to apply them creatively in different fields of Chemical Engineering and Oil Technology and are sensitive to the Environment and safety.

M3

Our curriculum offered to students to get trained in real-time Chemical Engineering and Oil Technology

M4

Making students to prepare for professional careers in Industry and advanced studies.

**DIPLOMA IN CHEMICAL ENGINEERING (OIL TECHNOLOGY)**  
**SCHEME OF INSTRUCTIONS (I YEAR):**

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
CHOT -101	English	3	-	90	3	20	80	100
CHOT -102	Engineering Mathematics - I	5	-	150	3	20	80	100
CHOT -103	Engineering Physics	3	-	90	3	20	80	100
CHOT -104	Engineering Chemistry & Environmental Studies	3	-	90	3	20	80	100
CHOT -105	Introduction to Chemical Engineering	5	-	150	3	20	80	100
CHOT -106	Materials Technology	5	-	150	3	20	80	100
<b>PRACTICAL:</b>								
CHOT -107	Engineering Drawing	-	3	90	3	40	60	100
CHOT -108	Workshop Practice	-	6	180	3	40	60	100
CHOT -109	Physics Lab	-	1.5	45	3	20	30	50
CHOT-110	Chemistry Lab	-	1.5	45	3	20	30	50
CHOT -111	Computer Fundamentals Lab	-	3	90	3	40	60	100
-	Activities	-	3	90	-	-	-	-
<b>TOTAL</b>		<b>24</b>	<b>18</b>	<b>720+ 540=1260</b>	-	<b>280</b>	<b>720</b>	<b>1000</b>

CHOT-101, 102, 103, 104, 107, 109, 110: Common to all  
CHOT-106, 108: Common with DCHE, DCHE (PC/PP),  
CHOT-105 not common with any course

**Note:** 30 students will go to Physics lab and the remaining 30 will go to Chemistry lab

**DIPLOMA IN CHEMICAL ENGINEERING (Oil Technology)**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**C-23, III SEMESTER**

Subject Code	Name of the Subject	Instruction period / week- Mod(non-mod)		Total Period / year	Scheme of Examination			
		Theory	Practical		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
CHOT- 301	Engineering Mathematics - II	4	-	60	3	20	80	100
CHOT -302	Electrical Technology	4	-	60	3	20	80	100
CHOT -303	Organic and Physical Chemistry	5	-	75	3	20	80	100
CHOT -304	Unit Operations-I	5	-	75	3	20	80	100
CHOT -305	Mass and Energy Balance	6	-	90	3	20	80	100
<b>PRACTICAL:</b>								
CHOT -306	CAD Practice in Chemical Engineering	-	3	45	3	40	60	100
CHOT -307	Electrical Technology Lab	-	3	45	3	40	60	100
CHOT -308	Organic and Physical Chemistry Lab	-	3	45	3	40	60	100
CHOT -309	Unit Operations-I Lab	-	6	90	3	40	60	100
-	Activities	-	3	45	-	-	-	-
<b>TOTAL</b>		<b>24</b>	<b>18</b>	<b>360+270 =630</b>		<b>260</b>	<b>640</b>	<b>900</b>

CHOT-301 Common to all branches.

CHOT-302, 303, 305, 306, 307, 308 Common to DCHE,DCHE(PC/ PP)

CHOT-304, 309 Common to DCHE(PC/ PP)

**DIPLOMA IN CHEMICAL ENGINEERING (Oil Technology)**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**C-23, IV SEMESTER**

Subject Code	Name of the Subject	Instruction period / week-Mod(non-mod)		Total Period / year	Scheme of Examination			
		Theory	Practical		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
CHOT - 401	Industrial Hazards and Safety	3	-	45	3	20	80	100
CHOT -402	Process Technology	6	-	90	3	20	80	100
CHOT -403	Technology of Vegetable Oils and Fats-I	4	-	60	3	20	80	100
CHOT -404	Technology of Vegetable Oils and Fats-II	5	-	75	3	20	80	100
CHOT -405	Basic Mechanical Engineering	4	-	60	3	20	80	100
CHOT-406	Unit Operations-II	5		75	3	20	80	100
<b>PRACTICAL:</b>								
CHOT -407	Unit Operations – II Lab	-	3	45	3	40	60	100
CHOT -408	Communication skills	-	3	45	3	40	60	100
CHOT -409	Technology of Vegetable Oils and Fats-I & II Lab	-	3	45	3	40	60	100
CHOT -410	Process Technology Lab	-	3	45	3	40	60	100
-	Activities	-	3	45	-	-	-	-
<b>TOTAL</b>		<b>27</b>	<b>15</b>	405+225 = 630	-	<b>280</b>	<b>720</b>	<b>1000</b>

CHOT-401, 408 common to all branches

CHOT-402,405, 406, 407, 410 common to DCHE(PC/ PP)

CHOT-403, 404, 409 not common to any course

**V Semester (Industrial Training)**  
**DIPLOMA IN CHEMICAL ENGINEERING (OIL TECHNOLOGY)**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**I SPELL INDUSTRIAL TRAINING**

**Subject Title** : **Industrial Training**  
**Subject Code** : **CHOT-501**  
**Duration** : **6 months**

S.NO	Code	TOPICS	Duration
1	CHOT-501	<ul style="list-style-type: none"> <li>• Practical training in Industry</li> <li>• Training Report Preparation</li> </ul> Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents(introduction of Industry, Plant Layout, Organization Chart, List of Major Equipments, List of Processes: Skills Acquired; Conclusions; References	Six Months

SI.No.	Subject	Duration	Scheme of evaluation		
			Item	Nature	Max. Marks
1	Industrial Training	6 months	1.First Assessment at Industry (After 12 Weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			2.Second Assessment at the Industry (After 22 weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			Final Summative assessment at institution level	Training Report	20
				Demonstration of any one of the skills listed in learning outcomes	30
Viva Voce					10
<b>TOTAL MARKS</b>					<b>300</b>

**VI Semester (Industrial Training)**  
**DIPLOMA IN CHEMICAL ENGINEERING (OIL TECHNOLOGY)**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**II SPELL INDUSTRIAL TRAINING**

**Subject Title** : **Industrial Training**  
**Subject Code** : **CHOT-601**  
**Duration** : **6 months**

S.NO	Code	TOPICS	Duration
1	CHOT-601	<ul style="list-style-type: none"> <li>• Practical training in Industry</li> <li>• Training Report Preparation</li> </ul> Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents(introduction of Industry, Plant Layout, Organization Chart, List of Major Equipments, List of Processes: Skills Acquired; Conclusions; References	Six Months

<i>Sl.No.</i>	<i>Subject</i>	<i>Duration</i>	<i>Scheme of evaluation</i>		
			<i>Item</i>	<i>Nature</i>	<i>Max. Marks</i>
<i>1</i>	<i>Industrial Training</i>	<i>6 months</i>	<i>1.First Assessment at Industry (After 12 Weeks)</i>	<i>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</i>	<i>120</i>
			<i>2.Second Assessment at the Industry (After 22 weeks)</i>	<i>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</i>	<i>120</i>
			<i>Final Summative assessment at institution level</i>	<i>Training Report</i>	<i>20</i>
				<i>Demonstration of any one of the skills listed in learning outcomes</i>	<i>30</i>
					<i>10</i>
<b>TOTAL MARKS</b>					<b>300</b>

**DIPLOMA IN CHEMICAL ENGINEERING (Oil Technology)**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**C-23, VII Semester**

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
CHOT -701	Industrial Management and Entrepreneurship	5	-	75	3	20	80	100
CHOT -702	Thermodynamics and Reaction Engineering	5	-	75	3	20	80	100
CHOT -703	Instrumentation & Process Control	5	-	75	3	20	80	100
CHOT -704	Unit Operations –III	4	-	60	3	20	80	100
CHOT -705	Technology of Vegetable Oils and Fats-III	5	-	75	3	20	80	100
<b>PRACTICAL:</b>								
CHOT-706	Chemical Plant Equipment Drawing	-	3	45	3	40	60	100
CHOT -707	Instrumentation, process control & Reaction Engineering Lab	-	3	45	3	40	60	100
CHOT -708	Life skills	-	3	45	3	40	60	100
CHOT-709	Project Work /Technology of Vegetable Oils and Fats-III Lab	-	3	45	3	40 (20+20)	60 (30+30)	100 (50+50)
CHOT-710	Unit Operations-III Lab	-	3	45	3	40	60	100
-	Activities	-	3	45	-	-	-	
<b>TOTAL</b>		<b>24</b>	<b>18</b>	360+270=630	-	<b>300</b>	<b>700</b>	<b>1000</b>

CHOT- 701,708 common to all

CHOT- 702, 703, 706, 707 Common to DCHE, DCHE(PC), DCHE(PP)

CHOT-704,710 Common DCHE(PC), DCHE(PP)

CHOT-705, 709 not common to any course

I Year

**DIPLOMA IN CHEMICAL ENGINEERING (OIL TECHNOLOGY)**  
**SCHEME OF INSTRUCTIONS (I YEAR):**

Subject Code	Name of the Subject	Instruction periods / week		Total Periods / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
CHOT -101	English	3	-	90	3	20	80	100
CHOT -102	Engineering Mathematics - I	5	-	150	3	20	80	100
CHOT -103	Engineering Physics	3	-	90	3	20	80	100
CHOT -104	Engineering Chemistry & Environmental Studies	3	-	90	3	20	80	100
CHOT -105	Introduction to Chemical Engineering	5	-	150	3	20	80	100
CHOT -106	Materials Technology	5	-	150	3	20	80	100
<b>PRACTICAL:</b>								
CHOT -107	Engineering Drawing	-	3	90	3	40	60	100
CHOT -108	Workshop Practice	-	6	180	3	40	60	100
CHOT -109	Physics Lab	-	1.5	45	3	20	30	50
CHOT-110	Chemistry Lab	-	1.5	45	3	20	30	50
CHOT -111	Computer Fundamentals Lab	-	3	90	3	40	60	100
-	Activities	-	3	90	-	-	-	-
<b>TOTAL</b>		<b>24</b>	<b>18</b>	<b>720+ 540=1260</b>		<b>280</b>	<b>720</b>	<b>1000</b>

CHOT-101, 102, 103, 104, 107, 109, 110: Common to all  
CHOT-106, 108: Common with DCHE, DCHE (PC/PP),  
CHOT-105 not common with any course

**Note:** 30 students will go to Physics lab and the remaining 30 will go to Chemistry lab

**CURRICULUM: C23-CHOT-101: English**

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
CHOT-101	English	3	90	20	80

**Time Schedule: C23-Common- 101 : ENGLISH**

S.no	Title of the Unit	Periods allotted	Weightage of Marks	No. of Short answer questions	No. of Long Answer questions	Mapping of COs
1	English for Employability	8	16	2	1	CO1, CO2, CO3, CO4, CO5
2	Living in Harmony	8				CO1, CO2, CO3, CO4, CO5
3	Connect with Care	8	26	2	2	CO1, CO2, CO3, CO4, CO5
4	Humour for Happiness	8				CO1, CO2, CO3, CO4, CO5
5	Never Ever Give Up!	8	10	1	1	CO1, CO2, CO3, CO4, CO5
6	Preserve or Perish	9	23			2
7	The Rainbow of Diversity	8		19	2	
8	New Challenges - Newer Ideas	8	1		CO1, CO2, CO3, CO4, CO5	
9	The End Point First	8			CO1, CO2, CO3, CO4, CO5	
10	The Equal Halves	8	16	1	1	CO1, CO2, CO3, CO4, CO5
11	Dealing with Disaster	9		1		CO1, CO2, CO3, CO4, CO5
	<b>Total</b>	<b>90</b>	<b>110</b>	<b>30</b>	<b>80</b>	

<b>Course Objectives</b>	- To improve grammatical knowledge and enrich vocabulary.
	- To develop effective reading, writing and speaking skills.
	- To comprehend themes related to Personality, Society, Environment to exhibit Universal Human Values.

<b>CO No.</b>	<b>Course Outcomes</b>
CO1	Apply and use various grammatical rules and concepts to communicate in academic, professional and everyday situations
CO2	Use appropriate vocabulary in various contexts.
CO3	Read and comprehend different forms of academic, professional and everyday texts.
CO4	Communicate effectively in speaking and writing in academic, professional and everyday situations.
CO5	Display human values by applying the knowledge of themes related to Self, Society, Science and Environment for holistic and harmonious living through communication.

### CO-PO Matrix

<b>Course Code CHOT-101</b>	<b>Course Title: English Number of Course Outcomes: 4</b>			<b>No. of Periods: 90</b>	
POs	Mapped with CO No.	CO Periods Addressing PO in Column 1		Level of Mapping (1,2,3)	Remarks
		Number	Percentage		
PO1		Not directly Applicable for English course, however activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.			
PO2					
PO3					
PO4					
PO5	CO5	16	18%		>50%: Level 3
PO6	CO1, CO2, CO3, CO4,	52	58%		21-50%: Level 2
PO7	CO1, CO2, CO3, CO4,CO5	22	24%		Up to 20%: Level 1

Level 3 – Strongly Mapped, Level 2- Moderately Mapped; Level 1- Slightly Mapped

### Learning Outcomes

#### 1. English for Employability

1.1. Perceive the need for improving communication in English for employability

1.2. Use adjectives and articles effectively while speaking and in writing

1.3. Write simple sentences

## **2. Living in Harmony**

2.1. Develop positive self-esteem for harmonious relationships

2.2. Use affixation to form new words

2.3. Use prepositions and use a few phrasal verbs contextually

## **3. Connect with Care**

3.1. Use social media with discretion

3.2. Speak about abilities and possibilities

3.3. Make requests and express obligations

3.4. Use modal verbs and main verbs in appropriate form

3.5. Write short dialogues for everyday situations

## **4. Humour for Happiness**

4.1. Realize the importance of humour for a healthy living

4.2. Improve vocabulary related to the theme

4.3. Acquire reading and speaking skills

4.4. Frame sentences with proper Subject – Verb agreement

4.5. Understand the features of a good paragraph and learn how to gather ideas as a preliminary step for writing a good paragraph.

## **5. Never Ever Give Up!**

5.1. Learn to deal with failures in life

5.2. Use the present tense form for various every day communicative functions such as speaking and writing about routines, professions, scientific descriptions and sports commentary

5.3. Write paragraphs with coherence and other necessary skills

## **6. Preserve or Perish**

6.1. Understand the ecological challenges that we face today and act to save the environment.

6.2. Narrate / Report past events

6.3. Develop vocabulary related to environment

6.4. Write e-mails

## **7. The Rainbow of Diversity**

7.1. Appraise and value other cultures for a happy living in multi-cultural workspace

7.2. Understand the usage of different types of sentences

7.3. Ask for or give directions, information, instructions

7.4. Use language to express emotions in various situations

7.5. Write letters in various real life situations

## **8. New Challenges – Newer Ideas**

8.1. Understand the functional difference between Active Voice and Passive Voice

8.2. Use Passive Voice to speak and write in various contexts

8.3. Understand the major parts and salient features of an essay

8.4. Learn about latest innovations and get motivated

## **9. The End Point First!**

9.1. Understand the importance of setting a goal in life

9.2. Report about what others have said both in speaking and writing

9.3. Write an essay following the structure in a cohesive and comprehensive manner

9.4. Apply the words related to Goal Setting in conversations and in life

## **10. The Equal Halves**

10.1. Value the other genders and develop a gender-balanced view towards life

- 10.2. Identify the use of different conjunctions in synthesising sentences
- 10.3. Write various types of sentences to compare and contrast the ideas
- 10.4. Apply the knowledge of sentence synthesis in revising and rewriting short essays
- 10.5. Develop discourses in speech and writing

### 11. Dealing with Disasters

- 11.1. Speak and write about different kinds of disasters and the concept of disaster management
- 11.2. Generate vocabulary relevant to disaster management and use it in sentences
- 11.3. Analyze an error in a sentence and correct it
- 11.4. Learn and write different kinds of reports

Textbook: ‘**INTERACT**’ (A Text book of English for I Year Engineering Diploma Courses) - by SBTET, AP

#### Reference Books:

- Martin Hewings : *Advanced Grammar in Use*, Cambridge University Press
- Murphy, Raymond : *English Grammar in Use*, Cambridge University Press
- Sidney Greenbaum : *Oxford English Grammar*, Oxford University Press
- Wren and Martin (Revised by N.D.V. Prasad Rao) : *English Grammar and Composition*, Blackie ELT Books, S. Chand and Co.
- Sarah Freeman : *Strengthen Your Writing*, Macmillan

### C23-CHOT-101 :English : Bifurcation of Syllabus for UNIT TESTS 1,2,3

Unit Test	Lessons / Chapters	Grammar / Language aspects ( Topics or Short Answer questions)	Writing Skills ( Topics for Long answer/ Essay Questions)
U.T 1	Chapters 1,2,3	a) articles & prepositions, b)Vocabulary: Affixes, synonyms, Antonyms, matching meanings, words & phrases, one word substitutes) c)Adjectives ( degrees of comparison) d) Main& Auxiliary Verbs e) phrasal verbs/ word order	a) Theme based Paragraph ( focus on LSRW skills, importance of English, Self-esteem, SWOC analysis, Social media ) b) Dialogue on themes of lessons 2&3 / Dialogue on General topic / a situation c) Reading comprehension
U.T 2	Chapters 4,5,6,7	a) concord b) Tenses c) Types of sentences d) Framing questions e) words &phrases, linkers	a) Theme based paragraph ( Humour for happy living, learning from failures, Environmental protection, multi-culture /global culture ) b) Letter writing ( formal& informal),

			c) instructions/ directions, E-mail writing
U.T 3	Chapters 8,9,10,11	a) Voice (active &passive) b) Speech( direct& indirect) c) Synthesis of sentences ( simple, complex, compound sentences) d) Error analysis e) words &phrases, linkers	a) Theme based paragraph/ Essay writing ( Technical innovations, Goal setting, gender sensitivity, dealing with disaster) b) Essay writing, Report writing c) Reading Comprehension
Unit Test Question Paper pattern (40 Marks )	Total 40 Marks ( Part A=16 Part B =24)	Short Answer questions ( Part-A) Q. 1 = 4 marks Q. 2 to 5 = 3 Marks each Total=16 Marks	Long Answer Questions: ( Part-B) Q. 6,7,8 @ 8 marks each ; Each question with Internal choice Total: 8X3 = 24 Marks

**C-23 - ENGINEERING MATHEMATICS-I**

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
CHOT-102	Engineering Mathematics-I	5	150	20	80

**Time Schedule**

S.No.	Chapter	No. of Periods	Marks Allotted	Short type	Essay type	COs mapped
<b>Unit - I: Algebra</b>						
1	Functions	6	3	1	0	CO1
2	Partial Fractions	5	3	1	0	CO1
3	Matrices and Determinants	20	16	2	1	CO1
<b>Unit - II: Trigonometry</b>						
4	Trigonometric Ratios	2	0	0	0	CO2
5	Compound Angles	5	3	1	0	CO2
6	Multiple and Submultiple angles	8	3	1	0	CO2
7	Transformations	6	5	0	1/2	CO2
8	Inverse Trigonometric Functions	6	5	0	1/2	CO2
9	Trigonometric Equations	6	5	0	1/2	CO2
10	Properties of triangles	5	5	0	1/2	CO2
11	Complex Numbers	6	3	1	0	CO2
<b>Unit III: Co-ordinate Geometry</b>						
12	Straight Lines	5	3	1	0	CO3
13	Circles	6	5	0	1/2	CO3
14	Conic Sections	12	5	0	1/2	CO3
<b>Unit – IV: Differential Calculus</b>						
15	Limits and Continuity	6	3	1	0	CO4
16	Differentiation	28	23	1	2	CO4
<b>Unit – V: Applications of Derivatives</b>						
17	Geometrical Applications	4	5	0	1/2	CO5
18	Physical Applications	6	5	0	1/2	CO5
19	Maxima and Minima	4	5	0	1/2	CO5
20	Errors and Approximations	4	5	0	1/2	CO5
Total		150	110	10	8	
<b>Marks</b>				30	80	

<b>Course Objectives</b>	<p>(i) To apply the principles of Algebra, Trigonometry and Co-Ordinate Geometry to real-time problems in engineering.</p> <p>(ii) To comprehend and apply the concept of Differential Calculus in engineering applications.</p>
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<b>Course Outcomes</b>	CO1	Identify functions as special relations, resolve partial fractions and solve problems on matrices and determinants.
	CO2	Solve problems using the concept of trigonometric functions, their inverses and complex numbers.
	CO3	Find the equations and properties of straight lines, circles and conic sections in coordinate system.
	CO4	Evaluate the limits and derivatives of various functions
	CO5	Find solutions for engineering problems using differentiation.

**C-23 - ENGINEERING MATHEMATICS – I  
(COMMON TO ALL BRANCHES)**

**Learning Outcomes**

**UNIT - I**

**C.O. 1 Identify functions, resolve partial fractions and solve problems on matrices and determinants.**

**L.O.** 1.1 Define Set, ordered pair and Cartesian product of two sets - examples.

1.2 Explain Relations and functions – examples

1.3 Find Domain & Range of functions in finite sets – simple examples.

1.4 Define rational, proper and improper fractions of polynomials.

1.5 Explain the procedure of resolving proper fractions of the types mentioned below into partial fractions

$$i) \frac{f(x)}{(ax+b)(cx+d)} \quad ii) \frac{f(x)}{(ax+b)^2(cx+d)}$$

1.6 Define a matrix and order of a matrix.

1.7 State various types of matrices with examples (emphasis on 3<sup>rd</sup> order square matrices).

1.8 Compute sum, difference, scalar multiplication and product of matrices. Illustrate the properties of these operations such as associative, distributive, commutative properties with examples and counter examples.

1.9 Define the transpose of a matrix and state its properties – examples.

1.10 Define symmetric and skew-symmetric matrices with examples. Resolve a square matrix into a sum of symmetric and skew-symmetric matrices and provide examples.

1.11 Define determinant of a square matrix; minor, co-factor of an element of a 3x3 square matrix with examples. Expand the determinant of a 3 x 3 matrix using Laplace expansion formula. State and apply the properties of determinants to solve problems.

1.12 Distinguish singular and non-singular matrices. Define multiplicative inverse of a matrix and list properties of adjoint and inverse. Compute adjoint and multiplicative inverse of a square matrix.

1.13 Solve system of 3 linear equations in 3 unknowns using Cramer's rule and matrix inversion method.

**UNIT - II**

**C.O. 2 Solve problems using the concept of trigonometric functions, their inverses and complex numbers.**

**L.O. 2.1** Define trigonometric ratios of any angle - List the values of trigonometric ratios at specified values.

2.2 Draw graphs of trigonometric functions - Explain periodicity of trigonometric functions.

2.3 Define compound angles and state the formulae of  $\sin(A\pm B)$ ,  $\cos(A\pm B)$ ,  $\tan(A\pm B)$  and  $\cot(A\pm B)$ .

2.4 Give simple examples on compound angles to derive the values of  $\sin 15^\circ$ ,  $\cos 15^\circ$ ,  $\sin 75^\circ$ ,  $\cos 75^\circ$ ,  $\tan 15^\circ$ ,  $\tan 75^\circ$  etc.

2.5 Derive identities like  $\sin(A+B) \sin(A-B) = \sin^2 A - \sin^2 B$  etc.

2.6 Solve simple problems on compound angles.

2.7 Derive the formulae of multiple angles  $2A$ ,  $3A$  etc and sub multiple angles  $A/2$  in terms of angle  $A$  of trigonometric functions.

2.8 Derive useful allied formulae like  $\sin^2 A = (1 - \cos 2A)/2$  etc.

2.9 Solve simple problems using the above formulae

Syllabus for Unit test-I completed

2.10 Derive the formulae on transforming sum or difference of two trigonometric ratios into a product and vice versa, examples on these formulae.

2.11 Solve problems by applying these formulae to sum or difference or product of two terms.

2.12 Explain the concept of the inverse of a trigonometric function by selecting an appropriate domain and range.

2.13 Define inverses of six trigonometric functions along with their domains and ranges.

2.14 Derive relations between inverse trigonometric functions so that the given inverse trigonometric function can be expressed in terms of other inverse trigonometric functions with examples.

2.15 State various properties of inverse trigonometric functions and identities like

$$\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}, \text{ etc.}$$

2.16 Apply formulae like  $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ , where  $x \geq 0, y \geq 0, xy < 1$  etc.,

to solve Simple problems.

2.17 Explain what is meant by solution of trigonometric equations and find the general solutions of  $\sin x = k$ ,  $\cos x = k$  and  $\tan x = k$  with appropriate examples.

2.18 Solve models of the type  $a \sin^2 x + b \sin x + c = 0$  and  $a \cos x + b \sin x = c$ .

2.19 State sine rule, cosine rule, tangent rule and projection rule and solve a triangle using these formulae.

2.20 List various formulae for the area of a triangle with examples.

2.21 Define complex number, its modulus, conjugate, amplitude and list their properties.

2.22 Define the operations on complex numbers with examples.

2.23 Represent the complex number in various forms like modulus-amplitude (polar) form, Exponential (Euler) form with examples.

### UNIT - III

#### Coordinate Geometry

**C.O.3 Find the equations and properties of straight lines, circles and conic sections in coordinate system.**

- L.O.3.1** Write the different forms of a straight line – general form, point-slope form, slope-intercept form, two-point form, intercept form and normal form (or perpendicular form).
- 3.2 Find distance of a point from a line, acute angle between two lines, intersection of two non-parallel lines and distance between two parallel lines.
- 3.3 Define locus of a point and circle.
- 3.4 Write the general equation of a circle and find the centre and radius.
- 3.5 Find the equation of a circle given (i) centre and radius, (ii) two ends of the diameter (iii) three non collinear points of type (0,0) (a,0), (0,b).
- 3.6 Define a conic section - Explain the terms focus, directrix, eccentricity, axes and latus-rectum of a conic with illustrations.
- 3.7 Find the equation of a conic when focus, directrix and eccentricity are given.
- 3.8 Describe the properties of Parabola, Ellipse and Hyperbola in standard forms whose axes are along the co-ordinate axes and solve simple examples on these conics.

Syllabus for Unit test-II
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**C.O.4 Evaluate the limits and derivatives of various functions.**

L.O. 4.1 Explain the concept of limit and meaning of  $\lim_{x \rightarrow a} f(x) = l$  and state the properties of limits.

4.2 Evaluate the limits of the type  $\lim_{x \rightarrow l} \frac{f(x)}{g(x)}$  and  $\lim_{x \rightarrow \infty} \frac{f(x)}{g(x)}$

4.3 State the Standard limits  $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$ ,  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ ,  $\lim_{x \rightarrow 0} \frac{\tan x}{x}$ ,  $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$ ,

$\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$ ,  $\lim_{x \rightarrow 0} (1+x)^{\frac{1}{x}}$ ,  $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$  (without proof) and solve simple problems

using these standard limits.

4.4 Explain the concept of continuity of a function at a point and on an interval

4.5 State the concept of derivative of a function  $y = f(x)$  – definition, first principle as  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$  and also provide standard notations to denote the derivative of a function.

4.6 Explain the significance of derivative in scientific and engineering applications.

4.7 Find the derivative of the elementary functions  $x^n$ ,  $a^x$ ,  $e^x$ ,  $\log x$ ,  $\sin x$ ,  $\cos x$  using the first principle.

4.8 Find the derivatives of standard algebraic, logarithmic and exponential functions.

4.9 Find the derivatives of trigonometric, inverse trigonometric and hyperbolic functions.

4.10 State the rules of differentiation of sum, difference, scalar multiplication, product and quotient of functions with simple illustrative examples.

4.11 Explain the method of differentiation of a function of a function (Chain rule) with illustrative examples.

4.12 Explain the method of differentiation of parametric functions with examples.

4.13 Explain the procedure for finding the derivatives of implicit functions with examples.

4.14 Explain the need of taking logarithms for differentiating some functions of  $[f(x)]^{g(x)}$  type – examples on logarithmic differentiation.

4.15 Explain the concept of finding the second order derivatives with examples.

4.16 Explain the concept of functions of several variables, finding partial derivatives and difference between the ordinary and partial derivatives with simple examples.

4.17 Explain the concept of finding second order partial derivatives with simple problems.

## C.O. 5 Evaluate solutions for engineering problems using differentiation

- L.O. 5.1** State the geometrical meaning of the derivative - Explain the concept of derivative to find the slopes of tangent and normal to the curve  $y=f(x)$  at any point on it.
- 5.2 Find the equations of tangent and normal to the curve  $y=f(x)$  at any point on it – examples.
- 5.3 Explain the derivative as a rate of change in distance-time relations to find the velocity and acceleration of a moving particle with examples.
- 5.4 Explain the derivative as a rate measurer in the problems where the quantities like volumes, areas vary with respect to time- illustrative examples.
- 5.5 Define the concept of increasing and decreasing functions - Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.
- 5.6 Explain the procedure to find the extreme values (maxima or minima) of a function of single variable- simple problems for quadratic and cubic polynomials.
- 5.7 Apply the concept of derivatives to find the errors and approximations in simple problems.

Syllabus for Unit test-III completed
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## C-23 - ENGINEERING MATHEMATICS – I

### CO/PO – Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	2				3	2	3
CO2	3	3	3	2				3	3	1
CO3	3	2	2	1				3	2	2
CO4	3	3	2	2				3	2	1
CO5	3	3	3	3				3	3	3
<b>Avg.</b>	3	2.6	2.2	2				3	2.4	2

**3** = Strongly mapped (High), **2** = moderately mapped (Medium), **1** = slightly mapped (Low)

#### Note:

**PO5:** Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

**PO6:** Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

**PO7:** Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

**PSO1:** An ability to understand the concepts of basic mathematical concepts and to apply them in various areas like computer programming, civil constructions, fluid dynamics, electrical and electronic systems and all concerned engineering disciplines.

**PSO2:** An ability to solve the Engineering problems using latest software tool, along with analytical skills to arrive at faster and appropriate solutions.

**PSO3:** Wisdom of social and environmental awareness along with ethical responsibility to have a successful career as an engineer and to sustain passion and zeal for real world technological applications.

**C-23 - ENGINEERING MATHEMATICS – I**

**PO- CO – Mapping strength**

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		No	%		
1	CO1, CO2, CO3,CO4,CO5	150	100%	3	>40% Level 3 Highly addressed
2	CO1, CO2, CO3,CO4,CO5	138	92%	3	
3	CO1, CO2, CO3,CO4,CO5	133	88.6%	3	
4	CO1, CO2, CO3,CO4,CO5	120	80%	3	25% to 40% Level 2
PSO 1	CO1, CO2, CO3,CO4,CO5	150	100%	3	Moderately addressed
PSO 2	CO1, CO2, CO3,CO4,CO5	135	90%	3	
PSO 3	CO1, CO2, CO3,CO4,CO5	125	83.3%	3	5% to 25% Level 1 Low addressed  <5% Not addressed

**C-23 - ENGINEERING MATHEMATICS – I  
(COMMON TO ALL BRANCHES)  
COURSE CONTENT**

**Unit-I  
Algebra**

**1. Functions:**

Definitions of Set, Ordered pair, Cartesian product of two sets, Relations, functions, domain & range of functions in finite sets.

**2. Partial Fractions:**

Definitions of rational, proper and improper fractions of polynomials. Resolve rational fractions (proper fractions) in to their partial fractions covering the types mentioned below.

$$i) \frac{f(x)}{(ax+b)(cx+d)} \qquad ii) \frac{f(x)}{(ax+b)^2(cx+d)}$$

**3. Matrices:**

Definition of a matrix, types of matrices-examples, algebra of matrices-equality of two matrices, sum, difference, scalar multiplication and product of matrices. Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a square matrix-Laplace's expansion, properties of determinants. Singular and non-singular matrices-Adjoint and multiplicative inverse of a square matrix- examples-System of linear equations in 3 variables-Solutions by Cramer's rule and Matrix inversion method-examples.

## Unit-II Trigonometry

4. **Trigonometric ratios:**  
Definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.
5. **Compound angles:**  
Formulas of  $\sin(A\pm B)$ ,  $\cos(A\pm B)$ ,  $\tan(A\pm B)$ ,  $\cot(A\pm B)$ , and related identities with problems.
6. **Multiple and sub multiple angles:**  
Formulae for trigonometric ratios of multiple angles  $2A$ ,  $3A$  and sub multiple angles  $A/2$  with problems.
7. **Transformations:** Transformations of products into sums or differences and vice versa - simple problems.
8. **Inverse trigonometric functions:**  
Definition, domains and ranges-basic properties- problems.
9. **Trigonometric equations:**  
Concept of a solution, principal value and general solution of trigonometric equations:  
 $\sin x = k$ ,  $\cos x = k$ ,  $\tan x = k$ , where  $k$  is a constant. Solutions of simple quadratic equations and equations of type  $a\cos x + b\sin x = c$ .
10. **Properties of triangles:**  
Relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle- problems.
11. **Complex Numbers:**  
Definition of a complex number, Modulus, conjugate and amplitude of a complex number, Arithmetic operations on complex numbers, Modulus- Amplitude (polar) form, Exponential form (Euler form) of a complex number- Problems.

## UNIT-III Coordinate geometry

12. **Straight lines:** various forms of straight lines, angle between lines, perpendicular distance from a point, intersection of non-parallel lines and distance between parallel lines-examples.
13. **Circle:** locus of a point, Circle, definition-Circle equation given (i) centre and radius, (ii) two ends of a diameter (iii) three non collinear points of type  $(0,0)$ ,  $(a,0)$ ,  $(0,b)$  - general equation of a circle – finding centre, radius.
14. Definition of a conic section, equation of a conic when focus directrix and eccentricity are given. Properties of parabola, ellipse and hyperbola in standard forms.

## UNIT-IV Differential Calculus

15. **Concept of Limit-** Definition and Properties of Limits and Standard Limits -Simple Problems- Continuity of a function at a point- Simple Examples only.
16. **Concept of derivative-** Definition (first principle)- different notations-derivatives of elementary functions. Derivatives of algebraic, logarithmic, trigonometric, inverse trigonometric and hyperbolic functions. Derivatives of sum, product, quotient, scalar multiplication of functions - problems. Chain rule, derivatives of parametric functions, derivatives of implicit functions, logarithmic differentiation – problems in each case. Second order derivatives – examples. Functions of several variables –First and second order partial differentiation-simple problems.

## UNIT-V

## Applications of Derivatives

17. Geometrical meaning of the derivative, equations of tangent and normal to a curve at any point - problems.
18. Physical applications of derivatives – velocity, acceleration, derivative as a rate measure – Problems.
19. Applications of the derivative to find the extreme values – Increasing and decreasing functions, finding the maxima and minima for quadratic and cubic polynomials.
20. Using the concept of derivative of a function of single variable, find the absolute error, relative and percentage errors and approximate values due to errors in measuring.

### Textbook:

Engineering Mathematics-I, a textbook for first year diploma courses, prepared & prescribed by SBTET, AP.

### Reference Books:

1. Shanti Narayan, A Textbook of matrices, S.Chand & Co.
2. Robert E. Moyer & Frank Ayers Jr., Schaum's Outline of Trigonometry, 4<sup>th</sup> Edition, Schaum's Series.
3. M. Vygotsky, Mathematical Handbook, Mir Publishers, Moscow.
4. Frank Ayers & Elliott Mendelson, Schaum's Outline of Calculus, Schaum's Series.

## C-23 Engineering Mathematics – I

### Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O. 1.1 to L.O. 2.9
Unit Test-II	From L.O. 2.10 to L.O. 3.8
Unit Test-III	From L.O. 4.1 to L.O. 5.7

### C-23 ENGINEERING PHYSICS

SUBJECT CODE	SUBJECT	TOTAL PERIODS	NUMBER PERIODS PER WEEK
CHOT -103	ENGINEERING PHYSICS	90	03

#### Time Schedule

S.No	Major topics	No. of Periods	Weightage of Marks	Short Answer type (3 marks)	Essay type (10 marks)	COs mapped
1.	Units and measurements	09	03	1	-	CO1
2.	Statics	11	13	1	1	
3.	Gravitation	12	20	-	2	CO2
4.	Concepts of energy	10	13	1	1	
5.	Thermal physics	10	13	1	1	CO3
6.	Sound	12	16	2	1	
7.	Electricity & Magnetism	13	16	2	1	CO4
8.	Modern physics	13	16	2	1	
<b>Total:</b>		<b>90</b>	<b>110</b>	<b>10</b>	<b>8</b>	

Course objectives	<p>(1) To understand the basic concepts of physics for various Engineering applications as required for industries.</p> <p>(2) To equip the students with the scientific advances in technology and make the student suitable for any industrial organization.</p>
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COURSE OUTCOMES	CO1	Familiarize with various physical quantities, their SI units and errors in measurements; understand the concepts of vectors and various forces in statics.
	CO2	Understand the concepts of gravitation with reference to applications in satellites, provides the knowledge of various forms of energy and their working principles.
	CO3	Familiarize with the knowledge of conduction of heat and gas laws; provides the knowledge on musical sound and noise as pollution and also the concepts of echo and reverberation.

	CO4	Provide basic knowledge of electricity and concepts of magnetism and magnetic materials; familiarize with the advances in Physics such as photoelectric cell, optical fibers, semiconductors, superconductors and nanotechnology.
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**MATRIX SHOWING MAPPING OF COURSE OUT COMES WITH PROGRAMME OUTCOMES**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	1			2
CO2	3		2	2	1		2
CO3	2				1		
CO4	2	2	2	2	2		3

3 = strongly mapped    2 = moderately mapped    1 = slightly mapped

**OBJECTIVES**

**Upon completion of the course the student shall be able to**

**1.0 Understand the concept of units and measurements**

- 1.1 Explain the concept of Units
- 1.2 Define the terms
  - a) Physical quantity, b) Fundamental physical quantities and
  - c) Derived physical quantities
- 1.3 Define unit
- 1.4 Define fundamental units and derived units
- 1.5 State SI units with symbols
- 1.6 State Multiples and Submultiples in SI system
- 1.7 State rules of writing S.I. units
- 1.8 State advantages of SI units
- 1.9 What are direct and indirect measurements.
- 1.10 Define accuracy and least count
- 1.11 Define error in measurement
- 1.12 Define absolute, relative and percentage errors with their formulae
- 1.13 Solve simple problems on absolute, relative and percentage errors

**2.0 Understand the concepts of statics**

- 2.1 Explain the concept of Vectors
- 2.2 Define scalar and vector quantities with examples
- 2.3 Represent vectors geometrically
- 2.4 Define the types of vectors (equal, negative, unit, co-initial, co-planar vectors, Position vector)
- 2.6 Resolve the vector into rectangular components
- 2.7 State and explain triangle law of addition of vectors
- 2.8 Define concurrent and co-planar forces
- 2.9 State and explain Lami's theorem
- 2.10 State parallelogram law of addition of forces with diagram
- 2.11 Write the expressions for magnitude and direction of resultant (no derivation)
- 2.12 Illustrate parallelogram law with examples (i) flying of bird and (ii) working of sling.
- 2.13 Define moment of force and couple.
- 2.14 Write the formulae and S.I units of moment of force and couple.
- 2.15 Solve simple problems on (i) Resolution of force and

(ii) Parallelogram law of forces (finding  $R, \alpha$  and  $\theta$ ).

### 3.0 Understand the concepts of Gravitation

- 3.1 State and explain Newton's universal law of gravitation.
- 3.2 Define  $G$  and mention its value.
- 3.3 Explain the acceleration due to gravity ( $g$ )
- 3.4 Explain the factors affecting the value of  $g$
- 3.5 Derive the relationship between  $g$  and  $G$ .
- 3.6 State and explain the Kepler's law of planetary motion
- 3.7 Define a satellite.
- 3.8 What are natural and artificial satellites? Give examples.
- 3.9 Define orbital velocity and write its formula.
- 3.10 Define escape velocity and write its formula.
- 3.11 Write a brief note on PSLV
- 3.12 Write a brief note on GSLV
- 3.13 Mention the applications of artificial satellites
- 3.14 Solve simple problems on (i) Newton's law of gravitation and (ii) calculation of orbital and escape velocities.

### 4.0 Understand the concepts of Energy.

- 4.1 Define work done and energy. Mention their SI units.
- 4.2 List various types of energy.
- 4.3 Define P.E with examples. Write its equation.
- 4.4 Define K.E with examples. Write its equation.
- 4.5 Derive relationship between K.E and momentum.
- 4.6 State the law of conservation of energy. Give various examples.
- 4.7 Write a brief note on solar energy.
- 4.8 Explain the principle of solar thermal conversion.
- 4.9 Explain the principle of photo voltaic effect
- 4.10 Solve simple problems on (i) work done (ii) P.E & K.E and (iii) Relation between K.E & momentum.

### 5.0 Understand the concepts of thermal physics

- 5.1 Define the concepts of heat and temperature
- 5.2 State the modes of transmission of heat
- 5.3 Define conduction, convection and radiation with two examples each.
- 5.4 State and explain Boyle's law
- 5.5 Define absolute zero temperature
- 5.6 Explain absolute scale of temperature
- 5.7 State the relationship between Degree Celcius, Kelvin and Fahrenheit temperatures
- 5.8 State Charles laws and write its equation
- 5.9 State Gay-Lussac's law and write its equation
- 5.10 Define ideal gas
- 5.11 Derive ideal gas equation
- 5.12 Explain why universal gas constant ( $R$ ) is same for all gases
- 5.13 Calculate the value of  $R$  for 1 gram mole of gas.
- 5.14 Solve simple problems on (i) Interconversion of temperatures between  $^{\circ}\text{C}$ ,  $\text{K}$  and  $\text{F}$  (ii) Gas laws and (iii) Ideal gas equation.

### 6.0 Understand the concepts of Sound

- 6.1 Define the term sound
- 6.2 Define longitudinal and transverse waves with one example each
- 6.3 Explain the factors which affect the velocity of sound in air
- 6.4 Distinguish between musical sound and noise
- 6.5 Explain noise pollution and state SI unit for intensity of sound
- 6.6 Explain sources of noise pollution
- 6.7 Explain effects of noise pollution

- 6.8 Explain methods of minimizing noise pollution
- 6.9 Define Doppler effect
- 6.10 List the Applications of Doppler effect
- 6.11 Define reverberation and reverberation time
- 6.12 Write Sabine's formula and name the parameters contained
- 6.13 Define echoes and explain the condition to hear an echo.
- 6.14 Mention the methods of reducing an echo
- 6.15 Mention the applications of an echo
- 6.16 What are ultrasonics
- 6.17 Mention the applications of ultrasonics, SONAR,
- 6.18 Solve simple problems on echo

## **7.0 Understand the concepts of Electricity and Magnetism**

- 7.1 Explain the concept of P.D and EMF
- 7.2 State Ohm's law and write the formula
- 7.3 Explain Ohm's law
- 7.4 Define resistance and specific resistance. Write their S.I units.
- 7.5 State and explain Kichoff's first law.
- 7.6 State and explain Kirchoff's second law.
- 7.7 Describe Wheatstone's bridge with legible sketch.
- 7.8 Derive an expression for balancing condition of Wheatstone's bridge
- 7.9 Describe Meter Bridge experiment with necessary circuit diagram.
- 7.10 Write the formulae to find resistance and specific resistance in meter bridge
- 7.11 Explain the concept of magnetism
- 7.12 What are natural and artificial magnets (mention some types)
- 7.13 Define magnetic field and magnetic lines of force and write the properties of magnetic lines of force
- 7.14 State and explain the Coulomb's inverse square law of magnetism
- 7.15 Define magnetic permeability
- 7.16 Define para, dia, ferro magnetic materials with examples
- 7.17 Solve simple problems on (i) Ohm's law (ii) Kirchoff's first law (iii) Wheatstone bridge (iv) meter bridge and (v) Coulomb's inverse square law

## **8.0 Understand the concepts of Modern physics**

- 8.1 State and Explain Photo-electric effect
- 8.2 State laws of photoelectric effect
- 8.3 Explain the Working of photoelectric cell
- 8.4 List the Applications of photoelectric effect
- 8.5 Recapitulate refraction of light and its laws
- 8.6 Define critical angle
- 8.7 Explain the Total Internal Reflection
- 8.8 Explain the principle and working of Optical Fiber
- 8.9 List the applications of Optical Fiber
- 8.10 Explain the energy gap based on band structure
- 8.11 Distinguish between conductors, semiconductors and insulators base on energy gap
- 8.12 Define doping
- 8.13 Explain the concept of hole
- 8.14 Explain the types of semiconductors : Intrinsic and extrinsic
- 8.15 What are n-type and P-type semiconductors
- 8.16 Mention the applications of semiconductors
- 8.17 Define super conductor and superconductivity
- 8.18 List the applications of superconductors
- 8.19 Nanotechnology definition, nonmaterials and applications

## **COURSE CONTENT**

### **1. Units and measurements**

Introduction – Physical quantity – Fundamental and Derived quantities – Fundamental and derived units - SI units –Multiples and Sub multiples – Rules for writing S.I. units-Advantages of SI units – Direct and indirect measurements – Accuracy and least count – Errors : Absolute, relative and percentage errors – Problems.

## 2. Statics

Scalars and Vectors – Representation of a vector - Types of vectors - Resolution of vector into rectangular components – Triangle law of vectors – Concurrent forces - Lami's theorem - Parallelogram law of forces : Statement, equations for magnitude and direction of resultant, examples – Moment of force and couple – Problems.

## 3. Gravitation

Newton's law of gravitation and  $G$  – Concept of acceleration due to gravity ( $g$ ) – Factors affecting the value of  $g$  – Relation between  $g$  and  $G$ - Kepler's laws – Satellites : Natural and artificial – Orbital velocity and escape velocity – Polar and geostationary satellites – Applications of artificial satellites – Problems.

## 4. Concepts of energy

Workdone & Energy-Definition and types of energy - potential energy - kinetic energy-- K.E and Momentum relation – Law of Conservation of energy, examples - Solar energy, principle of thermal and photo conversion – Problems.

## 5. Thermal physics

Modes of transmission of heat - Expansion of Gases - Boyle's law - Absolute scale of temperature - Thermometric scales and their inter conversion - Charle's law - Gay-Lussac's law - Ideal gas equation - Universal gas constant ( $R$ ) - Problems.

## 6. Sound

Sound - Nature of sound - Types of wave motion, Longitudinal and transverse – Factors affecting the velocity of sound in air - musical sound and noise - Noise pollution – Causes & effects- Methods of reducing noise pollution- Doppler effect- Echo- Reverberation-Reverberation time-Sabine 's formula - Ultrasonics & applications – SONAR - Problems.

## 7. Electricity & Magnetism

Concept of P.D and EMF - Ohm's law and explanation- Specific resistance- Kirchoff's laws - Wheatstone's bridge - Meter bridge.

Natural and artificial magnets – magnetic field and magnetic lines of force - Coulomb's inverse square law – Permeability – Magnetic materials – Para, dia, ferro – Examples – Problems.

## 8. Modern Physics

Photoelectric effect – laws of photoelectric effect – photoelectric cell - Applications of photo electric cell - Total internal reflection- Fiber optics - Principle and working of an optical fiber- Applications of optical fibers – Semiconductors : Based on Energy gap – Doping – Hole - Intrinsic and extrinsic semiconductors (n-type & p-type) – Applications of semiconductors - Superconductivity – applications – Nanotechnology definition, nano materials, applications.

### REFERENCES

- |   |                                   |
|---|-----------------------------------|
| 1. Intermediate physics - Volume - I & 2              | Telugu Academy (English version)  |
| 2. Unified physics Volume 1, 2, 3 and 4               | Dr. S.L Guptha and Sanjeev Guptha |
| 3. Concepts of Physics, Vol 1 & 2                     | H.C. Verma                        |
| 4. Text book of physics Volume I                      | Resnick & Holiday                 |
| 5. Fundamentals of physics                            | Brijlal & Subramanyam             |
| 6. Text book of applied physics                       | Dhanpath Roy                      |
| 7. NCERT Text Books of physics                        | Class XI & XII Standard           |
| 8. e-books/e-tools/websites/Learning Physics software |                                   |

## Engineering Chemistry and Environmental Studies (C-23)

### CHOT-104

Course code	Course Title	No. of Periods per week	Total No. of Periods	Marks for FA	Marks for SA
CHOT-104	Engineering Chemistry and Environmental Studies	3	90	20	80

#### Time Schedule

S . N	Unit Title/Chapter	No of Periods	Weight age of marks	Question wise distribution		Mapped with CO
				Essay	Short	
1	Fundamentals of Chemistry	14	21	1½*	2	CO1
2	Solutions, Acids and Bases	16	21	1½*	2	CO1
3	Electrochemistry	12	13	1	1	CO2
4	Corrosion	8	13	1	1	CO2
5	Water Treatment	8	13	1	1	CO3
6	Polymers & Engineering materials.	12	13	1	1	CO4
7	Fuels	6	3	0	1	CO4
8	Environmental Studies	14	13	1	1	CO5
Total		90	110	8	10	

### Course Objectives

<b>Course Title: Engineering Chemistry &amp; Environmental Studies</b>	
Course Objectives	To familiarize with the concepts of chemistry involved in the process of various Engineering Industrial Applications. To know the various natural and man-made environmental issues and concerns with an interdisciplinary approach that include physical, chemical, biological and socio cultural aspects of environment. to reinforce theoretical concepts by conducting relevant experiments/exercises



## 1.0 Atomic structure

- 1.1 Explain the charge, mass of fundamental particles of an atom (electron, proton and neutron) and the concept of atomic number and mass number.
- 1.2 State the Postulates of Bohr's atomic theory and its limitations.
- 1.3 Explain the significance of four Quantum numbers and draw the atomic structures of Silicon and Germanium.
- 1.4 Explain 1. Aufbau principle, 2 Pauli's exclusion principle 3 Hund's principle.
- 1.5 Define Orbital of an atom and draw the shapes of s, p and d- Orbitals.
- 1.6 Write the electronic configuration of elements up to atomic number 30
- 1.7 Explain the significance of chemical bonding
- 1.8 Explain the Postulates of Electronic theory of valency
- 1.9 Define and explain Ionic and Covalent bonds with examples of NaCl,  $H_2$ ,  $O_2$  and  $N_2$ . (\* Lewis dot method)
- 1.10 List out the Properties of Ionic compounds and covalent compounds and distinguish between their properties.

## 2.0 Solutions, Acids and Bases

- 2.1 Define the terms 1. Solution, 2. Solute and 3. Solvent
- 2.2 Classify solutions based on solubility.
- 2.3 Define mole and problems on mole concept.
- 2.4 Define the terms 1. Atomic weight, 2. Molecular weight and 3. Equivalent weight and calculate Molecular weight and Equivalent weight of the given acids. ( $HCl$ ,  $H_2SO_4$ ,  $H_3PO_4$ ) Bases ( $NaOH$ ,  $Ca(OH)_2$ ,  $Al(OH)_3$ ) and Salts ( $NaCl$ ,  $Na_2CO_3$ ,  $CaCO_3$ )
- 2.5 Define molarity and normality and numerical problems on molarity and normality
  - a) Calculate the Molarity or Normality if weight of solute and volume of solution are given
  - b) Calculate the weight of solute if Molarity or normality with volume of solution are given
  - c) Problems on dilution to convert high concentrated solutions to low concentrated

### Solutions

- 2.6 Explain Arrhenius theory of Acids and Bases and give the limitations of Arrhenius theory of Acids and Bases.
- 2.7 Define ionic product of water and pH and numerical problems on pH (Strong Acids and Bases).
- 2.8 Define buffer solution and classify buffer solutions with examples. Give its applications.

## 3.0 Electrochemistry

- 3.1 Define the terms 1. Conductor 2. Semiconductor 3. Insulator, 4. Electrolyte 5. Non-electrolyte. Give two examples each.
- 3.2 Distinguish between metallic conduction and Electrolytic conduction
- 3.3 Explain electrolysis by taking example fused NaCl and list out the applications of electrolysis.
- 3.4 Define Galvanic cell and explain the construction and working of Galvanic cell.
- 3.5 Distinguish between electrolytic cell and galvanic cell.
- 3.6 Define battery and list the types of batteries with examples.
- 3.5 Explain the construction, working and applications of i) Dry cell (Leclanche cell, ii) Lead storage battery iii) Lithium-Ion battery iii) Hydrogen-Oxygen fuel cell.

## 4.0 Corrosion

- 4.1 Define the term corrosion.

- 4.2 state the Factors influencing the rate of corrosion
- 4.3 Describe the formation of a) composition cell b) stress cell c) concentration cell during corrosion.
- 4.4 Define rusting of iron and explain the mechanism of rusting of iron.
- 4.5 Explain the methods of prevention of corrosion
- a) Protective coatings (anodic and cathodic coatings)
- b) Cathodic protection (Sacrificial anode process and Impressed–voltage process)

## 5.0 Water Treatment

- 5.1 Define soft water and hard water with respect to soap action.
- 5.2 Define and classify the hardness of water.
- 5.3 List out the salts that causing hardness of water(with Formulae)
- 5.4 State the disadvantages of using hard water in industries.
- 5.5 Define Degree of hardness and units of hardness(mg/L) or( ppm).
- 5.6 Numerical problems on hardness.
- 5.7 Explain the methods of softening of hard water by :a) Ion-exchange process, b) Reverse Osmosis.

## 6.0 Polymers & Engineering materials.

### A) Polymers

- 6.1 Explain the concept of polymerisation
- 6.2 Describe the methods of polymerization a)addition polymerization of ethylene b)condensation polymerization of Bakelite (Only flow chart)
- 6.3 Explain the methods of preparation and uses of the following plastics:
1. PVC 2.Teflon 3. Polystyrene 4. Nylon 6,6

### B) Engineering materials

- 6.4 Define an alloy. Write the composition and applications of the following.
- 1.Nichrome 2. Duraluminium 3. Stainless Steel.
- 6.5. Define elastomers: Write the composition and applications of the following
1. Buna- S 2. Neoprene
- 6.6 Define Composite materials: Write the composition and applications of the following:
- 1.Glass Fibre Reinforcement composites(GFR) 2. Carbon Fibre Reinforcement Composites(CFR)
- 6.7 Define Liquid Crystals. Classify and give applications of the following:
1. Nematic 2. Smectic crystals
- 6.7 Define Nano materials. Write the composition and applications of the following:
1. nanotubes 2. Nano crystals.

## 7.0 Fuels

- 7.1 Define the term fuel
- 7.2 Classify the fuels based on occurrence.
- 7.3 Write the composition and uses of the following:
1. LPG 2. CNG 3. Biogas 4. Power alcohol
- 7.4 Write the commercial production of Hydrogen as future fuel. Give its advantages and disadvantages.

## 8.0 ENVIRONMENTAL STUDIES

- 8.1 Define the term environment and explain the scope and importance of environmental studies.
- 8.2 Define the segments of environment 1).Lithosphere 2).Hydrosphere 3).Atmosphere 4).Biosphere
- 8.3 Define the following terms:  
1)Pollutant 2).Pollution 3).Contaminant 4)receptor 5)sink 6) particulates 7)dissolved oxygen (DO)  
8)Threshold limit value (TLV) 9).BOD 10) COD 11) eco system 12) Producers 13) Consumers  
14) Decomposers with examples.
- 8.4 State the renewable and non-renewable energy sources with examples.
- 8.5 State the uses of forest resources.
- 8.6 Explain the causes and effects of deforestation
- 8.7 Define air pollution and give its Global impacts( 1) Greenhouse effect, 2) Ozone layer depletion and 3) Acid rain)
- 8.8 Define Water pollution. Explain the causes, effects and control methods of Water pollution.
- 8.9 Define E-Pollution, State the sources of e-waste Explain its health effects and control methods.
- 8.10 Define green chemistry. Write the Principles and benefits of green chemistry.

### COURSE CONTENT

#### ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

##### 1. Fundamentals of Chemistry

**Atomic Structure:** Introduction - Fundamental particles – Bohr's theory – Quantum numbers –Aufbau principle - Hund's rule - Pauli's exclusion Principle- Orbitals, shapes of s, p and d orbitals - Electronic configurations of elements

**Chemical Bonding:** significance–Electronic theory of valency- types of chemical bonds – Ionic and covalent bond with examples–Properties of Ionic and Covalent compounds.

##### 2. Solutions, Acids and Bases

Solutions: Terms and Types of solutions- mole concept –numerical problems on mole concept -Methods of expressing concentration of a solution –molarity and normality – Numerical problems on molarity and normality. Acids and Bases: Arrhenius theory of acids and bases – Ionic product of water- pH – numerical problems on pH– Buffer solutions- Classification- applications.

##### 3. Electrochemistry

Conductors, semiconductors, insulators, electrolytes and non-electrolytes – electrolysis of fused NaCl– applications of electrolysis - Galvanic cell – Battery-Types- Dry Cell(Leclanche Cell),Lead Storage battery-Hydrogen –Oxygen fuel cell.

##### 4. Corrosion

Introduction - factors influencing corrosion - composition, stress and concentration cells–rusting of iron and its mechanism – prevention of corrosion by coating methods, cathodic protection methods.

##### 5. Water technology

Introduction–soft and hard water–causes of hardness–types of hardness–disadvantages of hard water – degree of hardness (ppm and mg/lit) – Numerical problems on hardness - softening methods – Ion- Exchange process– Reverse Osmosis.

##### 6. Polymers & Engineering materials

**Polymers:** concept of polymerization – types of polymerization – addition, condensation with examples – Preparation and uses of the following plastics i).PVC ii) Teflon iii) Polystyrene iv) Nylon 6,6

Elastomers: Preparation and application of the following elastomers i)Buna-s ii) Neoprene

Engineering materials:

Alloys-composition and applications of i) Nichrome, ii)Duralluminium iii) Stainless Steel.

Composite materials- Composition and applications of i) GFR ii) CFR

Liquid Crystals-types- applications of i) Nematic Crystals ii) Smectic crystals

Nano materials- Composition and applications of i) Nanotubes ii) Nano crystals..

## 7. Fuels

Definition and classification of fuels--composition and uses of i) LPG ii) CNG iii) Biogas  
iv) Power alcohol

## 8. ENVIRONMENTAL STUDIES

Environment –scope and importance of environmental studies – important terms related to environment–renewable and non-renewable energy sources–Forest resources – Deforestation -Air pollution–Global impacts on environment –Water pollution – causes – effects – control measures-  
E-Pollution- Sources-health effects-control methods. Green Chemistry- Principles-Benefits

Table specifying the scope of syllabus to be covered for Unit Test- 1, Unit Test- 2 and Unit Test -3

<b>Unit Test</b>	<b>Learning outcomes to be covered</b>
Unit Test - 1	<b>From 1.1 to 2.8</b>
Unit Test - 2	<b>From 3.1 to 5.7</b>
Unit Test - 3	<b>From 6.1 to 8.10</b>

### REFERENCE BOOKS

1. Telugu Academy Intermediate chemistry Vol. 1&2
2. Jain & Jain Engineering Chemistry
3. O.P. Agarwal, Hi- Tech. Engineering Chemistry
4. Sharma Engineering Chemistry
5. A.K. De Engineering Chemistry

Course Code	Course title	No of periods/week	Total no of periods	Marks FA for	Marks for SA
CHOT-105	INTRODUCTION TO CHEMICAL ENGINEERING	05	150	20	80

**TIME SCHEDULE**

S.No	Chapter/Unit title	No Of periods	Weightage of Marks	Short Answer Questions	Essay Answer Questions	CO's Mapped
1	Introduction	10	03	01	-	CO1
2	Physicochemical calculations	10	10	-	01	CO2,CO3
3	Material and energy balances	10	13	01	01	CO1,CO2
4	Equipment for flow of fluids	20	13	01	01	CO2,CO3
5	Heat transfer equipment	25	16	02	01	CO2,CO3,
6	Mass transfer equipment	25	13	01	01	CO3,CO4
7	Chemical Kinetics	15	13	01	01	CO1, CO2, CO3
8	Measuring Devices	20	13	01	01	CO3,CO4
9	Natural Resources and their utilization	05	03	01	-	CO2,CO3,CO4
10	Chemical and allied industries in state, national and international level	05	03	01	-	CO1,CO2,CO3,CO5
11	Chemical and allied industries in state, national and international level in Small, Medium and large scale	05	10	-	01	CO1,CO2,CO3,CO5
<b>Total</b>		<b>150</b>	<b>110</b>	<b>10</b>	<b>08</b>	

<b>Course Objectives</b>	<ol style="list-style-type: none"> <li>1. To familiarize with the knowledge of importance of Chemical Engineering, Physico-Chemical calculations and Material and energy balances, equipment for flow of fluids, Chemical kinetics, measuring devices, natural resources and their utilization</li> <li>2. To know the various Unit operations like heat and mass transfer operations</li> <li>3. To familiarize with the Chemical and allied industries available in state, national, international level and in small, medium and large scale</li> </ol>
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CO NO		Course Outcomes
CO1	CHOT-105.1	Explain the list of basic laws in chemical engineering
CO2	CHOT-105.2	Illustrate the principles of physico - chemical calculations, mass and energy balances with examples
CO3	CHOT-105.3	Demonstrate the skill of drawing and labelling equipment for flow of fluids, heat transfer and mass transfer operations
CO4	CHOT-105.4	Identify the various measuring devices for density, specific gravity, viscosity, humidity, pH, chemical composition, pressure, temperature, flow level and liquid level
CO5	CHOT-105.5	Examine the principles of chemical kinetics and list of the chemical and allied industries in state, national, international level in small, medium and large scale

### COs-POs /PSO MATRIX

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-105.1	1	-	3	-	-	-	-	3	-	-
CHOT-105.2	1	-	-	2	-	-	-	3	-	-
CHOT-105.3	-	2	-	-	-	-	-	3	-	-
CHOT-105.4	-	2	3	-	-	-	-	3	-	2
CHOT-105.5	1	2	-	-	-	-	-	3	2	-
<b>AVERAGE</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>				<b>3</b>	<b>2</b>	<b>2</b>

### Learning Objectives:

#### **1.0 Know the importance of Chemical Engineering**

**1.1** Know the importance of Chemical engineering

**1.2** Know Types of Unit Operations

**1.3** Understand Basic Laws

**1.4** List the Useful Mathematical Methods

**1.5** Comprehend Units and Dimensions

#### **2.0 Know Physico-Chemical Calculations**

**2.1** Define Energy

**2.2** Know Equivalent Mass(Weight)

**2.3** Define Solution

**2.4** Know various Electrochemical Processes

**2.5** Know Hardness of water.

**2.6** Define Humidity and saturation

#### **3.0 Understand Material and Energy Balances**

**3.1** Know Material Balances –only simple physical examples

**3.2** Understand Energy Balances- only simple physical examples

#### **4. 0 Know about Equipment for Flow of Fluids-only importance of equipment and its parts**

**4.1** Know the Introduction of flow of fluids

**4.2** Understand the Nature of a fluid

- 4.3 Define viscosity
- 4.4 Know about tubes and pipes 4.5 Understand the schedule No.
- 4.6 Know the classification of pumps
- 4.7 Know about positive displacement pumps with examples
- 4.8 Know about rotary positive displacement pumps
- 4.9 Know about centrifugal action pumps
- 4.10 Know about fans, blowers and compressors
- 4.11 know about flow measuring equipment-only importance, figures and parts
- 4.12 importance of manometer
- 4.13 know about venturi-meter, orifice meter, and rotameter

## **5.0 Heat Transfer Equipment**

- 5.1 Conduction
- 5.2 Convection
- 5.3 Radiation
- 5.4 know about Heat transfer equipment-only importance of equipment and parts
- 5.5 know about double pipe, shell and tube heat exchangers
- 5.6 know about plate type heat exchangers
- 5.7 know about Evaporation
- 5.8 know about short tube and long tube forced circulation evaporators

## **6.0 Mass Transfer Equipment**

- 6.1 Introduction
- 6.2 Know about Mass transfer operations
- 6.3 Know about Absorption equipment-only importance and parts
- 6.4 Know about distillation equipment-only importance and parts
- 6.5 Know about extraction equipment-only importance and parts
- 6.6 Know about adsorption
- 6.7 Know about drying equipment-only importance and parts
- 6.8 Know about cooling towers-only importance and parts
- 6.9 know about Crystallization equipment-only importance and parts

## **7.0 Chemical Kinetics**

- 7.1 Introduction
- 7.2 Thermodynamics Review
- 7.3 Some useful Terms in chemical Processing

## **8.0 Measuring Devices**

- 8.1 Density and Specific Gravity
- 8.2 Viscosity and Consistency
- 8.3 Humidity
- 8.4 pH
- 8.5 Chemical compositions
- 8.6 Pressure
- 8.7 Temperature
- 8.8 Flow meters
- 8.9 Liquid level

## **9.0 Natural Resources and their Utilization**

- 9.1 Renewable Raw Materials
- 9.2 Non-Renewable Raw Materials

## **10.0 Chemical Industries in India and abroad**

- a) Petro-chemical Industries
- b) Fertilization Industries
- c) Polymerization Industries

- d) Vegetables oils & fats Industries.
- e) Iron & Steel Industries
- f) Paint Industries
- g) Rubber Industries.

**11.0 Large , Medium, Small scale Industries.**

- a) Know some of the large scale industries
- b) Know some of the medium scale industries
- c) Know some of the small scale industries

**COURSE CONTENTS:**

- 1.0 Introduction** : importance of Chemical engineering-Types of Unit Operations  
Basic Laws ,Mathematical Methods-Units and Dimensions
- 2.0 Physico-Chemical Calculations:** Define Energy Equivalent Mass(Weight)Solution various Electrochemical Processes-Humidity and saturation Hardness of water.
- 3.0 Material and Energy Balances:** Energy Balances- only simple physical examples  
Material Balances –only simple physical examples
- 4.0 Equipment for Flow of Fluids:** Introduction of flow of fluids-the Nature of a fluid  
Viscosity-tubes and pipes-the schedule No classification of pumps-positive displacement pumps with examples rotary positive displacement pumps-rotameter- fans, blowers and compressors flow measuring equipment -only importance, figures and parts- manometer venturi-meter, orifice meter-centrifugal action pumps
- 5.0 Heat Transfer Equipment:** Conduction-Convection-Radiation-Heat transfer equipment- only importance of equipment and parts-double pipe , shell and tube heat exchangers-plate type heat exchangers-Evaporation-short tube and long tube forced circulation evaporators
- 6.0 Mass Transfer Equipment:** Mass transfer operations-Absorption equipment-only importance and parts-Crystallization equipment-only importance and parts distillation equipment -only importance and parts extraction equipment-only importance and parts- adsorption-drying equipment-only importance and parts cooling towers-only importance and part.- Crystallization equipment.
- 7.0. Chemical Kinetics:** Introduction-Some useful Terms in chemical Processing- Thermodynamics
- 8.0. Measuring Devices:** Liquid level-Viscosity and Consistency-Humidity-pH-Chemical Compositions-Pressure -Temperature -Flow meters-Density and Specific Gravity.
- 9.0 Natural Resources and their Utilization:** Renewable Raw Materials-Non-Renewable Raw Materials
- 10.0 Chemical Industries in India and abroad:** Petro-chemical Industries-Fertilization Industries Polymerization Industries- Vegetables oils & fats Industries.- Rubber Industries-Paint Industries-Iron & Steel Industries
- 11.0 Large , Medium, Small scale Industries.:** some of the large scale industries-small scale industries- the medium scale industries

**Reference books:**

- 1) Introduction to chemical engg.-sanyal,ghoshal and dutta.
- 2) Physical chemistry-ball and tuli.
- 3) Unit operations in chemical engg.-Maccabe ,smith and harriot

POs	Pos Mapped with CO No.	CO periods addressing PO in column 1		Level (1,2,3)	REMARKS
		NO	%		
PO1	CO1	40	44	3	>40% level3 Highly addressed 25% level2 Moderately addressed 5 to 25% level1 Low addressed <5% not addressed
PO2	CO2	5	6	1	
PO3	CO3,CO5	33	36	2	
PO4	CO4	12	14	1	
PO5					
PO6					
PO7					

**C-23, CHOT-105**  
**Subject Name: INTRODUCTION TO CHEMICAL ENGINEERING**  
**I Year**  
**Syllabus split up for Unit Test**

Unit test NO	Learning out comes to be covered
Unit test-I	Objective from 1.1 to 4.13
Unit test-II	Objective from 5.1 to 6.9
Unit test-III	Objective from 7.1to 11c

Course Code	Course title	No. of periods/week	Total no of periods	Marks of FA	Marks for SA
CHOT - 106	Materials Technology	05	150	20	80

#### TIME SCHEDULE

S.NO	Chapter/ unit title	No. of periods	Weightage Allocated	Short Answer Questions	Essay type questions	Cos Mapped
1	Introduction	05	03	1		CO1
2	Mechanical properties of metals and testing of materials	20	23	1	2	CO1, CO3
3	Structure of metals and alloys	13	13	1	1	CO1
4	Thermal equilibrium diagram	17	10		1	CO2
5	Production of iron and steel	22	23	1	2	CO1, CO3, CO4, CO5
6	Plain carbon and alloy steels	10	6	2		CO1, CO4, CO5
7	Non - ferrous metals and alloys	15	13	1	1	CO1, CO4
8	Miscellaneous materials	25	06	2		CO1, CO4, CO5
9	Corrosion	23	13	1	1	CO1, CO3
	<b>TOTAL</b>	<b>150</b>	<b>110</b>	<b>10</b>	<b>8</b>	

#### COURSE OBJECTIVES

<b>COURSE OBJECTIVES</b>	<ul style="list-style-type: none"> <li>i. Definition and classification of engineering materials and their applications, mechanical properties and testing of materials, structure of metals and alloys.</li> <li>ii. Thermal equilibrium diagram, cooling and allotropic forms of pure iron, manufacturing methods of iron and steel, classification, composition, properties, and applications of plain carbon and alloy steel.</li> <li>iii. Composition, properties, and applications of non-ferrous and metals and alloys applications of miscellaneous materials, types of corrosion , prevention methods of corrosion.</li> </ul>
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#### Course outcomes:

CO NO	Course Outcomes

CO1	CHOT-106.1	Describe the basics, definitions, structure, phenomenon of various concepts related to Engineering materials.
CO2	CHOT -106.2	Illustrate the concepts related to Thermal Equilibrium diagrams.
CO3	CHOT -106.3	Explain about the construction and working of various testing machines to test the properties, Corrosion prevention methods, manufacturing methods of various Engineering materials with the aid of block diagrams, flow diagrams and neat sketches.
CO4	CHOT -106.4	Analyse the properties of various Engineering materials.
CO5	CHOT -106.5	Appraise the applications of various Engineering materials.

### CO-PO/PSO MATRIX

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT -106.1	3							1	3	1
CHOT -106.2		2							3	
CHOT -106.3			3						3	1
CHOT -106.4				2					3	
CHOT -106.5			2							1
<b>AVERAGE</b>	<b>3</b>	<b>2</b>	<b>2.5</b>	<b>2</b>				<b>1</b>	<b>3</b>	<b>1</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

### Learning outcome

#### CHAPTER – 1

- a. Definition of Engineering Material.
- b. Classification of Engineering Materials
- c. Need of Engineering Materials and their applications.

#### CHAPTER – 2

2.1 Define the following properties

- a. Strength of a material
- b. Ultimate Strength
- c. Stress
- d. Strain
- e. Elasticity
- f. Tensile and compressive strength
- g. Ductility
- h. Hardness
- i. Toughness
- j. Brittleness
- k. Impact strength
- l. Fatigue and creep strength.

2.2 Distinguish between destructive and non-destructive methods of testing to identify various defects of materials and their applications..

2.3 Explain tensile strength and Compressive strength's by universal testing machine

2.4 Describe the hardness by Brinell hardness testing and Rockwell hardness testing machines.

2.5 Illustrate the determination of impact strength by Izod and Charpy's testing machines.

2.6 Summarize the procedures to detect the internal defects of a metal by radiography and ultrasonic tests.

### **CHAPTER -3**

- 3.1 Quote Unit cell and space lattice.
- 3.2 Describe the arrangements of atoms in FCC (Face Centered Cubic), BCC (Body Centered Cubic) and HCP (Hexagonally close packed) systems and give examples.
- 3.3 State the effect of grain size on mechanical properties.
- 3.4 Identify the factors promoting grain size.
- 3.5 Explain the phenomenon of crystallization.

### **CHAPTER – 4**

- 4.1 Explain Cooling curve and Allotropic forms of pure iron.
- 4.2 Draw Iron – Carbon thermal equilibrium diagram.
- 4.3 Locate the peritectic, eutectic, eutectoid points from the iron – carbon diagram.

### **CHAPTER – 5**

- 5.1 List the various raw materials required for the production of iron.
- 5.2 Describe the block diagram of various manufacture methods of steel and iron.
- 5.3 Explain the production of Pig iron in Blast Furnace.
- 5.4 Explain the production of Cast iron in Cupola Furnace.
- 5.5 Explain the manufacturing methods of steel.
- 5.6 List different types of cast iron.
- 5.7 Mention the properties of cast Iron
- 5.8 Mention applications of cast-iron.

### **CHAPTER – 6**

- 6.1 List the classification of plain carbon steels.
- 6.2 Describe the need for alloying the steel with other elements.
- 6.3 List the composition of alloy steels.
- 6.4 Mention the properties of alloy steels.
- 6.5 Mention the industrial applications of alloy steels.
- 6.6 Select the proper alloy steel for the given engineering application.

### **CHAPTER - 7**

- 7.1 Explain the importance of various non – ferrous metals and alloys – aluminium, copper, Nickel, lead, Tin, Zinc, titanium, Zirconium.
- 7.2 List the properties of aluminium, copper, zinc, tin, lead, and their applications.
- 7.3 Explain the effects of the alloying elements (a) Copper (b) Silica (c) Magnesium (d) Manganese with aluminium.
- 7.4 List the types of copper alloys (Brass & Bronze).
- 7.5 Mention the properties of copper alloys (Brass & Bronze).
- 7.6 Mention the applications of copper alloys (Brass & Bronze).
- 7.7 List the types of Nickel alloys (Monel, Hastalloy).
- 7.8 Mention the properties of Nickel alloys (Monel, Hastalloy).
- 7.9 Mention the applications of Nickel alloys (Monel, Hastalloy).

### **CHAPTER – 8**

- 8.1 Explain the Importance and types of Glass.
- 8.2 Mention the applications of Glass.
- 8.3 Describe the importance of glass and its lining as materials of construction for the process equipment.
- 8.4 List the properties of carbon and graphite.
- 8.5 List the applications of carbon and graphite.
- 8.6 Explain the composition of stoneware.
- 8.7 Mention the properties of stoneware.

- 8.8 Mention the applications of stoneware.  
 8.9 List the applications of asbestos, Rubber, Elastomers.  
 8.10 List the application of polymers.  
 8.11 Define refractories.  
 8.12 State the applications of refractories.  
 8.13 List the applications of Glass ceramics, Ceramites and Glass wool.

**CHAPTER – 9**

- 9.1 Define corrosion and explain the causes of corrosion.  
 9.2 Explain electro chemical theory of corrosion.  
 9.3 Describe (a) electrode potential (b) passivity (c) electro chemical series (d)polarization.  
 9.4 Explain briefly about (a) uniform corrosion (b) stress corrosion (c) pitting (d) hydrogen attack(e) Bimetallic corrosion (f) grain boundary corrosion (g) Fatigue corrosion  
 9.5 Explain briefly about the methods of prevention corrosion by a) proper selection of materials (b) organic coatings (c) inorganic coatings (d) Anodic and cathodic protection (e) Anodic and cathodic inhibitors.  
 9.6 Know the materials of construction for various process equipment for storing various chemicals.

POs	Pos Mapped with CO No.	CO periods addressing PO in column 1		Level (1,2,3)	REMARKS
		NO	%		
PO1	CO1	40	44	3	>40% level3 Highly addressed 25% level2 Moderately addressed 5 to 25% level1 Low addressed <5% not addressed
PO2	CO2	5	6	1	
PO3	CO3,CO5	33	36	2	
PO4	CO4	12	14	1	
PO5					
PO6					
PO7					

**Hyponated course contents:**

*COURSE CONTENTS:*

1. Introduction – Definition, Classification of engineering materials, need and applications.
2. Mechanical properties of metals & Testing of materials – define the terms ,Ultimate Strength , Stress , Strain ,Elasticity , tensile and compressive strength, ductility, hardness, toughness, brittleness, impact strength, fatigue and creep strength- various destructive testing methods of tensile strength,

compressive strength, hardness, impact strength and various non destructive testing methods – x ray,  $\square$  – ray and ultrasonic test.

3. Structure of metals and alloys – unit cell – space lattice – FCC, BCC, HCP space lattices – formation of grains by dendritic growth, effect of rate of cooling on grain formation – effect of grain size on mechanical properties – factors promoting grain size – crystallization.
4. Thermal equilibrium diagram – cooling curve for pure iron – allotropic forms of pure iron, iron – carbon thermal equilibrium diagram – peritectic, eutectic and eutectoid points in iron carbon diagram.
5. Production of iron and steel – Production of iron by Blast furnace, cast iron by cupola furnace – Steel by Bessemer converter, L.D converter, electric arc furnace- classification of cast iron – white, grey, malleable and S.G. cast irons.
6. Plain carbon steels and alloy steels – classification of plain carbon steels, application – alloying of steels – industrial applications of alloy steels, alloy steels for engineering applications.
7. Non ferrous metals and their alloys – importance of various non ferrous metals of aluminum, copper, nickel, lead, tin, zinc, titanium, zirconium, - properties of aluminum, copper zinc, tin, lead and their application – effect of alloying elements Cu, Si, Mg, Mn with aluminum – types of Nickel and copper alloys, their properties and applications.
8. Miscellaneous materials – Importance of glass ,types and applications – application of polymers – composition, properties, applications of stoneware – applications of asbestos, rubber, elastomers, polymers, epoxy resin, fibre glass, reinforced plastics,refractories,Glass ceramics, Ceramites ,Glass wool.
9. Corrosion : corrosion – causes of corrosion – electro chemical theory – electrode potential – passivity – electro chemical series – polarization – types of corrosion – uniform corrosion – stress corrosion

– pitting corrosion – hydrogen attack – bimetallic corrosion – grain boundary corrosion – fatigue corrosion – methods of prevention of corrosion.

#### REFERENCE BOOKS:

1. Engineering Chemistry by Jain & Jain, Dhanapat Rai Publications, New elhi.
2. Engineering Metallurgy by D. Swarup
3. Engineering Metallurgy by Higgins.
4. Corrosion Engineering by Fontane McGraw Hill.
5. Engineering Metallurgy by S.P.Naik.
6. Engineering Metallurgy by D. Swarup.
7. Material Science by HazraChowdhery.
8. An introduction to Science of corrosion and inhibition by S.N.Benerjee.
9. Elements of Fuels, furnaces and refractories by O.P.Gupta
10. Engineering Materials by Pakirappa.
11. Materials Science and EngineeringbyRaghavan V
12. Engineering Materials by R K Rajput

**C-23, CHOT-106**  
**Subject Name: Materials Technology**  
**I Year**  
**Syllabus split up for Unit Test**

<b>Unit test No.</b>	<b>Learning out comes to be covered</b>
Unit test-I	Objectives from 1.1 to 4.3
Unit test-II	Objective from 5.1 to 7.9
Unit test-III	Objective from 8.1 to 9.6

## ENGINEERING DRAWING

Course code	Course Title	No. of periods /week	Total No. of periods	Marks for FA	Marks for SA
CHOT-107	ENGINEERING DRAWING	3	90	40	60

### TIME SCHEDULE

S.No	Unit Title	No. of Periods	Weightage Allocated	Short Answer Questions	Essay type questions	CO'S Mapped
1	Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice	10	10	2		CO1
2	Principles of Geometric Constructions	15	15	1	1	CO2
3	Projections of points, lines, planes and solids	20	25	1	2	CO3
4	Sectional Views	20	10		1	CO4
5	Orthographic projection	25	20		2	CO5
<b>Total</b>		<b>90</b>	<b>80</b>	<b>4</b>	<b>6</b>	

### Course Objectives and Course Outcomes

<b>Course Objectives</b>	Upon completion of the course the student shall be able to understand the basic graphic skills and use them in preparation, reading and interpretation of engineering drawings.
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Course Outcomes	CO1	CHOT -107.1	Practice the use of engineering drawing instruments and Familiarise with the conventions to be followed in engineering drawing as per BIS
	CO2	CHOT -107.2	Construct the i) basic geometrical constructions ii) engineering curves
	CO3	CHOT -107.3	Visualise and draw the projections of i) Points ii) Lines Regular Planes iv) Regular Solids
	CO4	CHOT -107.4	Visualise and draw the sectional views of components
	CO5	CHOT -107.5	Visualise and draw the orthographic projections of components

### LEARNING OUTCOMES

Upon completion of the course the student shall be able to

## 1.0 Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice

- 1.1 State the importance of drawing as an engineering communication medium
- 1.2 Select the correct instruments to draw the different lines / curves.
- 1.3 Use correct grade of pencil and other instruments to draw different types of lines and for different purposes
- 1.4 Identify the steps to be taken to keep the drawing clean and tidy.
- 1.5 Write titles using vertical and slopping (inclined) lettering and numerals of 7mm, 10mm and 14mm height.
- 1.6 Acquaint with the conventions, notations, rules and methods of dimensioning in engineering drawing as per the B.I.S.
- 1.7 Dimension a given drawing using standard notations and desired system of dimensioning.

## 2.0 Principles of Geometric Constructions

- 2.1 Practice the basic geometric constructions like i) dividing a line into equal parts  
i) Exterior and interior tangents to the given two circles  
ii) Tangent arcs to two given lines and arcs
- 2.2 Draw any regular polygon using general method when i) side length is given  
i) Inscribing circle radius is given ii) describing circle radius is given
- 2.3 Draw the engineering curves like i) involute ii) cycloid

## 3.0 Projections of points, lines, planes and solids (All in first quadrant only)

- 3.1 Explain the basic principles of the orthographic projections
- 3.2 Visualise and draw the projection of a point with respect to reference planes (HP & VP)
- 3.3 Visualise and draw the projections of straight lines with respect to two reference  
Planes (up to lines parallel to one plane and inclined to other plane)
- 3.4 Visualise and draw the projections of planes (up to planes perpendicular to one plane and  
inclined to other plane)
- 3.5 Visualise and draw the projections of regular solids like Prisms, Pyramids, Cylinder, Cone (up to axis of  
solids parallel to one plane and inclined to other plane)

## 4.0 Sectional Views

- 4.1 Identify the need to draw sectional views.
- 4.2 Draw sectional views of regular solids by applying the principles of hatching.

## 5.0 Orthographic projection

- 5.1 Draw the orthographic views of an object from its pictorial drawing.
- 5.2 Draw the minimum number of views needed to represent a given object fully.

### Competencies and Key competencies to be achieved by the student

S.No	Major topic	Key Competency
1.	Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice	Explain the linkages between Engineering drawing and other subjects of study in Diploma course.
		Select the correct instruments to draw various entities in different orientation
		Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)

		Dimension a given drawing using standard notations and desired system of dimensioning
2.	Geometrical construction	Dividing a line into equal parts, tangents to circles, Construct involute, cycloid from the given data.
3.	Projection of points, Lines, Planes & Solids	Draw the projections of points, straight lines, planes & solids with respect to reference planes (HP& VP)
4.	Sectional Views	Differentiate between true shape and apparent shape of section Apply principles of hatching. Draw simple sections of regular solids
5.	Orthographic Projection	Draw the minimum number of views needed to represent a given object fully.

## COURSE CONTENTS:

- NOTES: 1. B.I.S Specification should invariably be followed in all the topics.  
2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.

### 1.0 Use of Drawing Instruments, Free Hand Lettering and Dimensioning Practice

Explanation of the scope and objectives of the subject of Engineering Drawing . Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46 –1988 – Mention B.I.S - Role of drawing in -engineering education - Basic Tools, tools for drawing– Mentioning of names under each classification and their brief description -Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet,

Importance of lettering – Types of lettering -Guide Lines for Lettering Practicing of letters & numbers of given sizes (7mm, 10mm and 14mm)-Advantages of single stroke or simple style of lettering - Use of lettering stencils-

Purpose of engineering Drawing, Need of B.I.S code in dimensioning -Shape description of an Engineering object -Definition of Dimensioning size description -Location of features, surface finish, fully dimensioned Drawing -Notations or tools of dimensioning, dimension line extension line, leader line, arrows, symbols, number and notes, rules to be observed in the use of above tools -Placing dimensions: Aligned system and unidirectional system ( SP-46-1988)-Arrangement of dimensions Chain, parallel, combined progressive, and dimensioning by co-ordinate methods-The rules for dimensioning standard, features “Circles (holes) arcs, angles, tapers, chamfers, and dimension of narrow spaces.

### 2.0 Geometric Constructions

Division of a straight line into given number of equal parts –Drawing interior and exterior tangents to two circles of given radii and centre distance-Drawing tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles), Tangent arc of given radius touching a circle or an arc and a given line, Tangent arcs of radius R, touching two given circles internally and externally-Construction of any regular polygon by general method for given side length, inscribing circle radius and describing/superscribing circle radius - Involute, Cycloid, explanations as locus of a moving point, their engineering application, viz., Gear tooth profile, screw threads, springs etc. – their construction

### 3.0 Projection of points, lines and planes and Solids (All in first quadrant only)

Classification of projections, Observer, Object, Projectors, Projection, Reference Planes, Reference Line, Various angles of projections –Differences between first angle and third angle projections  
 Projections of points -Projections of straight line –(a) Parallel to both the planes, (b)Perpendicular to one of the planes and (c) Inclined to one plane and parallel to other planes-Projections of regular planes-(a) Plane parallel to one of the reference planes, (b) Plane perpendicular to HP and inclined to VP and vice versa- Projections of regular solids- (a) Axis perpendicular to one of the planes, (b) Axis parallel to VP and inclined to HP and vice versa.

#### 4.0 Sectional Views

Need for drawing sectional views – what is a sectional view - Hatching – Section of regular solids inclined to one plane and parallel to other plane

#### 5.0 Orthographic Projections

Meaning of orthographic projection - Using a viewing box and a model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object -Concept of front view, top view, and side view sketching these views for a number of engineering objects - Explanation of first angle projection. – Positioning of three views in First angle projection -Projection of points as a means of locating the corners of the surfaces of an object – Use of meter line in drawing a third view when other two views are given -Method of representing hidden lines -Selection of minimum number of views to describe an object fully.

#### REFERENCE BOOKS

- 1 Engineering Graphics by P I Varghese – ( McGraw-hill)
- 2 Engineering Drawing by Basant Agarwal & C.M Agarwal - ( McGraw-hill)
- 3 Engineering Drawing by N.D.Bhatt.
- 4 T.S.M. & S.S.M on “ Technical Drawing” prepared by T.T.T.I., Madras.
- 5 SP-46-1998 – Bureau of Indian Standards.

#### PO-CO Mapping

CHOT-107	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2		1		1	2	3	1
CO2	3	2	2			2	1	2	3	1
CO3	3	2	2	1	1		1	2	3	1
CO4	3	2	2	1		2	1	2	3	1
CO5	3	2	2	1	1	2	1	2	3	1
CO6	3	2	2	1	1	2	1	2	3	1
<b>AVERAGE</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>

**3: High, 2: Moderate,1: Low**

**Table specifying syllabus to be covered for UNIT TEST I, II and III.**

Unit Test	Learning Outcomes to be Covered
Unit Test – I	From 1.1 to 2.3
Unit Test – II	From 3.1 to 3.5
Unit Test – III	From 4.1 to 5.2

### Workshop practice

Course code	Course title	No. of periods/week	Total no. of periods	Marks for FA	Marks for SA
CHOT-108	Workshop practice	6	180	40	60

S.No.	Major Topics	No. of periods
1.	Carpentry	48
2.	Fitting and welding	72
3.	Basic machine operations	44
4.	Plumbing	16
<b>TOTAL</b>		<b>180</b>

Course title : Workshop Practice	
<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes
	(ii) To use various basic implements used in general Engineering processes
	(iii) To know the etiquette of working with the fellow workforce
	(iv) To reinforce theoretical concepts by conducting relevant experiments/exercises
<b>Course Outcomes</b>	C01 Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	C02 Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	C03 Observe various parameters, their variations and graphically represent the same
	C04 Analyse the experimental results to draw inferences to make recommendations
	C05 Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

### CO-PO/PSO MATRIX

CO. NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT -108.1	3	1	2	2	2	1	2	1	1	1
CHOT -108.2	3	2	2	2	2	1	2	1	1	1
CHOT -108.3	3	1	2	3	2	1	2	1	1	1
CHOT -108.4	3	1	2	2	2	1	2	1	1	1
CHOT -108.5	3	2	2	2	2	1	2	1	1	1
<b>AVERAGE</b>	<b>3</b>	<b>1.4</b>	<b>2</b>	<b>2.2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

## Learning outcome

- 1.0 Use of different tools in Carpentry, Fitting, Welding and Turning section of workshop.
- 2.0 Prepare various carpentry joints, panel boards and cabinet boxes.
- 3.0 Hacksaw cutting, grinding, thread cutting for metal conduit; G.I. Pipes and rods etc, in fitting section.
- 4.0 Handle welding transformer and make lap and butt joints.
- 5.0 Exercise on lathe like simple turning, step turning, taper turning and knurling.
- 6.0 Exercise on thread cutting for pipes and rods on Lathes.
- 7.0 Hand drilling machines and grinding machine.
- 8.0 Know the basics of plumbing work and applications.
- 8.1 Know the types of pipe joints.
  - (a) Understand the symbols.
  - (b) Know the materials used in pipes.
  - (c) Assembling, threading, joining of pipes.
  - (d) Able to understand cross, T, L joints etc.

## COURSE CONTENT

### Following list of experiments are to be made by every student in the workshop

#### 1. CARPENTRY

1. Exercises on planning, sawing and chiselling
2. Prepare a half lap joint
3. Prepare a Dovetail joint.
4. Prepare a Mortise joint.
5. Prepare a 20 cm X 15 cm Teakwood switch board with hinges and bottom hook.
6. Fix the laminate sheet to the above box and cut suitable holes to mount tone flush type switch, socket.

#### 2. FITTING AND WELDING

1. Exercises to cut a metal conduit, G.I. Pipe and solid rod using hack saw.
2. 3 & 4 Thread cutting of G.I. pipe, metal conduit and solid rod using Die set.
5. & 6. Internal thread cutting using Tap set and cleaning the threads using reamers and make a hexagonal nut from a round rod.

#### 3. WELDING

1. Prepare a job and to make a lap joint and finish it using grinder.
2. Prepare a job and make a butt joint and finish it with grinder.
3. Prepare the job and make 'T' joint.

#### 4. MACHINE SHOP

1. Exercise on turning the given rod to get three different diameters using lathe.
2. Make a bolt and cut threads using lathe.
3. Cut the threads to G.I. Pipe using lathe.
4. Prepare a centre punch and knurl its head.
5. Make a square plate using power hack saw, remove sharp edges using grinder, make triangle and drill three holes of different diameters at the vertices.

#### 5. PLUMBING

Plumbing work and applications

1. Types of pipe joints.
2. Symbols
3. Materials used for pipes
4. Assembling, Threading, Joining of pipes.
5. Different fittings such as cross, L, T etc.,

## ENGINEERING PHYSICS LAB

Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
CHOT-109	PHYSICS LAB	3	45	20	30

### TIME SCHEDULE

S.No	List of experiments	No. of Periods
1.	Vernier calipers	03
2.	Micrometer (Screw gauge)	03
3.	Verification of Lami's theorem using concurrent forces	03
4.	Determination of g using simple pendulum	03
5.	Focal length and power of convex lens	03
6.	Refractive index of solid using travelling microscope	03
7.	Verification of Boyle's law using Quill tube	03
8	Determination of pole strength of the bar magnet through magnetic field lines	03
9	Resonance apparatus – Determination of velocity of sound in air	03
	<b>Experiments for demonstration</b>	
10	Meter bridge – Determination of resistance and specific resistance of a wire	03
11	Verification of Newton's law of cooling	03
12	Photo electric cell – Study of its characteristics	03
	Revision	06
	Test	03
	<b>Total:</b>	<b>45</b>

Course objectives	<p>(1) To provide strong practical knowledge of Physics to serve as a tool for various device applications in Engineering.</p> <p>(2) To enhance scientific skills of the students by incorporating new experiments so as to enrich the technical expertise of the students as required for industries.</p>
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	CO1	Improving accuracy in various measurements; understanding the nature of the forces keeping the body in equilibrium.
	CO2	Estimating the acceleration caused by the gravity of earth; Practical study of the concepts of refraction of light at curved/plane surface

COURSE OUTCOMES	CO3	Understanding the pressure of the gas as function of its volume; study of the combined magnetic field of the earth and an artificial magnet to estimate its pole strength; Estimating the velocity of sound in air through resonance phenomenon.
	CO4	Applying Kirchoff's laws to evaluate the specific resistance of a wire; Study of exchange of heat from system to surrounding by graphical analysis; Conversion of light to micro currents as potential engineering application.

**Objectives:**

**Upon completion of the course the student shall be able to**

- 1.0 Practise with Vernier calipers to determine the volumes of a cylinder and sphere..
- 2.0 Practise with Screw gauge to determine thickness of a glass plate and cross sectional area of a wire.
- 3.0 Verify the Lami's theorem using concurrent forces.
- 4.0 Determine the value of acceleration due to gravity using Simple Pendulum. To verify the result from  $l-T^2$  graph.
- 5.0 Calculate the Focal length and focal power of convex lens using distant object method, U-V method, U-V graph and  $1/U - 1/V$  graph methods. U-
- 6.0 Determine the refractive index of a solid using travelling microscope
- 7.0 Verify the Boyle's law using Quill tube. To draw a graph between P and  $1/l$ .
- 8.0 Determination of magnetic pole strength of a bar magnet by drawing magnetic lines of force and locating null points (either N-N or N-S method)
- 9.0 Determine the velocity of sound in air at room temperature and its value at zero degree centigrade.
- 10.0 Determine the resistance and specific resistance of material of a wire using Meter Bridge
- 11.0 To verify the Newton's law of cooling.
- 12..0 To study the characteristics of photo electric cell.

S.No	List of experiments	No. of Periods	COs
1.	Vernier calipers	03	CO1
2.	Micrometer (Screw gauge)	03	

3.	Verification of Lami's theorem using concurrent forces	03	
4.	Determination of g using simple pendulum	03	CO2
5.	Focal length and power of convex lens	03	
6.	Refractive index of solid using travelling microscope	03	
7.	Verification of Boyle's law using Quill tube	03	CO3
8	Determination of pole strength of the bar magnet through magnetic field lines	03	
9	Resonance apparatus – Determination of velocity of sound in air	03	
10	Meter bridge – Determination of resistance and specific resistance of a wire	03	CO4
11	Verification of Newton's law of cooling	03	
12	Photo electric cell – Study of its characteristics	03	

#### CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
C0.1	3	2	2	2	2	1	2
C0.2	3		1	1	1	1	1
C0.3	3	2			1		
C0.4	3	2	2			1	2

#### Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
1. Hands on practice on Vernier Calipers(03)	Find the Least count Fix the specimen in posit Read the scales Calculate the physical quantities of given object	Read the scales Calculate the requisite physical quantities of given objects
2. Hands on practice on Screw gauge(03)	Find the Least count Fix the specimen in posit Read the scales Calculate thickness of glass place and cross section of wire and other quantities	Read the scales Calculate thickness of given glass plate Calculate cross section of wire and other quantities

3. Verification of Parallelogram law of forces and Triangle law of forces(03)	Fix suitable weights Note the positions of threads on drawing sheet Find the angle at equilibrium point Construct parallelogram Compare the measured diagonal Construct triangle Find the length of sides Compare the ratios	Find the angle at equilibrium point Constructing parallelogram Construct triangle Compare the ratios of force and length
4. Simple pendulum(03)	<ul style="list-style-type: none"> <li>• Fix the simple pendulum to the stand</li> <li>• Adjust the length of pendulum</li> <li>• Find the time for number of oscillations</li> <li>• Find the time period</li> <li>• Calculate the acceleration due to gravity</li> <li>• Draw l-T and l-T<sup>2</sup> graph</li> </ul>	<ul style="list-style-type: none"> <li>• Find the time for number of oscillations</li> <li>• Find the time period</li> <li>• Calculate the acceleration due to gravity</li> <li>• Draw l-T and l-T<sup>2</sup> graph</li> </ul>
<b>Name of the Experiment(Periods)</b>	<b>Competencies</b>	<b>Key competencies</b>
5. Focal length and Focal power of convex lens (Separate & Combination) (03)	Fix the object distance Find the Image distance <ul style="list-style-type: none"> <li>• Calculate the focal length and power of convex lens and combination of convex lenses</li> <li>• Draw u-v and 1/u – 1/v graphs</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate the focal length and power of convex lens</li> <li>• Draw u-v and 1/u – 1/v graphs</li> </ul>
6 Refractive index of solid using traveling microscope(03)	<ul style="list-style-type: none"> <li>• Find the least count of vernier on microscope</li> <li>• Place the graph paper below microscope</li> <li>• Read the scale</li> <li>• Calculate the refractive index of glass slab</li> </ul>	<ul style="list-style-type: none"> <li>• Read the scale</li> <li>• Calculate the refractive index of glass slab</li> </ul>

7 . Boyle’s law verification (03)	<ul style="list-style-type: none"> <li>• Note the atmospheric pressure</li> <li>• Fix the quill tube to retort stand</li> <li>• Find the length of air column</li> </ul> <p>Find the pressure of enclosed air</p> <p>Find and compare the calculated value <math>P \times l</math></p>	<ul style="list-style-type: none"> <li>•• Find the length of air column</li> <li>• Find the pressure of enclosed air</li> </ul> <p>Find the value <math>P \times l</math></p>
Name of the Experiment	Competencies	Key competencies
8. Mapping of magnet lines of force(03)	<ul style="list-style-type: none"> <li>•• Draw magnetic meridian</li> <li>• Placed the bar magnet in NN and NS directions</li> <li>• Draw magnetic lines of force</li> </ul> <p>Locate the neutral points along equatorial and axial lines</p>	<ul style="list-style-type: none"> <li>• Draw magnetic lines of force</li> <li>• Locate the neutral points along equatorial and axial lines</li> </ul>
9. Velocity of sound in air –Resonance method (03)	<ul style="list-style-type: none"> <li>• Arrange the resonance apparatus</li> <li>• Adjust the reservoir level for booming sound</li> <li>• Find the first and second resonating lengths</li> <li>• Calculate velocity of sound</li> </ul>	<ul style="list-style-type: none"> <li>•• Adjust the reservoir level</li> <li>• Find the first and second resonating lengths</li> </ul> <p>Calculate velocity of sound at room temperature</p> <p>Calculate velocity of sound at <math>0^{\circ} \text{C}</math></p>
10 Meter bridge(03)	<ul style="list-style-type: none"> <li>••• Make the circuit connections</li> <li>• Find the balancing length</li> <li>• Calculate unknown resistance</li> <li>• Find the radius of wire</li> <li>• Calculate the specific resistance</li> </ul>	<ul style="list-style-type: none"> <li>• Find the balancing length</li> <li>• Calculate unknown resistance</li> <li>• Calculate the specific resistance</li> </ul>

**Scheme of Valuation for END Practical Examination :**

<b>A. Writing Aim, Apparatus, Formula, Graph, Precautions carries</b>	<b>10 (Ten)</b>
<b>Marks</b>	
<b>B. For Drawing the table, taking Readings, Calculation work,</b>	
<b>Drawing the graph, finding result carries</b>	<b>15 (Fifteen)</b>
<b>Marks C. Viva Voice</b>	<b>05</b>
<b>(Five) Marks</b>	
<b>Total</b>	<b>30 (Thirty) Marks</b>

**CHEMISTRY LABORATORY**  
(C-23 curriculum common to all Branches)

Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
CHOT-110	Chemistry Laboratory	3	45	20	30

CO1	Operate and practice volumetric apparatus and preparation of standard solution
CO2	Evaluate and judge the neutralization point in acid base titration
CO3	Evaluate the end point of reduction and oxidation reaction
CO4	Judge the stable end point of complex formation, stable precipitation
CO5	Judge operate and demonstrate and perform precise operations with instrument for investigation of water pollution parameters

**PO- CO mapping**

Course code CHOT-110	Chemistry Laboratory No of Cos:5			No Of periods 45
POs	Mapped with CO No	CO periods addressing PO in Col 1 NO	Level 1,2,3 %	remarks
PO1	CO1,CO2,CO3, CO4,CO5	12	26.66	>40% level 3 (highly addressed) 25% to 40% level2(moderately addressed 5% to 25% level1 (Low addressed < 5%(not addressed)
PO2	CO1,CO2,CO3, CO4,CO5	9	20	
PO3				
PO4	CO1,CO2,CO3, CO4,CO5	12	26.66	
PO5	CO2,CO3, CO4,CO5	12	26.66	
PO6				
PO7				

**COs-POs mapping strength (as per given table)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3		1				1		
CO2	2	3		2	2			1		
CO3	2	3		2	2			1		
CO4	2	3		2	2			1		
CO5	2	3		2	2			1		

3=strongly mapped      2= moderately mapped      1= slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities

from the following: i) Seminars ii) Tutorials iii) Guest Lectures iv) Assignments v) Quiz competitions  
vi) Industrial visit vii) Tech Fest viii) Mini project ix) Group discussions x) Virtual classes  
xi) Library visit for e-books

#### TIMESCHEDULE

S.No	Name of the Experiment	No. of Periods	Mapped with COs
1.	a) Recognition of chemical substances and solutions used in the laboratory by senses. b) Familiarization of methods for Volumetric analysis	03	CO1
2.	Preparation of Std $\text{Na}_2\text{CO}_3$ and making solutions of different dilution solution.	0	C
3.	Estimation of HCl solution using Std. $\text{Na}_2\text{CO}_3$ solution	0	C
4.	Estimation of NaOH using Std. HCl solution	0	C
5.	Determination of acidity of water sample	0	C
6.	Determination of alkalinity of water sample	0	C
7.	Estimation of Mohr's Salt using Std. $\text{KMnO}_4$	0	C
8.	Estimation of Ferrous ion by using Std. $\text{K}_2\text{Cr}_2\text{O}_7$	0	C
9.	Determination of total hardness of water using Std. EDTA solution	0	C
10.	Estimation of Chlorides present in water sample	0	C
11.	Estimation of Dissolved Oxygen(D.O )in water sample	0	C
12.	Determination of pH using pH meter	03	CO5
13.	Determination of conductivity of water and adjusting ionic strength	03	CO5
14.	Determination of turbidity of water	03	CO5
15.	Estimation of total solids present in water sample	03	CO5
	<b>Total:</b>	<b>45</b>	

#### Objectives:

##### Upon completion of the course the student shall be able to

- 1.0 Practice volumetric measurements (using pipettes, measuring jars, volumetric flask, burettes) and gravimetric measurements (using different types of balances), making dilutions, etc. To identify the chemical compounds and solutions by senses.
- 2.0 Practice making standard solutions with pre weighed salts and to make solutions of desired dilutions using appropriate techniques.
- 3.0 Conduct titrations adopting standard procedures and using Std.  $\text{Na}_2\text{CO}_3$  solution for estimation of HCl
- 4.0 Conduct titrations adopting standard procedures and using Std. HCl solution for estimation of NaOH
- 5.0 Conduct titrations adopting standard procedures to determine the acidity of given samples of water (One ground water and one surface / tap water, and rain water if available)
- 6.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water (One ground water and one surface / tap water)
- 7.0 Conduct titrations adopting standard procedures and using Std.  $\text{KMnO}_4$  solution for estimation of Mohr's Salt
- 8.0 Conduct titrations adopting standard procedures and using Std.  $\text{K}_2\text{Cr}_2\text{O}_7$  solution for estimation of Ferrous ion.
- 9.0 Conduct titrations adopting standard procedures to determine the total hardness of given samples of water (One ground water and one surface / tap water) using Std. EDTA solution

- 10.0 Conduct titrations adopting standard procedures to determine the chlorides present in the given samples of water and wastewater (One ground water and one surface / tap water)
- 11.0 Conduct the test using titrimetric / electrometric method to determine Dissolved Oxygen (D.O) in given water samples (One sample from closed container and one from open container / tap water)
- 12.0 Conduct the test on given samples of water / solutions (like soft drinks, sewage, etc.) to determine their pH using standard pH meter
- 13.0 Conduct the test on given samples of water / solutions
- a) To determine conductivity
- b) To adjust the ionic strength of the sample to the desired value
- 14.0 Conduct the test on given samples of solutions (coloured and non- coloured) to determine their turbidity in NTU
- 15.0 To determine the total solids present in given samples of water (One ground water and one surface / tap water)

**Competencies and Key competencies to be achieved by the student**

Name of the Experiment (No of Periods)	Competencies	Key competencies
Familiarization of methods for Volumetric analysis. Recognition of chemical substances And	-	--
Preparation of Std $\text{Na}_2\text{CO}_3$ and making solutions of different dilution(03)	Weighing the salt to the accuracy of .01 mg Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette Making appropriate dilutions	Weighing the salt to the accuracy of .01 mg Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette Making appropriate dilutions
Estimation of HCl solution using Std. $\text{Na}_2\text{CO}_3$ solution (03)	Cleaning the glassware and rinsing with appropriate solutions	Making standard solutions Measuring accurately the standard solutions and titrants Effectively Controlling the flow of the titrant Identifying the end point Calculating the results
Estimation of NaOH using Std.HCl solution (03)	Making standard solutions Measuring accurately the standard solutions	
Determination of acidity of water sample (03)	and titrants Filling the burette with titrant	
Determination of alkalinity of water sample (03)	Fixing the burette to the stand Effectively Controlling the flow of the	
Estimation of Mohr's Salt using Std. $\text{KMnO}_4$ (03)	titrant Identifying the end point	
Estimation of Ferrous ion by using Std. $\text{K}_2\text{Cr}_2\text{O}_7$ (03)	Making accurate observations Calculating the results	
Determination of total hardness of water using Std. EDTA solution (03)		
Estimation of Chlorides present in water sample (03)		
Estimation of Dissolved Oxygen(D.O) in water sample (By titration method) (03)		

Determination of pH using pH meter (03)	Familiarize with instrument Choose appropriate 'Mode' / 'Unit' Prepare standard solutions / buffers, etc.	Prepare standard solutions / buffers, etc. Standardize the instrument with appropriate standard solutions Plot the standard curve Make measurements accurately
Determination of conductivity of water and adjusting ionic strength to required level (03)	Standardize the instrument with appropriate standard solutions Plot the standard curve Make measurements accurately	
Determination of turbidity of water (03)	Follow Safety precautions	
Estimation of total solids present in water sample (03)	Measuring the accurate volume and weight of sample Filtering and air drying without losing any filtrate Accurately weighing the filter paper, crucible and filtrate Drying the crucible in an oven	Measuring the accurate volume and weight of sample Filtering and air drying without losing any filtrate Accurately weighing the filter paper, crucible and filtrate

#### SCHEME OF VALUATION

A) Writing Chemicals, apparatus ,principle and procedure		5M
B) Demonstrated competencies	20M	
Making standard solutions		
Measuring accurately the standard solutions and titrants		
Effectively controlling the flow of the titrant		
Identifying the end point		
Making accurate observations		
C) Viva-voce		5M
Total		30M

### Computer Fundamentals Lab

Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
CHOT-111	Computer Fundamentals Lab	3	90	40	60

**Time schedule:**

S.No.	Chapter/Unit Title	No. of sessions each of 3 periods duration	No.of Periods
1.	Computer hardware Basics	2	6
2.	Windows Operating System	2	6
3.	MS Word	8	24
4.	MS Excel	7	21
5.	MS PowerPoint	5	15
6.	Adobe Photoshop	6	18
<b>Total periods</b>		<b>30</b>	<b>90</b>

S.No.	Chapter/Unit Title	No.of Periods	CO's Mapped
1.	Computer hardware Basics	6	CO1
2.	Windows Operating System	6	CO1
3.	MS Word	24	CO2
4.	MS Excel	21	CO3
5.	MS PowerPoint	15	CO4
6.	Adobe Photoshop	18	CO5
<b>Total periods</b>		<b>90</b>	

<b>Course Objectives</b>	i)To know Hardware Basics ii)To familiarize operating systems iii)To use MS Office effectively to enable to students use these skills in future courses iv) To use Adobe Photoshop in image editing.
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<b>Course Outcomes</b>	At the end of the course students will be able to		
	CO1	CHOT-111.1	Identify hardware and software components
	CO2	CHOT-111.2	Prepare documents with given specifications using word processing software
	CO3	CHOT-111.3	Use Spread sheet software to make calculation and to draw various graphs / charts.
	CO4	CHOT-111.4	Use Power point software to develop effective presentation for a given theme or topic.
	CO5	CHOT-111.5	Edit digital or scanned images using Photoshop

### CO-PO/PSO MATRIX

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-111.1	3	3	3	3	3	3	3	3	2	3
CHOT-111.2	3	3	3	3	3	3	3	3	2	3
CHOT-111.3	3	3	3	3	3	3	3	3	2	3
CHOT-111.4	3	3	3	3	3	3	3	3	2	3
CHOT-111.5	3	3	3	3	3	3	3	3	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>

**3=Strongly mapped , 2=moderately mapped, 1=slightly mapped**

#### **Learning Outcomes:**

##### **I. Computer Hardware Basics**

- a).To Familiarize with Computer system and hardware connections
- b).To Start and Shut down Computer correctly
- c).To check the software details of the computer
2. To check the hardware present in your computer

##### **II. Windows's operating system**

3. To Explore Windows Desktop
4. Working with Files and Folders
5. Windows Accessories: Calculator – Notepad – WordPad – MS Paint

##### **III. Practice with MS-WORD**

6. To familiarize with Ribbon layout of MS Word  
Home – Insert- Page layout – References – Review- View.
7. To practice Word Processing Basics
8. To practice Formatting techniques
9. To insert a table of required number of rows and columns
10. To insert Objects, Clipart and Hyperlinks
11. To use Mail Merge feature of MS Word
12. To use Equations and symbols features

##### **IV.Practice with MS-EXCEL**

13. To familiarize with MS-EXCEL layout
14. To access and enter data in the cells
15. To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
16. To use built in functions and Formatting Data
17. To create Excel Functions, Filling Cells
18. To enter a Formula for automatic calculations
19. To sort and filter data in table.
20. To present data using Excel Graphs and Charts.
21. To develop lab reports of respective discipline.
22. To format a Worksheet in Excel, Page Setup and Print

##### **V. Practice with MS-POWERPOINT**

23. To familiarize with Ribbon layout features of PowerPoint 2007.
24. To create a simple PowerPoint Presentation
25. To set up a Master Slide in PowerPoint
26. To insert Text and Objects
27. To insert a Flow Charts
28. To insert a Table
29. To insert a Charts/Graphs

30. To insert video and audio
31. To practice Animating text and objects
32. To Review presentation

#### VI. Practice with Adobe Photoshop

33. To familiarize with standard toolbox
34. To edit a photograph.
35. To insert Borders around photograph.
36. To change Background of a Photograph.
37. To change colours of Photograph.
38. To prepare a cover page for the book in your subject area.
39. To adjust the brightness and contrast of the picture so that it gives an elegant look.
40. To type a word and apply the shadow emboss effects.

#### Key competencies:

Expt No	Name of Experiment	Competencies	Key competencies
1 (a).	To familiarize with Computer system and hardware connections	<ol style="list-style-type: none"> <li>a. Identify the parts of a Computer system: i). CPU ii). Mother Board iii) Monitor iv) CD/DVD Drive v) Power Switch vi) Start Button vii) Reset Button</li> <li>b. Identify and connect various peripherals</li> <li>c. Identify and connect the cables used with computer system</li> <li>d. Identify various ports on CPU and connect Keyboard &amp; Mouse</li> </ol>	Connect cables to external hardware and operate the computer
1 (b).	To Start and Shut down Computer correctly	<ol style="list-style-type: none"> <li>a. Log in using the password</li> <li>b. Start and shut down the computer</li> <li>c. Use Mouse and Key Board</li> </ol>	<ol style="list-style-type: none"> <li>a. Login and logout as per the standard procedure</li> <li>b. Operate mouse &amp; Key Board</li> </ol>
1 (c).	To Explore Windows Desktop	<ol style="list-style-type: none"> <li>a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts</li> <li>b. Access application programs using Start menu, Task manager</li> <li>c. Use Help support</li> </ol>	<ol style="list-style-type: none"> <li>a. Access application programs using Start menu</li> <li>b. Use taskbar and Task manager</li> </ol>
2.	To check the software details of the computer	<ol style="list-style-type: none"> <li>a. Find the details of Operating System being used</li> <li>b. Find the details of Service Pack installed</li> </ol>	Access the properties of computer and find the details

3.	To check the hardware present in your computer	<ul style="list-style-type: none"> <li>a. Find the CPU name and clock speed</li> <li>b. Find the details of RAM and Hard disk present</li> <li>c. Access Device manager using Control Panel and check the status of devices like mouse and key board</li> <li>d. Use My Computer to check the details of Hard drives and partitions</li> <li>e. Use the Taskbar</li> </ul>	<ul style="list-style-type: none"> <li>a. Access device manager and find the details</li> <li>b. Type /Navigate the correct path and Select icon related to the details required</li> </ul>
4.	Working with Files and Folders	<ul style="list-style-type: none"> <li>a. Create folders and organizing files in different folders</li> <li>b. Use copy / paste move commands to organize files and folders</li> </ul>	<ul style="list-style-type: none"> <li>a. Create files and folders Rename , arrange and search for the required folder/file</li> </ul>
	Working with Files and Folders Continued....	<ul style="list-style-type: none"> <li>c. Arrange icons – name wise, size, type, Modified</li> <li>d. Search a file or folder and find its path</li> <li>e. Create shortcut to files and folders (in other folders) on Desktop</li> <li>f. Familiarize with the use of My Documents</li> <li>g. Familiarize with the use of Recycle Bin</li> </ul>	<ul style="list-style-type: none"> <li>b. Restore deleted files from Recycle bin</li> </ul>
5.	To use Windows Accessories: Calculator – Notepad – WordPad – MS Paint	<ul style="list-style-type: none"> <li>a. Familiarize with the use of Calculator</li> <li>b. Access Calculator using Run command</li> <li>c. Create Text Files using Notepad and WordPad and observe the difference in file size</li> <li>d. Use MS paint and create .jpeg, .bmp files using MS Paint</li> </ul>	<ul style="list-style-type: none"> <li>a. Use windows accessories and select correct text editor based on the situation.</li> <li>b. Use MS pain to create /Edit pictures and save in the required format.</li> </ul>
6.	To familiarize with Ribbon layout of MS word. – Home – Insert- page layout- References- Review-View	<ul style="list-style-type: none"> <li>a. Create/Open a document</li> <li>b. Use Save and Save as features</li> <li>c. Work on two Word documents simultaneously</li> <li>d. Choose correct Paper size and Printing options</li> </ul>	<ul style="list-style-type: none"> <li>a. Create a Document and name appropriately and save</li> <li>b. Set paper size and print options</li> </ul>

7.	To practice Word Processing Basics	<ul style="list-style-type: none"> <li>a. Typing text</li> <li>b. Keyboard usage</li> <li>c. Use mouse (Left click / Right click / Scroll)</li> <li>d. Use Keyboard shortcuts</li> <li>e. Use Find and Replace features in MS-word</li> <li>f. Use Undo and Redo Features</li> <li>g. Use spell check to correct Spellings and Grammar</li> </ul>	<ul style="list-style-type: none"> <li>a. Use key board and mouse to enter/edit text in the document.</li> <li>b. Use shortcuts</li> <li>c. Use spell check/ Grammar features for auto corrections.</li> </ul>
8.	To practice Formatting techniques	<ul style="list-style-type: none"> <li>a. Formatting Text</li> <li>b. Formatting Paragraphs</li> <li>c. Setting Tabs</li> <li>d. Formatting Pages</li> <li>e. The Styles of Word</li> <li>f. Insert bullets and numbers</li> <li>g. Themes and Templates</li> <li>h. Insert page numbers, header and footer</li> </ul>	<ul style="list-style-type: none"> <li>a. Format Text and paragraphs and use various text styles.</li> <li>b. Use bullets and numbers to create lists</li> <li>c. Use Templates /Themes</li> <li>d. Insert page numbers date, headers and footers</li> </ul>
9.	To insert a table of required number of rows and columns	<ul style="list-style-type: none"> <li>a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table – marking borders. Merging and splitting of cells in a Table</li> <li>b. Changing the background colour of the table</li> <li>c. Use table design tools</li> <li>d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features</li> <li>e. Convert Text to table and Table to Text</li> <li>f. Use Sort feature of the Table to arrange data in ascending/descending order</li> </ul>	<ul style="list-style-type: none"> <li>a. Insert table in the word document and edit</li> <li>b. Use sort option for arranging data.</li> </ul>
10.	To Insert objects, clipart and Hyperlinks	<ul style="list-style-type: none"> <li>a. Create a 2-page document. &amp;Insert hyperlinks and t Bookmarks.</li> <li>b. Create an organization chart</li> <li>c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.</li> </ul>	<ul style="list-style-type: none"> <li>a. Insert hyperlinks &amp;Bookmarks</li> <li>b. Create organization charts/flow charts</li> </ul>

11.	To Use Mail merge feature of MS Word	<ul style="list-style-type: none"> <li>a. Use mail merge to prepare individually addressed letters</li> <li>b. Use mail merge to print envelopes.</li> </ul>	Use Mail merge feature
12.	To use Equations and symbols features.	<ul style="list-style-type: none"> <li>a. Explore various symbols available in MS Word</li> <li>b. Insert a symbol in the text</li> <li>c. Insert mathematical equations in the document</li> </ul>	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	<ul style="list-style-type: none"> <li>a. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button-</li> <li>b. Use Quick Access Toolbar-Title Bar- Ribbon-Worksheets-Formula Bar-Status Bar</li> </ul>	<ul style="list-style-type: none"> <li>a. Familiarize with excel layout and use</li> <li>b. Use various features available in toolbar</li> </ul>
14.	To access and Enter data in the cells	<ul style="list-style-type: none"> <li>a. Move Around a Worksheets-Quick access -Select Cells</li> <li>b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel</li> </ul>	<ul style="list-style-type: none"> <li>a. Access and select the required cells by various addressing methods</li> <li>b. Enter data and edit</li> </ul>
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	<ul style="list-style-type: none"> <li>a. Insert and Delete Columns and Rows-Create Borders-Merge and Center</li> <li>b. Add Background ColorChange the Font, Font Size, and Font Color</li> <li>c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width</li> </ul>	Format the excel sheet
16.	To use built in functions and Formatting Data	<ul style="list-style-type: none"> <li>a. Perform Mathematical Calculations verify -AutoSum</li> <li>b. Perform Automatic Calculations-Align Cell Entries</li> </ul>	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	<ul style="list-style-type: none"> <li>a. Enter formula</li> <li>b. Use Cell References in Formulae</li> <li>c. Use Automatic updating function of Excel Formulae</li> <li>d. Use Mathematical Operators in Formulae</li> <li>e. Use Excel Error Message and Help</li> </ul>	Enter formula for automatic calculations

18.	To Create Excel Functions, Filling Cells	<ul style="list-style-type: none"> <li>a. Use Reference Operators</li> <li>b. Work with sum, Sum if , Count and Count If Functions</li> <li>c. Fill Cells Automatically</li> </ul>	<ul style="list-style-type: none"> <li>a. Create Excel sheets involving cross references and equations</li> <li>b. Use the advanced functions for conditional calculations</li> </ul>
19.	To sort and filter data in table	<ul style="list-style-type: none"> <li>a. Sort data in multiple columns</li> <li>b. Sort data in a row</li> <li>c. Sort data using Custom order</li> <li>d. Filter data in work sheet</li> </ul>	<ul style="list-style-type: none"> <li>a. Refine the data in a worksheet and keep it organized</li> <li>b. Narrow a worksheet by selecting specific choice</li> </ul>
20.	To Practice Excel Graphs and Charts	<ul style="list-style-type: none"> <li>a. Produce an Excel Pie Chart</li> <li>b. Produce</li> <li>c. Excel Column Chart</li> </ul>	<ul style="list-style-type: none"> <li>a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph</li> <li>b. Produce a Pictograph in Excel</li> </ul>
21.	To develop lab reports of respective discipline	ate Lab reports using MS Word and Excel	<ul style="list-style-type: none"> <li>a. Insert Practical subject name in Header and page numbers in Footer</li> </ul>
22.	To format a Worksheet in Excel, page setup and print	<ul style="list-style-type: none"> <li>a. Shade alternate rows of data</li> <li>b. Add currency and percentage symbols</li> <li>c. Change height of a row and width of a column</li> <li>d. Change data alignment</li> <li>e. Insert Headers and Footers</li> <li>f. Set Print Options and Print</li> </ul>	<ul style="list-style-type: none"> <li>a. Format Excel sheet</li> <li>b. Insert headers &amp; footers and print</li> </ul>
23.	To familiarize with Ribbon layout & features of PowerPoint 2007.	<p>Use various options in PowerPoint</p> <ul style="list-style-type: none"> <li>a. Home</li> <li>b. Insert</li> <li>c. Design</li> <li>d. Animation</li> <li>e. Slideshow</li> <li>f. View</li> <li>g. Review</li> </ul>	Access required options in the tool bar

24.	To create a simple PowerPoint Presentation	<ul style="list-style-type: none"> <li>a. Insert a New Slide into PowerPoint</li> <li>b. Change the Title of a PowerPoint Slide</li> <li>c. PowerPoint Bullets</li> <li>d. Add an Image to a PowerPoint Slide</li> <li>e. Add a Textbox to a PowerPoint slide</li> </ul>	<ul style="list-style-type: none"> <li>a. Create simple PowerPoint presentation with photographs/Clip Art and text boxes</li> <li>b. Use bullets option</li> </ul>
25.	To Set up a Master Slide in PowerPoint and add notes	<ul style="list-style-type: none"> <li>a. Create a PowerPoint Design Template</li> <li>b. Modify themes</li> <li>c. Switch between Slide master view and Normal view</li> <li>d. Format a Design Template Master Slide</li> <li>e. Add a Title Slide to a Design Template</li> <li>f. The Slide Show Footer in PowerPoint</li> <li>g. Add Notes to a PowerPoint Presentation</li> </ul>	<ul style="list-style-type: none"> <li>a. Setup Master slide and format</li> <li>b. Add notes</li> </ul>
26.	To Insert Text and Objects	<ul style="list-style-type: none"> <li>a. Insert Text and objects</li> <li>b. Set Indents and line spacing</li> <li>c. Insert pictures/ clipart</li> <li>d. Format pictures</li> <li>e. Insert shapes and word art</li> <li>f. Use 3d features</li> <li>g. Arrange objects</li> </ul>	<p>Insert Text and Objects</p> <p>Use 3d features</p>
27.	To insert a Flow Chart / Organizational Charts	<ul style="list-style-type: none"> <li>a. Create a Flow Chart in PowerPoint</li> <li>b. Group and Ungroup Shapes</li> <li>c. Use smart art</li> </ul>	<p>Create organizational charts and flow charts using smart art</p>
28.	To insert a Table	<ul style="list-style-type: none"> <li>a. PowerPoint Tables</li> <li>b. Format the Table Data</li> <li>c. Change Table Background</li> <li>d. Format Series Legend</li> </ul>	<p>Insert tables and format</p>
29.	To insert a Charts/Graphs	<ul style="list-style-type: none"> <li>a. Create 3D Bar Graphs in PowerPoint</li> <li>b. Work with the PowerPoint Datasheet</li> <li>c. Format a PowerPoint Chart Axis</li> <li>d. Format the Bars of a Chart</li> <li>e. Create PowerPoint Pie Charts</li> <li>f. Use Pie Chart Segments</li> <li>g. Create 2D Bar Charts in PowerPoint</li> <li>h. Format the 2D Chart</li> </ul>	<p>Create charts and Bar graphs, Pie Charts and format.</p>

		e. Format a Chart Background	
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30.	To Insert audio & video, Hyperlinks in a slide Add narration to the slide	<ul style="list-style-type: none"> <li>a. Insert sounds in the slide and hide the audio symbol</li> <li>b. Adjust the volume in the settings</li> <li>c. Insert video file in the format supported by PowerPoint in a slide</li> <li>d. Use automatic and on click options</li> <li>e. Add narration to the slide</li> <li>f. Insert Hyperlinks</li> </ul>	<ul style="list-style-type: none"> <li>a. Insert Sounds and Video in appropriate format.</li> <li>b. Add narration to the slide</li> <li>c. Use hyperlinks to switch to different slides and files</li> </ul>
31.	To Practice Animation effects	<ul style="list-style-type: none"> <li>a. Apply transitions to slides</li> <li>b. To explore and practice special animation effects like Entrance, Emphasis, Motion Paths &amp; Exit</li> </ul>	Add animation effects
32.	Reviewing presentation	<ul style="list-style-type: none"> <li>a. Checking spelling and grammar</li> <li>b. Previewing presentation</li> <li>c. Set up slide show</li> <li>d. Set up resolution</li> <li>e. Exercise with Rehearse Timings feature in PowerPoint</li> <li>f. Use PowerPoint Pen Tool during slide show</li> <li>g. Saving</li> <li>h. Printing presentation <ul style="list-style-type: none"> <li>(a) Slides</li> <li>(b) Hand-out</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a. Use Spell check and Grammar feature</li> <li>b. Setup slide show</li> <li>c. Add timing to the slides</li> <li>d. Setup automatic slide show</li> </ul>

33	To familiarize with standard toolbox	<ul style="list-style-type: none"> <li>a. Open Adobe Photoshop</li> <li>b. Use various tools such as <ul style="list-style-type: none"> <li>i. The Layer Tool</li> <li>ii. The Color&amp; Swatches Tool</li> <li>iii. Custom Fonts &amp; The Text Tool</li> <li>iv. Brush Tool</li> <li>v. The Select Tool</li> <li>vi. The Move Tool</li> <li>vii. The Zoom Tool</li> <li>viii. The Eraser</li> <li>ix. The Crop Tool</li> <li>x. The Fill Tool</li> </ul> </li> </ul>	Open a photograph and save it in Photoshop
34	To edit a photograph	<ul style="list-style-type: none"> <li>a. Use the Crop tool</li> <li>b. Trim edges</li> <li>c. Change the shape and size of a photo</li> <li>d. Remove the part of photograph including graphics and text</li> </ul>	a. Able to edit image by using corresponding tools.
35	To insert Borders around photograph	<ul style="list-style-type: none"> <li>a. Start with a single background layer</li> <li>b. Bring the background forward</li> <li>c. Enlarge the canvas</li> <li>d. Create a border color</li> <li>e. Send the border color to the back</li> <li>f. Experiment with different colors</li> </ul>	Able to create a border or frame around an image to add visual interest to a photo
36	To change Background of a Photograph	<ul style="list-style-type: none"> <li>a. open the foreground and background image</li> <li>b. Use different selection tools to paint over the image</li> <li>c. Copy background image and paste it on the foreground.</li> <li>d. Resize and/or drag the background image to reposition.</li> <li>e. In the Layers panel, drag the background layer below the foreground image layer.</li> </ul>	Able to swap background elements using the Select and Mask tool and layers.
37	To change colors of Photograph	<ul style="list-style-type: none"> <li>a. Change colors using: <ul style="list-style-type: none"> <li>i) Color Replacement tool</li> <li>ii) <b>Hue/Saturation adjustment layer tool</b></li> </ul> </li> </ul>	Able to control color saturation

38	To prepare a cover page for the book in subject area	<ul style="list-style-type: none"> <li>a. open a file with height 500 and width 400 for the cover page.</li> <li>b. apply two different colors to work area by dividing it into two parts using Rectangle tool.</li> <li>c. Copy any picture and place it on work area→ resize it using free transform tool.</li> <li>d. Type text and apply color and style</li> <li>e. Apply effects using blended options</li> </ul>	Able to prepare cover page for the book
39	To adjust the brightness and contrast of picture to give an elegant look	<ul style="list-style-type: none"> <li>a. open a file.</li> <li>b. Go to image→ adjustments→ Brightness/Contrast.</li> <li>c. adjust the brightness and contrast.</li> <li>d. Save the image.</li> </ul>	Able to control brightness/contrast.
40	To type a word and apply the shadow emboss effects	<ul style="list-style-type: none"> <li>a. open a file</li> <li>b. Select the text tool and type text.</li> <li>c. Select the typed text go to layer→ layer style→ blended option→ drop shadow, inner shadow, bevel and emboss→ contour→ satin→ gradient overlay</li> <li>d. Save the image.</li> </ul>	Able to apply shadow emboss effects

**Table specifying the scope of syllabus to be covered for unit tests**

Unit Test	Learning outcomes to be covered
Unit test-1	From 1 to 8
Unit test-2	From 9 to 22
Unit test-3	From 23 to 40

# III SEMESTER

**DIPLOMA IN CHEMICAL ENGINEERING (Oil Technology)**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**C-23, III SEMESTER**

Subject Code	Name of the Subject	Instruction period / week- Mod(non-mod)		Total Period / year	Scheme of Examination			
		Theory	Practical		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
CHOT- 301	Engineering Mathematics - II	5	-	75	3	20	80	100
CHOT -302	Electrical Technology	4	-	60	3	20	80	100
CHOT -303	Organic and Physical Chemistry	5	-	75	3	20	80	100
CHOT -304	Unit Operations-I	5	-	75	3	20	80	100
CHOT -305	Mass and Energy Balance	6	-	90	3	20	80	100
<b>PRACTICAL:</b>								
CHOT -306	CAD Practice in Chemical Engineering	-	3	45	3	40	60	100
CHOT -307	Electrical Technology Lab	-	3	45	3	40	60	100
CHOT -308	Organic and Physical Chemistry Lab	-	3	45	3	40	60	100
CHOT -309	Unit Operations-I Lab	-	6	90	3	40	60	100
-	Activities	-	3	45	-	-	-	-
<b>TOTAL</b>		<b>24</b>	<b>18</b>	360+270 =630		<b>260</b>	<b>640</b>	<b>900</b>

CHOT-301 Common to all branches.

CHOT-302, 303, 305, 306, 307, 308 Common to DCHE,DCHE(PC/ PP)

CHOT-304, 309 Common to DCHE(PC/ PP)

**C-23**  
**ENGINEERING MATHEMATICS-II**

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
CHOT-301	Engineering Mathematics-II	4	60	20	80

**Time Schedule**

S.No.	Chapter/Unit title	No. of Periods	Marks Allotted	Short Type	Essay Type	COs mapped
<b>Unit – I: Indefinite integration</b>						
1	Indefinite integration	20	32	4	2	CO1
<b>Unit – II: Definite Integration and its applications</b>						
2	Definite Integrals	5	11	2	1/2	CO2
3	Area of curves	2	3	1	0	CO2
4	Mean and RMS values	3	8	1	1/2	CO2
<b>Unit – III: Differential Equations</b>						
5	Introduction to Differential Equations	5	3	1	0	CO3
6	Solution of first order differential equations	4	10	0	1	CO3
7	Solution of second order homogeneous differential equations	4	10	0	1	CO3
<b>Unit - IV Laplace transforms &amp; Fourier series</b>						
8	Laplace Transforms	5	10		1	CO4
9	Inverse Laplace Transforms	5	10		1	CO4
10	Fourier Series	7	13	1	1	CO4
Total		60	110	10	8	
<b>Marks</b>				30	80	

<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>(iii) To understand the concepts of indefinite integrals and definite integrals with applications to engineering problems.</li> <li>(iv) To understand the formation of differential equations and learn various methods of solving first order differential equations.</li> <li>(v) To learn the principles of solving homogeneous differential equations of second order.</li> <li>(vi) To comprehend and understand the concepts of Laplace transformations and Fourier series.</li> </ul>
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<b>Course Outcomes</b>	CO1	Integrate various functions using different methods.
	CO2	Evaluate definite integrals and learn its applications.
	CO3	Obtain differential equations and solve differential equations of first order and first degree. Solve homogeneous differential equations of second order.
	CO4	Find Laplace Transforms of various functions and expand the given functions as Fourier series.

## ENGINEERING MATHEMATICS – II

### Learning Outcomes

#### Unit-I

#### C.O. 1 Integrate various functions using different methods.

L.O.1.1. Explain the concept of Indefinite integral as an anti-derivative.

1.2. State the indefinite integral of standard functions and properties of  $\int (u + v) dx$  and  $\int k u dx$  where  $u, v$  are functions of  $x$  and  $k$  is constant.

1.3. Solve problems involving standard functions using the above rules.

1.4. Evaluate integrals involving simple functions of the following type by the method of substitution.

i)  $\int f(ax + b) dx$ , where  $f(x)$  is in standard form.

ii)  $\int (f(x))^n f'(x) dx$

iii)  $\int [f'(x)/f(x)] dx$

iv)  $\int [f(g(x))]g'(x) dx$

1.5. Find the integrals of  $\tan x$ ,  $\cot x$ ,  $\sec x$  and  $\operatorname{cosec} x$  using the above.

1.6. Evaluate the Standard integrals of the functions of the type

i)  $\frac{1}{a^2 + x^2}, \frac{1}{a^2 - x^2}, \frac{1}{x^2 - a^2}$

ii)  $\frac{1}{\sqrt{a^2 + x^2}}, \frac{1}{\sqrt{a^2 - x^2}}, \frac{1}{\sqrt{x^2 - a^2}}$

iii)  $\sqrt{x^2 - a^2}, \sqrt{x^2 + a^2}, \sqrt{a^2 - x^2}$

1.7. Evaluate integrals using decomposition method.

1.8. Solve problems using integration by parts.

1.9 Use Bernoulli's rule for evaluating the integrals of the form  $\int u.v dx$ .

1.10. Evaluate the integrals of the form  $\int e^x [f(x) + f'(x)] dx$

#### Unit-II

#### C.O.2 Evaluate definite integrals with applications.

L.O.2.1. State the fundamental theorem of integral calculus

2.2. Explain the concept of definite integral.

2.3. Solve simple problems on definite integrals over an interval using the above concept.

2.4. State various properties of definite integrals.

2.5. Evaluate simple problems on definite integrals using the above properties.

2.6. Find the area bounded by a curve and axes.

2.7. Obtain the mean and R.M.S values of the simple functions.

Syllabus for Unit test-I completed

### Unit -III

**C.O. 3 Form differential equations and solve differential equations of first order and first degree and Solve homogeneous differential equation of second order.**

**L.O.3.1.** Define a Differential equation, its order and degree

3.2 Find order and degree of a given differential equation.

3.3 Form a differential equation by eliminating arbitrary constants.

3.4 Solve the first order and first degree differential equations by variables separable method.

3.5 Solve linear differential equation of the form  $\frac{dy}{dx} + Py = Q$ , where P and Q are functions of x or constants.

3.6 Solve Differential equations of the type  $(aD^2 + bD + c)y = 0$  where a, b, c are real numbers and provide examples.

### Unit-IV

#### Laplace transforms & Fourier series

**C.O. 4 Find Laplace Transforms of various functions and expand the given functions as Fourier series.**

**L.O.** 4.1 Define Laplace Transform and explain the sufficient conditions of existence of Laplace Transform

4.2.Obtain Laplace transforms of elementary functions and solve simple problems.

4.3 State linearity property, first shifting theorem of Laplace transforms (without proof) and solve simple problems.

4.4 Define Inverse Laplace Transform.

4.5 Obtain Inverse Laplace Transforms for standard functions and solve simple problems.

4.6 State linearity property, first shifting theorem of Inverse Laplace transforms (without proof) and solve simple problems.

4.7 Define orthogonality of functions in an interval.

4.8 Define Fourier series of a function in the interval  $(c, c + 2\pi)$  and Euler's formulae for Fourier coefficients.

4.9 Write sufficient conditions for the existence of Fourier series expansion of a function in an interval.

4.10 Expand the functions  $f(x) = k$  (constant) and  $f(x) = x$  as Fourier series in the intervals  $(0, 2\pi)$  and  $(-\pi, \pi)$

Syllabus for Unit test-II completed

### Engineering Mathematics – II

#### CO/PO – Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	2				3	1	2
CO2	3	3	3	3				3	3	3
CO3	3	3	3	3				3	3	3
CO4	3	3	3	3				3	3	3
Avg.	3	2.75	2.75	2.75				3	2.5	2.75

**3** = Strongly mapped (High), **2** = Moderately mapped (Medium), **1** = Slightly mapped (Low)

**PO5:** Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

**PO6:** Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

**PO7:** Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

**PSO1:** An ability to understand the concepts of basic mathematical techniques and to apply them in various areas like computer programming, civil constructions, fluid dynamics, electrical and electronic systems and all concerned engineering disciplines.

**PSO2:** An ability to solve the Engineering problems using latest software tools, along with analytical skills to arrive at faster and appropriate solutions.

**PSO3:** Wisdom of social and environmental awareness along with ethical responsibility to have a successful career as an engineer and to sustain passion and zeal for real world technological applications.

**C-23**  
**Engineering Mathematics – II**  
**PO- CO – Mapping strength**

PO no	Mapped with CO no	CO periods addressing PO in column I		Level (1,2 or 3)	Remarks
		Number	%		
1	CO1, CO2, CO3,CO4	60	100%	3	>40% Level 3 Highly addressed
2	CO1, CO2, CO3,CO4	60	100%	3	
3	CO1, CO2, CO3,C04	60	100%	3	
4	CO2, CO3,C04	38	63.3%	3	
5					
6					
7					
PSO 1	CO1, CO2, CO3,CO4	60	100%	3	25% to 40% Level 2 Moderately addressed
PSO 2	CO1, CO2, CO3,CO4	40	66.6%	3	5% to 25% Level 1 Low addressed
PSO 3	CO1, CO2, CO3,CO4	45	75%	3	<5% Not addressed

**C-23**  
**ENGINEERING MATHEMATICS – II**  
**COURSE CONTENTS**

**Unit-I**

**Indefinite Integration:**

1. Integration regarded as anti-derivative – Indefinite integrals of standard functions. Properties of indefinite integrals. Integration by substitution or change of variable. Integrals of  $\tan x$ ,  $\cot x$ ,  $\sec x$ ,  $\operatorname{cosec} x$ .

Evaluation of integrals which are of the following forms:

$$i) \frac{1}{a^2 + x^2}, \frac{1}{a^2 - x^2}, \frac{1}{x^2 - a^2}$$

$$ii) \frac{1}{\sqrt{a^2 + x^2}}, \frac{1}{\sqrt{a^2 - x^2}}, \frac{1}{\sqrt{x^2 - a^2}}$$

$$iii) \sqrt{x^2 - a^2}, \sqrt{x^2 + a^2}, \sqrt{a^2 - x^2}$$

Integration by decomposition of the integrand into simple rational, algebraic functions.

Integration by parts, Bernoulli's rule and integrals of the form  $\int e^x [f(x) + f'(x)] dx$ .

### Unit-II

#### Definite Integral and its applications:

2. Definite integral-fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals. Area bounded by a curve and axes. Mean and RMS values of a function on a given interval.

### Unit -III

#### Differential Equations:

3. Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solutions of differential equations of first order and first degree using methods: variables separable, linear differential equation of the type  $\frac{dy}{dx} + Py = Q$ . Solutions of homogenous linear differential equations of second order with constant coefficients.

### Unit IV:

#### Laplace transforms & Fourier series

4. Definition, sufficient conditions for existence of Laplace Transform, LT of elementary functions, linearity property, state first shifting theorem with simple problems. Definition of Inverse Laplace Transform, ILT of elementary functions, linearity property, first shifting theorem with simple problems.
5. Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval  $(c, c + 2\pi)$ , Euler's formulae, sufficient conditions for existence of Fourier series expansion of a function, Fourier series expansion of basic functions limited to  $k$  (constant),  $x$  over the intervals  $(0, 2\pi), (-\pi, \pi)$ .

#### Reference Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Schaum's Outlines Differential Equations, Richard Bronson & Gabriel B. Costa
3. M. R. Spiegel, Schaum's Outline of Laplace Transforms, Schaums' Series.
4. M. V. Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

### C-23

#### Engineering Mathematics – II

#### Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O 1.1 to L.O 2.7
Unit Test-II	From L.O 3.1 to L.O 4.10

**Electrical Technology common with DCHE/DCHEPC/DCHEPP/DCHEOT/DPET**

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CHOT-302	Electrical Technology	4	60	20	80

Time Schedule

S.No	Chapter/unit title	No. of periods	Weightage allocated	Short Answer Questions	Essay type questions	CO'sMap ped
1	D.C & A.C Circuits	15	26	2	2	CO1
2	Electromagnetism and Electromagnetic Induction	10	19	3	1	CO2
3	D.C & A.C Machines	20	29	3	2	CO2
4	Electrical Measuring Instrument	05	13	1	1	CO3
5	Understand the different equipments & safety procedures used in industry.	05	13	1	1	CO4
6	Electronic Devices	05	10		1	CO5
<b>Total</b>		<b>60</b>	<b>60</b>	<b>10</b>	<b>8</b>	<b>1</b>

**Course objectives**

<b>Course objectives</b>	(i)	To know DC and AC circuits, electromagnetism and electromagnetic induction
	(ii)	To understand classification, application, construction and working principles of AC and DC machines
	(iii)	To understand different components, safety precautions in industries and working of electronic devices

**Course Outcomes**

<b>Course Outcomes</b>	<b>CO1</b>	Illustrate with example various terminology of electrical circuits and calculate different types of power quantities
	<b>CO2</b>	Analyse the principles of operations required for working of DC and AC machines
	<b>CO3</b>	Recognize different types of measuring instruments.
	<b>CO4</b>	Describe different methods and applications of heating, welding and safety procedures and devices.
	<b>CO5</b>	Explain about semiconductors and various semiconductor devices

## Learning Outcome

### Chapter-1

- 1.1 Understand the concepts of Current, Electric potential, potential difference, Resistance, Conductance, Specific resistance and conductivity.
- 1.2 Laws of resistance & Statement of Ohms Law.
- 1.3 Calculation of current, Voltage and Resistance in a given dc circuit.
- 1.4 Calculation of equivalent resistance in a – Series Circuit, parallel Circuit.
- 1.5 Simple problems on Series, Parallel Circuits.
- 1.6 State and explain Kirchoff's of Laws.
- 1.7 Define the following terms related to alternating quantities.  
i) Alternating quantity, ii) wave form iii) Cycle iv) Time period v) frequency vi) instantaneous value vii) RMS value viii) average value ix) form factor x) peak factor.
- 1.8 Express instantaneous value , RMS value and average value in terms of maximum value.
- 1.9 Explain phase and phase difference between two alternating quantities.
- 1.10 State leading and lagging vector quantities.
- 1.11 State phase relationships between voltage and current in (a) R (b) L (c) C (d) R – L – C in series.
- 1.12 Define Power factor .
- 1.13 State equation for i) Active power ii) reactive power iii) apparent power in single phase AC circuits.
- 1.14 Explain Star and Delta connections in 3 -  $\Phi$  circuits.
- 1.15 State phase and line voltages and currents and their relationship in Star and Delta connections.
- 1.16 State expression for i) Active power ii) reactive power iii) apparent power in 3- phase AC circuits.
- 1.17 Simple problems on the above.

### Chapter-2

- 2.1 Explain the terms – permeability, magnetic field strength, flux and Flux density – Relation between permeability, flux density and magnetic field strength.
- 2.2 Express the field strength due to i) straight current carrying conductor ii) on the axis of a solenoid.
- 2.3 State the following terms related to electromagnetic induction
  - i. Faraday's laws of electromagnetic induction
  - ii. Fleming's Left-Hand Rule
  - iii. Statically Induced emf iv. Dynamically Induced emf
  - v. Self-induced emf
  - vi. Mutually Induced emf
  - vii. Lenz's Law.
- 2.4 Give the expression for self inductance, Mutual Inductance and Coefficient of coupling. (No derivation).
- 2.5 Simple problems on above.

### Chapter-3

- 3.1 List the parts and function of each part of the D.C. Machine.
- 3.2 Classify the D.C. Machines as D.C. Generators and D.C. Motors – State their working principle.
- 3.3 State generated emf equation. (No derivation).
- 3.4 State and explain Back emf. (No derivation).
- 3.5 State torque equation. (No derivation).
- 3.6 Solve simple problems on above.
- 3.7 Explain the necessity of starter and explain 3 point starter with neat diagram.
- 3.8 Explain speed control of D.C. Shunt motor by armature control and (b) Field control methods. 3.9 State the applications of D.C. Generators and D.C. Motors
- 3.10 Explain the principle of working of a transformer.
- 3.11 Classify the types of transformers basing on construction of the transformers. (Core type and shell type).
- 3.12 State emf equation of a transformer. Solve simple problems. (No derivation).
- 3.13 State step – up and step – down transformers.
- 3.14 Explain Auto transformers.

- 3.15 Classify the three phase induction motors and single phase Induction motors – state the application of each motor.
- 3.16 Explain the construction and working principles of 3 – phase Induction Motors
- 3.17 Explain the construction and working principles of 1 – phase Induction Motors
- 3.18 Explain the necessity of starter in 3-phase induction motor 3.19 Explain i) DOL starter ii) Star Delta Starter with neat diagrams.
- 3.20 State the applications of 1 phase and 3-phase induction motors.

#### Chapter-4

- 4.1 Explain the construction and working of moving iron and moving coil instruments.
- 4.2 State uses of (a) Megger (b) Multi meter and (c) Energy Meter in electrical circuits.
- 4.3 Explain Thermocouple instruments for measuring temperatures.

#### Chapter-5

- 5.1 Explain the basic principles of electric Heating.
- 5.2 State applications of electric Heating.
- 5.3 Explain the basic principles of electric welding.
- 5.4 Classify the methods of electric welding, state applications of each method.
- 5.5 Describe the working of DC welding generator with neat diagram.
- 5.6 Describe the working of welding transformer with neat diagram.
- 5.7 State the function of the following i) Switch ii) Fuse iii) Circuit breaker iv) Relay v) Capacitor banks.
- 5.8 State safety precautions to be adopted for prevention of electric shock to persons working on electric equipments or live wires.
- 5.9 State procedures for first aid to a person came into contact with live wires.

#### Chapter-6

- 6.1 Classify the materials like conductors, insulators and semi conductors based on i) Valence electrons ii) Conductivity iii) Energy band diagrams.
- 6.2 Explain the P- type semiconductor and N – type semiconductor.
- 6.3 Explain P – N Junction diode.
- 6.4 State the applications of a P – N Junction diode (as a rectifier).
- 6.5 Explain the P– N – P and N – P – N transistors and their applications.

### COURSE CONTENTS

1. Concepts of Current, Electric potential, potential difference, Resistance, Conductance, Specific resistance and conductivity. Ohm's Law – simple problems on D.C.circuits – Equivalent and resistance- Parallel circuits – Kirchoff's Laws – Problems- Single Phase circuits – Definitions related to alternative quantities - Phase and phase difference – leading and lagging quantities – Phase relationships between voltage and current in R, L, C, R-L in series, R-C in series and R-L-C in series – define power factor – Solve simple A.C.circuits – expression– active power and reactive power- apparent power in single phase circuits- star and delta connections in 3phase circuits - expression– active power and reactive power- apparent power – simple problems on above.
2. Concepts of different terms related to Electromagnetism – electromagnetic induction – expressions for field strength due to straight current carrying conductor and on the axis of solenoid - Dynamically induced emf – statically induced emf – self and mutually induced emf – self inductance and mutual inductance – Simple Problems.
3. D.C & A.C. Machines – working – construction – types of D.C.generators – types of D.C motors – Generated emf – Back emf – torque – equations – 3 – point starter – speed control – Applications

of D.C Generators D.C. Motors- Single – phase– Auto transformers – Construction and working principles of 3-phase and single phase induction motors –DOL starter and Star delta starter Applications - Single – phase and Three – Phase induction motors.

4. Electrical Measuring Instruments – Construction and working of moving iron and moving coil instruments – Megger, Multimeter – Single – Phase energy meter – Thermocouple Instruments.
5. Understand the different equipments& safety procedures used in industry basic principles of electric heating and welding methods – classification of methods of electric heating and welding with their applications- D.C.welding generator- welding transformer – functions of switch, fuse, circuit breaker, Relay , Capacitor banks and Motor control centres- safety precautions to prevent shock – safety procedures for first aid against electric shock.
6. Electronic Devices – Semiconductors – P type and N type semiconductor – P – N Junction diode – PNP transistor and NPN transistors with their applications.

#### REFERENCES BOOKS:

1. Electrical Technology – By B.L. Theraja (Vol – I and Vol – II)
2. Fundamentals of Electrical Engineering and Electronics – By B.L. Theraja.
3. The Art and Science of utilization of electrical energy - By H. Partab.
4. Electrical Technology – By Huges
5. Electrical Technology – By V.K. Mehta

Course code CHOT-302	Course title : Electrical Technology Number of course outcomes:05			No. of periods: 60	
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1,CO3,CO6	45	75	3	>40% Level 3 Highly addressed
PO2	CO2,CO5	9	15	1	
PO3	CO4	6	10	1	
PO4					25% to 40% Level 2 Moderately addressed
PO5					
PO6					5 to 25% Level 1 Low addressed
PO7					
					<5% Not addressed

#### CO-PO/PSO MATRIX

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-302.1		2						3		
CHOT-302.2	3								3	
CHOT-302.3		2							3	
CHOT-302.4		3								2
CHOT-302.5		2							3	
<b>AVERAGE</b>	<b>3</b>	<b>2.25</b>						<b>3</b>	<b>3</b>	<b>2</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

**C-23, CH/CHPC/CHPP/CHOT-302**  
**Subject Name: Electrical Technology**  
**III semester**  
**Syllabus split up for Unit Test**

nit test NO	Learning out comes to be covered
Unit test-I	Objectives from 1.1 to 3.5
Unit test-II	Objective from 3.6 to 6.5

Course code	Course title	No.Of Periods / week	Total number of periods	Marks for FA	Marks for SA
CHOT-303	Organic and physical chemistry	5	75	20	80

**TIME SCHEDULE**

S.No.	Major Topics	No of Periods	Weightage allocated	Short Answer Questions	Essay type questions	Cos mapped
1.	Chemistry of Aliphatic compounds-I	12	13	1	1	CO1, CO2, CO3, CO4
2.	Chemistry of Aliphatic compounds-II	16	26	2	2	CO1, CO2, CO3, CO4
3.	Chemistry of Aromatic compounds	13	23	1	2	CO1, CO2, CO3, CO4
4.	Electro Chemistry	12	19	3	1	CO1, CO2, CO5
5.	Chemical Equilibrium	14	23	1	2	CO1, CO2
6.	Thermo Chemistry	08	6	2		CO1
<b>Total</b>		<b>75</b>	<b>110</b>	<b>10</b>	<b>8</b>	

**Course objectives:**

1. To familiarize with the knowledge of classification, nomenclature, isomerism, preparation and properties of organic compounds.
2. To familiarize with the knowledge of electrochemistry, chemical equilibrium and thermochemistry
3. To understand and reinforce the concept in various chemical processes for better production results.

<b>Course outcomes</b>	<b>CO1</b>	CHOT-303.1	Appraise basic concepts of thermochemistry, Electrolysis, Physical and organic chemistry,
	<b>CO2</b>	CHOT-303.2	Find the applications of aliphatic and aromatic hydrocarbons, electrochemistry
	<b>CO3</b>	CHOT-303.3	Explain the Preparation methods of aliphatic and aromatic hydrocarbons
	<b>CO4</b>	CHOT-303.4	Find the Properties of aliphatic and aromatic hydrocarbons
	<b>CO5</b>	CHOT-303.5	Solve problems in electro chemistry, thermochemistry and equilibrium

## CO-PO/PSO MATRIX

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-303.1		2						3		
CHOT-303.2	3								3	
CHOT-303.3		2							3	
CHOT-303.4		3								2
CHOT-303.5		2							3	
<b>AVERAGE</b>	<b>3</b>	<b>2.25</b>						<b>3</b>	<b>3</b>	<b>2</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

### Learning outcomes

#### 1. Chemistry of Aliphatic Compounds-I.

- 1.1 Give Introduction to organic chemistry.
- 1.2 Explain the unique characteristics of carbon.
- 1.3 Explain hybridization of carbon in organic compounds i.e.,  $sp^3$ ,  $sp^2$  and  $sp$ .
- 1.4 Give the classification of organic compounds.
- 1.5 Explain IUPAC nomenclature of organic compounds.
- 1.6 Explain homologous series and characteristics.
- 1.7 Explain isomerism: Structural isomerism and Stereo isomerism (Geometrical and optical) with examples.
- 1.8 Explain the preparation of Alkanes:  
Preparation of Methane and Ethane by (i) De-carboxylation (ii) Wurtz reaction (Ethane only) (iii) by reduction of Alkyl Halides.
- 1.9 Properties of alkanes: (i) Halogenation (ii) Nitration (iii) Combustion of methane and ethane.
- 1.10 Explain the preparation of alkenes :  
Preparation of Ethylene by: (i) Dehydration of ethyl alcohol (ii) Dehydrohalogenation of ethyl bromide (iii) Dehalogenation of 1, 2 – dibromo ethane.
- 1.11 Explain the Properties of Ethylene: Reaction with (i)  $H_2$ , (ii)  $Br_2/CCl_4$  (iii) Ozone (iv) Oxidation by  $KMnO_4$ .
- 1.12 Explain the preparation of alkynes:  
Preparation of Acetylene from (i) Calcium carbide (ii) Dehydro halogenation of 1,2 di-bromo ethane (iii) Dehalogenation of 1, 1, 2, 2 – tetra bromo ethane.
- 1.13 Explain the Properties of Acetylene: Reaction with (i)  $H_2 / Ni$  (ii)  $Br_2 / CCl_4$  (iii)  $H_2O$  in presence of 30%  $H_2SO_4$  and 1%  $HgSO_4$ .
- 1.14 List the uses of ethane, methane, ethylene and acetylene.

#### 2. Chemistry of Aliphatic Compounds-II.

- 2.1 Explain ethyl chloride preparation from (i)Grove's process (ii)  $PCl_3$  (iii) Ethylene explain the reaction of Ethyl Chloride with (i)  $KOH$  (ii)  $KCN$  (iii)  $AgCN$  (iv) Wurtz Reaction  
Uses of ethyl chloride

#### 2.2 Explain Chloroform preparation from

- (i) Ethyl alcohol (ii) Methane (iii)  $CCl_4$

Properties of Chloroform (i) Reimer-Tiemann reaction (ii) Carbylamine or isocyanide test (iii) Oxidation (iv)  $HNO_3$   
Uses of ethyl chloride

### 2.3 Alcohols:

Classification of into primary, secondary and tertiary alcohols.

Distinction of primary, secondary and tertiary alcohols using Lucas reagent.

Explain the Preparation of Ethyl alcohol from

i) Ester hydrolysis (ii) grignard reagent (iii) fermentation of molasses

Explain the reaction of Ethyl alcohol with i) Acetic acid ii) Conc.  $H_2SO_4$

iii) Bleaching powder (iv)  $PCl_3$

Uses of ethyl alcohol

### 2.4 Aldehydes:

Explain Preparation of acetaldehyde from (i) Oxidation of ethyl alcohol (ii) Distillation of calcium acetate and calcium formate. (iii) Acetylene.

Explain Properties of Acetaldehyde i) Addition of Grignard reagent (ii) Reaction with hydrazine (iii) Aldol condensation (iv) Silver mirror test (v) Fehling's test Uses of acetaldehyde.

### 2.5 Ketones:

Explain the Preparation of acetone from (i) Oxidation of Isopropyl alcohol (ii) Distillation of calcium acetate (iii) Propyne.

Explain Properties of acetone (i) Addition of Grignard reagent (ii) Reaction with hydrazine (iii) Iodoform reaction

Uses of acetone

### 2.6 Carboxylic Acids:

Explain the Preparation of Acetic acid from (i) Ester hydrolysis (ii) Oxidation of ethyl alcohol (iii) Hydrolysis of methyl cyanide. Explain the Properties of Acetic acid

(i) Reaction with sodium (ii) Reaction with ethyl alcohol (iii) Reaction with  $Cl_2/P$  (Hell – Volhard – Zelinsky reaction) Uses of Acetic acid.

### 2.7 Ethers:

Explain the Preparation of diethyl ether i) Williamson's synthesis ii) Dehydrating of ethyl alcohol Explain the Properties of ether i) Halogenation ii) Hydrolysis by dil.  $H_2SO_4$  iii) Action HI.

Uses of ether.

## 3. Chemistry of Aromatic compounds.

3.1 Explain aromaticity and Huckel's rule.

3.2 Explain the nomenclature of aromatic compounds.

3.3 Explain the preparation, properties and uses of benzene.

3.4 Explain the preparation, properties and uses of nitrobenzene

3.5 Explain the preparation, properties and uses of Aniline

3.6 Explain the preparation, properties and uses of Phenol

3.7 Explain the preparation, properties and uses of toluene

3.8 Explain the preparation, properties and uses of benzoic acid.

## 4. Electro Chemistry.

4.1 Give introduction to electrochemistry.

4.2 Explain about electrolytes and non-electrolytes with examples.

4.3 Define electrolytic conduction and metallic conduction

4.4 Differentiate electrolytic conduction and metallic conduction

4.5 Explain about Strong electrolytes and weak electrolytes with examples.

4.6 Explain Faraday's laws of electrolysis.

4.7 Solve simple problems based on Faraday's laws.

4.8 List applications of electrolysis.

## 5. Chemical equilibrium

5.1 Define chemical Equilibrium:

Reversible and irreversible reactions – examples. Homogeneous and heterogeneous Equilibria – examples.

- 5.2 Explain chemical equilibrium and its characteristics.
- 5.3 Explain law of Mass Action
- 5.4 Apply law of mass action to a general reaction i.e.  $mA + nB \rightleftharpoons pC + qD$
- 5.5 Explain the effect of (i) concentration (ii) Pressure (iii) Temperature and (iv) Catalyst on chemical equilibrium.
- 5.6 Explain Lechatelier's principle –
- 5.7 Apply Lechatelier's principle to (i) manufacture of  $NH_3$  by Haber's process (ii) Formation of  $SO_3$  in contact process.

## 6. Thermo chemistry.

- 6.1 Give Introduction to thermochemistry.
- 6.2 Define 1<sup>st</sup> law of thermo dynamics and know the equations for “E”, “Q”, “W” and “H”.
- 6.3 Define Internal energy and Enthalpy.
- 6.4 Explain exothermic and Endothermic reactions with examples.
- 6.5 Types of heats of reactions.  
i) Heat of formation ii) Heat of combustion iii) Heat of neutralization  
iv) Heat of solution.

## COURSE CONTENT:

1. Introduction – Classification and nomenclature of organic compounds – Isomerism – Preparation, properties and uses of Alkanes, Alkenes and Alkynes
2. Ethyl Chloride, Chloroform, Alcohols, Aldehydes, Ketones, Carboxylic acids, Ethers. Polymerization- Addition and Condensation polymerization
3. Preparation, properties and uses of – Benzene, Nitro benzene, Aniline.
4. Electrolytes, non-electrolytes, Arrhenius theory- Faraday's laws of electrolysis – Problems.
5. Chemical equilibrium – Law of mass action – Effect of concentration, pressure, temperature and catalyst on chemical equilibrium – Lechatelier's principle – Applications.
6. Internal energy and Enthalpy-First law of Thermodynamics– Exothermic and Endothermic reactions – Different heats of reactions.

## REFERENCE BOOKS:

1. Intermediate Chemistry – Vol, 1 & 2 published by Telugu Academy (or) Vikram Series.
2. Text book of Applied Science – R.V. Subba Rao published by: Book Traders, Hyderabad.
3. Text Book of Organic Chemistry – Arun Bahl & B.S. Bahl, published by S. Chand & Co, New Delhi.
4. Essentials of Physical Chemistry – Bahl & Tuli, published by S. Chand & Co, New Delhi.

<b>Course code CHOT-303</b>	<b>Course Title: ORGANIC AND PHYSICAL CHEMISTRY</b> <b>No of Course outcomes 06</b>			<b>No of periods: 75</b>	
<b>POs</b>	<b>Mapped with CO No</b>	<b>CO periods addressing PO in Column 1</b>		<b>Level (1, 2, 3)</b>	<b>Remarks</b>
		<b>NO</b>	<b>%</b>		
PO1	CO2	17	22	1	>40%- level 3
PO2	CO1, CO3, CO4 and CO5	58	78	3	25%-40% level 2  5-25% : level 1  <5%: not addressed

**C-23, CH/CHPC/CHPP/CHOT-303**  
**Subject Name: Organic and Physical chemistry**  
**III semester**  
**Syllabus split up for Unit Test**

<b>Unit test No.</b>	<b>Learning out comes to be covered</b>
Unit test-I	Objectives from 1.1 to 3.8
Unit test-II	Objective from 4.1 to 6.5

Course code	Course title	No. of periods/week	Total no of periods	Marks of FA	Marks for SA
CHOT- 304	UNIT OPERATIONS-1	05	75	20	80

#### TIME SCHEDULE

S.NO	Chapter/ unit title	No. of periods	Weight age Allocated	Short Answer Questions	Essay type questions	Cos Mapped
1	Introduction to fluid flow phenomena and basic equations of fluid flow.	12	16	2	1	CO1, CO2, CO5
2	Flow of incompressible fluids in pipe and flow past immersed bodies.	12	16	2	1	CO2, CO3, CO4
3	Know about flow measurement & transportation of fluids.	17	23	1	2	CO3, CO5
4	Heat transfer by conduction.	7	13	1	1	CO1, CO4, CO5
5	Principles of heat flow in fluids.	7	13	1	1	CO1, CO4, CO5
6	Heat transfer to fluids with and without phase change.	7	03	1		CO4, CO5
7	Radiation heat transfer.	3	03	1		CO1, CO3
8	Heat exchange equipment and Evaporation.	10	23	1	2	CO3
	<b>Total</b>	<b>75</b>	<b>110</b>	<b>10</b>	<b>8</b>	

#### COURSE OBJECTIVES

<b>COURSE OBJECTIVES</b>	<ul style="list-style-type: none"> <li>i. Introduction to fluid flow, and basic equations of fluid in pipes flow meters, problems based on above topics</li> <li>ii. Modes of heat transfer, heat transfer to fluids with at without phase change problems based on above topics.</li> <li>iii. Types of heat exchanges and evaporators, evaporator accessories, performance of an evaporation.</li> </ul>
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CO NO		COURSE OUTCOMES
CO1	CHOT-304.1	Compose the types of fluids, Definitions, Laws of heat transfer and mechanisms.
CO2	CHOT-304.2	Formulate the basic equations of mass and momentum, Laminar and turbulent flow, Friction factor in pipes.
CO3	CHOT-304.3	Describe the Working and constructions of Flow meters, pressure measuring devices, heat exchange equipment.
CO4	CHOT-304.4	Deduce the derivations of Bernoulli's equation, Hagen-Poiseuille's equation, Pressure drop equations, Composite wall, Cylindrical wall and LMTD.
CO5	CHOT-304.5	Solve Problems based on Bernoulli's equation, Hagen-Poiseuille's equation, Pressure drop equations, Composite wall, Cylindrical wall and LMTD.

**Course outcomes :**

**CO-PO/PSO MATRIX:**

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-304.1	3							3		
CHOT-304.2		2	2					2	2	
CHOT-304.3			2						2	
CHOT-304.4		2						2		2
CHOT-304.5		3	2						3	
<b>AVERAGE</b>	<b>3</b>	<b>2.33</b>	<b>2</b>					<b>2.33</b>	<b>2.33</b>	<b>2</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

**Learning outcome**

**CHAPTER – 1 :**

- 1.1 Definition of a fluid, types of fluid physical properties of fluid and their units, Newton's law of viscosity.
- 1.2 List the Fluid pressures, concept of pressure, measurement of pressure. Using Working and Manometers .
- 1.3 Describe Reynolds experiment, laminar and turbulent flow, boundary layers formation.
- 1.4 Explain the boundary layer separation, boundary layer effects on fluid flow. Mass balance and momentum balance equations.
- 1.5 Evaluate the equation of continuity derivation, Bernoulli's , modified Bernoulli's equations and problems based on their equations.
- 1.6 Problems based on Reynolds number, pressure drop.

**CHAPTER – 2**

- 2.1 Describe the flow in incompressible fluids in pipes, shear stress distribution in pipe, equation and friction factor for laminar flow.
- 2.2 Define laminar flow in pipes, average velocity, Kinetic energy factor, explain the Hagen Poiseuille equation for pressure drop calculations.

- 2.3 Explain friction factor in turbulent flow, the roughness parameter, effect of roughness, and the friction factor contraction.
- 2.4 Illustrate the energy loss due to flow in pipe fittings sudden expansion and contraction,
- 2.5 solve simple problems on energy losses in fluid flow through pipes, friction factor in laminar and turbulent flow.
- 2.6 Predict the equivalent length, drag, drag coefficient and different types of drag.
- 2.7 Compare the relationship between drag coefficient and Reynolds number in laminar and turbulent flow.
- 2.8 Differentiate free settling and hindered settling, quote Stokes law, solve problems on Stokes law.
- 2.9 Summarize the packed bed and the equations of pressure drop in packed beds, the process of fluidization and application of fluidization.

### CHAPTER – 3:

- 3.1 List the classification of flow meters, pumps, and various types of pipe fittings.
- 3.2 Explain the principle, construction and working of flow meters, reciprocating, centrifugal pump.
- 3.3 Summarize the classification and pipes and tubes, schedule number, gauge for pipes and tubes.
- 3.4 Describe the functions of pump in fluid handling, the principle, construction and working of reciprocating positive displacement pump i) Piston pump ii) Plunger pump iii) Diaphragm pump.
- 3.5 Explain the principle, construction and working of rotary positive displacement pumps. i) Gear pump ii) Screw pump
- 3.6 Inventory the terms related to a pump  
i) Suction head ii) Discharge head iii) Total head iv) NPSH  
v) Cavitation vi) Priming vii) Mechanical efficiency viii) Power required
- 3.7 Describe the working of i) fan ii) blower iii) vacuum pump at differentiate between the fan and a blower.
- 3.8 Solve the problems based on flow meters, and centrifugal pump.

### CHAPTER -4:

- 4.1 List the mechanism of heat flow.
- 4.2 Define the steady state and unsteady state heat flow and the Fourier's law heat conduction.
- 4.3 Quote the thermal conductivity of a substance of its units.
- 4.4 Evaluate the derivation of equation for heat conduction through a single plane walls a cylindrical wall and composite wall.
- 4.5 Differentiate the significance of lagging, economic lagging, thickness and insulating materials.
- 4.6 Explain the compound resistances in series and solve problems in case of heat conduction through a flat wall, cylindrical wall and composite wall.

### CHAPTER – 5

- 5.1 Define modes of heat transfer with examples.
- 5.2 Explain the working of typical heat exchanger and the terms approach and range.
- 5.3 Differentiate the counter current and parallel current flows in an heat exchanger and locate the temperature variations along the length of the heat exchanger curve in both cases.
- 5.4 Explain the enthalpy balances in heat exchangers and in Total condensers, the rate of heat transfer heat flux, average temperature of fluid stream and overall heat transfer coefficient.

- 5.5 Evaluate the logarithmic mean temperature difference, variable overall heat transfer coefficient.
- 5.6 Explain the film concept in heat transfer by convection and the film coefficient analogy to thermal conductivity.
- 5.7 Evaluate the overall heat transfer coefficient from individual heat transfer coefficients.
- 5.8 Solve problems based on calculate of LMTD, and overall heat transfer coefficients.

#### **CHAPTER – 6:**

- 6.1 Explain the regimes of heat transfer in fluids, thermal boundary layer. 6.2 Explain the heat transfer by forced convection
- 6.3 Predict graetz and pecelet numbers.
- 6.4 Practice the various empirical equations used to calculate ‘h’ such as i) Dittus – boelter equation ii) siedler – tate equation iii) Colburn equation.
- 6.5 Explain the mechanism of heat transfer from condensing vapours , boiling liquids, pool boiling nucleate boiling and film boiling.
- 6.6 Distinguish the drop wise and film type condensation.
- 6.7 Solve problem based on dimension less numbers and heat transfer coefficient using various empirical equations.

#### **CHAPTER – 7 :**

- 7.1 Define the terms related to radiation such as absorptivity, reflectivity and transitivity , emission power , black body emissivity, kirchoff’s law.
- 7.2 Describe the Stefan Boltzmann law, planck’s law and wiens displacement law.
- 7.3 Explain the process and radiation between surfaces.
- 7.4 Explain the angle of vision and view factor.
- 7.5 Solve the problem related to the laws of radiation.
- 7.6 Explain and evaluate the combined heat transfer by conduction , convection and radiation.

#### **CHAPTER – 8:**

- 8.1 List the classification and evaporators and heat exchangers.
- 8.2 Explain the principle, construction and working of a double pipe heat exchanger, shell and tube heat exchanger.
- 8.3 Explain the principle. Construction and working of multi pass heat exchanger and temperature patterns in multi pass exchanges with sketches.
- 8.4 List the external surface heat exchangers i) fin type ii) plate type with a neat diagram.
- 8.5 Explain the function of a condenser, kettle type boiler, calandrias with a neat sketch.
- 8.6 illustrate the term evaporation, the different liquid properties to be considered in evaporation.
- 8.7 List the evaporator accessories such as a) steam traps b) condensers c) entrainment separators d) barometric leg e) ejectors f) salt removal systems.
- 8.8 Explain the principle, constructions and working of standard vertical tube evaporates, falling film and climbing film evaporators and forced circulation evaporates, multiple effect evaporator system with a sketch.
- 8.9 Give the performance of an evaporator a) economy b) capacity of an evaporator, the boiling point elevation at the effect of hydrostatics head capacity and economy of a multiple effect evaporators.
- 8.10 Explain the enthalpy balance equations for the single effect evaporators enthalpy concentration diagram.
- 8.11 Solve the problems on calculation of the heat transfer area, steam requirement and economy in case of a signal effect evaporation.
- 8.12 Explain the various methods of feeding the multiple effect evaporator system with its advantages and disadvantages.

## Hyponated Course contents:

### 1. Introduction to fluid flow phenomena and basic equations of fluid flow:

**Fluid:** definition of fluid, ideal fluid, real fluid, compressible and incompressible fluids, newtonian and non-newtonian fluids; physical properties of fluids– density, viscosity, velocity head, pressure head, static head, pressure concept; manometers: U–tube manometer, inverted U tube manometer, inclined manometer– differential manometer – flow pattern in circular tubes important of Reynold's number, laminar flow, turbulent flow, Reynold's experiment - flow in boundary layer- solve problems on Reynolds number and pressure drop in manometers, boundary layer separation and its effects on flow. Mass balance, momentum balance, stream line and stream tube, continuity equation- average velocity, mass velocity, Bernoulli's equation, modified Bernoulli's equation for frictional flow, pump work, kinetic energy correction, solve problems on various heads using Bernoulli's equation and pump work in Bernoulli's equation.

### 2. Flow of incompressible fluids in pipes and flow past immersed bodies:

Friction –skin friction, wall shear, equations for friction factor, relationship between skin friction parameters, flow of incompressible fluids, shear stress distribution in pipes, equation for friction factor, laminar flow in pipes, average velocity, kinetic energy factor, momentum correction factor for laminar flow of Newtonian fluids, Hagen Poiseuille equation, average velocity, effect of Roughness, friction factor chart, energy loss for fluids during flow, expansion and contraction losses in fitting, equivalent length, solve simple problems on friction factor in Laminar & turbulent flow and energy losses in fluid flow through pipes. Drag- Types of drag, drag coefficient, stokes law, drag coefficient Vs Reynolds number Curve, fanning friction factor, friction in flow through beds of solids, equivalent particle diameter, sphericity, packed bed, void fraction, pressure drop equations- flow of particles through fluids, free settling, hindered settling, equations for terminal velocities for different particles, Reynolds number ranges, fluidization, fluidization velocities and pressure drops, applications of fluidization, simple problems on Stoke's law.

### 3. Know about flow measurement & transportation of fluids:

Flow meters- head meters, area meters, orifice meter, venturi meter, pitot tube , rotameter- turbine meter- schedule number, gauge for pipes, pipes and tubes, pipe fitting and joints; Valves – gate valve, globe valve, plug valve, check valve, diaphragm valve, butterfly valve, ball valve, safety valve or relief valve, Pumps-functions of a pump, classification of pumps, positive displacement pumps, Reciprocating pumps, piston pumps, plunger pumps, diaphragm pumps, rotary pumps, gear pump, screw pump; Centrifugal pumps – single and multistage centrifugal pumps, different types of casings, suction head, discharge head, total developed head, NPSH, priming, cavitation, characteristic curves, equipment for gas flow- fans, blowers, compressors; Vacuum producing equipment– ejectors– solve simple problems on calculation of velocities, volumetric flow rates using venturi and orifice meters, power required by a centrifugal pump.

### 4. Heat transfer by conduction:

Mechanisms of heat flow, Fourier's law of heat conduction, thermal conductivity, steady state and unsteady state conduction, derivation of equation for heat conduction through a single plane wall, a cylindrical wall and composite wall, compound resistances in series, significance of lagging, economic lagging thickness, heat insulating materials, solve simple problems on calculation of rate of heat flow, intermediate temperatures in case of heat conduction through a flat wall, cylindrical wall and composite walls.

**5. Principles of heat flow in fluids:**

**Convection:** convection, natural convection and forced convection, working of typical heat exchanger, approach and range, counter current and parallel current flows in an heat exchanger, temperature variations along the length of the heat exchanger in both cases, enthalpy balances in heat exchangers and in total condensers, rate of heat transfer, heat flux, average temperature of fluid stream and overall heat transfer coefficient, logarithmic mean temperature difference (LMTD), variable overall heat transfer coefficient and Solve simple problems on calculation of LMTD, film co-efficient (individual heat transfer coefficients), analogy between film co-efficient and thermal conductivity, Nusselt number, Prandtl number, fouling factors, Calculation of Overall heat transfer coefficients from individual coefficients, Classification of Individual heat transfer coefficients and its magnitude – solve simple problems on calculation of overall heat transfer coefficients

**6. Heat transfer to Fluids without and with phase change:**

Regimes of heat transfer in fluids, thermal boundary layer, heat transfer by forced convection in laminar flow and turbulent flow, Graetz and Peclet numbers, various empirical equations used to calculate  $h_i$  such as 1. Dittus – boelter equation 2. Sieder – tate equation 3. Colburn equation, heat transfer from condensing vapors, drop wise and film wise condensation, heat transfer to boiling liquids-pool boiling, nucleate boiling and film boiling, Solve simple problems to calculate various dimensionless numbers and heat transfer coefficient using various empirical equations.

**7. Radiation Heat transfer:**

Fundamentals of radiation, absorptivity, reflectivity and transitivity, emission of radiation, wave length, emissive power, black body radiation, black body emissivity, emissivities of solids, laws of Black body radiation, stefanboltzmann law, planck's law and wiens displacement law, absorption of radiation by opaque solids, reflectivity, absorptivity, Kirchoff's law, radiation between surfaces, angle of vision, view factor, combined heat transfer by conduction, convection and radiation.

**8. Heat exchange equipment and evaporation:**

Classification of heat exchangers; principle, construction and working of a double pipe heat exchanger, shell and tube heat exchanger, floating head heat exchanger, multipass heat exchanger, temperature patterns in multipass exchangers, extended surface heat exchangers – Fin type and plate type heat exchangers, function of a condenser, a) Kettle type boilers b) Calandrias Evaporation: Definition, different liquid properties to be considered in evaporation, Types of evaporators: Principle, construction and working of a) standard vertical tube evaporator, b) falling film and climbing film evaporators, c) forced circulation evaporators, evaporator accessories such as a) Steam traps b) Condensers c) Entrainment separators d) Barometric leg e) Ejectors f) Salt removal systems, performance of an evaporator, economy and capacity of an evaporator, boiling point elevation, and the effect of hydrostatics head, Duhring's rule, enthalpy balance equation for the single effect evaporator, enthalpy concentration diagram, solve simple problems on calculation of the heat transfer area, steam requirement and economy in case of a single effect evaporator, working principle of the multiple effect evaporator system, methods of feeding the multiple effect evaporator system with its advantages and disadvantages, capacity and economy of a multiple effect evaporators

**REFERENCE BOOKS**

1. Unit operations of chemical Engg by Wareen L. Mc Cabe, Julian C. Smith and Peter Harriott, Fifth edition, Mc Graw Hill Publication.
2. Introduction to Chemical Engg by Walter L. Badger & Julius T. Bancho. Mc GRAW Hill Publication.
3. Process Heat Transfer by Donald Q. Kern, Mc GRAW Hill Publication.
4. Heat Transfer by D.P. Tiwari, Umesh publications, New Delhi

Course code CHOT-304	Course Title: Unit operations -1 Number of course Outcomes: 08			No. of periods 90	
PO's	Pos Mapped with CO No.	CO periods addressing PO in column 1		Level (1,2,3)	Remarks
		No. of Periods	Percentage		
PO1	CO1	20	21	1	25% Level2 Moderately addressed
PO2	CO2, CO4, CO5	38	41	3	>40% Level3 Highly addressed
PO3	CO2, CO3, CO5.	32	37	2	5 to 25% level1 Low addressed
PO4					5 to 25% level1 Low addressed

**C-23, CHPC/ CHPP /CHOT-304**  
**Subject Name: Unit Operations-I Syllabus split**  
up for Unit Test

Unit test NO	Learning out comes to be covered
Unit test-I	Objective from 1.1 to 3.8
Unit test-II	Objective from 4.1 to 8.12

Course code	Course title	No.Of Periods / week	Total number of periods	Marks for FA	Marks for SA
CHOT-305	Mass and Energy Balance	6	90	20	80

**TIME SCHEDULE**

S.No	Major Topics	No of Periods	Weightage allocated	Short Answer Questions	Essay type questions	COS mapped
1.	Units and Dimensions	12	6	2	-	CO1, CO2
2.	Basic Calculations	24	26	2	2	CO1, CO2
3.	Material balance without Chemical Reactions	18	23	1	2	CO2, CO4, CO5
4.	Material balance with Chemical Reactions	12	16	2	1	CO2, CO4, CO5
5.	Energy balance	14	23	1	2	CO2, CO4, CO5
6.	Combustion	10	16	2	1	CO3
<b>Total</b>		<b>90</b>	<b>110</b>	<b>10</b>	<b>8</b>	

**Course objectives:**

1. To familiarize with the terms used in Mass and Energy Balance, Physico-Chemical relations ,and Combustion.
2. To calculate Mass Balance Problems and Energy balance problems and evaluating various parameters used in chemical engineering.
3. To understand and reinforce the Physico-Chemical relation concepts in solving material and energy balance problems of chemical engineering for better production results. **Course outcomes**

<b>Course outcomes</b>	<b>CO1</b>	CHOT-305.1	Examine the basic concepts of Physico-Chemical relations.
	<b>CO2</b>	CHOT-305.2	Evaluate problems related to Physico-Chemical relations, mass balances and Energy balances.
	<b>CO3</b>	CHOT-305.3	Evaluate the procedures adopted for combustion calculations.
	<b>CO4</b>	CHOT-305.4	Analyse and correlate the mass balance and energy balance solutions of chemical engineering.
	<b>CO5</b>	CHOT-305.5	Apply the mass and energy balance in the chemical industry in the design aspects.

**CO-PO/PSO MATRIX:**

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-305.1	3	1	1	1	2	1	1	3	1	1
CHOT-305.2	2	3	2	3	3	3	3	3	2	1
CHOT-305.3	2	1	3	1	1	1	1	3	1	1
CHOT-305.4	3	3	2	1	2	2	1	3	1	2
CHOT-305.5	3	2	1	1	2	1	2	3	3	2
Average	2.6	2	1.8	1.4	2	1.6	1.4	3	1.6	1.4

## Learning outcomes

After completion of the course, the student will be able to

### 1.0 Units and Dimensions:

1.1 Know about Physical Quantities

1.2 Know Fundamental and Derived quantities

1.3 Know about Unit and System of units

1.4 Know the Formula, Units in SI system and Dimensional formula of different derived quantities.

1.5 Know the conversion factors for various fundamental quantities (Mass, Length, Time and Temperature) from one system of unit to another system of units.

1.6 Know the conversion factors for the following derived quantities

a) Force b) Newton's Law conversion factor c) Pressure from one system of unit to another system of units.

1.7 Know the conversion factors for the following derived quantities

a) Work done b) Heat c) Power from one system of unit to another system of units.

1.8 Know the conversion factors for the following derived quantities.

a) Viscosity b) Heat capacity c) Latent heat d) Specific heat from one system of unit to another system of units.

1.9 Know the conversion factors for the following derived quantities

a) Kinematic Viscosity b) Surface Tension c) Density d) Specific Volume from one system of unit to another system of units.

1.10 Know different dimensionless groups

1.11 Know the conversion of a equation from one system of units into another system of units.

1.12 Numerical problems on all the above topics

### 2.0 Basic Calculations:

#### (a) Stoichiometric and composition relationships

2.1 Define Atom, Molecule, Mole, Gram-atom, Gram-molecule, Gram molar volume

2.2 Define Molarity, Normality, Molality, PPM, Weight percent, Volume percent, Mole percent, Analysis on dry basis and wet basis

2.3 Define Density and Specific gravity, different gravity scales, and relation between gravity scale and Specific gravity,

2.4 know the Variation of density and specific gravity with temperature

2.5 Numerous problems on all the above topics

#### (b) Behaviour of ideal gases

2.6 Kinetic theory of gases

2.7 Know about Gas laws: Boyle's law, Charles law, Gay-Lussac's law, Avogadro's law,

2.8 Derivation of Ideal gas equation

2.9 Know about Vander Waal's equation of state, Critical properties of substances

2.10 Ideal gas constant-Derive the value of ideal gas constant in different system of units

- 2.11 state and explain Dalton's law of partial pressures, Amagat's law of partial volumes for gaseous mixtures
- 2.12 Explain the characteristics of an Ideal gas, Differences between Ideal gas and Real gas
- 2.13 (i) Derive the equation  $\text{volume \%} = \text{mole \%} = \text{pressure \%}$  for an ideal gas mixture  
(ii) Know about average molecular weight of a gas mixture and the evaluation procedure
- 2.14 Know the evaluation procedure for the density of a gaseous mixture
- 2.15 Numerous problems on all the above topics **(c) Vapour Pressures:**
- 2.16 Define vapour pressure, understand the relation between vapor pressure and boiling point
- 2.17 Know the effect of temperature on vapor pressure
- 2.18 Know the methods of evaluation of vapor pressure
  - (a) Antoine equation
  - (b) Clausius – Clapeyron equation.
  - (b) Vapor pressure reference substance plot - Cox chart, Duhring's lines
- 2.19 Ideal solutions and Non-Ideal solutions. Differences between Ideal and Non-Idealsolutions
- 2.20 Define (a) Raoult's Law (b) Henry's Law for solutions
- 2.21 Numerous problems on all the above topics **(d) Humidity and Saturation:**
- 2.22 Define and explain the following.
  - (a) Un-saturation, Saturation
  - (b) Humidity, Absolute humidity, Relative Humidity, Molal absolute humidity, %Saturation
  - (c) Dew Point
- 2.23 Know about Dry and wet bulb temperature
- 2.24 Numerous problems on all the above topics

### **3.0 Material balance without chemical reactions:**

- 3.1 Know Unit operation and Unit Process. Give Examples
- 3.2 Know about representation of unit operations/unit processes by a process flow chart or a block diagram
- 3.3 Know the basis for material balances
- 3.4 Understand the terms in the general material balance equation
- 3.5 Define and explain tie substance, key component and inert substance
- 3.6 Establish the steps to solve material balance problems
- 3.7 Know about Degrees of Freedom
- 3.8 Know about steady and un-steady state mass balance
- 3.9 Solve material balance problems related to Evaporation
- 3.10 Solve material balance problems related to Drying
- 3.11 Solve material balance problems related to Mixing
- 3.12 Solve material balance problems related to Distillation
- 3.13 Solve material balance problems related to Extraction
- 3.14 Solve material balance problems related to Crystallization
- 3.15 Know about Bypass in continuous chemical processes with examples
- 3.16 Know about Recycle in continuous chemical processes with examples
- 3.17 Know about Purge streams in continuous chemical processes with examples
- 3.18 Know about Blow-down streams in continuous chemical processes with examples
- 3.19 Numerous problems on all the above topics
- 3.20 material balance around multiple effect evaporator using specific data .

### **4.0 Material balance with chemical reactions:**

- 4.1 Know about Stoichiometry, application of stoichiometry, stoichiometric equations, stoichiometric coefficients, and stoichiometric proportions .Give suitable examples
- 4.2 Define and explain (a) limiting component and (b) excess reactant
- 4.3 Understand % conversion in a chemical reaction

- 4.4 Understand % yield in a chemical reaction
- 4.5 Understand Degree of completion in a chemical reaction
- 4.6 Know about theoretical quantity of reactant
- 4.7 Know about selectivity of a chemical process
- 4.8 Solve problems related to oxidation of sulphur compounds
- 4.9 Solve problems related to recovery of metals and non-metals from ores
- 4.10 Solve problems related to all the above concepts

#### 5.0 Energy balance:

- 5.1 Explain the terms internal energy and enthalpy
- 5.2 Define Heat and Work
- 5.3 State and explain 1st law of thermodynamics – problems related to 1st law
- 5.4 Derive the general energy balance equation for a steady flow process
- 5.5 Know the terms sensible heat, latent heat of fusion, latent heat of vaporization
- 5.6 Define Heat capacity and Specific heat
- 5.7 Explain the importance of mean heat capacity
- 5.8 Do the problems on heat requirement calculations, using  $Q = mcp\Delta T$  and  $Q = ncp\Delta T$
- 5.9 Know about exothermic, endothermic, adiabatic and isothermal reaction systems
- 5.10 Define and explain Heat of Formation, Heat of combustion and Heat of Reaction,
- 5.11 Know about Heat of Solution, Heat of Neutralization, Heat of mixing and Heat of Crystallization.
- 5.12 energy balance around short tube vertical evaporator using specific data.

#### 6.0 Combustion process:

- 6.1 Distinguish between Partial and Complete Combustion
- 6.2 Define and explain Calorific values (Gross and Net Calorific values)
- 6.3 Calculate the calorific value of a fuel using Dulong's Formulae
- 6.4 Know about net hydrogen
- 6.5 Solve combustion problems related to refuse analysis
- 6.6 Explain the proximate and ultimate analysis of coal
- 6.7 Know about the composition of flue gas obtained after combustion of a fuel
- 6.8 Calculate the air requirement for combustion of a specific fuel
- 6.9 Know the compositions of fuel and flue gases, and calculate the flue gas analysis using fuel analysis
- 6.10 Calculate the fuel analysis using flue gas analysis for complete combustion and incomplete combustion
- 6.11 Solve problems related to combustion

### Hyponated course content with Reference books:

#### 1.0 Units and Dimensions:

Physical Quantities-Fundamental and Derived quantities-Unit and System of units-Formula, Units in System and Dimensional formula of different derived quantities-Area, Volume, Velocity, Acceleration, Density, Specific volume, Work done-Energy-Enthalpy-Power-Heat Capacity-Humidity-Mass flow rate-Momentum-Acceleration due to gravity-Volumetric flow rate-Viscosity Specific heat-Latent heat-Surface Tension-Kinematic viscosity- Conversion factors for various fundamental quantities-Mass, Length, Time and Temperature from one system of unit to another system of unit-Conversion factors for various derived quantities- Force, Newton's Law conversion factor, Pressure, Work done, Heat, Power, Viscosity, Heat capacity, Latent heat, Specific heat, Kinematic Viscosity, Surface Tension, Density, Specific volume from one system of unit to another system of unit-Dimensionless groups-Reynolds number, Prandtl number, Nusselt number, Grashof number, Peclet

number, Mach number, Schmidt number, Graetz number, Lewis number, Sherwood number, Stanton number-Conversion of one system of equation into another system.

## 2.0 Basic Calculations:

### (a) Stoichiometric and composition relationships:

Define Atom, Molecule, Mole, Gram-atom, Gram-molecule, Gram molar volume-Different methods of expressing concentration-Define Molarity, Normality, Molality, PPM, Weight percent, Volume percent, Mole percent, Analyse on dry basis and wet basis-Define Density and Specific gravity, specific gravity scales, Variation of density and specific gravity with temperature Numerous problems on all the above topics.

### (b) Behaviour of ideal gases:

Kinetic theory of gases-Gas laws: Boyle's law, Charles law, Gay-Lussac's law, Avogadro's law, Derivation of Ideal gas equation-Vander Waal's equation of state, Critical properties of substances-Ideal gas constant-Derive the value of ideal gas constant in different system of units Define and explain Dalton's law of partial pressures, Amagat's law of partial volumes for gaseous mixtures-Characteristics of an Ideal gas, Differences between Ideal gas and Real gas-Derive the equation  $\text{volume \%} = \text{mole \%} = \text{pressure \%}$  for an ideal gas mixture-Average molecular weight of a gas mixture-Density of a gaseous mixture-Numerous problems on all the above topics.

### (c) Vapor Pressures:

Vapor pressure, Relation between vapor pressure and boiling point-Effect of temperature on vapor pressure-Methods of vapor pressure determination-Antoine equations, Clausius-Clapeyron equation-Vapor pressure reference substance plot -Cox chart, Duhring's lines-Ideal solutions and Non-Ideal solutions-Differences between Ideal and Non-Ideal solutions-Define (a) Raoult's Law (b) Henry's Law for solutions-Numerous problems on all the above topics.

### (d) Humidity and Saturation:

Un-saturation, Saturation-Humidity-Absolute humidity-Relative Humidity-Molal absolute humidity-% Saturation-Dew Point-Dry and wet bulb temperature-Numerous problems on all the above topics.

## 3.0 Material balance without chemical reactions:

Unit operation and Unit Process-Give examples for unit operation and unit processes-Representation of unit operations/unit processes by a process flow chart or a block diagram Basis for material balances-Terms in the general material balance equation-Tie substance, key component and inert substance-Steps to solve material balance problems-Degrees of Freedom Steady and un-steady state mass balance-Material balance problems related to Evaporation-Material balance problems related to Drying-Material balance problems related to Mixing-Material balance problems related to Distillation-Material balance problems related to Extraction-Material balance problems related to Crystallization-Bypass in continuous chemical processes with examples-Recycle in continuous chemical processes with examples-Purge streams in continuous chemical processes with examples-Blowdown streams in continuous chemical processes with examples-Numerous problems on all the above topics.

## 4.0 Material balance with Chemical Reactions:

Stoichiometry, application of stoichiometry, stoichiometric equations, stoichiometric coefficients, and stoichiometric proportions-Limiting component-Excess reactant- % conversion in a chemical reaction system-% yield in a chemical reaction system-Degree of completion in a chemical reaction system-Theoretical quantity of reactant-Selectivity of a chemical process Oxidation of sulphur compounds-Recovery of metals and non-metals from ores-Problems related to all the above concepts.

## 5.0 Energy Balance:

Internal energy and enthalpy-Heat and Work-1st law of thermodynamics-Problems related to 1st law-General energy balance equation for a steady flow process-Sensible heat, Latent heat of Fusion, Latent heat of vaporization-Heat capacity and Specific heat-Importance of mean heat capacity-Problems

on heat requirement calculations using  $Q = mcp\Delta T$  and  $Q = ncp\Delta T$ -Exothermic, Endothermic, Adiabatic and Isothermal reaction systems-Heat of Reaction, Heat of Formation and Heat of combustion-Heat of Solution, Heat of Neutralization, Heat of mixing and Heat of crystallization.

### 6.0 Combustion process:

Distinguish between Partial and Complete Combustion-Calorific values (Gross and Net Calorific values)-Calorific value of a fuel using Dulong's Formulae-Net hydrogen-Combustion problems related to refuse analysis-Proximate and ultimate analysis of coal-Composition of flue gas obtained after combustion of a fuel-Air requirement for combustion of a specific fuel-Compositions of fuel and flue gases, and calculate the flue gas analysis using fuel analysis-Fuel analysis using flue gas analysis for complete combustion and incomplete combustion-Problems related to combustion.

### REFERENCE BOOKS:

S.No.	Book Title	Author	Publications
1	Chemical Process Principles	1. 2. Olaf A. Hougen 3. Kenneth M. Watson Ronald A. Ragatz	Asia Publishing House
2	Basic Principles and calculations in Chemical Engineering	1. David M. Himmelbleau	
3	Introduction to Stoichiometry (SI units)	1. K.A. Gavhane	Nirali Prakashan
4	Stoichiometry and Process Calculations	1. K.V. Narayanan 2. B. Lakshmi Kutty	Prentice Hall of India Pvt Limited, New Delhi
5	Stoichiometry (SI Units)	1. B.I. Bhatt 2. S.M. Vora	Tata McGraw-Hill Publishing company Limited, New Delhi
6.	Process Calculations	1. V. Venkataramani 2. N. Anantharaman	Prentice Hall of India Pvt Limited, New Delhi
7.	Process calculations for Chemical Engineers	1. Ch. Durga Prasad Rao 2. D.V.S. Murthy	MAC Millan India Limited

<b>Course code</b> <b>CHOT-305</b>		<b>Course Title: Mass and Energy Balance</b> <b>No of Course outcomes 07</b>	<b>No of periods:</b> <b>75</b>
<b>POs</b>	<b>Mapped with</b> <b>CO No</b>	<b>CO periods addressing</b> <b>PO in Column 1</b>	<b>Level</b> <b>(1, 2, 3)</b> <b>Remarks</b>

			NO	%		
PO1	CO1, CO3, CO4, CO5	30	40	2	CO1, CO3, CO4, CO5	>40%- level 3 25%-40% level 2
PO2	CO2, CO3, CO4	29	39	2	CO2, CO3, CO4	5-25% : level 1
PO3	CO2	16	21	1	CO2	<5%: not addressed
PO4						
PO5						
PO6						
PO7						

**C-23, CH/CHPC/ CHPP /CHOT-305**  
**Subject Name: Mass and Energy Balance**  
Syllabus split up for Unit Test

Unit test No.	Learning out comes to be covered
Unit test-I	Chapters from 1 to 3
Unit test-II	Chapters from 4 to 6

### CAD practice in Chemical Engineering (CHOT-306)

course code	Course title	No.of Periods / week	Total number of periods	Marks for FA	Marks for SA
CHOT-306	<b>CAD practice in Chemical Engineering</b>	3	45	40	60

<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
<b>Course Outcomes</b>	C01	Demonstrate the skill of planning and learning basics of chemical Engineering
	C02	Practice commands modifying commands and different equipment symbols
	C03	Dimensioning commands and three dimensional modelling
	C04	Practice plant layout using CAD

#### CO-PO/PSO MATRIX:

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-306.1	3	-	-	-	-	-	-	-	-	2
CHOT-306.2	-	-	3	-	-	3	3	3	-	-
CHOT-306.3	-	-	3	-	2	3	3	-	-	1
CHOT-306.4	-	-	3	2	2	-	3	2	-	3
Average	3	-	3	2	2	3	3	2.5	-	2

#### Learning outcome

1. Introduction to CAD and its applications
  - a. Features of CAD
  - b. Starting and exiting
  - c. Drawing screen creation , saving and opening a drawing
  - d. Using pull down menu
  - e. Key board input
  - f. Setting of units and limits of a drawing
2. Drawing commands
  - a. Understanding the coordinate systems- Absolute coordinates, relative coordinates, polar coordinates
  - b. Creation of lines, arcs, rectangle, polygon, ellipse, donut, polylines and text.

- c. Selecting objects, erasing, undo, redo, oops
- 3. Modifying commands
  - a. Copy, mirror, offset, array, move, rotate, scale, stretch, lengthen, trim, extend, break, chamfer, fillet, explode, editing text, hatching
- 4. Dimensioning
  - a. Dimensioning commands, setting dimensioning style, linear dimensions, aligned, ordinate, radius, diameter, angular, editing a dimension, align text
- 5. Three dimensional modelling
  - a. Viewing in three dimensions
  - b. Types of three dimensional modelling i.e, wire frame models, surface models and solid models
  - c. Editing of solids i.e, joining and subtracting of solids.
- 6. Plotting of an CAD drawing using printer
- 7. Drawing of symbols for pumps and compressors.
- 8. Drawing of symbols for vertical and horizontal boiler
- 9. Drawing of symbols for pipe lines.
- 10. Flow sheet symbols
  - a. Reducer, venturi meter, orifice meter, rotameter, sight flow indicator, pitot tube, burner , air trap bucket trap, vacuum trap, flat trap, separator, ejector
- 11. Draw the 2D drawings; Knuckle joint, screw jack.
- 12. Draw the following chemical equipments using CAD
  - a. Double pipe heat exchanger b) Mixer
- 13. Drawing of symbols for agitator, absorbers, fractionating column
- 14. Basic instrument symbols
  - a. Basic symbols for instrument with single service and function
  - b. For combination to instrument or device with two services or functions for transmitters and for diaphragm valves
- 15. Draw the plant layout using CAD
  - a. Sugar Industry      b. Cement Industry
- 16. 2D modelling and 3 D modelling .
- 17. simulation of fluid mechanics and heat transfer operations .
- 18. Python tool.

Course code	Course title	No. of periods/week	Totalno.of periods	Marks for FA	Marks for SA
CHOT-307	Electrical Technology Lab	3	45	40	60

<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
<b>Course Outcomes</b>	C01	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	C02	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	C03	Observe various parameters, their variations and graphically represent the same
	C04	Analyse the experimental results to draw inferences to make recommendations
	C05	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

### List of experiments in Electrical Technology Lab.

1. Verification of ohms Law and Determination of the resistance of the given resistor.
2. Measurement of power in D.C. Circuit consisting of resistance in a) Series b) parallel c) Series and parallel combination.
3. Calibrate the given 1-phase energy meter (know how to connect the energy meter in a given circuit)
4. Study of starters a) 3-point starters b) D.O.L starters and c) star/Delta starters.
5. Obtain the speed control of D C Shunt Motor by Field control method.
6. Obtain the speed control of D C Shunt Motor by Armature control Method.
7. Measure the line voltage and phase voltage, line current and phase current in a given a) star connected load and b) Delta connected load.
8. Conduct the Load test on Single phase Capacitor type Induction Motor.
9. Measure the primary and secondary voltages of step-up Transformers and step down transformer
10. Single –phase circuit wiring (single-lamp controlled by a single-way switch)  
Single lamp controlled by two-way switch.

### Organic & physical chemistry lab

Course code	Course title	No. of periods/week	Totalno.of periods	Marks for FA	Marks for SA
CHOT-308	Organic & physical chemistry lab	3	45	40	60

S. No.	Major Topics	No. of periods
1.	Determination of Melting point of Solid Organic compounds. Determination of Boiling points of liquid organic compounds	6
2.	Detection of Elements	9
3.	Reactions of Functional groups	6
4.	Systematic identification of functional groups in an Organic Compound	15
5.	Preparation of Organic Compounds.	9
<b>Total</b>		<b>45</b>

<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
<b>Course Outcomes</b>	C01	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	C02	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	C03	Observe various parameters, their variations and graphically represent the same
	C04	Analyse the experimental results to draw inferences to make recommendations
	C05	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

#### CO-PO/PSO MATRIX:

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-307.1	1	-	-	3	-	-	-	1	-	-
CHOT-307.2	3	1	-	1	-	2	-	2	3	2
CHOT-307.3	1	1	-	-	-	-	-	1	2	-
CHOT-307.4	-	2	1	-	-	-	-	2	3	2

CHOT-307.5	-	-	1	-	2	3	-	-	2	-
Average	1.67	1.33	1	2	2	2.5	-	1.5	2.5	2

### Learning outcome

#### List of experiments in Organic and Physical Chemistry Lab.

##### 1.0 Conduct

1.1 Determination of Melting Point of solid Organic Compounds.

1.2 Determination of Boiling Point of liquid organic Compounds.

##### 2.0 Know detection of following elements present in organic compounds.

2.1 Carbon

2.2 Hydrogen

2.3 Oxygen

2.4 Nitrogen

2.5 Sulphur

2.6 Halogens.

##### 3.0 Know Reactions of functional groups present in organic compounds.

3.1 Alcohols

3.2 Acids

3.3 Aldehydes

3.4 Ketones

3.5 Amines

3.6 Amides

3.7 Esters.

##### 4.0 Understand Systematic identification of the functional groups in Organic compounds.

##### 5.0 Understand Preparation of following Organic Compounds

5.1 preparation of Phenol-formaldehyde.

5.2 Preparation of Azodye.

5.3 Preparation of Aspirin.

#### COURSE CONTENT:

1. Determination of Melting Points and Boiling Point of Organic Compounds.

2. Detection of elements Carbon – Hydrogen – Oxygen – Nitrogen – Sulphur – Halogens.

3. Reactions of functional groups – OH, -COOH, -CHO, -CO-R, -NH<sub>2</sub>, -CONH<sub>2</sub>, -COOR.

4. Identification of functional groups in an Organic Compound.

5. Preparation of organic Compounds – Acetanilide – Bromoacetanilide – Nitro Benzene – Azodye – Aspirin.

## Unit Operations-I Lab

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CHOT-309	Unit Operations-I Lab	6	90	40	60

### Course title : Unit Operations-I Lab(CHOT-309)

<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
<b>Course Outcomes</b>	C01	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	C02	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	C03	Observe various parameters, their variations and graphically represent the same
	C04	Analyse the experimental results to draw inferences to make recommendations
	C05	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

### CO-PO/PSO MATRIX:

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-309.1	3	2	2	2	-	-	-	3	1	2
CHOT-309.2	3	2	3	3	-	-	-	3	3	3
CHOT-309.3	2	3	3	3	-	-	-	2	2	2
CHOT-309.4	3	3	2	2	-	-	-	3	2	3
CHOT-309.5	3	2	3	3	-	-	-	3	3	3
Average	2.8	2.4	2.6	2.6	-	-	-	2.8	2.2	2.6

### List of experiments:

1. Calibration of a given Rota meter
2. Verify the Bernoulli's equation using Bernoulli's apparatus.

3. Determination of frictional losses in various pipes and fittings
4. Determination of friction factor of various pipes in the given experimental set up.
5. Calculates the coefficient of discharge of venturi meter and draw graph between  $C_d$  Vs  $N_{Re}$ .
6. Calculates the coefficient of discharge of orifice meter and draw graph between  $C_d$  Vs  $N_{Re}$ .
7. Perform the test to determine the characteristics of a centrifugal pump and draw the characteristic curves.
8. Identification of the laminar and turbulent flow using Reynolds apparatus.
9. Verification of Fourier's law of heat conduction through composite walls.
10. Verification of Fourier's law of heat conduction and determination of thermal conductivity of a metal bar.
11. Determination of overall heat transfer co-efficient in a double pipe heat exchanger for a Counter current flow.
12. Determination of overall heat transfer co-efficient in a double pipe heat exchanger for a Co-current flow
13. Determination of overall heat transfer co-efficient in a shell and tube heat exchanger for a Counter current flow
14. Determination of overall heat transfer co-efficient in a shell and tube heat exchanger for a Co-current flow
15. Determination of heat transfer co-efficient for natural convection of air. 16. Determination of heat transfer co-efficient for forced convection of air
17. Determination of Stefan Boltzmann's constant.
18. Determination of emissivity of a test plate

# **IV SEMESTER**

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
CHOT - 401	Industrial Hazards and Safety	3	-	45	3	20	80	100
CHOT -402	Process Technology	6	-	90	3	20	80	100
CHOT -403	Technology of Vegetable Oils and Fats-I	4	-	60	3	20	80	100
CHOT -404	Technology of Vegetable Oils and Fats-II	5	-	75	3	20	80	100
CHOT -405	Basic Mechanical Engineering	4	-	60	3	20	80	100
CHOT-406	Unit Operations-II	5		75	3	20	80	100
<b>PRACTICAL:</b>								
CHOT -407	Unit Operations – II Lab	-	3	45	3	40	60	100
CHOT -408	Communication skills	-	3	45	3	40	60	100
CHOT -409	Technology of Vegetable Oils and Fats-I & II Lab	-	3	45	3	40	60	100
CHOT -410	Process Technology Lab	-	3	45	3	40	60	100
-	Activities	-	3	45	-	-	-	-
<b>TOTAL</b>		<b>27</b>	<b>15</b>	405+225 = 630		<b>280</b>	<b>720</b>	<b>1000</b>

CHOT-401, 408 common to all branches

CHOT-402,405, 406, 407, 410 common to DCHE(PC/ PP)

CHOT-403, 404, 409 not common to any course

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
CHOT -401	INDUSTRIAL HAZARDS AND SAFETY	03	45	20	80

### Time Schedule

S.NO	Name of the Chapter	Periods	Weightage of marks	Short answer type questions	Essay type questions	CO's mapped
01.	Industrial Hygiene & safety	6	13	01	01'	CO1, CO2,
02.	Industrial Hazards and fire Hazards	8	26	02	02	CO1, CO2,
03.	Personal Protection & Equipment Protection	8	16	02	01	CO1, CO2
04.	Fire Protection and Extinguishing	7	13	01	01	CO3, CO5
05.	Occupational Diseases & First aid	8	16	02	01	CO1, CO3, CO5
06.	Chemical Process Safety & MSDS,HAZOP	8	26	02	02	CO1, CO3,
Total		45	110	10	08	

<b>Course Objectives</b>	<ol style="list-style-type: none"> <li>1. To familiarize with the knowledge of industrial hygiene, safety, industrial hazards and fire hazards</li> <li>2. To know the various personal protection, equipment protection, fire protection and extinguishing</li> <li>3. To familiarize with the occupational diseases, first aid, chemical process safety, MSDS and HAZOP</li> </ol>
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CO NO	Course Outcomes
CO1	CHOT-401.1 Explain the concept of industrial hygiene, safety, industrial and fire hazards
CO2	CHOT-401.2 Illustrate the methods of personal protection, equipment protection, fire protection and extinguishing
CO3	CHOT-401.3 Demonstrate the information about occupational diseases and first aid methods
CO4	CHOT-401.4 Identify the various methods for chemical process safety
CO5	CHOT-401.5 Examine the principles and standard procedures for MSDS AND HAZOP

## CO/PO'S MATRIX:

CO 's/PO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO
CHOT-401.1	1	-	3	-	-	-	-	3	-	-
CHOT-401.2	1	-	-	2	-	-	-	3	-	-
CHOT-401.3	-	2	-	-	-	-	-	3	-	-
CHOT-401.4	-	2	3	-	-	-	-	3	-	2
CHOT-401.5	1	2	-	-	-	-	-	3	2	-
<b>AVERAGE</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	-	-	-	<b>3</b>	<b>2</b>	<b>2</b>

### Objectives:

#### I. Industrial Hygiene and safety: -

- 1.1. Define and understand industrial hygiene.
- 1.2. Understand the recognition of chemical hazards
- 1.3. Industrial evaluation and monitoring of hazard
- 1.4. Know about the controlling techniques of hazards
- 1.5. Explain the toxicity of hazardous chemicals in the work plan.
- 1.6. Know the physical classification of chemicals.
- 1.7. Explain the industrial process /operations that may produce health hazards..

#### II. Industrial Hazards and fire Hazard

- 2.1 Know the importance of safety in work plan.
- 2.2 Understand the economic aspects and direct and indirect costs of hazards.
- 2.3 Know about the safety in the storage of hazardous chemicals
- 2.4 Understand the specific guidelines for the storage of chemicals such as ammonia, Chlorine, LPG.
- 2.5 Know about the storage inspections.
- 2.6 Know about general recommendations for storage of chemicals in an industry.
- 2.7 List out various industrial hazards and fire hazards while processing the following:
  - a) Hazardous gases
  - b) acids
  - c) alkalies
  - d) Corrosive substances
  - e) flammable substances /explosives
- 2.8 Know about safety instructions.

#### III: Personal Protection & Equipment Protection

- 3.1 Know about safety practices
- 3.2 Know about safety in steps of maintenance works.
  - a) Vessel entry
  - b) Welding operations
- 3.3 Know the types of personal protection equipment and their applications
- 3.4 Know about selection of protective equipment for the handling of different chemical substances.
- 3.5 Know about the equipment protection with the following items:
  - a) guards
  - b) rupture discs
  - c) safety valves.

#### IV: Fire prevention and extinguishing

- 4.1 Know the causes of fire.
- 4.2 Know about the safety triangle.
- 4.3 Know about the detection of fire through automatic fire alarms
- 4.4 Know about classification of fires.

4.5. Know about portable and fixed fire extinguishers.

4.6 Know about dust explosion.

#### **V: Occupational diseases and first aid**

5.1 Know about the occupational diseases

5.2 Know about the diseases notified in factories act 1987.

5.3 Know about diseases namely pneumoconiosis, silicosis, Bagassosis.

5.4 Know about the health hazards due to lead, mercury, chromium, arsenic, manganese, Benzene.

5.5 Explain first aid operations

5.6 Explain the precautions to be taken in toxic atmospheres.

5.7 Explain the steps to be taken in case of

a) Chemical Contact    b) Spilling of hazardous solids, Liquids, and gases.

5.8 Know about electric shocks and burns and first aid given in shocks & burns.

#### **VI: Chemical process safety**

6.1 Know about risks associated with industrial activity.

6.2 Understand the hazardous chemical processes.

6.3 Know about hazards in chemical reactors.

6.4 Know about hazards in certain chemical reactions such as nitration, halogenations, polymerization, oxidation

6.5 Know about operational deviations such as pressure, Temperature & flow.

6.6 Understand technical report of a chemical plant for chemical process safety.

6.7 Know about material safety data sheet (MSDS).

6.8 Understand hazard operative procedure (HAZOP).

### **COURSE CONTENTS:**

#### **1. Industrial Hygiene:**

Industrial hygiene - Recognition of chemical hazards -Industrial evaluation and monitoring of hazard-controlling techniques of hazards - Toxicity of hazardous chemicals in the work place - Physical classification of chemicals- industrial process /operations that produce health hazards.

#### **2. Industrial Hazards and fire Hazard**

Importance of safety - economic aspects- Direct and indirect costs of hazards - Safety in the storage of hazardous chemicals - Guidelines for the storage of chemicals Ammonia, Chlorine, LPG.- Storage inspections - General recommendations for storage of chemicals in an industry- Industrial hazards and fire hazards processing the Hazardous gases, acids, alkalies, Corrosive substances, flammable substances /explosives safety instructions.

#### **3. Personal Protection & Equipment Protection**

Safety practices - safety in maintenance works like Vessel entry, Welding operations

Types of personal protection equipment , applications- selection of protective equipment for different chemical substances- equipment protection : guards, rupture discs, safety valves.

#### **4. Fire prevention and extinguishing**

Causes of fire - safety triangle - detection of fire through automatic fire alarms – classification of fires - portable and fixed fire extinguishers- dust explosion.

#### **5. Occupational diseases and first aid**

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Occupational diseases - diseases notified in factories act 1987 - pneumoconiosis, silicosis, Bagassosis - Health hazards due to lead, mercury, chromium, arsenic, manganese, Benzene –

**First aid operations-** precautions taken in toxic atmospheres- steps to be taken in case of Chemical Contact, Spilling of hazardous solids, Liquids, and gases - electric shocks and burns and first aid given in shocks & burns.

#### 6. Chemical process safety

Risks associated with industrial activity - hazardous chemical processes - hazards in chemical reactors- Hazards in chemical reactions such as nitration, halogenations, polymerization, oxidation - operational deviations in pressure, Temperature & flow -Technical report of a chemical plant for chemical process safety - material safety data sheet(MSDS)-hazrd operative procedure(HAZOP).

Text Book: 1. Industrial hygiene & Chemical safety By M.H.Fulekar , I.K.International  
2. Industrial health and safety management by A.M. Sarma ,  
Himalaya publishing house

#### Reference:

1. Industrial Accident prevention – Heinrich HW
2. Injury Prevention and Control – Geetam Mohan and Tiwari
3. Fire and Explosion Protection Handbook – Denis P Nolan
4. Loss Prevention in process industries-Lees FP

Course code CHOT-401	Course Title: INDUSTRIAL HAZARDS AND SAFETY Number of course Outcomes: 05			No. of periods 45	
	PO's	Pos Mapped with CO No.	CO periods addressing PO in column 1		Level (1,2,3)
No. of Periods			Percentage		
PO1	CO1	20	21	1	25% Level2 Moderately addressed
PO2	CO2, CO4, CO5	38	41	3	>40% Level3 Highly addressed
PO3	CO2, CO3, CO5.	32	37	2	5 to 25% level1 Low addressed
PO4					5 to 25% level1 Low addressed

#### C-23, CHOT-401

**Subject Name:** INDUSTRIAL HAZARDS AND SAFETY

**Syllabus split up for Unit Test**

Unit test No.	Learning out comes to be covered
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Unit test-I	Learning Objectives from 1.1 to 3.5
Unit test-II	Learning Objectives from 4.1 to 6.8

**Process Technology\_CHOT-402**

Course code	Course title	No.Of Periods / week	Total number of periods	Marks for FA	Marks for SA
CHOT-402	Process Technology	6	90	20	80

**TIME SCHEDULE**

S.No.	Major Topics	No of Periods	Weightage allocated	Short Answer Questions	Essay type questions	Cos mapped
1.	Basic industrial chemicals	12	13	1	1	CO1, CO2, CO4, CO5
2.	Water and Fertilizer industry	19	26	2	2	CO1, CO2, CO5
3.	Industrial gases and Inorganic products	15	16	2	1	CO1, CO2, CO5
4.	Coal chemicals, Petroleum refining and Petrochemical industry	17	26	2	2	CO1, CO3, CO5
5.	Oils, fats, soap, Pulp, Paper and Sugar industry	16	16	2	1	CO1, CO3, CO5
6.	Polymerization, Rubber polymer and Rubber industries	11	13	1	1	CO1, CO3, CO5
<b>Total</b>		<b>90</b>	<b>110</b>	<b>10</b>	<b>8</b>	

<b>Course objectives:</b>	<ol style="list-style-type: none"> <li>1. To familiarize with different chemical products, unit operations used in the processes.</li> <li>2. To know the use of unit operations in the manufacturing processes.</li> <li>3. To understand and reinforce the unit operations concepts in various chemical processes for better production results.</li> </ol>
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**COURSE OUTCOMES**

Course outcomes	CO1	CHOT-402.1	Describe the basic concepts, fundamentals, Sources and raw materials (feed stocks) involved in the manufacture of various inorganic and organic products.
	CO2	CHOT-402.2	Summarize the properties of various inorganic and organic products
	CO3	CHOT-402.3	Illustrate the manufacturing processes of various inorganic and organic products with the aid of process flow diagram.
	CO4	CHOT-402.4	Identify the specific unit operations used in the manufacturing processes
	CO5	CHOT-402.5	detect the trouble shooting involved in various unit operations and processes.

Illustrate the manufacturing processes of various Inorganic and organic chemicals with the aid of process flow diagram.

Summarize the properties of various inorganic and organic products.

Appraise the Uses and industrial applications of various inorganic and organic chemicals.

#### CO-PO/PSO MATRIX:

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-402.1	3	-	-	-	-	-	-	2	-	-
CHOT-402.2	-	-	3	-	-	-	-	-	2	1
CHOT-402.3	-	-	3	-	-	-	-	-	-	1
CHOT-402.4	-	-	-	2	-	-	-	-	2	-
CHOT-402.5	-	-	2	-	-	-	-	-	2	-
<b>AVERAGE</b>	<b>3</b>	<b>-</b>	<b>2.67</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>1</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

#### Learning outcome:

##### 1.0 Basic industrial chemicals.

- 1.1 State different industrial manufacturing methods HCl and its uses
- 1.2 State and explain the manufacturing of sodium carbonate by solvay process and uses of soda ash
- 1.3 State and explain the manufacturing of sodium hydroxide through electrolytic process, and its properties and uses.
- 1.4 State and explain the manufacturing of ammonia through steam reforming of naphtha or natural gas, properties and uses of ammonia
- 1.5 State and explain the manufacture of nitric acid, properties and uses of HNO<sub>3</sub>
- 1.6 State and explain the manufacturing process of sulfuric acid by double absorption and double contact process, properties and uses of H<sub>2</sub>SO<sub>4</sub>
- 1.7 State and explain the manufacturing method of sodium sulfate from naturally occurring Glauber's salt, properties and uses of sodium sulphate

##### 2.0 Water and Fertilizer industry.

- 2.1 List 4 sources of water.
- 2.2 State the impurities and mineral matter present in water.
- 2.3 Classify various scales formed and method of removal of scales due to impurities in water.
- 2.4 Explain the process of purification of water by ion – exchange method.
- 2.5 Explain permutit method of water purification.
- 2.6 Explain the stages involved in municipal water treatment.
- 2.7 Explain sewage water treatment of process plants.
- 2.8 List the industrial uses of urea, phosphoric acid, ammonium phosphate, ammonium sulphate, super phosphate and N-P-K fertilizers
- 2.9 Explain the manufacturing method of urea by Total recycle using ammonia and carbon dioxide.
- 2.10 Explain the manufacturing of phosphoric acid by wet process
- 2.11 Explain the manufacturing process of monoammonium phosphate (MAP) and diammonium phosphate (DAP).
- 2.12 Explain the process of making of ammonium sulphate.
- 2.13 Explain the manufacturing process of single super phosphate and triple super phosphate.
- 2.14 Explain the manufacture of mixed fertilizers (n-p-k) grades.

##### 3.0 Industrial gases and Inorganic products.

- 3.1 State two methods of manufacturing of oxygen and nitrogen.

- 3.2 Explain the concept of conventional linde cycle.
- 3.3 Explain the manufacturing of oxygen and nitrogen by liquefaction and rectification of air using conventional linde double column rectifier and main condenser.
- 3.4 List the industrial applications of nitrogen, oxygen, carbon dioxide, silicon carbide, calcium carbide and glass
- 3.5 State 4 sources of carbon dioxide.
- 3.6 Explain the manufacture of carbon dioxide from molasses fermentation method
- 3.7 Explain the manufacture of cement by wet and dry process.
- 3.8 Explain the manufacturing of silicon carbide and calcium carbide.
- 3.9 Explain the manufacturing of soda glass.
- 4.0 Coal chemicals, Petroleum refining and Petrochemical industry.**
- 4.1 Explain the formation of coal.
- 4.2 List the grades of coal, chemicals obtained from coal, coal tar.
- 4.3 Explain about coke, coal gas, water gas, producer gas and synthesis gas,
- 4.4 Explain high temperature carbonization of coal.
- 4.5 Explain the recovery of chemicals when coal is subjected to coking.
- 4.6 Explain coal tar distillation
- 4.7 Describe the origin of crude petroleum.
- 4.8 Explain the atmospheric distillation and vacuum distillation of crude petroleum in a refinery to obtain different cuts.
- 4.9 Explain the principles of cracking and process of catalytic cracking.
- 4.10 Explain the principles of catalytic reforming and process of catalytic reforming.
- 4.11 State the feed stocks desirable to manufacture different petrochemicals.
- 4.12 State the petrochemicals obtained from methane, ethylene, propylene and butylene
- 4.13 Explain the manufacturing process of chloromethanes from methane.
- 4.14 State the uses of methane, ethylene, propylene and butylene..
- 5.0 Oils, fats, soaps, Pulp, Paper and Sugar industry.**
- 5.1 Distinguish between oils and fats
- 5.2 Explain the process of extraction of vegetable oil from seeds using mechanical expeller and solvent extraction method.
- 5.3 List the raw materials required in the manufacture of soap, pulp and paper.
- 5.4 Explain the continuous process for the production of soap.
- 5.5 Explain the recovery of glycerine from soap industry.
- 5.6 State the two processes followed to produce pulp.
- 5.7 Explain the sulphate or Kraft process to manufacture pulp.
- 5.8 Explain the industrial method of manufacturing paper from sulphate pulp.
- 5.9 Explain the process to which the black liquor should be subjected to recover its chemical constituents for reuse in the manufacture of pulp.
- 5.10 Explain inversion of sugar.
- 5.11 Explain the manufacture of sugar from sugar cane.
- 5.12 Explain the manufacture of industrial alcohol (ethyl alcohol) from molasses.
- 5.13 List the industrial applications of alcohol (ethyl-alcohol), sugar, glycerine
- 6.0 Polymerization and Rubber industries.**
- 6.1 Differentiate polymer compounds from plastics.
- 6.2 State the different varieties of polymers and plastics.
- 6.3 Distinguish between thermoset and thermo plastic.
- 6.4 Explain the manufacturing method of LDPE, HDPE.
- 6.5 State the industrial applications of polyethylene.
- 6.6 Understand the classification of rubbers.
- 6.7 Explain the manufacturing process of ethyl benzene.

- 6.8 Explain the manufacturing process of styrene from ethyl benzene.  
 6.9 Explain the manufacturing of butadiene.  
 6.10 Explain the manufacturing process of styrene- butadiene rubber.

Course code CHOT-402	Course Title: Process Technology No of Course outcomes 06			No of periods: 90	
POs	Mapped with CO No	CO periods addressing PO in Column 1		Level (1, 2, 3)	Remarks
		NO	%		
PO1	CO1	27	30	2	>40%- level 3
PO2					25%-40% level 2
PO3	CO2, CO3, CO5	53	59	3	5-25% : level 1
PO4	CO4	10	11	1	<5%: not addressed

### Hyponated course contents

#### 1. Basic industrial chemicals:

Industrial uses of hydrochloric acid, soda ash, caustic soda, ammonia, nitric acid, sulphuric acid, sodium sulphate-Industrial manufacturing methods of sodium carbonate, NaOH, HNO<sub>3</sub>, sulphuric acid, sodium sulphate- manufacturing processes of HCl, Na<sub>2</sub>CO<sub>3</sub>, NaOH, NH<sub>3</sub>, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, Na<sub>2</sub>SO<sub>4</sub>-types of electrolytic cells- cell notations of diaphragm cells, membrane cells and mercury cells.

#### 2. Water and Fertilizer industry :

Sources of water-impurities and mineral material present in water-scale formation - methods of removal of scales-, softening of water by ion- exchange and permutit methods- stages involved in municipal water treatment, sewage water treatment. Manufacture of Urea, H<sub>3</sub>PO<sub>4</sub>, mono and di calcium phosphates, MAP and DAP, Ammonium phosphate, single super phosphate, triple super phosphate, mixed fertilizers, Industrial applications of urea, H<sub>3</sub>PO<sub>4</sub>, ammonium sulphate

#### 3. Industrial gases and Inorganic products :

Industrial manufacturing methods of oxygen and nitrogen, CO<sub>2</sub>, cement, glass - linde cycle concept-, manufacturing processes of oxygen and nitrogen, CO<sub>2</sub>, SiC, CaC<sub>2</sub>, Cement, glass- applications of O<sub>2</sub> and N<sub>2</sub>, carbon dioxide, SiC, CaC<sub>2</sub>, soda glass.

#### 4. Coal chemicals, Petroleum refining and Petrochemicals :

Formation of coal- grades of coal- chemicals from coal- coal gas, water gas, producer gas and synthesis gas and their applications-high temperature carbonization of coal-recovery of chemicals when coal is subjected to coking-coal tar distillation - chemicals obtained from coal tar distillation. Origin of crude petroleum-crude petroleum distillation and various refinery products- catalytic cracking, reforming principles. Feed stocks desirable to manufacture petrochemicals- petrochemicals obtained from methane, ethylene, propylene and butylene-manufacturing process of chloroethanes from methane

#### 5. Oils, fats, soaps, Pulp, Paper and Sugar industry :

Difference between Fats and oil -oil extraction by expeller and solvent extraction method - sources of raw materials required to soap production- production of soap, recovery of glycerin from soap Raw materials for pulp - major process to produce pulp, kraft or sulphate process to manufacture of pulp-manufacturing

of paper from sulphate pulp- recovery of chemicals from black liquor manufacture of sugar from sugar cane-inversion of sugar-manufacturing of industrial alcohol (ethyl alcohol) -industrial applications of alcohol and sugar.

**6. Polymerization and Rubber industries :**

Differentiate between polymer and plastics- thermoset and thermoplastic- manufacturing of LDPE, HDPE, and polyester, applications of polyethylene.

Classification of rubbers-manufacturing of styrene, butadiene and SBR.

**REFERENCE BOOKS :**

1. Shreves Chemical Process Industries – George T Austin.
2. Chemtech IIT – Vol. II, III and IV
3. Outlines of Chemical Technology by GopalaRao( Dryden).
4. Chemical Technology Vol – I and Vol – II by Sukla and Pandey.

**C-23, CHPC/ CHPP /CHOT-402**  
**Subject Name: Process Technology Syllabus**  
**split up for Unit Test**

<b>Unit test NO</b>	<b>Learning out comes to be covered</b>
Unit test-I	Learning Objectives from 1.1 to 3.9
Unit test-II	Learning Objective from 4.1 to 6.10

**TECHNOLOGY OF VEGETABLE OILS AND FATS-I**

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
CHOT-403	TECHNOLOGY OF VEGETABLE OILS AND FATS-I	04	60	20	80

**TIME SCHEDULE**

S.No	Chapter/Unit title	No Of periods	Weightage of Marks	Short Answer Questions	Essay Answer Questions	CO's Mapped
1	Introduction of Fatty acids	05	16	02	01	CO1
2	Other Constituents and Physical, Chemical properties of Fatty acids	10	23	01	02	CO2,CO3
3	Analysis of oils, fats and fatty acids	10	26	02	02	CO1,CO2
4	Analytical methods of fatty acids	15	23	01	02	CO2,CO3
5	Uses of fatty acids	10	06	02	-	CO2,CO3,
6	Concept of surface activity	10	16	02	01	CO3,CO4
	<b>Total</b>	<b>60</b>	<b>110</b>	<b>10</b>	<b>08</b>	

<b>Course Objectives</b>	<ol style="list-style-type: none"> <li>1. To familiarize with the knowledge of Fatty acids, Constituents, Physical, Chemical properties of Fatty acids</li> <li>2. To know the various processes employed for analysis of oils, fats and fatty acids and analytical methods of fatty acids</li> <li>3. To reinforce the theoretical concepts of fatty acids and the concept of surface activity</li> </ol>
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CO NO	Course outcomes
CO1	CHOT-403.1 Explain the classification of fatty acids
CO2	CHOT-403.2 Identify the various methods of analysis of oils and fats
CO3	CHOT-403.3 Examine the principles of analytical methods of fatty acids
CO4	CHOT-403.4 Compare the uses of fatty acids in various fields
CO5	CHOT-403.5 Demonstrate the concept of surface activity.

**CO-PO/PSO MATRIX:**

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-403.1	1		3					1		2
CHOT-403.2	1			2			2	1		
CHOT-403.3		2			2				2	
CHOT-403.4		2	3						2	
CHOT-403.5	1	2				2		1	2	
<b>AVERAGE</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

**OBJECTIVES :****1.0 Know about the Nomenclature, Structure, Source, Composition and Classification of Fatty acids.**

1.1 Know about the Nomenclature, Structure, Source, Composition of fatty acids.

1.2 Classification of fatty acids.

1.3 Properties and uses of different types of Fatty acids.

1.4 Occurrence of glycerides and fatty acids in fats.

1.5 Fatty acid reactions

**2.0 Other Constituents and Physical, Chemical properties of Fatty Acids**

2.1 Constituents imparting colour, odour and stability of Fatty Acids.

2.2 Physical and Chemical properties of fatty acids.

2.3 Know the fatty acid composition of ground nut oil, coconut oil, cotton seed oil.

2.4 Know the fatty acid composition of palm oil, sunflower oil, sesame oil.

2.5 Know the fatty acid composition of rice bran oil, Palm kernel oil.

**3.0 Analysis of oils, fats and fatty acids.**

3.1 Moisture content of oil seeds and cakes.

3.2 Acid value

3.2 Saponification value.

3.3. Iodine value

3.4 Free fatty acids.

3.5 Colour of oil.

**4.0 Analytical methods of fatty Acids**

4.1 Identification of fatty acid.

4.2 Methods to know colour, odour and stability of fatty acids

4.3 Techniques of separation of Oils, fats and fatty acids.

a. Classification b. Distillation or physical refining

4.4 Chromatographic methods of separation for Oils, fats and fatty acids with special emphasis on thin layer and gas liquid partition chromatography.

**5.0 Uses Of Fatty Acids.**

5.1 In food industry such as Bread, Rolls, Cakes, Bakery, eatables.

- 5.2 In chocolate, cocoa butter.
- 5.3 By using as emulsifier for food applications.
- 5.4 In the production of Bio-diesel.
- 5.5 In power generation.
- 6.0 **Concept of surface activity.**
- 6.1 Structure of surfactant molecules.
- 6.2 Hydrophilic, lipophilic balance.
- 6.3 Anionic, cationic, nonionic, amphoteric surfactants. 6.4 Chemistry and Synthesis of surfactants
- 6.5 Biodegradation of Surfactants.

## **COURSE CONTENTS :**

### **1.0 Introduction of Fatty Acids :**

Nomenclature, Structure, Source, Composition and Classification of Fatty acids, Occurrence of glycerides and fatty acids in oils and fats, Fatty acid reactions.

### **2.0 Other Constituents and Physical, Chemical properties of Fatty Acids.**

Constituents imparting colour, odour and stability of Fatty Acids- Physical and Chemical properties of fatty acids- Fatty Acid composition of ground nut oil, coconut oil, cotton seed oil- palm oil, sunflower oil, sesame oil- rice bran oil, Palm kernel oil

### **3.0 Analysis of oils, fats and fatty acids.**

Moisture content of oil seeds and cakes- Acid value- Saponification value- Iodine value- Free fatty acids- Colour of oil.

### **4.0 Analytical methods of Fatty Acids.**

Stability- Identification- Adulteration- Techniques of separation of fatty acids- Classification - Distillation or physical refining- Chromatographic methods of separation with special emphasis on thin layer and gas liquid partition chromatography.

### **5.0 Uses of oils and fats.**

- 5.1 In food industry such as Bread, Rolls, Cakes, Bakery, eatables- In chocolate, cocoa butter- By using as emulsifier for food applications- In the production of Bio-diesel- in power generation.

### **6.0 Concept of surface activity.**

Structure of surfactant molecules- Hydrophilic, lipophilic balance- Anionic, cationic, nonionic, amphoteric surfactants- Chemistry and Synthesis of surfactants- Biodegradation of Surfactants

## **REFERENCE BOOKS:**

1. Treatise on Fats, Fatty acids and Olechemicals – Narula.
2. Baileys Industrial Oil and Fat Products (Vol 1 to 6) – Y.H. Hui.
3. Oils and Fats manual Vol. 1 & 2 – A. Karleskind.
4. Recent advances in Chemistry and Technologies of Fats and Oils.

**Subject Name: TECHNOLOGY OF VEGETABLE OILS AND FATS-I,  
IV SEMESTER  
Syllabus split up for Unit Test**

<b>Unit test NO</b>	<b>Learning out comes to be covered</b>
Unit test-I	Objective from 1.1 to 3.5
Unit test-II	Objective from 4.1 to 6.5

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
CHOT-404	TECHNOLOGY OF VEGETABLE OILS AND FATS-II	05	75	20	80

#### TIME SCHEDULE

S.No	Chapter/Unit title	No Of periods	Weightage of Marks	Short Answer Questions	Essay Answer Questions	CO's Mapped
1	Cultivation, Sampling & Storage of oil seeds	10	13	01	01	CO1
2	Oil seeds processing	15	29	03	02	CO2,CO3
3	Oil Refining	20	29	03	02	CO1,CO2
4	Manufacture of vanaspati, ghee, butter, margarine	20	26	02	02	CO2,CO3
5	Bio-diesel	10	13	01	01	CO2,CO3,
	<b>Total</b>	<b>75</b>	<b>110</b>	<b>10</b>	<b>08</b>	<b>CO3,CO4</b>

<b>Course Objectives</b>	<ol style="list-style-type: none"> <li>To familiarize with the knowledge of Cultivation, Sampling, Harvesting, Cleaning, Grading, Storage and Processing of Oil seeds</li> <li>To know the various processes employed for refining of crude oils and fats</li> <li>To reinforce the theoretical concepts in the manufacturing of Vanaspati, ghee, butter, margarine and Bio-diesel</li> </ol>
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CO NO	COURSE OUTCOMES
CO1	CHOT-404.1 Explain various methods of Cultivation, Sampling, Storage and processing of oil seeds
CO2	CHOT-404.2 Examine the principles of oil expelling, solvent extraction methods and equipments
CO3	CHOT-404.3 Demonstrate the skill of drawing and labelling equipments for refining of Vegetable oils and fats
CO4	CHOT-404.4 Illustrate the production methods for preparation of oil based products with flow sheets
CO5	CHOT-404.5 Describe the flow sheet for the production of Bio-diesel

**CO-PO/PSO MATRIX:**

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CHOT-404.1	1		3		2		1		
CHOT-404.2	1			2			1		
CHOT-404.3		2				2		2	
CHOT-404.4		2	3					2	3
CHOT-404.5	1	2					1		
<b>AVERAGE</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

**PSO1:** An ability to understand the concepts of basic chemical engg. techniques and to apply them in various areas like unit operations, unit processes and all concerned engineering disciplines

### Learning Outcome:

#### OBJECTIVES :

#### 1.0 Know about origin of oils and fats.

- 1.1 Know about the cultivation, harvesting, cleaning and storage of oil seeds at farmer's level.
- 1.2 Know about sampling and grading of oil seeds.
- 1.3 Know about cleaning and storage of oil seeds at the industry.

#### 2.0 Know about oil seeds processing.

- 2.1 Know the methods of expelling oil from seeds.
- 2.2 Understand the principles of oil expelling.
- 2.3 Know about the pretreatment of oil seeds before expelling.
- 2.4 Draw the sketch of single screw expeller and explain the process of expelling.
- 2.5 Draw the sketch of double screw expeller and explain the processing of expelling.
- 2.6 Know the principles of solvent extraction.
- 2.7 Know about rice bran solvent extraction.
- 2.8 Understand the molecular diffusion and undissolved oil theory of solvent extraction.
- 2.9 List out various solvents used in solvent extraction.
- 2.10 Know the merits and demerits of different solvents.
- 2.11 Know various pretreatment methods for preparing oil seeds for solvent extraction. List out various solvent extractors.
- 2.12 Draw a neat sketch of vertical basket type solvent extractor and explain the process.
- 2.13 Draw a neat sketch of horizontal type solvent extractor and explain the process.
- 2.14 Draw a neat sketch of rotary type solvent extractor and explain the process.

#### 3.0 Know about various processes employed for refining.

- 3.1 Know about various equipment (plants) employed for neutralization of oils (removal of FFA).
- 3.2 Pretreatment methods like degumming, bleaching, fractionation
- 3.3 Know about physical refining of oils and fats.
- 3.4 Know about the principles of hydrogenation and winterization of oils.
- 3.5 Describe the Production of hydrogen gas with a flow sheet from Water electrolysis process.
- 3.6 Explain the refining of Crude Palm Oil with a flow sheet.

#### 4.0 Know about the manufacturing methods of vanaspathi, ghee, butter and margarine.

- 4.1 Explain the manufacturing process of vanaspathi with a flow sheet and list out its uses.
- 4.2 List out additives in vanaspathi. Know the general information of margarine and its applications.
- 4.3 Know the chemistry of margarine formulations.
- 4.4 Know about product characteristics of margarine.
- 4.5 List out additives used in margarine.

- 4.6 Draw a neat flow sheet of margarine manufacturing plant and explain it.
- 4.7 Know different types of margarine.
- 4.8 Know chemical composition of butter.
- 4.9 Draw a neat block diagram of manufacture of low fat butter and spreads and explain them.
- 4.10 Know about peanut butter and its composition.
- 4.11 Draw a neat flow sheet of peanut butter manufacture and explain it.
- 4.12 Explain the manufacturing process of ghee and list out its uses.

### **5.0. Know about Bio-diesel**

- 5.1. know about the composition of bio-diesel
- 5.2. know about the feed stocks for bio-diesel
- 5.3. Know the properties and uses of bio-diesel
- 5.4. know about the production technology of bio-diesel

## **COURSE CONTENTS :**

### **1. Introduction :**

Sources of oils and fats, sources of oil in vegetable matter, constituents of composition of oil of different oil seeds, cultivating, harvesting, cleaning and storage in fields, sampling and grading, heat treatment and storage, post harvest treatment of oil seeds, cleaning, heat treatment, preparation of oil seeds. Necessity for Govt. policy for encouraging oil seeds cultivation.

### **2. Oil seeds processing :**

Expelling of oils from sources, premature methods, oil expellers, batch and continuous expellers, principles in oil expelling, preparation of oil seeds and sources for solvent extraction, principles of solvent extraction, diffusion theory and undissolved oil theory, solvents in solvent extraction, types of solvent extraction, separation of oil from miscella, separation of solvent from cakes and solvent recovery, processing of cake making for feeds.

### **3. Know about various processes employed for refining :**

Degumming, neutralization of oils and fats, bleaching, hydrogenation of oils and fats, deodorization, chemical refining, physical refining, winterization, Palm oil refining.

### **4. Manufacturing methods of butter, margarine, ghee, vanaspathi:** Manufacturing processes of butter, margarine, ghee, vanaspathi.

### **5. Bio-diesel**

Composition of bio-diesel-natural resources of bio-diesel-properties and uses of bio-diesel- Manufacturing process of bio-diesel

## **REFERENCE BOOKS :**

- 1. Treatise on Fats, Fatty acids and Oleochemicals – Narula.
- 2. Baileys Industrial Oil and Fat Products (Vol 1 to 6) – Y.H. Hui.
- 3. Oils and Fats manual Vol. 1 & 2 – A. Karleskind.
- 4. Recent advances in Chemistry and Technologies of Fats and Oils.

**C-23, CHOT-404**

**Subject Name: TECHNOLOGY OF VEGETABLE OILS AND FATS-II,  
IV SEMESTER**

**Syllabus split up for Unit Test**

<b>Unit test NO</b>	<b>Learning out comes to be covered</b>
Unit test-I	Objective from 1.1 to 3.6
Unit test-II	Objective from 4.1 to 5.4

## Basic Mechanical Engineering

Course code	Course title	No. of periods/week	Total no of periods	Marks for FA	Marks for SA
CHOT-405	Basic Mechanical Engineering	04	60	20	80

### Time Schedule

S.No.	Chapter/Unit title	No.of periods	Weightage allocated	Short Answer Questions	Essay type questions	CO's Mapped
1	Measuring Instruments	10	16	2	1	C01,C02,C03,C04,C05
2	Friction and Lubrication	05	13	1	1	C01,C02,C03,C04,C05
3	I C Engines	15	26	2	2	C01,C02,C03,C04,C05
4	Steam Boilers	10	26	2	2	C01,C02,C03,C04,C05
5	Air Compressors	10	13	1	1	C01,C02,C03,C04,C05
6	Steam Turbines & Nozzles	10	16	2	1	C01,C02,C03,C04,C05
<b>Total:</b>		<b>60</b>	<b>110</b>	<b>10</b>	<b>8</b>	<b>C01,C02,C03,C04,C05</b>

### Course objectives:

<b>Course Objectives</b>	(i)	To familiarize with the knowledge of different tools, equipment and machinery used in the field of Mechanical Engineering
	(ii)	To use various tools for mechanical measurements and to know fabricating methods of mechanical products
	(iii)	To know the different methods of producing and transmitting mechanical power

### Course outcomes:

<b>Course outcomes</b>	C01	CHOT-405.1	Familiarize with the concepts of measurement and measuring instruments.
	C02	CHOT-405.2	Explain about friction and lubrication in various mechanical tools & equipment.
	C03	CHOT-405.3	Enumerate the working of IC Engines and Boilers.
	C04	CHOT-405.4	Describe the working of Air compressors with the help of diagrams.
	C05	CHOT-405.5	Explain about the concept of steam turbines and nozzles.

**CO-PO/PSO MATRIX:**

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-405.1	3						2	2		
CHOT-405.2	3	2					2		3	
CHOT-405.3	3	2					2			
CHOT-405.4	3						2	2		2
CHOT-405.5	3	2					2			
<b>AVERAGE</b>	<b>3</b>	<b>2</b>					<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

**Learning outcome:****Objectives:****1.0 Know about Measuring Instruments.**

- 1.1 Know about Measurement, types of measurement
- 1.2 Familiarise with the use of checking and measuring Instruments.
- 1.3 Line diagrams of different measuring tools.
- 1.4 Specific use of each Instrument
- 1.5 Least count of different measuring tools. Differentiate measuring and checking Instruments.

**2.0 Friction and Lubrication**

- 2.1 To appreciate the existence of friction in elements of power transmission
- 2.2 Understand the concept of friction
- 2.3 Explain the necessity of lubrication
- 2.4 Give the classification of lubricants
- 2.5 Explain the properties of good lubricant
- 2.6 State different methods of lubrication

**3.0 I.C. Engines**

- 3.1 Define Heat engine
- 3.2 Classify Heat engines.
- 3.3 Give examples for each type.
- 3.4 Summarize the advantages of I.C.engines and E.C.engines.
- 3.5 Give the classification of I.C.engines.
- 3.6 Draw a neat sketch of an I.C engine and name the various parts.
- 3.7 Explain the working of 4 stroke petrol engine with a line diagram
- 3.8 Explain the working of 2 stroke petrol engine with a line diagram
- 3.9 Explain the working of a 4 stroke and 2 stroke diesel engine with a line diagram.
- 3.10 Compare two stroke engine with 4 stroke engine
- 3.11 Compare SI engine with CI engine
- 3.12 Explain the help of a line sketch ignition system of an SI engine.
- 3.13 Explain the help of a line sketch ignition system of an CI engine.
- 3.14 Necessity of scavenging and super charging

**4.0 Boilers**

- 4.1 Define Boiler
- 4.2 Give the classification of Boiler
- 4.3 Differentiate fire tube and water tube boiler
- 4.4 Name different types of Boilers
- 4.5 Explain the construction and working of a simple Vertical Boiler with a line diagram
- 4.6 Explain Lancashire Boiler with a line diagram.
- 4.7 Explain the construction and working of a Babcock and Wilcox Boiler with a line diagram.

- 4.8 List the different Boiler mountings  
 4.9 State the specific use of each mounting.  
 4.10 List the different Boiler accessories.  
 4.11 State the functions of the boiler accessories.  
**5.0 Air Compressors**  
 5.1 State the functions of air compressors.  
 5.2 Enumerate the uses of compressed air.  
 5.3 Name the different types of compressors.  
 5.4 Explain with line diagram the working of a single acting reciprocating air compressor.  
 5.5 State the advantages of multi stage compressors over single stage compressors.  
 5.6 Explain the use of inter cooler.  
 5.7 Name the types of rotary compressors.  
 5.8 Explain with line diagram the working of a centrifugal compressor.  
 5.9 Explain with line diagram the working of an axial flow type compressor.  
**6.0 Steam Turbines & Nozzles**  
 6.1 State the function of steam nozzle in a turbine.  
 6.2 Name different types of nozzles.  
 6.3 Define steam turbine  
 6.4 Explain the working of impulse turbine with a line diagram  
 6.5 Explain the working of a Reaction turbine with a line diagram

**COs-POs mapping strength:**

Course code CHOT-405	Course Title: Basic Mechanical Engineering			No.of Periods 60	
POs	Mapped with CO No.	CO Periods addressing PO In Column 1		Level (1, 2, 3)	Remarks
		No	%		
PO1	CO1 to CO5	25	42	3	
PO2	CO2, CO3, CO5	20	33	2	
PO3					
PO4					
PO5					
PO6					
PO7	CO1 to CO5	15	25	2	

**Hyponated Course contents with Reference books:**

**1. Measuring Instruments**

Dividers:- Sizes and uses, Combination square, Bevel protractor, Universal bevel protractor, Sinebar, Universal surface guage, Engineers parallels, Slip gauges, Screw pitch guage, Vernier caliper, Vvernier height guage – least count of the measuring tools – comparison between measuring and checking instruments.

**2. Friction and Lubrication**

Friction in elements of power Transmission. Concept of friction - different types of friction- lubrication – concept – necessity of lubrication – classification of lubricants – properties of a good lubricant - different methods of lubrication – wick lubrication – ring lubrication – splash lubrication – forced lubrication.

**3. I.C. Engine**

Heat engines - examples for each type – advantages- classification of I.C.engines- neat sketch of I C engine indicating component parts, the function of each part – cylinder, crank case, crank pin, crank, crank shaft, connecting rod, wrist pin, piston, cooling fins, cylinder head, exhaust valve, inlet valve. 4 stroke petrol engine- 2 stroke petrol engine - 4 stroke and 2 stroke diesel engines – Comparison of 4 stroke with 2 stroke engine – Diesel engine with Petrol engine – Fuel and ignition system of SI engines ( fuel tank, fuel pump, fuel filter, carburetor and spark plug) – injection system of CI engine ( fuel tank, fuel feed pump, fuel filter, injection pump and injector) with simple sketch and explanation of each component of the above systems – importance of scavenging and super charging.

**4. Boilers**

Classification of Boilers - fire tube and water tube boilers- construction and working of a simple Vertical Boiler - Lancashire Boiler – Babcock and Wilcox Boiler – Boiler mountings: water level indicator – pressure gauge – safety valve – steam stop valve – feed check valve – blow off cock – fusible plug . Boiler accessories – steam trap and separator – economizer – super heater – air pre heater - feed water pump.

**5. Air Compressors**

Functions of air compressor – uses of compressed air – types of air compressors – single stage reciprocating air compressor , its construction and working with a line diagram – multistage compressors – advantages over single stage compressors – use of air cooler – rotary compressors – types – centrifugal compressor – axial flow type compressor.

**6. Steam Nozzles & Steam turbines**

Steam nozzles – functions – types – convergent – divergent – convergent and divergent – Steam turbines – classification – impulse – reaction turbines – working principle with line diagram of the above two types – governing of steam turbines – throttle – by pass – nozzle control.

**REFERENCE BOOKS :**

1. Basic Mechanical Engineering : Roy and Chowdary
2. Workshop Technology I & II by Hazra Chowdary
3. Elements of Heat Engines vol II by R C Patel &Karmachandani 4. Thermodynamic Vol I & II by Pakirappa.
5. General Mechanical Engg. By Pakirappa.
6. Hydraulic Machinery by R S Kurmi.

**C-23, CHOT-405**

**Subject Name: BASICS OF MECHANICAL ENGINEERING  
IV SEMESTER**

**Syllabus split up for Unit Test**

<b>Unit test NO</b>	<b>Learning out comes to be covered</b>
Unit test-I	Objective from 1.1 to 3.14
Unit test-II	Objective from 4.1 to 6.5

Unit operations - II

Course code	Course title	No. of periods/week	Total no of periods	Marks of FA	Marks for SA
CHOT - 406	Unit operations - II	05	75	20	80

S.NO	Chapter/ unit title	No. of periods	Weight age Allocated	Short Answer Questions	Essay type questions	Cos Mapped
1	Fundamental of mass transfer operations	18	26	2	2	CO1
2	Distillation	18	26	2	2	CO2, CO3, CO4, CO5
3	Absorption and Stripping	08	13	1	1	CO2, CO3, CO4, CO5
4	Humidification and Drying	12	16	2	1	CO2, CO3, CO4, CO5
5	Extraction and Leaching	11	16	2	1	CO2, CO3, CO4, CO5
6	Crystallization and Adsorption	08	13	1	1	CO2, CO3, CO4, CO5
	<b>Total</b>	<b>75</b>	<b>110</b>	<b>10</b>	<b>8</b>	

**Course Objectives**

<b>COURSE OBJECTIVES</b>	<p>i. To familiarize with the knowledge of fundamentals of mass transfer or separation operations, diffusion, types of diffusion, in gases and liquids, study state diffusion of A through nondiffusing B, molar flux and statement of Fick's Law, concept of phase equilibria, Azeotrope, equilibrium curves Bubble point and Dew point diagrams.</p> <p>ii. To use various basic industrial applications of Distillation and absorption and stripping types of distillations, equilibrium driving force in distillation, industrial equipment of distillation, (HETP), types of packing materials, packed bed columns, McCabe Thiele method of determine the number of stages, limiting operating conditions, stage and efficiency of distillation of column.</p> <p>iii. To know the operating equation for absorption and stripping, equilibrium diagrams, stages, characteristics, equipment used, problems based on for absorptions and stripping Humidification and drying equipment, basic terminology associated, psychrometric charts, constant rate and falling rate, drying rate curves problems on drying.</p> <p>iv. To reinforce theoretical concepts of extraction and Leaching, crystallization and adsorption, equipment required for conducting extraction and leaching, crystallization and adsorption.</p>
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## Course outcomes

CO NO		COURSE OUTCOMES
CO1	CHOT-406.1	Develop the basics of mass transfer operations like distillation absorption, stripping, humidification, drying ,extraction, Leaching, and crystallization – adsorption
CO2	CHOT-406.2	Deduce the derivation for the equation related to 1) Molecular diffusion in gases and liquids 2) Operating equations for various mass transfer operations.
CO3	CHOT-406.3	Describe the Construction and working of equipments used for distillation, absorption, humidification, extraction, Leaching and crystallization.
CO4	CHOT-406.4	Explain the various applications of mass transfer operations.
CO5	CHOT-406.5	Solve numerical problems related to various mass transfer operations.

### CO-PO/PSO MATRIX:

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-406.1	3							3		
CHOT-406.2	2	2								
CHOT-406.3			3						2	
CHOT-406.4	2							2		
CHOT-406.5	3	2							2	
<b>AVERAGE</b>	<b>3</b>	<b>2</b>	<b>3</b>					<b>3</b>	<b>2</b>	

3=STRONGLY MAPPED

2=MODERATELY MAPPED

1=SLIGHTLY MAPPED

### Learning outcome

#### CHAPTER – 1

- 1.1 List the basics of mass transfer operations, diffusivity in gases and liquids
- 1.2 Illustrations of mass transfer separation techniques, the role of mass transfer operations in an industrial chemical processes.
- 1.3 Give the classification of mass transfer diffusivity in gases separation operations, significance of equilibrium in mass transfer operations
- 1.4 Distinguish between molecular diffusion and eddy diffusion ,molecular diffusion in gases and liquids.
- 1.5 Define molar flux, statement of Fick's law of molecular diffusion, phase, phase rule and degrees of freedom.
- 1.6 Evaluate the derivation of equation for steady state molecular diffusion in fluids at rest and in laminar flow.
- 1.7 Evaluate the derivation of equation for steady state diffusion of A through non-diffusing B in gases and liquids
- 1.8 Evaluate the derivation of equation for steady state Equi-molar counter diffusion in gases and liquids.
- 1.9 Solve the simple problems on Fick's law, steady state diffusion of A through non-diffusing B and steady state Equi-molar counter diffusion in gases and liquids.

#### CHAPTER – 2

- 2.1 Distinguish between distillation and absorption or stripping , stage, equilibrium or Ideal or theoretical stage.
- 2.2 List the industrial applications of distillation, feed stage conditions, the limiting operating conditions of a distillation column, a stage and efficiency.
- 2.3 Explain the flash vaporization or equilibrium distillation, differential distillation and Rayleigh's equation.

- 2.4 Describe steam distillation and steam distillation law, equilibrium and driving force in distillation.
- 2.5 Explain the continuous rectification or distillation or fractionation column with stripping section and enriching section, industrial equipment required for distillation.
- 2.6 Demonstrate Height equivalent to theoretical plate (HETP), the arrangements of condensers, trays, reboilers for distillation column.
- 2.7 Categorize the different types of packing material used in the packed bed columns.
- 2.8 Use the Mc-Cabe Thiele method to determine the number of stages required to obtain certain degree of separation.
- 2.9 Solve the problems on Mc-Cabe Thiele method to determine the number of stages.

### **CHAPTER – 3**

- 3.1 List the basics of absorption and stripping, industrial applications of absorption and stripping.
- 3.2 Evaluate the operating equation for absorption and stripping.
- 3.3 Explain the equilibrium diagrams for absorption and stripping, minimum absorbent flow rate.
- 3.4 Explain the about number of equilibrium stages for absorption and stripping, operating characteristics of absorption and stripping column.
- 3.5 Describe the equipment used for absorption and stripping.
- 3.6 Solve the problems in absorption and stripping.

### **CHAPTER – 4**

- 4.1 List the basics of humidification, dehumidification operations, industrial applications of humidification, drying operations.
- 4.2 Define dry and wet bulb temperatures, basic terminology associated with drying.
- 4.3 Explain the psychrometer charts, cooling towers.
- 4.4 Describe the various humidification equipment, drying equipment and its classification.
- 4.5 Practice the constant rate and falling rate period associated with drying, drying rate curves, the factors that influence the rate of drying.
- 4.6 Solve the problems on time of drying, the time of drying and related problems

### **CHAPTER – 5**

- 5.1 Differentiate among liquid-liquid extraction, absorption and distillation.
- 5.2 List the industrial applications of extraction – Leaching and basics of Leaching
- 5.3 Select the criteria for solvent required for conducting extraction.
- 5.4 Explain the single stage and multistage extraction.
- 5.5 Explain the different kinds of equipment required for conducting extraction.
- 5.6 Explain the different types of equipment required for leaching.

### **CHAPTER – 6**

- 6.1 List the basics and industrial applications of crystallization, adsorption.
- 6.2 Classification of crystallizers, major types of adsorbents and their properties.
- 6.3 Explain the solubility, un-saturation, saturation and super saturation, mechanism of crystallization.
- 6.4 Explain the equipment required for crystallization.
- 6.5 Distinguish between chemisorption and physical adsorption.
- 6.6 Explain the various devices employed for conducting adsorption.

### **Course Contents:**

#### **1.0 Fundamentals of mass transfer or separation operations:**

Definition of mass transfer operation--Separation by phase creation, separation by phase addition, separation by barrier, separation by solid agent, separation by force field or gradient--Experimental illustrations of mass transfer operations--Direct contact of two immiscible phases, Phases separated by membrane, Direct contact of miscible phases, Use of surface phenomenon, Examples regarding various

mass transfer operations involving all possible combination of the three aggregates of matter i.e. solid, liquid and gas--Industrial applications of mass transfer operations-- Significance of equilibrium in mass transfer operations—Molecular diffusion and eddy diffusion-- Molar flux and statement of Fick's law of molecular diffusion--Diffusion in gases and liquids-- Steady state diffusion of A through non-diffusing B and steady state equi-molar counter diffusion in gases-- Steady state diffusion of A through non-diffusing B and steady state equi-molar counter diffusion in liquids—Diffusivity or diffusion coefficient of gases and liquids-- Phase, phase rule and degrees of freedom--Concept of phase equilibria in terms of temperature, pressure, chemical potential, activity, activity coefficient and other thermodynamic variables--Concept of vapor pressure, Characteristics of ideal solution and non-ideal solution and differences between ideal and non-ideal solutions— Raoult's law and Henry's law-- Vapor-liquid equilibria and equilibrium curves (x-y curve and T-x-y curve)-- Relative volatility between two components of a vapor-liquid mixture--Azeotrope, their equilibrium curves and their formation reasons--Bubble point and dew point--Triangular phase diagram for ternary systems--Definition of mass transfer coefficient

## 2.0 Distillation:

Difference between distillation and absorption or stripping--Industrial applications of distillation--Flash vaporization or equilibrium distillation--Differential distillation and Rayleigh's equation--Steam distillation and steam distillation law--Equilibrium and driving force in distillation--Stage, Equilibrium or Ideal or Theoretical stage— Continuous rectification, Feed line equation, Operating equations for stripping section and enriching section--Equipment for conducting distillation, Tray columns, Packed columns, Bubble cap columns, Condensers for distillation column, Reboilers for distillation column, Arrangement of condensers and reboilers, Effect of pressure drop on distillation, Packing material, Random packing and regular packing, Height equivalent to theoretical plate (HETP)-Assumptions of McCabe-Thiele methods and Use of McCabe-Thiele method to calculate the number of stages required for separation--Feed stage conditions, Sub-cooled liquid, Bubble point liquid, Partially vaporized feed, Dew point vapor, Super heated vapor--Limiting operating conditions of a distillation column, Minimum reflux ratio, Total reflux ratio, Optimum reflux ratio, stage, point efficiency, Murphree tray efficiency, overall efficiency.

## 3.0 Absorption and Stripping:

Basics of absorption and stripping—Definition of absorption and stripping— Industrial applications of absorption and stripping--Operating equation for absorption and stripping--Equilibrium diagrams for absorption and stripping-- minimum absorbent flow rate ---equilibrium stages for absorption and stripping--General operating characteristics of absorption and stripping column, Liquid entrainment, High pressure drop, Flooding, Loading, Coning, Weeping, Dumping-- Equipment used for absorption and stripping, Tray tower, Packed column, Packing material, Random packing and Random packing, Spray tower, Bubble column, Centrifugal contractor, Venturi scrubber.

## 4.0 Humidification and Drying:

Industrial applications of humidification operations, Absolute humidity, Molal absolute humidity, Relative humidity, Percentage saturation-- Dry and wet bulb temperatures-Psychrometer charts-- Various humidification equipments, Tray tower, Spray chamber, Spray ponds, Cooling towers--Natural draft cooling tower, Mechanical draft cooling tower, Induced draft cooling tower--Typical cooling tower arrangements, Atmospheric cooling tower, Countercurrent induced draft, Cross-flow induced draft cooling tower- Industrial applications of drying-- Basic terminology associated with drying, Moisture content on wet basis, Moisture content on dry basis, Equilibrium moisture content, Bound and Un-bound moisture, Free moisture content, Critical moisture content--Constant rate and falling rate period associated with drying--Drying rate curves, Moisture content Vs time, Drying rate Vs moisture content-Time of drying and related problems on time of drying--Factors that influence the rate of drying, Gas velocity, Humidity of gas, Area of drying surface, Temperature--Drying equipment and its classification, Batch dryer, Continuous dryer, Tray dryer, Rotary dryer, Drum dryer, Spray dryer.

## 5.0 Extraction and Leaching:

Industrial applications of extraction--Selection criteria for solvent required for conducting extraction, Selectivity, Recoverability, Distribution coefficient, Capacity, Density, Insolubility of solvent, Interfacial tension-- single stage and multistage extraction--Different kinds of equipment required for conducting extraction-- industrial applications of leaching— Different types of equipment required for leaching, Batch extractors for leaching of oil from seeds, Bollman extractor or Basket extractor, Rotocell extractor, Pachuca tank and Continuous extractors for leaching.

### 6.0 Crystallization and Adsorption:

Industrial applications of crystallization--Solubility, un-saturation, saturation and super saturation-- Methods of super saturation--Mechanism of crystallization--Equipment required for crystallization, Batch crystallizer, Continuous crystallizer, Stirred tank crystallizer, Swenson walker crystallizer, Agitated tank crystallizer, Double pipe crystallizer, Vacuum crystallizer, Evaporative crystallizer, Double tube baffle crystallizer --Classification of crystallizers--Industrial applications of adsorption, Pressure swing adsorption--Major types of adsorbents and their properties--Differences between chemisorption and physical adsorption- Devices employed for conducting adsorption, Stirred tank, cyclic models, continuous counter current operation models.

### REFERENCE BOOKS:

1. Mass transfer operations by Robert E. Treybal.
2. Unit Operations of Chemical Engineering by Warren L. McCabe, Julian C. Smith, Peter Harriot.
3. Mass Transfer-I by Kiran D. Patil.
4. Mass Transfer-II by K.A. Gavhane.
5. Separation Process Principles by J.D. Seader, Ernest J. Henley

Course code CHOT-406	Course Title: Unit operations -II Number of course Outcomes: 08			No. of periods 75	
POs	Mapped with CO No.	CO periods addressing PO in column 1		Level (1,2,3)	Remarks
		NO.	%		
PO1	CO1, CO2, CO4, CO5	42	57	3	>40% Level3 Highly addressed 25% to 40% Level2 Moderately addressed 5 to 25 % Level1 Low addressed <5% Not addressed
PO2	CO2, CO5	15	20	2	
PO3	CO3	18	23	1	

**C-23, CHPC/ CHPP /CHOT-406**  
**Subject Name: Unit Operations-II Syllabus**  
**split up for Unit Test**

Unit test NO	Learning out comes to be covered
Unit test-I	Objectives from 1.1 to 3.6
Unit test-II	Objective from 4.1 to 6.6

### Unit Operations II Lab

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
CHOT-407	Unit Operations II Lab	3	45	40	60

### UNIT OPERATIONS -II LAB

Course title :Unit Operations -II Lab(CHOT--407)	
<b>Course Objectives</b>	(i)To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant Experiments/exercises
<b>Course Outcomes</b>	CO1   Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	CO2   Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	CO3   Observe various parameters, their variations and graphically represent the same
	CO4   Analyse the experimental results to draw inferences to make recommendations
	CO5   Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

### CO-PO/PSO MATRIX:

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-407.1	3	2	1	-	-	-	-	3	2	1
CHOT-407.2	3	3	-	-	-	-	-	3	2	1
CHOT-407.3	3	3	2	1	1	-	-	3	2	1
CHOT-407.4	3	3	2	1	1	2	2	3	2	1
CHOT-407.5	3	2	2	1	3	2	2	3	2	1
Average	2.8	2.8	1.7	1	1.25	2	2	3	2	1

### List of experiments:

1. Draw a standard plot between mole fraction of more volatile component and specific gravity of the liquid mixture.
2. Draw a standard plot between mole fraction of more volatile component and refractive index of the liquid the mixture.
3. Verify Rayleigh's equation by conducting simple distillation experiment.
4. Verify Steam distillation law by conducting steam distillation experiment.
5. To determine the height equivalent to theoretical plate (HETP).

6. To obtain the liquid- liquid equilibrium data and determine the distribution coefficient (  $K= y/x$  )for the system Toluene, water and acetic acid and to plot a liquid-liquid- equilibrium (L-L-E) diagram between y and x.
7. To obtain the vapour liquid equilibrium data and to plot a V-L-E diagram for a given mixture.
8. To obtain the solid liquid equilibrium data and to plot a Langmuir adsorption isotherm for the system activated charcoal, acetic acid and water.
9. To determine the vapour diffusion coefficient for a highly volatile liquid (acetone).
10. To determine the rate of drying of a given sample and plot the drying rate curve.

<b>Course Title : Communication Skills</b>	<b>Course code: -CHOT- 408</b> <b>{ Common to all Branches}</b>
<b>Year/ Semester : IV Semester</b>	<b>Number of Periods : 45 ( 3 hrs per week)</b>
<b>Type of Course : Practical</b>	<b>Max Marks : 100</b> <b>{ Internal 40 + External 60 }</b>

**Course Objectives:** The students shall

- communicate effectively in diverse academic, professional and everyday situations
- exhibit appropriate body language and etiquette at workplace
- be employable through preparing appropriate job applications and attend interviews confidently with all necessary skills

**Course Outcomes:** The students shall

**CO1:** Listen and comprehend the listening inputs related to different genres effectively

**CO2:** Communicate effectively in interpersonal interactions, interviews, group discussions and presentations

**CO3:** Acquire employability skills: job hunting, resume writing, attending interviews

**CO4:** Practise appropriate body language and professional etiquette

**Course Delivery:** Text book: “**Communication Skills**”

by State Board of Technical Education and Training, AP

<b>Sl No</b>	<b>Unit</b>	<b>Teaching Hours</b>
1	Listening Skills	6
2	Work place Etiquette	3
3	Introduce oneself	3
4	Short presentation (JAM)	6
5	Group Discussion	6
6	Resume Writing and Cover Letter	3
7	Interview Skills	9
8	Presentation Skills	9
<i>Total</i>		<i>45</i>

**Course Content:**

**UNIT I: Listening Skills**

**6 periods**

Pre – While- Post-listening activities- Listening to audio content ( dialogues/ speech/ narrations)  
- answering the questions and fill in the blanks- vocabulary

**UNIT 2: Work place Etiquette**

**3 periods**

Basics of Etiquette- politeness/ courtesy, good manners- features of work place etiquette- adaptability, positive attitude, body language.

**UNIT 3: Introducing Oneself**

**3 periods**

Speak about oneself - introduce oneself to a gathering/ formal & informal situations- Know about others- filling in the grid- introducing oneself in interviews

**UNIT 4: Short Presentation****6 periods**

Dos and Don'ts in short presentation- speak for a minute without repetition, deviation & hesitation - the techniques to speak fluently – defining and describing objects, people, phenomena, events.- speaking on randomly chosen topics.

**UNIT 5: Group Discussion****6 periods**

Fundamentals of Group Discussion- Dos and Don'ts- filling the Grid- possible list of topics- practice sessions- sample videos-Group activity

**UNIT 6: Resume Writing and Cover Letter****3 periods**

Pre activity: answer the questions- jotting down biographical information- sample resumes- tips, Dos and Don'ts- model resumes- practice exercises on Resume writing

**UNIT 7: Interview Skills****9 periods**

Pre –while-post activities: - things to do at three stages – respond to notifications- know the information about the organisation-practice FAQs - preparation of good/ suitable C V, Body language, tips for success in interviews, model / mock interviews.

**UNIT 8: Presentation Skills****9 periods**

Preparatory work: observe pictures and answer questions- different kinds of presentations- PPTs, Flash cards, Posters, Charts. - tips to prepare aids, slide show, model PPTs, - checklist on pre, while and post presentations.

**Mapping Course Outcomes with Programme Outcomes:**

PO	1	2	3	4	5	6	7
CO	POs 1 to 5 are applications of Engineering Principles, can't be directly mapped to Communication Skills					1,2,3,4	1,2,3,4

**CO –PO Mapping**

CO	Course Outcome	Cos / Unit Mapped	POs mapping	Cognitive levels as per Bloom's Taxonomy R/U/A/An ( Remembering / Understanding / Applying/ Analysing)
CO 1	Listen and comprehend listening inputs related to different genres effectively	Unit 1	6,7	R/U/A

CO2	Communicate effectively in interpersonal interactions, interviews, group discussions and presentations	3,4,5,7,8	6,7	R/U/A/An
CO3	Acquire employability skills: job hunting, resume writing, attending interviews	6,7	6,7	R/U/A/An
CO4	Practise appropriate body language and professional etiquette	2, 3, 4,5,7,8	6,7	R/U/A

### ASSESSMENT

#### C23-CHOT-408: English Communication Skills Lab

- The assessment for C23-Common 408 : ‘English Communication Skills’ is on par with all other practical subjects comprising 40 marks for Internal assessment and 60 marks for External examination attaining the final total of 100 Marks.
- The Internal Assessment can be conducted in the form of Assignments in all the 8 Units. One or Two assignments can be conducted in each Unit, awarding 10 marks for each assignment and the total marks can be averaged to 40 marks as suggested below.
- These assignments should focus mostly on LISTENING and SPEAKING skills rather than writing. However, for the practice sake, students can write down their assignments in a separate note book to enable them speak/present in the end exam fluently. The students should submit these assignment note books to the teacher.
- Questioning styles vary from Unit to Unit as different skills are assessed in each Unit with specific parameters as given in the workbook.
- Listening skills can be tested by playing different Audio/ Video clips ( appropriate in content and language, preferably without subtitles) and test their skill of listening comprehension . Follow pre-while-post stages of listening activity and students should answer general, specific, inferential, vocabulary questions.
- Personal profile, describing a place/a thing/ a person/ an event / a picture, JAM, presentations, Direct interaction with the teacher/ examiner are the topics for individual speaking skills.
- Role plays, GD and Interview skills should be made as group activities and the teacher assesses various skills of the students as given in the workbook.
- Teacher should maintain a record of the following Assessment sheet ( one for each student) to award Internal marks.

Calculating Internal marks through Assignments :				
Name of the Student:		PIN:	Branch:	Academic Year:
S	Title of the Unit	Assignment 1:	Assignment 2:	Total Marks in each Unit
.		10 Marks	10 Marks	

<b>No.</b>				<b>(Average for 10 Marks)</b>
1	Listening Skills			
2	Workplace etiquette			
3	Introducing Oneself			
4	Short Presentations (JAM)			
5	Group Discussion			
6	Resume & Cover Letter			
7	Interview Skills			
8	Presentation Skills			
	Marks Scored			Ex: 65
	Total No. of Units			8
	Internal Assessment : Average for 40 Marks	(65/8 ) X4 = 32.5		33 ( for 40 Marks)

<b>Aspects to be evaluated to test speaking skills</b>			
<b>S.No</b>	<b>Language Aspects</b>	<b>Organising Aspects</b>	<b>Body Language aspects</b>
<b>1</b>	Content: Quality, clarity and relevance of ideas	Coherence, cohesion of relevant ideas	Postures
<b>2</b>	Fluency	Proper beginning, topic sentence, expansion/details, conclusion	Gestures,
<b>3</b>	Vocabulary	Using proper Linkers	Eye contact
<b>4</b>	Pronunciation	Avoid repetitions, clichés, fillers	Audibility, pitch, Permissible pauses
<b>5</b>	Grammar ( Syntax, semantics)		Other Permissible body movements

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
CHOT409	Technology of Vegetable oils and Fats-I & II Lab	3	45	40	60

<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises	
<b>Course Outcomes</b>	C01	Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	C02	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	C03	Observe various parameters, their variations and graphically represent the same
	C04	Analyse the experimental results to draw inferences to make recommendations
	C05	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

#### List of experiments:

1. Analysis of different oil seeds.
2. Determination of moisture content in oil seeds and cakes.
3. Determination of Acid Value to know Free Fatty Acid % in the Crude or Refined Oil.
4. Determination of Acid Value to know Free Fatty Acid % in the Crude or Fatty Acid.
5. Determination of saponification value a) Crude/Refined Oil b) Crude/ Refined Fatty Acid.
6. Determination of Iodine value a) Crude/Refined Oil b) Crude/ Refined Fatty Acid.
7. Determination of colour of the oil (crude and/or refined oil).
8. Determination of unsaponifiable matter in a)Crude/Refined Oil b)Crude/ Refined Fatty Acid.
9. Determination of percentage reduction of colour in crude oils by bleaching.
10. Determination of Flash point of vegetable oils

### PROCESS TECHNOLOGY LAB(CHOT-410)

Course code	Course title	No.Of Periods / week	Total number of periods	Marks for FA	Marks for SA
CHOT-410	Process Technology Lab	3	45	40	60

#### Course objectives:

- i. To familiarize with the knowledge of different chemicals, tools and instruments used in the laboratory
- ii. To know the etiquette of working with the fellow workforce
- iii. To reinforce theoretical concepts by conducting relevant experiments

#### Course outcomes

<b>Course outcomes</b>	<b>CO1</b>	Demonstrate the skill of planning and organising experimental set up for a desired purpose
	<b>CO2</b>	Observe various parameters and graphically represent the same
	<b>CO3</b>	Analyse the experimental results to draw inferences
	<b>CO4</b>	Practice ethics and etiquette while working in a group and display professionalism while communicating as a member and leader in a group

#### Learning objects:

On completion of the study of the subject the student should be able to,

1. Determination of total and dissolved solids in ppm of tap water/Seawater.
2. Determination of the total hardness & permanent hardness in water by E.D.T.A method
3. Determination of chlorides present in water/common salt
4. Estimation of BOD and COD of given sample of water
5. Estimation of sulphates present in water/ common salt.
6. Determination of acid value of coconut oil / vegetable oil.
7. Estimation of Saponification value of the given sample.
8. Determination of iodine value of given vegetable oil.
9. Determination of pH of the given sample of solution by using P<sup>H</sup> meter.
10. Estimation of sugar content in a given sample by using polarimeter.
11. Determination of conductivity of the given sample of solution by conductivity meter.
12. Calculate the flash and fire point of oil sample using Abel's apparatus
13. Calculate the flash and fire point of oil sample using Pensky Martin's apparatus
14. Find the percentage composition of moisture content, volatile matter, ash content and fixed carbon content of coal using proximate analysis of coal
15. Find the percentage of CO, CO<sub>2</sub> and O<sub>2</sub> of a sample of flue gas by Orsat apparatus

# **V & VI Semesters (Industrial Training)**

**V & VI Semesters (Industrial Training)**  
**DIPLOMA IN CHEMICAL ENGINEERING (OIL TECHNOLOGY)**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

**INDUSTRIAL TRAINING**

**Subject Title** : **Industrial Training**  
**Subject Code** : **CHOT-501**  
**Duration** : **6 months**

**Time schedule**

S.NO	Code	TOPICS	Duration
1	CHOT-501	<input type="checkbox"/> Practical training in Industry <input type="checkbox"/> Training Report Preparation Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents(introduction of Industry, Plant Layout, Organization Chart, List of Major Equipments, List of Processes: Skills Acquired; Conclusions; References	Six Months

**Course Objectives and Course Outcomes**

Upon completion of the course the student shall be able to	
<b>Course Objectives</b>	1.Expose to real time working environment 2. Enhance knowledge and skill already learnt in the institution. 3. Acquire the required skills of manufacturing processes, assembling, servicing, supervising in the engineering fields. 4. Install the good qualities of integrity, responsibility and self confidence.
<b>COURSE OUTCOMES</b>	CO1 Apply theory to practical work situations
	CO2 Cultivate sense of responsibility and good work habits
	CO3 Exhibit the strength, teamwork spirit and self-confidence
	CO4 Write report in technical projects

**PO-CO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2				2		1	3		2
CO2						3		3		2
CO3						3		3		2
CO4						3		3		2

**3: High, 2: Moderate, 1: Low**

## **Learning Outcomes**

The student shall be able to display the following skill sets

- 1) Technical Skills (Manufacturing/Service/Drafting/Maintenance etc)
- 2) Reading drawings and analysing Specifications
- 3) Recognize and Practice safety Measures
- 4) Handling Tools/Instruments/Materials/Machines
- 5) Assess and Control of quality parameters
- 6) Planning, Organizing and recording Skills

<i>Sl.No.</i>	<i>Subject</i>	<i>Duration</i>	<i>Scheme of evaluation</i>		
			<i>Item</i>	<i>Nature</i>	<i>Max. Marks</i>
<i>1</i>	<i>Industrial Training</i>	<i>6 months</i>	<i>1.First Assessment at Industry (After 12 Weeks)</i>	<i>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</i>	<i>120</i>
			<i>2.Second Assessment at the Industry (After 22 weeks)</i>	<i>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</i>	<i>120</i>
			<i>Final Summative assessment at institution level</i>	<i>Training Report</i>	<i>20</i>
				<i>Demonstration of any one of the skills listed in learning outcomes</i>	<i>30</i>
				<i>Viva Voce</i>	<i>10</i>
<b>TOTAL MARKS</b>					<b>300</b>

**Weightage of marks for Assessment of Skill sets during first and second assessment.**

<i>Skill Set Sl.No</i>	<i>SKILL SET</i>	<i>Max Marks Allotted For each parameter</i>
<i>1</i>	Handling of various Equipments/Instruments	<i>15</i>
<i>2</i>	Supervising the Process of various manufacturing units in Chemical Engineering	<i>20</i>
<i>3</i>	Working with equipments, Instruments	<i>25</i>
<i>4</i>	Troubleshooting Skills	<i>25</i>
<i>5</i>	Safety aspects and crisis management	<i>15</i>
<i>6</i>	Soft skills and Reporting skills	<i>20</i>
	<i>Total</i>	<i>120</i>

During assessment the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the weightage assigned as above. In case the student

has undergone training in a few skill sets then the total marks obtained shall be raised to 120 marks for the given assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets. **Illustration**

If the student has undergone training in only 4 skill sets (namely serial number 1, 3, 4, 5 of above skill sets) and marks awarded during assessment is 50 out of 80 marks, then the marks of 50 shall be enhanced to 120 proportionately as  $(50/80)*120=75$ .

## **GUIDELINES FOR INDUSTRIAL TRAINING**

1. Duration of the training: 6 months.
2. Eligibility: The As per SBTET norms
3. Training Area: Students may be trained in the fields  
Fabrication/Foundry/Manufacturing/Service/Drafting/Maintenance etc.
4. The candidate shall put a minimum of 90% attendance during Industrial Training.
5. If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training.
6. Formative assessment at industry level shall be carried out by the Mentor from of the industry, where the student is undergoing training and the faculty in charge (Guide) from the concerned section in the institution.
7. The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks.
8. If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.
9. Final Summative assessment at institution level is done by a committee including  
1. Head of the section(Concerned discipline ONLY),  
2. External examiner and  
3. Faculty members who assessed the students during Industrial Training as members.

No gap/holidays between one spell to another

### **Guidelines and responsibilities of the faculty members who are assessing the students' performance during Industrial Training:**

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2. Shall guide the students in all aspects regarding training.
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**Department of Technical Education**

Name of the institution:

PIN:

student:

Semester:

Name of the Industry

Visit (I /II)

Date of visit Name of the  
Period of training

Maximum marks (120)

<i>Skill Set Sl. No</i>	<i>SKILL SET</i>	<i>Max Marks Allotted For each parameter</i>	<i>Precisely completes the task</i>	<i>Completes the task, mistakes are absent, but not Precise</i>	<i>Completes the task, Mistakes are a few</i>	<i>Makes attempt, Mistakes are many</i>
1	<b>Handling of various Equipments/Instruments(15 )</b> (i) Specifications of equipment and instruments	10	10	8	6	2
	(ii) Measuring the process parameters	5	5	4	3	1
2	<b>Supervising the Process of various manufacturing units in Chemical Engineering (20)</b> (i) Raw materials and Product, byproducts	4	4	3	2	1
	(ii) Process Flow diagram, Line diagrams	3	3	2	1	1
	(iii) Process monitoring	5	5	4	3	1
	(iv) Design aspects	4	4	3	2	1
	(v) Quality control and Quality assurance	4	4	3	2	1
3	<b>Working with equipments, Instruments (25)</b> (i) Working condition parameters	8	8	6	5	2
	(ii) Startup-Shutdown	5	5	4	3	1
	(iii) Maintenance	12	12	10	7	3
4	<b>Troubleshooting Skills (25)</b> (i) Fault-Finding	15	15	12	9	3
	(ii) Rectification	10	10	8	6	2
5	<b>Safety aspects and crisis management (15)</b> (i) Safety procedures	4	4	3	2	1
	(ii) Use of Personnel Protection Equipment	5	5	4	3	1
	(iii) Crisis management during hazards, accidents	3	3	3	2	1
	(iv) Pollution control techniques	3	3	3	2	1
6	<b>Soft skills and Reporting skills(20)</b> (i) Communication Skills (oral/writing skills)	4	4	3	2	1
	(ii) Human relations.	4	4	3	2	1
	(iii) Supervisory abilities.	4	4	3	2	1
	(iv) Reporting technical issues	4	4	3	2	1
	(v) Maintenance of records in the industry.	4	4	3	2	1

(Marks in words: )

Signature of the Training In-charge (Mentor)

Name

Designation:

Signature of the visiting staff Name(Guide)

Name:

Designation:

## INDUSTRIAL TRAINING

**Subject Title** : **Industrial Training**  
**Subject Code** : **CHOT-601**  
**Duration** : **6 months**

### Time schedule

S.NO	Code	TOPICS	Duration
1	CHOT-601	<input type="checkbox"/> Practical training in Industry <input type="checkbox"/> Training Report Preparation Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents(introduction of Industry, Plant Layout, Organization Chart, List of Major Equipments, List of Processes: Skills Acquired; Conclusions; References	Six Months

### Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to	
<b>Course Objectives</b>	1.Expose to real time working environment 2. Enhance knowledge and skill already learnt in the institution. 3. Acquire the required skills of manufacturing processes, assembling, servicing, supervising in the engineering fields. 4. Install the good qualities of integrity, responsibility and self confidence.
<b>COURSE OUTCOMES</b>	CO1 Apply theory to practical work situations
	CO2 Cultivate sense of responsibility and good work habits
	CO3 Exhibit the strength, teamwork spirit and self-confidence
	CO4 Write report in technical projects

### PO-CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2				2		1	3		2
CO2						3		3		2
CO3						3		3		2
CO4						3		3		2

**3: High, 2: Moderate,1: Low**

### Learning Outcomes

The student shall be able to display the following skill sets

- 1) Technical Skills (Manufacturing/Service/Drafting/Maintenance etc)
- 2) Reading drawings and analysing Specifications
- 3) Recognize and Practice safety Measures
- 4) Handling Tools/Instruments/Materials/Machines
- 5) Assess and Control of quality parameters
- 6) Planning, Organizing and recording Skills

<i>Sl.No.</i>	<i>Subject</i>	<i>Duration</i>	<i>Scheme of evaluation</i>		
			<i>Item</i>	<i>Nature</i>	<i>Max. Marks</i>
<i>1</i>	<i>Industrial Training</i>	<i>6 months</i>	<i>1.First Assessment at Industry (After 12 Weeks)</i>	<i>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</i>	<i>120</i>
			<i>2.Second Assessment at the Industry (After 22 weeks)</i>	<i>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</i>	<i>120</i>
			<i>Final Summative assessment at institution level</i>	<i>Training Report</i>	<i>20</i>
				<i>Demonstration of any one of the skills listed in learning outcomes</i>	<i>30</i>
				<i>Viva Voce</i>	<i>10</i>
<b><i>TOTAL MARKS</i></b>					<b><i>300</i></b>

<i>Skill Set Sl.No</i>	<i>SKILL SET</i>	<i>Max Marks Allotted For each parameter</i>
<i>1</i>	Handling of various Equipments/Instruments	<i>15</i>
<i>2</i>	Supervising the Process of various manufacturing units in Chemical Engineering	<i>20</i>
<i>3</i>	Working with equipments, Instruments	<i>25</i>
<i>4</i>	Troubleshooting Skills	<i>25</i>
<i>5</i>	Safety aspects and crisis management	<i>15</i>
<i>6</i>	Soft skills and Reporting skills	<i>20</i>
	<b><i>Total</i></b>	<b><i>120</i></b>

During assessment the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the weightage assigned as above. In case the student has

undergone training in a few skill sets then the total marks obtained shall be raised to 120 marks for the given assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets. **Illustration**

If the student has undergone training in only 4 skill sets (namely serial number 1, 3, 4, 5 of above skill sets) and marks awarded during assessment is 50 out of 80 marks, then the marks of 50 shall be enhanced to 120 proportionately as  $(50/80)*120=75$ .

## GUIDELINES FOR INDUSTRIAL TRAINING

1. Duration of the training: 6 months.
2. Eligibility: The As per SBTET norms
3. Training Area: Students may be trained in the fields  
Fabrication/Foundry/Manufacturing/Service/Drafting/Maintenance etc.
4. The candidate shall put a minimum of 90% attendance during Industrial Training.
5. If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training.
6. Formative assessment at industry level shall be carried out by the Mentor from of the industry, where the student is undergoing training and the faculty in charge (Guide) from the concerned section in the institution.
7. The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks.
8. If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.
9. Final Summative assessment at institution level is done by a committee including  
1. Head of the section(Concerned branch of the discipline),  
2. External examiner and  
3. Faculty members who assessed the students during Industrial Training as members.

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**Department of Technical Education**

**Name of the institution:**

**Visit (I /II)**

**PIN:**

**Date of visit**

**Name of the student:**

**Period of training**

**Semester:**

**Name of the Industry**

**Maximum marks (120)**

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**(Marks in words: )**

**Signature of the Training In-charge (Mentor)**

**Signature of the visiting staff Name(Guide)**

**Name**

**Name:**

**Designation:**

**Designation:**

# VII Semester

**DIPLOMA IN CHEMICAL ENGINEERING (Oil Technology)**  
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
**C-23, VII Semester**

Subject Code	Name of the Subject	Instruction period / week-Mod(nonmod)		Total Period / year	Scheme of Examination			
		Theory	Practical		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
<b>THEORY:</b>								
CHOT -701	Industrial Management and Entrepreneurship	5	-	75	3	20	80	100
CHOT -702	Thermodynamics and Reaction Engineering	5	-	75	3	20	80	100
CHOT -703	Instrumentation & Process Control	5	-	75	3	20	80	100
CHOT -704	Unit Operations –III	4	-	60	3	20	80	100
CHOT -705	Technology of Vegetable Oils and Fats-III	5	-	75	3	20	80	100
<b>PRACTICAL:</b>								
CHOT-706	Chemical Plant Equipment Drawing	-	3	45	3	40	60	100
CHOT -707	Instrumentation, process control & Reaction Engineering Lab	-	3	45	3	40	60	100
CHOT -708	Life skills	-	3	45	3	40	60	100
CHOT-709	Project Work /Technology of Vegetable Oils and Fats-III Lab	-	3	45	3	40 (20+20)	60 (30+30)	100 (50+50)
CHOT-710	Unit Operations-III Lab	-	3	45	3	40	60	100
-	Activities	-	3	45	-	-	-	-
<b>TOTAL</b>		<b>24</b>	<b>18</b>	<b>360+270=630</b>	<b>-</b>	<b>300</b>	<b>700</b>	<b>1000</b>

CHOT- 708 common to all

CHOT- 702, 703, 706, 707 Common to DCHE, DCHE(PC), DCHE(PP)

CHOT-701, separate(not common with all other branches, common to DCHE, DCHE(PC/PP)

CHOT-704,710 Common DCHE(PC), DCHE(PP)

CHOT-705, 709 not common to any course

**INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP**

<b>Course code</b>	<b>Course title</b>	<b>No.Of Periods / week</b>	<b>Totalnumber of periods</b>	<b>Marks for FA</b>	<b>Marks for SA</b>
CHOT-701	Industrial Management and Entrepreneurship	5	75	20	80

**Time Schedule**

<b>S.No.</b>	<b>Major Topics</b>	<b>No of Periods</b>	<b>Weightage allocated</b>	<b>Short Answer Questions</b>	<b>Essay type questions</b>	<b>Cos mapped</b>
1.	Principles and functions of Management	5	06	2		CO1
2.	Organisation structure & organisational behaviour	14	26	2	2	CO1
3.	Production Management	10	13	1	1	CO2
4.	Materials Management	10	13	1	1	CO2
5.	Marketing ,Sales & Feasibility study	10	13	1	1	CO1
6.	Industrial legislation & safety	8	13	1	1	CO4, CO1
7	Introduction to ISO 9000 & T.Q.M.	8	13	1	1	CO4
8	Role of Enterprenuer and Enterprenuerial Development	10	13	1	1	CO3
Total		75	110	10	8	

**Course objectives:**

1. To familiarize with different management, production and material principles and different structures of organization.
2. To know the role and expectations of entrepreneur.
3. To understand and reinforce the subject to establish a small scale industry

<b>Course outcomes</b>	<b>CO1</b>	CHOT-701.1	To familiarize with the basics, principles and functions of management, ownership and marketing
	<b>CO2</b>	CHOT-701.2	To familiarize with materials and production management
	<b>CO3</b>	CHOT-701.3	To know the role of entrepreneur and feasibility report
	<b>CO4</b>	CHOT-701.4	To understand safety , quality and iso standards to in the industry

**CO-PO/PSO Matrix:**

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-701.1	3		2			1		3		2
CHOT-701.2	3							3		
CHOT-701.3	3	1		1	1				1	
CHOT-701.4	3	1		1	1	1			1	
<b>AVERAGE</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>		<b>3</b>	<b>1</b>	<b>2</b>

**3=STRONGLY MAPPED**

**2=MODERATELY MAPPED**

**1=SLIGHTLY MAPPED**

**Learning out comes:**

**On completion of the course the student will be able to**

**1.0 Understand the principles of management as applied to industry.**

- 1.1 Define industry, commerce (Trade) and business.
- 1.2 Know the need for management.
- 1.3 Understand the evolution of management
- 1.4 Explain the principles of scientific management.
- 1.5 Understand functions of Management.
- 1.6 Differentiate between management and administration.

**2.0 Know the organisation structure of an industry and the behaviour of an individual in an organisation.**

- 2.1 Understand types of ownerships
- 2.2 Differentiate types of ownerships.
- 2.3 Understand salient features of joint stock companies.
- 2.4 Understand the philosophy and need of organisation structure of an industry.
- 2.5 Understand the line and staff organisations.
- 2.6 List the advantages and limitations of line and staff organisations.
- 2.7 List different departments in a large scale industry.
- 2.8 Explain the factors of effective organisation.
- 2.9 Understand organisational behaviour.
- 2.10 Conduct for analysis.
- 2.11 Assess the incurring applicants.
- 2.12 Outline the selection process.
- 2.13 Understand the sources of manpower.
- 2.14 State motivation theories.

- 2.15 State Maslow's Hierarchy of needs.
- 2.16 Explain the phenomena of satisfaction.
- 2.17 Explain the performance levels.
- 2.18 Design reward system
- 2.19 Explain quality of work life.
- 2.20 Explain socio-technical and socio-psychological approach.
- 2.21 List out different leadership models.
- 2.22 Explain the trait theory of leadership.
- 2.23 Explain behavioural theory of Leadership.
- 2.24 Explain the process of decision Making.
- 2.25 Outline the communication process.
- 2.26 Analyse the behaviour of groups in an organisation.
- 2.27 Explain group dynamics.
- 2.28 Detail the process of managing conflict.
- 2.29 Explain conflict resolution strategies.
  
- 3.0 Understand the different aspects of production management.**
- 3.1 Differentiate and integrate production, planning and control.
- 3.2 Relate the production department with other departments.
- 3.3 State the need for planning and its advantages.
- 3.4 Explain the stages of Production, planning and control.
- 3.5 Explain routing methods.
- 3.6 Explain scheduling methods.
- 3.7 Explain dispatching.
- 3.8 Draw PERT/CPM networks.
- 3.9 Identify the critical path.
  
- 4.0 Understand the role of materials management industries.**
- 4.1 Explain the role of the materials in Industry.
- 4.2 Derive expression for inventory control.
- 4.3 Explain ABC analysis.
- 4.4 Define safety stock.
- 4.5 Define reorder level.
- 4.6 Derive an expression for economic ordering quantity.
- 4.7 Explain stock layout.
- 4.8 List out stores records.
- 4.9 Explain the Bin card.
- 4.10 Describe Cardex method.
- 4.11 Explain purchasing procedures.
- 4.12 List out purchase records.
- 4.13 Describe the stores equipment
- 4.14 Describe material handling methods and need.
- 4.15 Describe material lifting methods. List out hoists, cranes, conveyers, trucks, and forklift trucks.
- 4.16 Explain the concept of cost.
- 4.17 List out the elements of cost.
- 4.18 Explain the concept of contribution.
- 4.19 Explain break-even analysis.
  
- 5.0 Understand marketing, sales and feasibility study.**
- 5.1 Explain marketing functions.
- 5.2 Explain Sales function.
- 5.3 List out market conditions.
- 5.4 Differentiate Sellers and Buyers' market.
- 5.5 Differentiate monopoly, oligarchy, and perfect competition.
- 5.6 Conduct market and demand surveys.
- 5.7 Differentiate product and production analysis.
- 5.8 Identify the input materials, i.e. Bill of materials

- 5.9 Define the main policy requirements.
- 5.10 Decide the location.
- 5.11 Evaluate Economic and Technical factors.
- 5.12 Preparation of feasibility study.
- 5.13 List out different products currently in demand with market or industry. 5.14 Role of advertising, media of advertising and selection of media

## **6.0 Comprehend the provisions of industrial legislation in India. & Safety procedures**

- 6.1 Describe employer and employee relations.
- 6.2 Describe the mechanics of Trade Unions.
- 6.3 Describe mechanics of settlement of in outs.
- 6.4 Explain the significance of collective bargain.
- 6.5 List out Welfare activities.
- 6.6 List out subsidy schemes.
- 6.7 Explain the Totalwelfare concept.
- 6.8 List out the rights and responsibilities of employees and employers.
- 6.9 List out the salient features of Indian Factories Act.
- 6.10 List out the salient features of Minimum Wages Act.
- 6.11 List out the salient features of Industrial Disputes Act.
- 6.12 List out the salient features of Workmen’s Compensation Act 6.13 List out the salient features of E. S .I. Act.
- 6.14 List out the salient features of consumer protection rights Act
- 6.15 Explain the importance of safety at Work place.
- 6.16 List out the important provisions related to safety.
- 6.17 Explain the significance and mechanics of safety education.
- 6.18 Explain hazard and accident.
- 6.19 List out different hazards in the Industry.
- 6.20 Explain the causes of accidents.
- 6.21 Explain the direct and indirect cost of accidents.
- 6.22 List out Electrical Hazards.
- 6.23 List out types of fire extinguishers.
- 6.24 Describe the method of artificial Respiration.
- 6.25 Describe the method of CPR.
- 6.26 Describe the mechanics of safety Drills.
- 6.27 List out provisions of Indian Electricity Rules laid in the electricity act1923.

## **7.0 Understand ISO 9000 & TQM.**

- 7.1 Understand the concept of quality.
- 7.2 Know the quality systems and elements of quality systems.
- 7.3 Know the principles of quality Assurance.
- 7.4 Know the Indian Standards on quality systems.
- 7.5 Know the evolution of ISO standards.
- 7.6 Discuss ISO standards and ISO 9000 series of quality systems.
- 7.7 State the constituents of ISO 9000 series of standards for quality systems.
- 7.8 State the outstanding features and drawbacks of ISO 9000 series of standards.
- 7.9 List the beneficiaries of ISO 9000.
- 7.10 Understand 5-Principles and ZERO DEFECT.

## **8.0 Understand the role of entrepreneur in economic development and in improving the quality of life.**

- 8.1 Outline the concepts of Entrepreneurship.
- 8.2 Define the word entrepreneur.
- 8.3 Determine the role of Entrepreneurship.
- 8.4 Describe the profile of an entrepreneur.
- 8.5 Explain the requirements of an entrepreneur.
- 8.6 Outline the expectations of Entrepreneurship.
- 8.7 Determine the role of entrepreneurs in promoting Small Scale Industries.

- 8.8 Describe the details of self-employment schemes.
- 8.9 Explain the method of product selection.
- 8.10 Explain the method of site selection.
- 8.11 Outline the method of plant layout.
- 8.12 State the needs for a planned and co-ordinated effect.
- 8.13 State the importance of follow up.
- 8.14 Describe the small business scheme.
- 8.15 List the financial assistance programmes.
- 8.16 List out the organisations that help an entrepreneur.
- 8.17 Conduct a demand survey.
- 8.18 Conduct a market survey.

Course code CHOT-701	Course Title: Industrial management and entrepreneurship No of Course outcomes 05			No of periods: 75	
POs	Mapped with CO No	CO periods addressing PO in Column 1		Level (1, 2, 3)	Remarks
		NO	%		
PO1	CO1, CO2, CO3, CO4	75	54	3	>40%- level 3
PO2	CO3, CO4	26	19	1	25%-40% level 2
PO3	CO1	38	27	2	
					5-25% : level 1
					<5%: not addressed

### Hyponated course outcomes

#### 1. Principles and functions of management :

Definitions of Industry, Commerce and Business. Evolution of management theories. Principles of Scientific Management, functions of management. Difference of administration and management.

#### 2. Organisation Structure & organisational behaviour :

Role of industry, Types of ownership – Sole proprietorship, Partnership, Private limited, Public limited company, Industrial Cooperatives, Philosophy, types of Organisations, Line and Staff and functional organisations. Advantages and limitations, departments in a large scale industry. Effective organisation. Job analysis, Assessing applicants, selection, motivation, different theories, satisfaction, performance reward systems quality of work life, socio-technical and socio-psychological approaches, Leadership in organisation, decision making, communication, group dynamics, Managing conflict.

#### 3. Production Management :

Production, planning and control, relation with other departments, need for planning and advantages Routing, scheduling, despatching, PERT and CPM, simple problems.

#### 4. Materials Management :

Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order, level, Economic ordering quantity, Cost Elements of Cost, Contribution, Break even analysis, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Bin card, Cardex, Material handling, Manual lifting, Hoist, Cranes, conveyors, trucks, fork trucks.

#### 5. Marketing, Sales & Feasibility Study :

Sellers and Buyers markets, Marketing, Sales, Market conditions, monopoly, oligarchy, perfect competition, Budgets, Pricing Policies. Market Survey, Product and production Analysis, Materials input, Manpower, Location, Economic and Technical Evaluation, preparation of Feasibility study reports, - different products – Mechanical, Electrical, Electronics, consumer items, Consumer desires etc.

**6. Industrial Legislation & safety :**

Employer – Employee relations, Trade, Union Settlement of disputes, collective bargaining, Welfare activities, subsidies, TotalWelfare concept, rights and responsibilities and Employers and employees. Salient features of (i) Indian Factories Act, (ii) Minimum Wages Act, (iii) Industrial Disputes Act, (iv) Workmen’s compensation Act, (v) E.S.I Act. (Vi) Consumer protection act Important of Safety at work places, factories Act- Provisions, Safety Education, Hazards, causes of accidents, Cost of accidents, Electrical Hazards, Fire Extinguishers Artificial respiration, safety drills, Indian Electricity rules.

**7. Introduction to ISO 9000 and TQM :**

Concept of quality discussed by B. Crosby W. Edward, Deming, Joseph M. Jura Kooru Ishikawa, Genichi Taguchi, ShigcoShingo. Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, quality control and quality assurance. Elements quality systems : Management responsibility, Quality system, contract review, design control, document control, purchasing, purchaser – supplied product, product identification and traceability, process control, Inspection and testing. Principles of quality assurance – Definition of quality assurance. Indian standards on quality systems – Main features of IS 13999 : 1990, IS 14000 : 1990, IS 14004 : 1990, IS 14001 : 1990, IS 14002 :

1990, IS 14003: 1990. Know the necessity of International standards – Evolution of ISO. **5-S** principles – importance – meaning – approach – benefits. Various standards under ISO – Outstanding features of ISO 9000 series of standards – ISO 9000 Phenomenon ISO 9000 series of quality systems – Constituents of ISO 9000 series of standards for quality systems. Drawbacks of ISO 9000 series of standards, list the beneficiaries of ISO 9000 (Whom does ISO 9000 help).

**8. Role of Entrepreneur & Entrepreneurial Development :**

Concept, definition, role, expectation, entrepreneurship Vs Management, promotion of S.S.I. Self – employment schemes. Product selection, site selection, plant layout, profile and requirement, need for a planned and co-coordinated effort, following, Institutional support needed, Financial assistance programmes, Demand survey, Market survey.

**REFERENCE BOOKS :**

1. Industrial Engineering and Management-by O.P Khanna
2. Production Management- by Buffa.
3. Engineering Economics and Management Science - by Banga & Sharma.
4. S.S.I Hand Book by S.B.P. Publishers.
5. Personnel Management by Flippo.
6. Industrial Management and Entrepreneurship by ZakriaBaig.
7. Entrepreneurship – by NITTT&R, Chennai.

**C-23, CHOT-701**

**Subject Name: Industrial Management and Entrepreneurship**

**Syllabus split up for Unit Test**

Unit test NO	Learning out comes to be covered
Unit test-I	Objective from 1.1 to 4.19
Unit test-II	Objective from 5.1 to 8.18

## THERMODYNAMICS AND REACTION ENGINEERING

Course code	Course title	No.Of Periods / week	Total number of periods	Marks for FA	Marks for SA
CHOT-702	Thermodynamics and reaction engineering	5	75	20	80

### TIME SCHEDULE

S.No.	Major Topics	No of Periods	Weightage allocated	Short Answer Questions	Essay type questions	COS mapped
1.	Introduction and First law of thermodynamics Volumetric properties of pure fluids	18	26	2	2	CO1, CO2, CO3, CO4, CO5
2.	The second law of thermodynamics	12	16	2	1	CO2, CO3, CO4, CO5
3.	Refrigeration and Liquefaction	10	13	1	1	CO2, CO4, CO5
4.	Chemical reaction equilibria	10	16	2	1	CO1, CO2, CO3, CO5
5.	Chemical kinetics and ideal reactors	18	26	2	2	CO2, CO3, CO5
6.	Catalysis and Industrial reactors	07	13	1	1	CO1, CO2, CO4
<b>Total</b>		<b>75</b>	<b>110</b>	<b>10</b>	<b>8</b>	

<b>Course objectives:</b>	<ol style="list-style-type: none"> <li>1. To familiarize with the terms used in thermodynamics, thermodynamic processes, properties of fluids, second law of thermodynamics, refrigeration and liquefaction, Lechleiter's principle, rate of reaction, factors affecting rate of reaction, methods to analyse rate data, industrial reactors and catalysis</li> <li>2. To apply thermodynamic laws for steady state flow process and feasibility of a chemical process, Lechleiter's principle to Haber's and contact process</li> <li>3. To understand and reinforce the thermodynamic concepts in various chemical processes for better production results.</li> </ol>
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### Course outcomes

<b>CO1</b>	CHOT-702.1	Interpret the basic concepts and definitions of thermodynamics, reaction engineering and catalysis
<b>CO2</b>	CHOT-702.2	understand various thermodynamic properties and their evaluation, applications of thermodynamics, reactors and catalysts
<b>CO3</b>	CHOT-702.3	Deduce the derivations of thermodynamics and reaction engineering
<b>CO4</b>	CHOT-702.4	Illustrate with the help of neat diagrams the construction and working of heat engines, heat pumps and various reactors
<b>CO5</b>	CHOT-702.5	Solve the problems on first and second law of thermodynamics and reaction engineering

**CO-PO/PSO MATRIX:**

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-702.1	3	-	-	-	-	-	-	2	-	-
CHOT-702.2	-	2	-	-	-	-	-	1	-	-
CHOT-702.3	2	2	-	-	-	-	-	-	2	-
CHOT-702.4	-	-	2	-	-	-	-	-	2	-
CHOT-702.5	2	2	-	-	-	-	-	-	2	-
<b>AVERAGE</b>	<b>2.33</b>	<b>2</b>	<b>2</b>	-	-	-	-	<b>1.5</b>	<b>2</b>	-

**3=STRONGLY MAPPED**

**2=MODERATELY MAPPED**

**1=SLIGHTLY MAPPED**

**Learning outcome**

After completion of the course, the student will be able to

**1.0 Introduction, First law of thermodynamics and volumetric properties of pure fluids**

**1.1** Describe importance of thermodynamics.

**1.2** Define internal energy, enthalpy and their units in SI system.

**1.3** Define the statement for 1<sup>st</sup> law of thermodynamics.

**1.4** Derive an expression of first law of thermodynamics for the following processes: a) Closed process  
b) Steady state flow process.

**1.5** Differentiate between state and path functions.

**1.6** Distinguish extensive and intensive properties.

**1.7** Derive the relation of constant volume and constant pressure processes

**1.8** Define heat capacity and specific heat

**1.9** Explain (a) Equilibrium (b) Reversible process.

**1.10** Describe the PVT behaviour of pure substances.

**1.11** Define ideal gas and the characteristics of ideal gas.

**1.12** Define compressibility factor and know about compressibility Charts.

**1.13** Derive  $C_p - C_v = R$  for a mole of an ideal gas.

**1.14** Explain about the following processes.

A) Isobaric b) Isochoric c) Isothermal and d) Adiabatic.

**1.15** Derive expression for  $\Delta U$ ,  $\Delta H$ , Q and W in the above processes connecting PVT properties.

**1.16** Solve problems on calculation of  $\Delta U$ ,  $\Delta H$ , Q and W in the above processes connecting PVT Properties.

**2.0 The second law of thermodynamics.**

**2.1** Explain second law of thermodynamics.

**2.2** Distinguish between heat engine and heat pump.

**2.3** Give the schematic representation of heat engine and heat pump.

**2.4** Define cop in heat engine and heat pump.

**2.5** Define and explain Carnot cycle for an ideal gas.

**2.6** Explain Carnot cycle principle.

**2.7** Define entropy and its SI units.

**2.8** Explain the entropy characteristics.

**2.9** Describe the entropy changes of an ideal gas.

**2.10** Derive the mathematical statement of 2<sup>nd</sup> law of thermodynamics.

**2.11** Define third law of thermodynamics.

**3.0 Refrigeration and Liquefaction.**

**3.1** Define refrigeration.

- 3.2 Explain the cycle of refrigeration.
- 3.3 List the methods of refrigeration.
- 3.4 list the applications of refrigeration.
- 3.5 Define refrigerant.
- 3.6 Describe classification of refrigerants (primary and secondary).
- 3.7 Explain the principle of Carnot cycle refrigerator.
- 3.8 Explain about choice of refrigerant.
- 3.9 Explain the method of obtaining vapour compression refrigeration.
- 3.10 Explain the method of obtaining vapour absorption refrigeration.
- 3.11 Solve simple problems on ton of refrigeration, COP on refrigeration
- 3.12 Explain about liquefaction
- 3.13 Explain Linde and Claude liquefaction processes
- 4.0 Chemical reaction equilibria.**
- 4.1 Define equilibrium.
- 4.2 Explain about the standard Gibbs free energy change and the equilibrium constant.
- 4.3 Explain the effect of temperature on the equilibrium constants.
- 4.4 Evaluation of equilibrium constants.
- 4.5 Explain the relation between equilibrium constants and composition.
- 4.6 4.6 Simple problems on equilibrium constant calculations
- 5.0 Chemical kinetics and ideal reactors.**
- 5.1 Introduction to chemical kinetics
- 5.2 Explain the importance of reaction kinetics in chemical industries.
- 5.3 Explain the classification of reactions.
- 5.4 Define reaction rate and know its units.
- 5.5 Explain the variables affecting the rate of reaction.
- 5.6 Define single, multiple, elementary and non-elementary reactions.
- 5.7 Explain about molecularity and order of reaction.
- 5.8 Explain about rate constant  $k$ , representation of a rate equation.
- 5.9 Explain about temperature – dependent term of a rate equation.
- 5.10 Explain temperature dependency from Arrhenius law.
- 5.11 Explain about constant – volume batch reactor.
- 5.12 Describe about
- a) Integral method of analysis of data.
  - b) Differential method of analysis of data.
- 5.13 Define the following with examples.
- a) Zero order
  - b) First order
  - c) Second order .
- 5.14 Explain broad classification of reactor types.
- 5.15 Explain ideal batch reactor with diagram and design equation.
- 5.16 Define space time and space velocity.
- 5.17 Explain the steady state mixed flow reactor with diagram and design equation.
- 5.18 Explain steady state plug flow reactor with diagram and design equation.
- 6.0 Catalysis and Industrial reactors.**
- 6.1 Define catalysis.
- 6.2 Describe about the types of catalysis.
- 6.3 Scribe the characteristics of a catalytic reactions.
- 6.4 Define auto catalysis.
- 6.5 Explain the function of promoters, accelerators, carriers, inhibitors in catalytic reaction with examples.
- 6.6 Explain catalyst poisoning.

- 6.7 List out some important commercially available catalysts.
- 6.8 List six industrial catalytic processes.
- 6.9 Explain the working principle of the following with the help of neat sketches. a)  
 Fixed bed reactors  
 b) Moving bed reactors  
 c) Fluidized bed reactors

## **HYPONATED COURSE CONTENTS**

### **1.0 Introduction and First law of thermodynamics.**

The importance of thermodynamics- Internal energy – Formulation of first law –closed process - State functions and path functions – Enthalpy – Steady state flow process – –Constant volume and constant pressure processes - heat capacity and specific heat- Equilibrium – Reversible process.

#### **Volumetric properties of pure fluids.**

PVT behaviour of pure substances – Ideal gas —Definition of compressibility factor-

Derivation of  $C_p - C_v = R$  for a mole of an ideal gas-State and explain about the following processes : A) Isobaric b) Isochoric c) Isothermal and d) Adiabatic.

The different expressions for  $\Delta U$ ,  $\Delta H$ ,  $Q$  and  $W$  in the above processes connecting PVT properties- Problems on calculation of  $\Delta U$ ,  $\Delta H$ ,  $Q$  and  $W$  in the above processes

### **2.0 The second law of thermodynamics:**

Statement – The heat engine and heat pump- Carnot cycle for an ideal gas – Entropy – Entropy changes of an ideal gas – Mathematical statement of the second law – The third law of thermodynamics – Statement – Problems.

### **3.0 Refrigeration and Liquefaction:**

The Carnot refrigerator – Vapor – Compression cycle – Comparison of refrigeration cycles – Refrigerant – Choice of refrigerant – Absorption refrigeration – Heat pump Liquefaction- Linde and Claude liquefaction Processes.

### **4.0 Chemical reaction equilibria :**

Application of equilibrium criteria to chemical reactions – The standard Gibbs energy change and the equilibrium constant – Effect of temperature on the equilibrium constant – Evaluation of equilibrium constants – Relation between equilibrium constants and composition.

### **5.0 Chemical kinetics and ideal reactors.**

Chemical kinetics – Classification of reactions – Variables affecting the rate of reaction – Reaction rate- Concentration – Dependent term of a rate equation – Single and multiple reactors, elementary and non-elementary reactions – Molecularity and order of a reaction – Rate constant  $K$  – Representation of a rate equation – Constant volume batch reactor – Integral method of analysis of data and differential method of analysis of data. – Broad classification of reactor types – Ideal batch reactor – Space time and space velocity – Steady state mixed flow reactor – Steady stated plug flow reactor – Holding time and space time for flow systems – Problems.

### **6.0 Catalysis and Industrial Reactors :**

Types of catalysis – Characteristics of catalytic reactions – Auto catalysis – Accelerators, Promoters, inhibitors, poisons- some important catalysts- industrial catalytic processes- Important industrial reactors

**REFERENCE BOOKS :**

1. Introduction to Chemical Reaction Engineering – by K.A. Gavane, Nirali Publications.
2. Chemical Kinetics – by J.M. Smith.
3. Introduction to Chemical Engineering Thermodynamics – by Smith and Vannes, 4<sup>th</sup> Edition.
4. Chemical reaction Engineering – by Octave Levenspiel, 2<sup>nd</sup> edition.

Course code CHOT-702		Course Title: thermodynamics and reaction engineering No of Course outcomes 07			No of periods: 75	
POs	Mapped with CO No		CO periods addressing PO in Column 1		Level (1, 2, 3)	Remarks
			NO	%		
PO1	CO1, CO3, CO5	43	44	3		>40%- level 3
PO2	CO2, CO3, CO5	25	33	2		25%-40% level 2
PO3	CO4	17	23	1		5-25% : level 1
PO4						<5%: not addressed
PO5						
PO6						
PO7						

**C-23-CHOT-702**

**Subject Name: THERMODYNAMICS AND REACTION  
ENGINEERING VII SEMESTER  
Syllabus split up for Unit Test**

Unit test No.	Learning out comes to be covered
Unit test-I	Course Objective from 1.1 to 3.13
Unit test-II	Course Objective from 4.1 to 6.9

INSTRUMENTATION AND PROCESS CONTROL

Course code	Course title	No. of periods/week	Total no.of periods	Marks for FA	Marks for SA
CHOT-703	Instrumentation & Process Control	05	75	20	80

TIME SCHEDULE

S.No.	Major Topics	No of Periods	Weightage allocated	Short Answer Questions	Essay type questions	Cos mapped
1.	Introduction and Qualities of measurement	8	13	1	1	CO1
2.	Measurement of Temperature.	12	26	2	2	CO2, CO3, CO4 CO5
3.	Measurement of pressure and Vacuum:	9	13	1	1	CO2, CO3, CO4 CO5
4.	Measurement of Liquid level, Density and Viscosity.	10	13	1	1	CO2, CO3, CO4 CO5
5.	Measurement of composition.	9	13	1	1	CO2, CO3, CO4 CO5
6.	Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations:	9	13	1	1	CO2, CO3, CO4 CO5
7	Principles of automatic process control and modes available for process control.	14	16	2	1	CO4
8	Digital instruments	4	3	1		CO5
<b>Total</b>		<b>75</b>	<b>110</b>	<b>10</b>	<b>8</b>	

**Course objectives**

Course objectives
(i) To familiarize with the measurement, control of process and process instrumentation. (ii) To use various instruments to measure the temperature, pressure, vacuum, level, density, viscosity and composition. (iii) To know the principle ,construction ,and working of different instruments.

**Course Outcomes**

CO1	<b>CHOT-703.1</b>	Illustrate with example the Definitions and concepts of First and Second order systems with various inputs and responses.
CO2	<b>CHOT-703.2</b>	Derive the response equations for various inputs related to First and Second order systems.

CO3	<b>CHOT-703.3</b>	Illustrate the Principle, Construction and working of various instruments to measure temperature, pressure, vacuum, level, density, viscosity and composition with diagram.
CO4	<b>CHOT-703.4</b>	Compare the applications of the temperature, pressure, vacuum, level, density, viscosity and composition measuring instruments
CO5	<b>CHOT-703.5</b>	Describe the Instrumentation diagrams and working of automatic process control systems both pneumatic and hydraulic operated.

**CO-PO/PSO Matrix:**

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-703.1	3	2	-	-	-	-	-	2	-	-
CHOT-703.2	2	2	-	-	-	-	-	2	-	-
CHOT-703.3	-	-	2	-	-	-	-	-	2	-
CHOT-703.4	2	-	-	-	2	-	-	2	-	2
CHOT-703.5	-	-	2	-	-	-	-	-	2	-
<b>AVERAGE</b>	<b>2.33</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>2</b>

**3=STRONGLY MAPPED**

**2=MODERATELY MAPPED**

**1=SLIGHTLY MAPPED**

## Learning Outcome

### Unit-1: Introduction and Qualities of measurement

Know the importance of Instrumentation and process control in Chemical Industries.

- 1.0 Know the meaning of measurement.
- 1.1 Know the differences between direct and in-direct measurement.
- 1.2 Know about different elements of an instrument.
- 1.3 Know about the Static characteristics of an instrument.
- 1.4 Know about the Dynamic characteristics of an instrument.
- 1.5 Know about a First order system and physical examples of first order system.
- 1.6 Know about a Second order system and physical examples of second order system.
- 1.7 Know about various input functions like Step input, Impulse input, Sinusoidal input and Linear input.
- 1.8 Know about the response of a first order system for a given input functions with derivations.
- 1.9 Know about the parameters that characterize a first order system and a second order system.

### Unit-2 Measurement of Temperature.

- 2.1 Know about different temperature scales in different units.
- 2.2 Know about Principle, construction and working of expansion thermometers.
- 2.3 Know about Vapor actuated thermometer.
- 2.4 Know about the sources of static error in industrial pressure spring thermometers.  
Know about thermo-electricity and thermo-electric circuit or Thermocouple. Know about Seebeck effect, Peltier effect and Thomson effect.
- 2.5 Know the types of industrial thermocouples.
- 2.6 Know about the accessories of an industrial thermocouple.
- 2.7 Know the mechanical properties of thermal well materials.
- 2.8 Know the effect of location of reference junction and lead wires for a Thermocouple.
- 2.9 Know about the principle, construction, working of Milli-voltmeter and its application.
- 2.10 Know about the principle, construction, working of Null Potentiometer circuit and its application.
- 2.11 Know about temperature coefficient of resistance.
- 2.12 Know about industrial resistance thermometer bulbs.
- 2.13 Know about resistance thermometer elements.
- 2.14 Know about thermal wells and lead wires for resistance thermometers.
- 2.15 Know the indicating elements of industrial resistance thermometers like

Wheat stone bridge circuit and Modified wheat stone bridge circuit also known as “Callender Griffith circuit”.

- 2.16 Know about radiation temperature measurement.
- 2.17 Know about radiation receiving elements.
- 2.18 Know the types of radiation pyrometers.
- 2.19 Know about Optical pyrometer and its principle, construction and working.

### **Unit-3: Measurement of pressure and Vacuum:**

- 3.1 Know the basic concepts of pressure measurement.
- 3.2 Know different types of pressures.
- 3.3 Know about different types of liquid column manometers, their principle construction and working.
- 3.4 Know different types of pressure measuring elements.
- 3.5 Know the mechanical indicating elements.
- 3.6 Know about inductance coil method of an indicating element.
- 3.7 Know about resistance rod indicating element.
- 3.8 Know about electric pressure gauge of indicating element.
- 3.9 Know about different types of vacuum gauges.

### **Unit-4: Measurement of Liquid level, Density and Viscosity.**

- 4.1 Know the principle construction and working of liquid level method of measuring density.
- 4.2 Know the direct methods of liquid level measurement.
- 4.3 Know the principle construction and working of bubbler system for measurement of liquid level.
- 4.4 Know the level measurement in pressure vessels.
- 4.5 Know about principle construction and working of displacement float liquid level system.
- 4.6 Know about principle construction and working of pneumatic balance displacement float liquid level system.
- 4.7 Know the basic concepts for measuring density.
- 4.8 Know the principle construction and working of displacement-meter for measuring density by Republic flow-meter Company.
- 4.9 Know the principle construction and working of hydrometer for density measurement.
- 4.10 Know the basic concept of viscosity measurement.
- 4.11 Know the principle construction and working of viscosity measurement by Viscosity meter- Brabender Corporation.
- 4.12 Know the principle construction and working of viscosity measurement by Continuous Viscosity meter.

### **Unit-5: Measurement of composition.**

- 5.1 Know the determination of gas analysis by thermal conductivity method.
- 5.2 Know the determination of moisture content in gases by Psychrometer.
- 5.3 Know the determination of moisture in Paper and Lumber.
- 5.4 Know the determination of PH of a solution by PH cell (Measuring cell & Calomel cell) method.
- 5.5 Know about Spectroscopic methods of analysis
- 5.6 Know about Working Principle of Spectro-Photometer.
- 5.7 Know about Working Principle of Gas-Liquid Chromatography.

### **Unit-6: Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations:**

- 6.1 Know about recording instruments used for process instrumentation.
- 6.2 Know about indicating and signalling instruments.
- 6.3 Know about control centre.
- 6.4 Know about signal conversion devices.
- 6.5 Know about the instrumentation diagrams.
- 6.6 Know about the instrumentation diagram for a distillation column.
- 6.7 Know about the instrumentation diagram for an evaporator.
- 6.8 Know about the instrumentation diagram for a reactor.
- 6.9 Know about the instrumentation diagram for extractor

### **Unit-7: Principles of automatic process control and modes available for process control.**

- 7.1 Know about a simple automatic process control.
- 7.2 Know about components of a control system.
- 7.3 Know about types of control systems.
- 7.4 Know the basic nomenclature associated with a control system.

- 7.5 Know about control actions.
- 7.6 Know the expressions for the transfer function for the proportional control, Proportional-Derivative, Proportional-Integral, Proportional-Integral-Derivative control actions.
- 7.7 Know about the components of a hydraulic system.
- 7.8 Know about the construction, working of a hydraulic system incorporated with proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action.
- 7.9 Know about the components of a pneumatic system.
- 7.10 Know about the construction, working of a Pneumatic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action.
- 7.11 Know about Control valve, its components, working and characteristics.
- 7.12 Know about the Elaborate Explanation of programmable logic control and Distributive control system.

## 8. Digital Instruments

- 8.1 Know IOT (Internet of Things) and IIOT (Industry Internet of Things) fundamentals
- 8.2 List various digital sensors for concentration, thermal, pressure, flow and level.

Hyponated course contents with Reference books

### Unit-1: Introduction and Qualities of measurement

Importance of instrumentation --Meaning of measurement - Different elements of an instrument - Static characteristics of an instrument - Dynamic characteristics of an instrument - First order system and physical examples - Second order system and physical examples of second order system -Various input functions like Step input, Impulse input, Sinusoidal input and Linear input

### Unit-2: Measurement of Temperature.

Different temperature scales in different units—Principle, working and working of expansion thermometers like Mercury in glass thermometer, Bi-metallic thermometer and Pressure spring thermometer - Vapor actuated thermometer--Sources of static error in industrial pressure spring thermometers - Thermo-electricity and thermo-electric circuit or Thermocouple - Accessories of an industrial thermocouple - Millivoltmeter and its application - Null Potentiometer circuit and its and its application - Resistance thermometer elements - Wheat stone bridge circuit and Modified wheat stone bridge circuit -Radiation temperature measurement - Radiation receiving elements - construction and working - Optical pyrometer and Radiation pyrometer.

### Unit-3: Measurement of pressure and Vacuum:

Basic concepts of pressure measurement - liquid column manometers - pressure spring gauge, Bellow pressure element, Diaphragm element, Differential pressure indicating manometer, Bell differential pressure gauge--Mechanical indicating elements, Principle, working and construction of Pressure tight shaft and torque tube shaft--Principle, construction and working of inductance coil method of an indicating element--Principle, construction and working of resistance rod indicating element--Principle construction and working of electric pressure gauge of indicating element--Principle construction and working of different types of vacuum gauges like Mc-leod vacuum gauge, Pirani vacuum gauge, Thermocouple vacuum gauge, Thermionic type ionization vacuum gauge.

### Unit-4: Measurement of Liquid level, Density and Viscosity:

Basic concepts for measuring density--Principle construction and working of displacementmeter for measuring density by republic flow-meter Company--Principle construction and working of hydrometer for density measurement--Principle construction and working of liquid level method of measuring density--Direct methods of liquid level measurement, Float and tape liquid level system, Hydraulic remote transmission of liquid level system--Principle construction and working of bubbler system for measurement of liquid level--Level measurement in pressure vessels, Principle construction and working of differential pressure manometer for measuring liquid level in pressure vessels-- Principle construction and working of displacement float liquid level system--Principle construction and working of pneumatic balance displacement float liquid level system--Basic concepts of viscosity measurement--Principle construction and working of viscosity measurement by Viscosity meter-Brabender Corporation--Principle construction and working of viscosity measurement by Continuous Viscosity meter.

### **Unit-5: Measurement of composition:**

Gas analysis by thermal conductivity method--Determination of moisture content in gases by Psychrometer--Determination of moisture in Paper and Lumber--Determination of  $P^H$  of a solution by  $P^H$  cell (Measuring cell & Calomel cell) method--Spectroscopic analysis methods, Absorption spectroscopy, Emission spectroscopy, Mass spectroscopy, Working Principle of Spectro -Photometer, Gas -Liquid Chromatography.

### **Unit-6: Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations:**

Recording instruments used for process instrumentation, Circular recording chart and concentric indicating scale, Strip recording chart and linear indicating scale, Multi-record recorder-- Indicating and signalling instruments, Eccentric scale indicator, Concentric indicating scale--Control centre--Signal conversion devices, Transducer, Amplifier-Instrumentation diagrams--Instrumentation diagram of Control schemes for heat exchangers-- Instrumentation diagram for a distillation column--Instrumentation diagram for an evaporator--Instrumentation diagram for a reactor, Instrumentation diagram for extractor.

### **Unit-7: Principles of automatic process control and modes available for process control.**

Simple automatic process control system--Components of a control system, Process, measuring element, Controller, Comparator, Final control element, Types of control systems, Feedback control system or closed loop control system - Feed forward control system (Open loop control system)--Basic nomenclature associated with a control system, Load, Controlled variable, set point, error, measured variable, manipulated variable, Proportional gain, Proportional band, Offset--Control actions, Proportional control action, Integral control action, Derivative control action, Proportional-Integral control action, Proportional-Derivative control action, ON-OFF Control action, Proportional-Integral-Derivative control action-Expressions for the transfer function for the proportional control, Proportional-Derivative, Proportional-Integral, Proportional-Integral-Derivative control actions-- Know about the components of a hydraulic system--Construction, working of a hydraulic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-IntegralDerivative control action--Components of a pneumatic system, Construction, working of a Pneumatic system incorporated with Proportional, Proportional-Integral, ProportionalDerivative and Proportional-Integral-Derivative control action--Control valve, its components, working and characteristics—Elaborate Explanation of programmable logic control and Distributive control system.

### **Unit-8. Digital Instruments**

IOT and IIOT fundamentals- Digital sensors for concentration ,thermal ,pressure, flow and level.

### **REFERENCE BOOKS:**

1. Industrial Instrumentation by Donald P. Eckmann
2. Industrial Instrumentation & Control by S K Singh.
3. Process systems analysis & Control by Donald R. Coughanowr.
4. Chemical Process Control by George Stephanopoulos.
5. Process Control by Peter Harriot.
6. Instrumentation & Process Measurements by W Bolton.

<b>Course code</b> CHOT-703	<b>Course title : Instrumentation &amp; Process Control</b> <b>Number of course outcomes: 05</b>			<b>No. of periods:75</b>	
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO2, CO3	35	38	2	>40% Level 3 Highly addressed
PO2	CO4, CO5	45	50	3	
PO3	CO1	20	22	1	25% to 40% Level 2 Moderately addressed
PO4					5 to 25% Level 1 Low addressed
PO5					
PO6					
PO7					<5% Not addressed

**C-23-CHOT-703**  
**CHOT-703, Instrumentation & Process Control VII SEMESTER**  
**Syllabus split up for Unit Test**

Unit test NO	Learning out comes to be covered
Unit test-I	Learning Objective from 1.1 to 4.12
Unit test-II	Learning Objective from 5.1 to 8.2

### Unit Operations- III

Course code	Course title	No. of periods/week	Total no of periods	Marks for FA	Marks for SA
CHOT-704	Unit Operations- III	4	60	20	80

#### TIME SCHEDULE

S.No.	Chapter/Unit title	No. of periods	Weightage allocated	Short Answer Questions	Essay type questions	CO's Mapped
1.	Introduction and Properties of particulate solids	10	16	2	1	CO1,CO2, CO4, CO5
2.	Storage and conveyance	6	13	1	1	CO1,CO2, CO5
3.	Mixing	7	13	1	1	CO1,CO2, CO5
4.	Size Reduction	17	26	2	2	CO1,CO2, CO3,CO4, CO5
5.	Mechanical Separations	10	26	2	2	CO1,CO2, CO3,CO4, CO5
6.	Filtration	10	16	2	1	CO1,CO2, CO3,CO4, CO5,
	<b>Total</b>	<b>60</b>	<b>110</b>	10	8	

#### Course objectives (1 to 3) (Representing broader aim of the course)

<b>Course Objectives</b>	(i) To Impart the basic concepts of mechanical operations and develop an understanding of Size analysis, Size reduction and solid handling. (ii) To Familiarize with mechanical separation method such as filtration, sedimentation, transportation of solids etc. and associated equipment used for achieving these methods. (iii) The students are exposed to basic theory, calculations and machines involved in various solid handling operations.
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#### Course outcomes

#### Course outcomes (max8) (Representing the outcome of each or two chapters together)

CO NO	Course Outcomes
CO1	CHOT-704.1 Understand Mechanical Unit Operations and their role in chemical engineering industries.
CO2	CHOT-704.2 Summarize the Characterization of particulate solids, phenomenon of screening and principle involved in various separation techniques, size reduction operations, agitators, mixers, conveyers etc.
CO3	CHOT-704.3 Operate various mechanical separations, size reduction equipments etc with diagram.
CO4	CHOT-704.4 Estimate the power consumption of the equipments for mixing ,size reduction operations
CO5	CHOT-704.5 Apply the concept of filtration, size reduction and other mechanical separations in chemical and allied industries.

### CO-PO/PSO Matrix:

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT-704.1	2				1			2		
CHOT-704.2	2		2						2	
CHOT-704.3			2						3	
CHOT-704.4	2	1						2		
CHOT-704.5	2		2						2	
<b>AVERAGE</b>	<b>2</b>	<b>1</b>	<b>2</b>		<b>1</b>			<b>2</b>	<b>2.33</b>	

**3=STRONGLY MAPPED**

**2=MODERATELY MAPPED**

**1=SLIGHTLY MAPPED**

### Learning Outcome

#### **1.0 Understand properties of particulate solids.**

- 1.1 Importance of mechanical operations in chemical industries.
- 1.2 State the importance of size, shape, density and sphericity of a particle 1.3 Know about volume – surface mean diameter.
- 1.4 Know about the mixed particle sizes and size analysis.
- 1.5 Know about the specific surface, average particle size and particle population.
- 1.6 Specify various standard screening sieves viz. Taylor standard series & Indian standard series.
- 1.7 Know about differential & cumulative screen analysis.
- 1.8 Compare actual & ideal screens.
- 1.9 Distinguish between screen effectiveness and screen capacity.
- 1.10. Derive the equation for screen effectiveness
- 1.11. Solve problems on screen analysis and screen effectiveness.

#### **2.0 Understand the storage and conveyance of solids.**

- 2.1 Know about storage of solids.
- 2.2 Understand the bulk storage of solids.
- 2.3 Know about bin storage-Flat bottomed bins, sloped bottomed bins
- 2.4 Know about silos and hoppers.
- 2.5 List out various conveyors.
- 2.6 know the working principles of various conveyors-belt conveyors, screw conveyors, BucketElevators, pneumatic conveyors

#### **3.0 Understand the objective of mixing.**

- 3.1 State the various mixing equipments.
- 3.2 Explain the mixing of various systems like liquid-liquid, solid-liquid, gas-liquid, solid- solids.
- 3.3 Explain the working principle of mixing equipments used for liquid-liquid mixing- propellers, Paddles and turbines.
- 3.4 Describe the working principle of mixing equipments used for solid mixing-Ribbon blenders, Tumbling mixers, kneading machines, and Banbury mixer
- 3.5 Draw the diagrams of Ribbon blender and Banbury mixer.
- 3.6 Know the difference between mixing, agitation and blending.
- 3.7 Explain about vortex formation and its significance.

#### **4.0 Understand the size reduction operation.**

- 4.1 Explain the principle involved in size Reduction.
- 4.2 Calculate the mechanical efficiency and crushing efficiency.
- 4.3 State and explain (a) Rittinger's Law (b) Kick's Law (c) Bond's crushing law and work index.
- 4.4 Evaluate the power requirement for crushing and grinding.

- 4.5 Classify the size reduction equipment.
- 4.6 Distinguish the crushing and grinding equipment.
- 4.7 Explain the working principles of following crushing equipment: Jaw crusher, Gyratory Crusher, Roll crusher.
- 4.8 Explain the working principles of the following grinding equipment: Hammer mill, Rod mill, Ball mill and Ultrafine grinders.
- 4.9 Draw the line sketches of Jaw crusher, Roll mill and Ball mill.
- 4.10 Evaluate angle of nip in crushing rolls.
- 4.11 Evaluate the critical speed of Ball mill.
- 4.12 Mention the applications of various crushers and grinders.
- 4.13 Distinguish between closed circuit grinding and open circuit grinding.
- 4.14 Solve simple problems based on Rittinger's Law, Kick's Law and Bond's crushing law.
- 4.15 Solve problems on evaluating critical speed of a ball mill
- 4.16 Solve problems on evaluating angle of nip of Roll Crusher

**5.0 Understand mechanical separations.**

- 5.1 List out the industrial screens and mention their applications.
- 5.2 Know about Grizzlies, Trommels, Shaking and vibrating screens.
- 5.3 Understand various classifiers.
- 5.4 Know about hydraulic classifiers-Mineral jig, Wilfley table
- 5.5 know the working principle of froth flotation.
- 5.6 Know about magnetic separation and electro separation.
- 5.7 Know about air separation methods-Air separator, cyclone separator, Bag filter.
- 5.8 Know about the working principles of Electrostatic precipitator and scrubber.
- 5.9 Draw a neat sketch of cyclone separator.
- 5.10 Discuss the process of batch sedimentation and identify various zones.
- 5.11 Explain the Stokes law and Newtons law.
- 5.12 Know about free settling and hindered settling.
- 5.13 Define terminal velocity.
- 5.14 know the principle of working of industrial thickener with diagram.
- 5.15 Solve simple problems on terminal velocity.

**6.0 Know about filtration.**

- 6.1 State the principles of cake filtration.
- 6.2 State the principles of constant rate filtration and constant pressure filtration.
- 6.3 Know about working principle of plate and frame filter press and leaf filter.
- 6.4 Draw a neat sketch of rotary drum filter.
- 6.5 Know about working principle of continuous rotary drum vacuum filter.
- 6.6 Know the various types of filter medium used and its requirements.
- 6.7 Know the functions of filter aid and mention various filter aid.
- 6.8 State the principles of centrifugal filtration.
- 6.9 Know the application and selection of various filters.
- 6.10 Draw the neat sketches of centrifugal filters.
- 6.11 Explain the working principle of Batch and continuous centrifugal filters.

**Hyponated Course contents with Reference books:**

1. **Properties of particulate solids:** Particle size, shape, density and sphericity-mixed particle Sizes and size analysis-specific surface, average particle size and particle population-Standard screening sieves viz Taylor standard series & Indian standard series differential & Cumulative screen analysis- actual & ideal screens- Screen effectiveness problems on screen Effectiveness.
2. **Storage and conveyance of solids :** Various types of storage of solids- Bin storage- flat Bottomed bin, sloped bottomed bin, silos, hoppers and bulk storage-Conveying-types of Conveyors- Working principles- Belt conveyor, screw conveyor, pneumatic conveyor and Bucket elevator.

3. **Mixing** :Objectives of mixing, Liquid-liquid mixers-paddles, turbines, propellers, agitators- Solid-liquid mixers, mixer for viscous masses-Banbury mixer, ribbon blenders, tumblingMixers.
4. **Size Reduction** :Principles of comminution-Size Reduction laws-Efficiencies in size reduction- Size reduction equipment(crushers and grinders)-Evaluation of angle of nip-critical speed of ball mill-Closed circuit grinding and open circuit grinding- simple Problems on size reduction laws.
5. **Mechanical Separations** :Industrial screens-Their applications-Grizzlies, Trommels, Shaking, vibrating screens, classifiers-hydraulic classifiers, jigging, tabling, froth Flotation- Magnetic separation and electrostatic separation-Air separation-cyclone Separator, bag filters, electrostatic separators.
6. **Filtration** :Application of filters-Classification of filters-Selection of filters-Plate and Frame filter press, leaf filters, continuous rotary filters-Filter aids-Constant pressure and Constant rate filtration-Centrifugal filtration-Batch, semi continuous, continuous centrifuges.

#### REFERENCE BOOKS :

1. “Unit Operations of Chemical Engineering” by Warren L. McCabe, Julian C.Smith, Peter Harriot.Mc. Graw Hill Publication, Fifth Edition.
2. Introduction to chemical Engineering by Warren L. Badger & Julius T. Banchero, McGraw – Hill publication.
3. Unit Operations –I & II, K.A.Ghavane, NiraliPrakasham Publications.

#### Cos-Pos mapping strength (as per given time table)

Course Code:	Course Title: Unit Operations-III			No of periods	
CHOT-704	Number of course outcomes: 05			60	
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No.	%		
PO1	CO1,CO2	27	17	1	
PO2	CO2,CO3,CO4	44	27	2	
PO3	CO2,CO3	39	24	1	
PO4	CO3,CO4	25	16	1	
PO5	CO3	20	12	1	
PO6	CO2,CO3	39	24	1	
PO7	CO5	8	1	-	

#### Subject Name: Unit Operations-III Syllabus split up for Unit Test

Unit test No.	Learning out comes to be covered
Unit test-I	Objective from 1.1 to 3.7
Unit test-II	Objective from 4.1 to 6.11

### TECHNOLOGY OF VEGETABLE OILS AND FATS-III

Course Code	Course title	No of periods/week	Total no of periods	Marks for FA	Marks for SA
CHOT-705	TECHNOLOGY OF VEGETABLE OILS AND FATS-III	05	75	20	80

#### Time Schedule

S.No	Chapter/Unit title	No Of periods	Weightage of Marks	Short Answer Questions	Essay Answer Questons	CO's Mapped
1	Fatty acids	10	13	01	01	CO1
2	Glycerin	15	23	01	02	CO2,CO3
3	Oil based products	15	23	01	02	CO1,CO2
4	Surface coatings	15	19	03	01	CO2,CO3
5	Miscellaneous fat based products	10	19	03	01	CO2,CO3,
6	Toilet Soap	10	13	01	01	CO1,CO2
	<b>Total</b>	<b>75</b>	<b>110</b>	<b>10</b>	<b>08</b>	<b>CO3,CO4</b>

<b>Course Objectives</b>	<ol style="list-style-type: none"> <li>1. To familiarize with the knowledge of Fatty acid splitting, physical and chemical properties of glycerin, various oil based products</li> <li>2. To know the various processes employed for surface coatings</li> <li>3. To reinforce the theoretical concepts of miscellaneous fat based products and toilet soap</li> </ol>
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CO NO	Course Outcomes
<b>CHOT-705.1</b>	Explain various methods of fat splitting, fatty acid fractionation and distillation
<b>CHOT-705.2</b>	Examine the processing and modification techniques of oils by polymerization and oxidation methods
<b>CHOT-705.3</b>	Describe the flow sheets for the production of glycerin, varnishes, paints, soaps, detergents, lubricants and greases
<b>CHOT-705.4</b>	Compare applications of glycerin, varnishes, paints, soaps, detergents, lubricants and greases
<b>CHOT-705.5</b>	Illustrate the product characteristics of glycerin, fatty alcohols, varnishes, soaps, detergents, lubricants and greases

## OBJECTIVES

### 1.0 Know about fatty acids.

- 1.1 Know about the theory and practice of fat splitting.
- 1.2 Describe the various processes available for fat splitting.
- 1.3 Know about fatty acid a) fractionation b) distillation c) hydrogenation.
- 1.4 Know about the purification methods.
- 1.5 Know about the miscellaneous applications of fats and fatty acids in foods, pharmaceutical, textile, plastic, leather and other industries.

### 2.0 To understand the physical and chemical properties of glycerin.

- 2.1 Know about the processes for treatment of sweet water and spent soap lye.
- 2.2 Understand crude glycerine a) Distillation b) Refining
- 2.2 Know about the methods of manufacture of glycerin from natural sources.
- 2.3 Know about the synthetic glycerin.
- 2.4 Know about the properties of glycerin and its corresponding utilization.

### 3.0 Know about the various oil based products.

- 3.1 Know about fatty alcohols
- 3.2 Know about Castor oil & its oleo chemical
- 3.3 Know about the processing and modification of oils by polymerization.
- 3.4 Know about the processing and modification of oils by oxidation and isomerisation.

### 4.0 Coatings.

- 4.1 Know about various processes and plant and machinery employed for the manufacture of surface coatings.
- 4.2 Know about the constituents of oil.
- 4.3 Know about the manufacturing method of varnishes.
- 4.4 Know about advantages, properties, uses of varnishes.
- 4.5 Know about the properties of paints.
- 4.6 Know about the manufacturing methods of different paints and additives of paints.
- 4.7 Know about different paints and their uses.
- 4.8 Know about printing inks and linoleum and manufacturing method.

### 5.0 Know about miscellaneous fat based products.

- 5.1 Know about the manufacture and utilization of phosphorous and sulphur coating products.
- 5.2 Know about the various products obtained by hydrogenation.
- 5.3 Know about the properties and specific uses of metallic soaps.
- 5.4 Know about the different types of soaps and detergents.
- 5.5 List out some of Oil based industries on State, National and International level
- 5.6 Know about the uses of natural fats and oils in cosmetics.
- 5.7 Know about lubricants and greases.
- 5.8 Materials of constructions used in vegetable oil industry.
- 5.9 Safety precautions to be taken.

### 6.0. Know about the manufacturing methods of various types of soaps

- 6.1. Know about boiling, saponification, spray drying, continuous neutralization, drying and finishing operations of toilet soap.

## COURSE CONTENTS

- Theory and Practice of fat splitting, various processes fraction etc, of fatty acids and their purification separation of fats and fatty acids.
- Treatment of sweet water and spent lye sources of glycerine and manufactures. Synthetic glycerine and properties of glycerine and uses,
- Modifications of oils and fats by polymerization, oxidation and isomerisation, fatty alcohols, castor oil and oleo chemicals.
- Surface coatings, procuring and machinery constituents of oils, Manufactures of varnishes and uses and properties of paints, preparation, properties, uses and additions, printing ink and linoleum.

- Manufacture of Phosphorous and sulphur based products and uses. Detergents, metallic soaps-use of oils and fats in cosmetics, lubricants and greases safety and materials of construction in oil industry. Manufacturing methods of various types of soaps-boiling, saponification, spray drying, continuous neutralization, finishing operations of toilet soap.

**REFERENCE BOOKS :**

1. Treatise on Fats, Fatty acids and Ole chemicals – Narula.
2. Baileys Industrial Oil and Fat Products (Vol 1 to 5) – Y.H. Hui
3. Oils and Fats manual Vol. 1 & 2 – A. Karleskind.
4. Recent advances in Chemistry and Technologies of Fats and Oils.

**C-23-CHOT-705**

**CHOT-705, TECHNOLOGY OF VEGETABLE OILS AND FATS-III VII SEMESTER**

**Syllabus split up for Unit Test**

<b>Unit test NO</b>	<b>Learning out comes to be covered</b>
Unit test-I	Objective from 1.1 to 3.4
Unit test-II	Objective from 4.1 to 6.1

## CHEMICAL PLANT EQUIPMENT DRAWING

Course code	Course title	No. of periods/week	Totalno.of periods	Marks for FA	Marks for SA
CHOT-706	Chemical plant equipment drawing	3	45	40	60

### TIME SCHEDULE

S.No	Chapter/unit title	No. of periods	Weightage allocated	Short Answer Questions	Essay type questions	CO's Mapped
1	Drawing of heat transfer equipment	12	20		1	CO1
2	Drawing of mass transfer and mechanical unit operations	13	20		1	CO1
3	Process flow diagrams using process description (flow sheeting)	10	20		1	CO2
04.	Process instrumentation diagrams, process equipment layouts and plant layouts	10	20	5		CO1
	total	45	80	5	3	

### Course objectives

<b>Course objectives</b>	(i) To draw various heat transfer, mass transfer and mechanical unit operations equipment
	(ii) To draw process block diagram/flow diagram using process description
	(iii) To draw process instrumentation diagrams, process layouts and plant layouts

### Course Outcomes

<b>Course Outcomes</b>	CO1	Demonstrate the skill of drawing and labelling heat transfer, mass transfer and mechanical unit operations equipments
	CO2	Practice the flow sheeting of process flow diagrams using process description for the production of various chemical compounds
	CO3	Sketch the instrumentation diagrams of the equipments for unit operations
	CO4	Follow the principles of process equipment layout in chemical process industries
	CO5	List the factors in identification of plant location for the proposed chemical process plant layout

### CO-PO/PSO MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
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CHOT -706.1	3	3	3	3				2	2	3
CHOT -706.2	2	3	3	3				3	2	2
CHOT -706.3	2	3	2	2				3	2	3
CHOT -706.4	3	2	2	3				2	3	3
CHOT -706.5	2	2	2	2				3	3	2
<b>Average</b>	2.4	2.6	2.4	2.6				2.6	2.4	2.6

## Learning Outcome

### Chapter-1

- 1.1 Draw a neat sketch of Shell & tube heat exchanger (1-1)
- 1.2 Draw a neat sketch of 2-4 Shell & tube heat exchanger
- 1.3 Draw a neat sketch of Short tube vertical evaporator
- 1.4 Draw a neat sketch of Long tube forced circulation evaporator

### Chapter-2

- 2.1 Draw a neat sketch of Rotary drum vacuum filter
- 2.2 Draw a neat sketch of Bubble cap plate
- 2.3 Draw the neat sketch of Jaw crusher
- 2.4 Draw a neat sketch of Plate & Frame filter press
- 2.5 Draw a neat sketch of Basket centrifuge
- 2.6 Draw a neat sketch of Rotary drum driers
- 2.7 Draw a neat sketch of Crystallizer

### Chapter-3

- 3.1 Draw the sketch for the production of glacial acetic acid using acetaldehyde
- 3.2 Draw the sketch for the production of para-nitroaniline from Para -nitrochlorobenzene
- 3.3 Draw the sketch for the production of acetone from Iso-propanol
- 3.4 Draw the sketch for the production of Diethyl oxalate from oxalic acid and ethanol
- 3.5 Draw the sketch for the conversion of ethanol to alcohol by azeotropic distillation
- 3.6 Draw the sketch for the manufacture of any fertilizer /any petrochemical product.

### Chapter-4

#### Part-A

- 4.1 Draw the Instrumentation diagram for Reactor temperature control
- 4.2 Draw the Instrumentation diagram for Hot fluid temperature control in heat exchanger
- 4.3 Draw the Instrumentation diagram for Spray drier temperature control
- 4.4 Draw the Instrumentation diagram for Control of mechanically agitated vessel used for gas absorption
- 4.5 Draw the Instrumentation diagram for Distillation column tower pressure control

#### Part-B

- 4.6 Understand the important Equipment layout in Ammonia plant
- 4.7 Understand the important Equipment layout in water treatment plant
- 4.8 Understand the important Equipment layout in sugar manufacturing unit
- 4.9 Understand the important Equipment layout in paper industry
- 4.10 Understand the important Equipment layout in cement plant

#### Part-C

- 4.11 Know the diagram of project layout for phosphoric acid, urea plant, ammonia plant and utilities of DAP plant in fertilizer Industry
- 4.12 Know the diagram of a project layout consisting various units of pulp and paper Industry
- 4.13 Know the diagram of project layout of CDU, FCCU, utilities etc in petroleum refinery
- 4.14 Understand the diagrams of a project layout of Glycerin, vanaspathi, soap of vegetable oil industry.

## COURSE CONTENTS:

### Unit-1: Drawings of Chemical Engineering equipment

Draw the neat sketches of Shell & tube heat exchanger (1-1)- 2-4 Shell & tube heat exchanger - Short tube vertical evaporator - Long tube forced circulation evaporator .

**Unit-2:** Draw the neat sketches of Rotary drum vacuum filter - Bubble cap plate - Jaw crusher- Plate & Frame filter press- Basket centrifuge- Rotary drum driers- Crystallizer.

### Unit-3 Process flow diagrams using process description (Flow sheeting)

Production of glacial acetic acid using acetaldehyde solution- Para-nitro aniline from Para- nitrochlorobenzene.- acetylene from Isopropanol- Diethyl oxalate from oxalic acid and ethanol Conversion of ethanol to alcohol by Azeotropic distillation – fertilizer / a petrochemical product.

### Unit-4: Process instrumentation diagrams of equipments

Reactor temperature control-Hot fluid temperature control in heat exchanger - Spray drier temperature control--Control of mechanically agitated vessel used for gas absorption Distillation column tower pressure control.

### Process equipment layout

Equipment layout in Ammonia plant - water treatment plant - sugar manufacturing unit- paper industry - cement plant

### Plant layouts and location identification

Plant layout for phosphoric acid - urea plant in fertilizer industry - D.A.P plant- pulp and paper industry - petroleum refinery - Vegetable oil industry for vanaspathi.

## REFERENCE BOOKS:

1. Chemical Engineering drawing by KA Ghavane, Nirali publications
2. Chemical Engineering drawing by R.S.Hiremath. Nirali Publications.
3. Introduction to Chemical Engineering by Badger & Bencherio, Mc Graw Hill Publications
4. Unit operation of Chemical Engineering by Mc Cabe and Smith – Mc Graw Hill publications
5. Plant design drawing by Vibrant & Dryden, Mc Graw Hill publications

Course code CHOT-706	Course title : Chemical plant equipment drawing Number of course outcomes:05			No. of periods	
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO4	7	8		>40% Level 3 Highly addressed
PO2	CO2,CO3	27	30		25% to 40% Level 2 Moderately addressed
PO3	CO1	50	56		
PO4					5 to 25% Level 1 Low addressed
PO5	CO5	6	6		
PO6					<5% Not addressed
PO7					

**IPC and RE Lab**

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
CHOT-707	IPC and RE Lab	3	45	40	60

Course title :IPC and RE Lab(CHOT-707)	
<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes
	(ii) To use various basic implements used in general Engineering processes
	(iii) To know the etiquette of working with the fellow workforce
	(iv) To reinforce theoretical concepts by conducting relevant experiments/exercises
<b>Course Outcomes</b>	C01 Demonstrate the skill of planning and organizing experimental set up for a desired purpose.
	C02 Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems.
	C03 Observe various parameters, their variations and graphically represent the same.
	C04 Analyse the experimental results to draw inferences to make recommendations.
	C05 Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group.

**CO-PO/PSO MATRIX**

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CHOT -707.1	3	2	2	2	-	-	-	3	1	2
CHOT -707.2	3	3	3	3	-	-	-	3	3	3
CHOT -707.3	3	3	2	3	-	-	-	3	2	3
CHOT -707.4	3	3	2	3	-	-	-	3	2	3
CHOT -707.5	3	3	3	3	-	-	-	3	3	3
<b>Average</b>	3	2.8	2.4	2.8	-	-	-	3	2.2	2.8

**List of experiments for Instrumentation, Process Control:**

1. Determine the response of a bare thermometer and plot the response curve.
2. Determine the response of a thermometer with thermal well and plot the response curve.
3. Calibrate a given thermocouple and plot a graph between the experimentally obtained thermal EMF and temperature data against the theoretical thermal EMF and temperature data.
4. Obtain the resistance and temperature data for a given resistance thermometer.
5. Calibrate a given pressure gauge by using a Dead weight piston gauge.
6. Determine the response of a single tank liquid level system for a given step input and determine the time constant. Plot the response by using a complete response method and incomplete response method.

7. Determine the response of a second tank of a two tank interacting liquid level system for a given step input and determine the time constants. plot the response by using an incomplete response method.
8. Determine the response of a second tank of a two tank non-interacting liquid level system for a given step input and determine the time constants. plot the response by using an incomplete response method.
9. Determine the response of an air oven incorporated with ON-OFF control system and determine the offset for the system.
10. Determine the valve coefficient CV for a linear type control valve and plot the control valve characteristics.
11. Determine the valve coefficient CV for an Equal percentage type control valve and plot the control valve characteristics.
12. Determine the damping coefficient for critical, over and under damped condition of a second order U-tube manometer.

**List of experiments for Reaction Engineering Lab:**

13. Perform an experiment to calculate the volume required for constant volume batch reactor.
14. Perform an experiment to calculate the volume required for constant volume steady state mixed flow reactor.
15. Perform an experiment to calculate the volume required for constant volume steady state plug flow reactor.

<b>Course Title : Life Skills</b>	<b>Course code : C23- CHOT-708</b> <b>{ Common to all Branches}</b>
<b>Year/ Semester : VII Semester</b>	<b>Total periods : 45</b>
<b>Type of Course : Practical</b>	<b>Max Marks : 100</b> <b>{ Sessional 40 + External 60 }</b>

**Course Objectives:** The students shall

- understand the relevance of life skills in both personal and professional lives
- practise life skills complementarily in life-management to lead a happy and successful life

**Course Outcomes:** The students shall

**CO1:** exhibit right attitude and be adaptable in adverse and diverse situations.

**CO2:** set appropriate goals and achieve them through proper planning, time management and self-motivation

**CO3:** solve diverse real-life and professional problems with critical thinking and creativity for a stress-free life.

**CO4:** be an ideal team player and manifest as a leader.

**Course Delivery:**

Text book: “**Life Skills**” – by State Board of Technical Education and Training, AP

Sl no	Unit	Teaching Hours
1	Attitude	4
2	Adaptability	4
3	Goal Setting	4
4	Motivation	4
5	Time Management	4
6	Critical thinking	4
7	Creativity	4
8	Problem Solving	5
9	Team work	4
10	Leadership	4
11	Stress Management	4
	<b>Total</b>	<b>45</b>

**Course Content:**

**UNIT I: Attitude matters!**

Preparatory activity-Role play; Generating word bank; Types of attitude. Read the passage and answer the related questions, read the story and discuss issues raised; Express opinions on the given topic and fill the grid with relevant words.

**UNIT 2: Adaptability... makes life easy!**

Pair work-Study the given pictures and understand adaptability -read the anecdote and discuss, read the story and answer the questions, role play

**UNIT 3: Goal Setting... *life without a goal is a rudderless boat!***

Short term goals and long term goals-SMART features, observe the pictures and answer questions- matching- read the passage and answer questions-filling the grid.

**UNIT 4: Motivation... *triggers success!***

Types of motivation-difference between motivation and inspiration- matching different personalities with traits - dialogue followed by questions - writing a paragraph based on the passage.

**UNIT 5: Time Management ... *the need of the hour!***

Effective Time Management- Time quadrant - Group task on management of time- Time wasters- fill in the grid, read the story and answer the questions- prioritising tasks.

**UNIT 6: Critical Thinking... *Logic is the key!***

Preparatory activity-read the passage and answer the questions- differentiate between facts and assumptions- components of critical thinking- complete the sets of analogies- choose the odd one out- true or false statements- decide which of the conclusions are logical.

**UNIT 7: Creativity.... *The essential YOU!!***

Definition- Pre-activity-read the anecdote and answer the questions- matching celebrities with their fields of specialisation- think of creative uses of objects- think creatively in the given situations.

**UNIT 8: Problem Solving... *there is always a way out!***

Preparatory activity-read the story and answer the questions- discuss the given problem and come out with three alternative solutions- group activity to select the best solution among available alternatives- discuss the problem and plan to analyse it.

**UNIT 9: Team Work... *Together we are better!***

Advantages of team work- Characteristics of a team player- Activity-Observe the pictures and classify them into two groups- team game - read the story and answer the questions- fill in the grid.

**UNIT 10 : Leadership... *the making of a leader!***

Characteristics of effective leadership- styles of leadership- Activity-read the dialogue and answer the questions- identify the people in the picture and describe them- discuss leadership qualities of the given leaders- filling the grid- read the quotes and write the name of the leader.

**UNIT 11: Stress Management ... *live life to the full !!***

Types of stress- Strategies for Stress Management- Activity-read the passage and answer the questions, read the situation and write a paragraph about how to manage stress.

**Mapping Course Outcomes with Program Outcomes**

P O	1	2	3	4	5	6	7
C O	POs 1 to 5 are applications of Engineering Principles, can't directly be mapped to Life Skills					1,2,3,4	1,2,3,4

### Cos- POs Mapping :

CO	Course Outcome	CO Unit Mapped	PO mapped	Cognitive levels as per Bloom's Taxonomy R/U/Ap/An/Ev/Cr ( Remembering / Understanding/ Applying/Analysing/ Evaluating/ Creating )
CO 1	To exhibit right attitude and be adaptable to adverse and diverse situations	All Lessons ( 1 to 11)	6,7	U/Ap/ An
CO2	To set appropriate goals and achieve them through proper planning, time management and self-motivation	3,4,5	6,7	U/Ap/An
CO3	To solve diverse real-life and professional problems with critical thinking and creativity for a stress-free life	6,7,8,11	6,7	U/Ap/An/ Ev/ Cr.
CO4	To be an ideal team player and manifest as a leader	9,10	6,7	U/Ap/An/ Ev

#### ASSESSMENT

##### C23-CHOT-708: Life Skills

- The assessment for C23-chot- 708 is on par with all other practical subjects comprising 40 marks for Internal Assessment and 60 marks for External examination attaining the final total of 100 Marks.
- The Internal Assessment can be conducted in the form of Assignments in all the 11 Units together, taking the average for 40 marks as suggested below.
- The Assessment sheet provided after each lesson in the workbook can be evaluated as an assignment (A) for 10 marks. In addition to that, another assignment (B) can be conducted for 10 marks in each Unit, awarding total average of 10 marks for each Lesson. Finally the grand total can be averaged for 40 marks as Internal marks.
- The students can present these assignments (B) to the teacher orally and they should also write down their assignments (B) in a separate note book for practice as they are going to speak/present in the external examination and submit the same to the teacher.
- The questions for Assignment styles vary from Lesson to Lesson as different skills are assessed in each Lesson with specific parameters. We can also consider the questions of assignments given after each lesson in the workbook.

- The assignment questions can also be given based on case studies, personal experiences, observations, making inferences/ analysis/ forming opinions, solving puzzles, questions on logical thinking, reasoning, evaluating and writing reviews..etc.

Calculating Internal marks through Assignments				
Name of the student:		PIN:	Branch:	Academic Year:
<b>S</b>	<b>Title of the Unit / Lesson</b>	<b>Assignment A: 10Marks</b>	<b>Assignment B: 10 Marks</b>	<b>Total Marks in each Unit/ Lesson ( Average for 10 Marks)</b>
<b>.</b>		<b>( assessment sheets after each lesson)</b>		
<b>N</b>				
<b>o</b>				
<b>.</b>				
1	Attitude			
2	Adaptability			
3	Goal setting			
4	Motivation			
5	Time Management			
6	Critical Thinking			
7	Creativity			
8	Problem Solving			
9	Team work			
10	Leadership			
11	Stress Management			
	Marks scored	Example: :		90
	Total Number of Assignments			11
	Internal Assessment: Average for 40 Marks	Example: (90/11) X4=32.7		33

#### End Exam Model paper: C23-CHOT-708 : Life Skills Lab

##### Guidelines to prepare the question paper of the Lab End exam for 60 marks:

I. Define any three of the following terms of Life skills: ( Oral ) – 10 Marks

( From Lessons 1 to 11)

II. Recollect and narrate an incident either from your personal experience or observation where you have exhibited/ learned about any one of the following life skills. (oral) – 15 Marks.

( From Lessons 1 to 4: Attitude/ Adaptability/Motivation/Goal setting/

III. Recollect and narrate an incident either from your personal experience or observation where you have exhibited/ learned about any one of the following life skills. (oral) – 15Marks.

( From Lessons 5, 9,10,11 : Time Management, Team Work, Leadership, Stress Management )

IV. A question on problem solving skill, using creativity and critical thinking.

( A case study/a problematic situation should be provided by the examiner and the students should answer it in writing.)

Ex: Analyse the following problematic situation and write down the possible solutions and choose the best among them using your creativity and critical thinking / How do you solve the following problem?– ( written ) 20 Marks

( From Lessons 6,7,8: Creativity/ Critical Thinking/ Problem Solving )

**Note: The questions I to III can be evaluated through Viva Voce and Q.No. IV should be answered by the students in writing. The examiner can adapt the blended mode of evaluation ( oral& written) in view of the more number of students and time constraint.**

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
CHOT-709	Project Work/ Technology of Vegetable Oils and Fats-III Lab	3	45	40	60

<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant Experiments/exercises.	
<b>Course Outcomes</b>	C01	Demonstrate the skill of planning and organizing experimental set up for a desired purpose.
	C02	Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems.
	C03	Observe various parameters, their variations and graphically represent the same.
	C04	Analyse the experimental results to draw inferences to make recommendations.
	C05	Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group.

#### A list of topics suggested for project work:

- Basic design and cost estimating of the following equipment based on the problems suggested by teachers on topics;
  - Heat exchangers and condensers
  - Distillation units
  - Pumping installation
  - Absorber
  - Extractor
  - Water purification system
  - Crystalliser
  - Evaporator
  - Dryer
  - Project works related to pollution control of solid, liquid and gaseous pollutants
- Prepare a detailed project report on the production of a chemical.
- Design and fabricate small prototype Chemical Engineering equipment's useful for doing experiments in the laboratory.
- To conduct a survey of a Petroleum refinery/ Petrochemical / Chemical Industry and produce a report on
  - Various safety methods being followed
  - Various pollution control methods being carried out.
  - Production, planning and control systems
  - Process instrumentation of the plant
  - Maintenance schedule of Chemical Engineering Equipment
  - Material transportation and storage of chemicals

### **List of Experiments to be conducted**

1. Detection of adulteration.
2. Preparation and analysis of fatty acids.
3. Preparation and analysis of esters.
4. Analysis of oils and fatty acids by thin layer and gas liquid chromatography.
5. Analysis of Vanaspathi.
6. Preparation of soap.
7. Analysis of soaps and sulphated oils.
8. Analysis of crude and pure glycerine.
9. Analysis of detergent powders and cakes.

## Unit operations-III Lab

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
CHOT-710	Unit operations-III Lab	3	45	40	60

Course title: Unit operations-III Lab(CHOT-710)	
<b>Course Objectives</b>	(i) To familiarize with the knowledge different materials tools used in general Engineering processes (ii) To use various basic implements used in general Engineering processes (iii) To know the etiquette of working with the fellow workforce (iv) To reinforce theoretical concepts by conducting relevant experiments/exercises
<b>Course Outcomes</b>	C01   Demonstrate the skill of planning and organizing experimental set up for a desired purpose
	C02   Perform precise operations/tasks with Engineering equipment or instrument for investigation of Engineering problems
	C03   Observe various parameters, their variations and graphically represent the same
	C04   Analyse the experimental results to draw inferences to make recommendations
	C05   Practice ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

### List of Experiments:

1. Verification of the various laws of crushing by using Jaw crusher.
2. Verification of various crushing laws using roll crusher.
3. Determination of angle of nip in roll crusher.
4. Determination of critical speed & energy consumed in size reduction using ball mill / rod mill.
5. Perform screen analysis for determination of average size, Specific surface area, Particle population for the given sample.
6. Determination of effectiveness of screening in separating the given material by use of vibrating screens.
7. Perform froth flotation experiment to separate a mixture of coal into two fractions.
8. Verification of Stoke's law by settling a particle in a liquid column
9. Perform batch Sedimentation experiment to calculate the thickener area required using Kynch formula.
10. Determination of the resistance offered by filter cake & filter medium under constant pressure & constant rate of filtration in filtration operation by plate & frame type of filter press.

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