REGULATIONS, CURRICULUM AND SYLLABUS

for

B. TECH

CHEMICAL ENGINEERING

PONDICHERRY UNIVERSITY
PONDICHERRY-605 014
1. Conditions for Admission:

(a) Candidates for admission to the first semester of the 8 semester B.Tech Degree programme should be required to have passed:

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (a mere pass for OBC and SC/ST candidates) in aggregate of subjects - Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / Biology (Botany & Zoology) or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

(b) For Lateral entry in to third semester of the eight semester B.Tech programme:

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in engineering / technology with a minimum of 60 % marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in any B.Sc. course with mathematics as one of the subjects of study with a minimum of 60 % marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in main and ancillary subjects excluding language subjects. The list of diploma programs approved for admission for each of the degree programs is given in Annexure A.

2. Age Limit:

The candidate should not have completed 21 years of age as on 1st July of the academic year under consideration. For Lateral Entry admission to second year of degree programme, candidates should not have completed 24 years as on 1st July of the academic year under consideration. In the case of SC/ST candidates, the age limit is relaxable by 3 years for both the cases.
3. **Duration of Programme:**

The Bachelor of Technology degree programme shall extend over a period of 8 consecutive semesters spread over 4 academic years - two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examinations.

4. **Eligibility for the award of Degree:**

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the faculty of Engineering and has passed the prescribed examinations in all the semesters.

5. **Branches of Study:**

   Branch I  - Civil Engineering  
   Branch II - Mechanical Engineering  
   Branch III - Electronics & Communication Engineering  
   Branch IV - Computer Science & Engineering  
   Branch V  - Electrical & Electronics Engineering  
   Branch VI - Chemical Engineering  
   Branch VII - Electronics & Instrumentation Engineering  
   Branch VIII - Information Technology  
   Branch IX - Instrumentation & Control Engineering  
   Branch X  - Biomedical Engineering  

or any other branches of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

6. **Subjects of Study:**

The subjects of study shall include theory and practical courses as given in the curriculum and shall be in accordance with the prescribed syllabus. The subjects of study for the first two semesters shall be common for all branches of study.

7. **Examinations:**

The theory and practical examinations shall comprise continuous assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April / May).
(a) Theory courses for which there is a written paper of 75 marks in the university examination.

The Internal Assessment marks of 25 has to be distributed as 10 marks each for two class tests and 5 marks for class attendance in the particular subject. The distribution of marks for attendance is as follows.

- 5 marks for 95% and above
- 4 marks for 90% and above but below 95%
- 3 marks for 85% and above but below 90%
- 2 marks for 80% and above but below 85%
- 1 mark for 75% and above but below 80%

In total, three tests are to be conducted and the better two are to be considered for assessment.

(b) Practical courses for which there is a university practical examination of 50 marks:

The internal assessment marks of 50 has to be distributed as 20 marks for the periodic practical works and records submitted thereof, 15 marks for an internal practical examination, 5 marks for an internal viva voce, and 10 marks for class attendance in the particular subject. The distribution of marks is as given below.

- 10 marks for 95% and above
- 8 marks for 90% and above but below 95%
- 6 marks for 85% and above but below 90%
- 4 marks for 80% and above but below 85%
- 2 marks for 75% and above but below 80%

8. Requirement for appearing for University Examination:

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

(i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

   (Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by University along with a medical certificate obtained from a medical officer not below the rank of Asst. Director)

(ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester.
(iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

9. Procedure for completing the course:

A candidate can join the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire course should be completed within 14 consecutive semesters (12 consecutive semesters for students admitted under lateral entry).

10. Passing Minimum:

(i) A candidate shall be declared to have passed the examination in a subject of study only if he/she secures not less than 50% of the total marks (Internal Assessment plus University examination marks) and not less than 40% of the marks in University examination.

(ii) A candidate who has been declared “Failed” in a particular subject may reappear for that subject during the subsequent semesters and secure a pass. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

(a) Applications for revaluation should be filed within 4 weeks from the date of declaration of results or 15 days from the date of receipt of marks card whichever is earlier.

(b) The candidate should have attended all the college examinations as well as university examinations.

(c) If a candidate has failed in more than two papers in the current university examination, his/her representation for revaluation will not be considered.

(d) The request for revaluation must be made in the format prescribed duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.
The internal assessment marks obtained by the candidate shall be considered only in the first attempt for theory subjects alone. For the subsequent attempts, University examination marks will be made up to the total marks. Further the University examination marks obtained in the latest attempt shall alone remain valid in total suppression of the University examination marks obtained by the candidate in earlier attempts.

11 Award of Letter Grades:

The assessment of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded as per the range of total marks (out of 100) obtained by the candidate, as detailed below:

<table>
<thead>
<tr>
<th>Range of Total Marks</th>
<th>Letter</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 to 100</td>
<td>S</td>
<td>10</td>
</tr>
<tr>
<td>80 to 89</td>
<td>A</td>
<td>9</td>
</tr>
<tr>
<td>70 to 79</td>
<td>B</td>
<td>8</td>
</tr>
<tr>
<td>60 to 69</td>
<td>C</td>
<td>7</td>
</tr>
<tr>
<td>55 to 59</td>
<td>D</td>
<td>6</td>
</tr>
<tr>
<td>50 to 54</td>
<td>E</td>
<td>5</td>
</tr>
<tr>
<td>0 to 49</td>
<td>F</td>
<td>0</td>
</tr>
<tr>
<td>Incomplete</td>
<td>FA</td>
<td></td>
</tr>
</tbody>
</table>

‘F’ denotes failure in the course. ‘FA’ denotes absent / detained as per clause 8.

After results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

(a) The college in which the candidate has studied.

(b) The list of courses enrolled during the semester and the grades scored.

(c) The Grade Point Average (GPA) for the semester and The Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.
(d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding grades points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses

\[ GPA = \frac{\text{Sum of } (C \times GP)}{\text{Sum of } C} \]

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA.

The conversion of CGPA into percentage marks is as given below

\[ \% \text{ Marks} = (CGPA - 0.5) \times 10 \]

12 Award of Class and Rank:

(i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

(ii) A candidate who qualifies for the award of the degree passing in all subjects pertaining to semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in FIRST CLASS with DISTINCTION.

(iii) A candidate who qualifies for the award of the degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in FIRST CLASS.

(iv) All other candidates who qualify for the award of degree shall be declared to have passed the examination in SECOND CLASS.

(v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from 1\text{st} to 8\text{th} semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1\text{st} to 8\text{th} semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.
13. **Provision for withdrawal:**

A candidate may, for valid reasons, and on the recommendation of the Head of the Institution be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded DISTINCTION whereas they are not eligible to be awarded a rank.

14. **Discontinuation of Course:**

If a candidate wishes to temporarily discontinue the course for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

15. **Revision of Regulations and Curriculum:**

The University may from time to time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.
### ANNEXURE – A

<table>
<thead>
<tr>
<th>B.Tech courses in which admission is sought</th>
<th>Diploma courses eligible for admission</th>
</tr>
</thead>
</table>
| Civil Engineering                           | Civil Engineering  
Civil and Rural  
Engineering Architectural  
Assistantship Architecture  
Agricultural Engineering                       |
| Mechanical Engineering                      | Mechanical Engineering  
Automobile Engineering  
Agricultural Engineering  
Mechanical and Rural  
Engineering Refrigeration and Air-conditioning Agricultural Engineering  
Engineering & Farm Equipment Technology  
Metallurgy  
Production Engineering  
Machine Design & Drafting  
Machine tool maintenance and Repairs  
Printing Technology / Engineering Textile Engineering / Technology Tool Engineering |
| Electrical and Electronics Engineering      | Electrical Engineering  
Electrical and Electronics Engineering  
Electronics and Instrumentation Engineering  
Electronics Engineering  
Medical Electronics  
Instrumentation and Control Engineering  
Applied Electronics |
| Chemical Engineering                        | Chemical Engineering  
Chemical Technology  
Petrochemical Technology Petroleum  
Engineering Ceramic Technology  
Plastic Engineering  
Paper & Pulp Technology  
Polymer Technology |
| Information Technology                      | Computer Science and Engineering  
Computer Technology  
Electrical and Electronics Engineering  
Electronics & Communication Engineering  
Electronics & Instrumentation Engineering  
Instrumentation Engineering / Instrumentation Engineering / Technology |
| Computer Science & Engineering              |                                                                                                       |
# CURRICULUM

## B.TECH (CHEMICAL ENGINEERING)

(With effect from Academic year 2009 – 10)

## I Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>Subjects</th>
<th>Periods</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td>Cr IA UE TM</td>
</tr>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>T101</td>
<td>Mathematics I</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>2</td>
<td>T102</td>
<td>Physics</td>
<td>4 - - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>3</td>
<td>T103</td>
<td>Chemistry</td>
<td>4 - - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>4</td>
<td>T110</td>
<td>Basic Civil &amp; Mechanical Engineering</td>
<td>4 - - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>5</td>
<td>T111</td>
<td>Engineering Mechanics</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>6</td>
<td>T112</td>
<td>Communicative English</td>
<td>4 - - 3</td>
<td>25 75 100</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>P104</td>
<td>Physics Lab</td>
<td>- - 3</td>
<td>50 50 100</td>
</tr>
<tr>
<td>2</td>
<td>P105</td>
<td>Chemistry Lab</td>
<td>- - 3</td>
<td>50 50 100</td>
</tr>
<tr>
<td>3</td>
<td>P106</td>
<td>Workshop Practice</td>
<td>- - 3</td>
<td>50 50 100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>22 2 9 29</td>
<td>30 60 0 900</td>
</tr>
</tbody>
</table>

## II Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>Subjects</th>
<th>Periods</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td>Cr IA UE TM</td>
</tr>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>T107</td>
<td>Mathematics II</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>2</td>
<td>T108</td>
<td>Material Science</td>
<td>4 - - 3</td>
<td>25 75 100</td>
</tr>
<tr>
<td>3</td>
<td>T109</td>
<td>Environmental Science</td>
<td>4 - - 3</td>
<td>25 75 100</td>
</tr>
<tr>
<td>4</td>
<td>T104</td>
<td>Basic Electrical and Electronics Engineering</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>5</td>
<td>T105</td>
<td>Engineering Thermodynamics</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>6</td>
<td>T106</td>
<td>Computer Programming</td>
<td>3 1 - 3</td>
<td>25 75 100</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>P101</td>
<td>Computer Programming Lab</td>
<td>- - 3</td>
<td>50 50 100</td>
</tr>
<tr>
<td>2</td>
<td>P102</td>
<td>Engineering Graphics</td>
<td>2 - 3 2</td>
<td>50 50 100</td>
</tr>
<tr>
<td>3</td>
<td>P103</td>
<td>Basic Electrical and Electronics Lab</td>
<td>- - 3</td>
<td>50 50 100</td>
</tr>
<tr>
<td>4</td>
<td>P107</td>
<td>NSS/ NCC *</td>
<td>- - -</td>
<td>- - -</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>22 4 9 27</td>
<td>30 60 0 900</td>
</tr>
</tbody>
</table>

* To be completed in I and II semesters, under Pass/Fail option only and not counted for CGPA calculation.
### III Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub Code</th>
<th>Subjects</th>
<th>Peroids</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td>Cr IA UE TM</td>
</tr>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MA T31</td>
<td>Mathematics III</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>2</td>
<td>CH T32</td>
<td>Physical Chemistry</td>
<td>4 - - 3</td>
<td>25 75 100</td>
</tr>
<tr>
<td>3</td>
<td>CH T33</td>
<td>Strength of Materials</td>
<td>4 - - 3</td>
<td>25 75 100</td>
</tr>
<tr>
<td>4</td>
<td>CH T34</td>
<td>Electrical and Electronics Engineering</td>
<td>4 - - 3</td>
<td>25 75 100</td>
</tr>
<tr>
<td>5</td>
<td>CH T35</td>
<td>Process Calculations</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>6</td>
<td>CH T36</td>
<td>Momentum Transfer</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH P31</td>
<td>Physical Chemistry Lab</td>
<td>- - 3 2</td>
<td>50 50 100</td>
</tr>
<tr>
<td>2</td>
<td>CH P32</td>
<td>Strength of Materials Lab</td>
<td>- - 3 2</td>
<td>50 50 100</td>
</tr>
<tr>
<td>3</td>
<td>CH P33</td>
<td>Electrical and Electronics Engg. Lab</td>
<td>- - 3 2</td>
<td>50 50 100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>21 3 9 27</td>
<td>300 60 900</td>
</tr>
</tbody>
</table>

### IV Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub Code</th>
<th>Subjects</th>
<th>Peroids</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td>Cr IA UE TM</td>
</tr>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MA T41</td>
<td>Mathematics IV</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>2</td>
<td>CH T42</td>
<td>Organic Chemistry</td>
<td>4 - - 3</td>
<td>25 75 100</td>
</tr>
<tr>
<td>3</td>
<td>CH T43</td>
<td>Chemical Engineering Thermodynamics</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>4</td>
<td>CH T44</td>
<td>Process Heat Transfer</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>5</td>
<td>CH T45</td>
<td>Mass Transfer I</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td>6</td>
<td>CH T46</td>
<td>Mechanical Operations</td>
<td>3 1 - 4</td>
<td>25 75 100</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH P41</td>
<td>Organic Chemistry lab</td>
<td>- - 3 2</td>
<td>50 50 100</td>
</tr>
<tr>
<td>2</td>
<td>CH P42</td>
<td>Momentum Transfer lab</td>
<td>- - 3 2</td>
<td>50 50 100</td>
</tr>
<tr>
<td>3</td>
<td>CH P43</td>
<td>Chemical Engineering Drawing</td>
<td>- - 3 2</td>
<td>50 50 100</td>
</tr>
<tr>
<td>4</td>
<td>SP P44</td>
<td>Physical Education*</td>
<td>- - -</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>19 5 9 29</td>
<td>30 60 900</td>
</tr>
</tbody>
</table>

* Pass/ Fail option only and not counted for CGPA calculation
## V Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>Subjects</th>
<th>Subjects Code</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Cr</th>
<th>IA</th>
<th>UE</th>
<th>TM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH T51</td>
<td>Process Instrumentation</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CH T52</td>
<td>Mass Transfer II</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CH T53</td>
<td>Chemical Reaction Engineering - I</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CH T54</td>
<td>Energy Technology and Management</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>CH T55</td>
<td>Chemical Process Industries</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CH T56</td>
<td>Chemical Engineering Practice</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH P51</td>
<td>Mass Transfer Lab I</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CH P52</td>
<td>Heat Transfer Lab</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CH P53</td>
<td>Mechanical Operations Lab</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>HS P54</td>
<td>General Proficiency I</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>0</td>
<td>-</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## VI Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>Subjects</th>
<th>Subjects Code</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Cr</th>
<th>IA</th>
<th>UE</th>
<th>TM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MA T61</td>
<td>Numerical Methods and Special Functions</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CH T62</td>
<td>Mass Transfer III</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CH T63</td>
<td>Chemical Reaction Engineering - II</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CH T64</td>
<td>Process Design of Chemical Equipments</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>--------</td>
<td>Elective I</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>--------</td>
<td>Elective II</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH P61</td>
<td>Mass Transfer Lab II</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CH P62</td>
<td>Chemical Reaction Engg. Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CH P63</td>
<td>Technical Analysis Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>HS P64</td>
<td>General Proficiency II</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>0</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### VII Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>Subjects</th>
<th>Periods</th>
<th>Cr</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH T71</td>
<td>Process Dynamics and Control</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>CH T72</td>
<td>Mechanical Design of Chemical Equipments</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>CH T73</td>
<td>Industrial Management</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>---------</td>
<td>Elective III</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>---------</td>
<td>Elective IV</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH P71</td>
<td>Computer aided design lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CH PW7</td>
<td>Project Work (Phase I)</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CH P72</td>
<td>Seminar</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CH P73</td>
<td>Industrial Visit / Training</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>17</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

### VIII Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>Subjects</th>
<th>Periods</th>
<th>Cr</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH T81</td>
<td>Transport Phenomena</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>CH T82</td>
<td>Process Engineering Economics</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>CH T83</td>
<td>Pollution Control in Process Industries</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>---------</td>
<td>Elective V</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>---------</td>
<td>Elective VI</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CH P81</td>
<td>Process Dynamics and Control Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CH PW8</td>
<td>Project Work (Phase II)</td>
<td>-</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>CH P82</td>
<td>Comprehensive Viva Voce</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>CH P83</td>
<td>Professional Ethical Practice</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>17</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

Total : 220 credits
## List of Electives

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>A. Electives I &amp; II (VI Semester)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CH E61</td>
<td>Petroleum Refinery Engineering</td>
</tr>
<tr>
<td>2</td>
<td>CH E62</td>
<td>Bio Chemical Engineering</td>
</tr>
<tr>
<td>3</td>
<td>CH E63</td>
<td>Nano Technology</td>
</tr>
<tr>
<td>4</td>
<td>CH E64</td>
<td>Drugs and Pharmaceutical Technology</td>
</tr>
<tr>
<td>5</td>
<td>CH E65</td>
<td>Nuclear Engineering</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Elective III &amp; IV (VII Semester)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Electives V &amp; VI (VIII Semester)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>15</td>
</tr>
</tbody>
</table>
UNIT I
**Calculus:** Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

UNIT II
**Multiple Integrals and Applications:** Multiple integrals – change of order of integration. Applications: Areas (double integration) and volumes by triple integration (Cartesian and polar) – mass and center of mass (constant and variable densities).

UNIT III
**Analytical Solid Geometry:** Directional cosines and ratios – angle between two lines – the equation of plane - equations to a straight line and shortest distance between two skew lines.

UNIT IV
**Differential Equations:** Exact equations, First order linear equations, Bernoulli’s equation, orthogonal trajectories, growth and decay, geometrical applications and electric circuits. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut’s type.

UNIT V
**Differential Equations (Higher order):** Linear differential equations of higher order – with constant coefficients, the operator D - Euler’s linear equation of higher order with variable coefficients - simultaneous linear differential equations – solution by variation of parameters method – simple applications to electric circuits.

**Text Book**

**Reference Book**
UNIT I

Acoustics and NDT: Ultrasonics - Ultrasonic Waves Productions (Piezoelectric and Magnetostriction method) - Detections (Acoustic Grating)

Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine’s formula for Reverberation Time. NDT applications - Pulse Echo Method - Liquid Penetrant Method

UNIT II


UNIT III


Fiber Optics - Principle and Propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fibers (material, refractive index, mode)

UNIT IV


UNIT V

Nuclear Energy Source: General Properties of Nucleus (Size, Mass, Density, Charge) - Mass Defect - Binding Energy - Disintegration in fission - Nuclear Fusion (p-p and C-N cycle) - Nuclear Reactor: Materials Used in Nuclear Reactors - PWR - BWR - FBTR
Text Books
2. V. Rajendran, Engineering Physics, TMH, New Delhi 2008.

Reference Books
UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Phase Rule: Definition and derivation of phase rule. Application to one component system - water and sulphur systems. Thermal analysis, condensed phase rule. Two component alloy systems - Pb-Ag, Cu-Ni and Mg-Zn systems.

Text books

Reference Books
T 110 BASIC CIVIL AND MECHANICAL ENGINEERING

PART-A CIVIL ENGINEERING

UNIT I
Buildings, Building Materials: Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space index-construction materials-stone, brick, cement, cement-mortar, concrete, steel- their properties and uses.

UNIT II

UNIT III

PART - B MECHANICAL ENGINEERING

UNIT IV
Internal and External Combustion Systems: Working principles of IC engines – Classification – Diesel and petrol engines: two stroke and four stroke engines. Steam generators(Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories.


UNIT V

Casting : Green and dry sand moulding processes for ferrous and non-ferrous metals – applications.

UNIT VI
Metal Joining: Elements of arc and gas welding, brazing and soldering – Bolted joint types – Adhesive Bonding; classification of adhesives – applications. Sheet Metal Processing- Punching, blanking, shearing, bending, and deep drawing processes; descriptions and applications.
Text Books:

Reference Books
UNIT I
Fundamental of Mechanics: Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon’s theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, concept of free body diagrams, applications in solving the problems on static equilibrium of bodies.

UNIT II
Plane Trusses: Degrees of freedom, Types of supports and reactions, Types of loads, Analysis of Trusses-method of joints, method of sections
Friction: Introduction, Static dry friction, simple contact friction problems, ladders, wedges, screws and belt friction.

UNIT III
Properties of Surfaces: Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

UNIT IV

UNIT V
Kinematics and Kinetics of Rigid bodies: Plane motion, Absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum

Text Books

Reference Books
T112 COMMUNICATIVE ENGLISH

UNIT I
Basic Communication Theory: Importance of Communication - stages of communication, modes of communication - barriers to communication - strategies for effective communication - Listening: Importance, types, barriers - Developing effective listening skills.

UNIT II
Comprehension and Analysis: Comprehension of technical and non-technical material - Skimming, scanning, inferring-Note making and extension of vocabulary, predicting and responding to context- Intensive Reading and Reviewing

UNIT III
Writing: Effective sentences, cohesive writing, clarity and conciseness in writing - Introduction to Technical Writing - Better paragraphs, Definitions, Practice in Summary Writing - Four modes of writing - Use of dictionaries, indices, library references - making bibliographical entries with regard to sources from books, journals, internet etc.

UNIT IV

UNIT V

Reference Books:
P104 PHYSICS LABORATORY

List of experiments (Any 10 Experiments)

1. Thermal conductivity – Lee’s DISC
2. Thermal conductivity - Radial flow
3. Spectrometer – Prism or Hollow prism
4. Spectrometer – Transmission grating
5. Spectrometer - Ordinary & Extraordinary rays
6. Newton’s rings
7. Air – wedge
8. Half shade polarimeter – Determination of specific rotatory power
9. Jolly’s experiment – determination of α
10. Magnetism: i – h curve
11. Field along the axis of coil carrying current
12. Vibration magnetometer – calculation of magnetic moment & pole strength
13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
14. Determination of optical absorption coefficient of materials using laser
15. Determination of numerical aperture of an optical fiber

P105 CHEMISTRY LABORATORY

List of experiments (Any 10 Experiments)

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
10. Estimation of copper in copper sulphate solution.
11. Estimation of calcium by permanganometry.
12. Estimation of iron by colorimetry.

Demonstration Experiments( Any two of the following )

1. Determination of COD of water sample.
2. Determination of lead by conductometry.
3. Percentage composition of sugar solution by viscometry.
P106 WORKSHOP PRACTICE

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Trade</th>
<th>List of Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fitting</td>
<td>Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle.</td>
</tr>
<tr>
<td>2.</td>
<td>Welding</td>
<td>Study of arc and gas welding equipment and tools – Edge preparation – Exercises on lap joint and V Butt joints – Demonstration of gas welding</td>
</tr>
<tr>
<td>4.</td>
<td>Carpentry</td>
<td>Study of tools and Machineries – Exercises on Lap joints and Mortise joints</td>
</tr>
</tbody>
</table>

LIST OF EXERCISES

I Fitting

1. Study of tools and Machineries
2. Symmetric fitting
3. Acute angle fitting

II Welding

1. Study of arc and gas welding equipment and tools
2. Simple lap welding (Arc)
3. Single V butt welding (Arc)

III Sheet metal work

1. Study of tools and machineries
2. Funnel
3. Waste collection tray

IV Carpentry

1. Study of tools and machineries
2. Half lap joint
3. Corner mortise joint.
T107 MATHEMATICS – II

UNIT I

Algebra: Binomial, exponential and logarithmic series (without proof) – problems on summation, approximation and coefficients.

UNIT II


UNIT III

Trigonometry: Expansions for \( \sin^n \theta, \cos^n \theta, \tan^n \theta, \sin (n\theta), \cos(n\theta), \tan(n\theta) \). Exponential, circular, hyperbolic, inverse hyperbolic and logarithmic functions of a complex variable – separation of real and imaginary parts.

UNIT IV

Vector Analysis: Scalar fields and Vector fields – Gradient, Divergence and Curl – their properties and relations – Gauss and Stokes theorems (without proof), simple problems for their verification.

UNIT V


Text Books:

Reference Book:
T108 MATERIAL SCIENCE

UNIT I
Crystal Structure and Defects: Crystal Systems – Bravais Lattices – Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices for a cubic crystal– Powder X Ray Diffraction Method - Lattice defects – Qualitative ideas of point, line, surface and volume defects

UNIT II

UNIT III

UNIT IV

UNIT V
Advanced Materials: Liquid Crystals – Types – Application as Display Devices – Metallic Glasses – Nanomaterials (one, Two & three Dimensional) – Physical Properties and Applications of Carbon Nano Tubes

Text books:

Reference Books:
UNIT I

UNIT II

UNIT III
Air Pollution: Air pollution-sources of air pollution. Sources, effects and control measures of oxides of nitrogen, oxides of sulphur, oxides of carbon, hydrocarbon, chlorofluorocarbons and particulates. Green house effect-causes and effects on global climate and consequences. Ozone depletion-causes, mechanism and effect on the environment. Smog-sulfurous and photochemical smog-effect on the environment. Acid rain-theory of acid rain and effects.

UNIT IV
Water Pollution and Solid Waste Management Sources: effects and control measures of –water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and radioactive pollution. Solid waste management – causes, effect and control measures of urban and industrial wastes.
UNIT V
Human population and the environment-population growth, variation among nations, population explosion, role of information technology in environment and human health.

Text Books:


Reference Books:

2. G. S. Sodhi, Fundamental concepts of environmental chemistry, Narosa publishing house, New Delhi
T104 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

PART A - ELECTRICAL

UNIT - I

UNIT – II
Node and mesh methods of analysis of DC circuits and simple AC circuits - Introduction to three phase circuits, Introduction to three phase system - phase and line parameters – relations, power measurement – voltmeter and ammeter method, two and three wattmeter methods.

UNIT – III
Principle of DC generator and motor - Transformer, synchronous generator, induction motor (single phase). Sources for electrical energy conversion-thermal and hydraulic plant (Block diagram approach only). Components of AC transmission and distributions systems – line diagram.

PART B – ELECTRONICS

UNIT – IV
Half-wave rectifier and Full-wave rectifier- filters - Amplifiers-common emitter and common collector amplifiers- Hartley oscillator and RC phase shift oscillator. Transducers – Resistance temperature detector (RTD) – Linear variable differential transformer (LVDT) - Strain gauge – Piezo electric transducer.

UNIT – V

UNIT – VI
Model of communication system – Analog and digital – Wired and wireless channel. Block diagram of various communication systems – Microwave, satellite, optical fiber and cellular mobile system. Network model – LAN, MAN and WAN – Circuit and packet switching – Overview of ISDN.
Text Books

Reference Books
2. J.B. Gupta, A Course in Electrical Power, Katson Publishing House, New Delhi,
T105 THERMODYNAMICS

UNIT I
Basic Concepts and Definitions: Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics.

UNIT II
First Law of Thermodynamics: The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases

UNIT III

UNIT IV
Gas Power Cycles: Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Bryton cycles and their efficiencies

UNIT V
Refrigeration Cycles and Systems: Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system (only theory)- Liquifaction and solidification of gases

Text Books:

Reference Books :
T106 COMPUTER PROGRAMMING

UNIT - I

UNIT - II
Problem solving techniques – Program – Program development cycle – Algorithm design – Flowchart - Pseudo code. Introduction to C – C tokens – data types – Operators and expressions – I/O functions

UNIT - III
Decision making statements – branching and looping – arrays – multidimensional arrays – Functions – Recursion – Passing array to functions Storage classes – Strings – String library functions

UNIT - IV
Structures – Arrays and Structures – nested structures – passing structures to functions – user defined data types– Union Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and structures

UNIT - V
Files – operations on a file – Random access to files – command line arguments Introduction to preprocessor – Macro substitution directives – File inclusion directives - conditional compilation directives – Miscellaneous directives

Text Books

Reference Books
List of Exercises

OS Commands, Word Processor and Spreadsheets

1. Study of OS commands-Compilation and execution of simple C programs
2. Use of mail merge in word processor
3. Use of spreadsheet to create Charts(XY, Bar, Pie) and apply the formulae wherever necessary C Programming (Flowcharts and algorithms are essential for the programming exercises)
4. Greatest of three numbers using conditional operator and if statement
5. Read two numbers and swap those two numbers using temporary variable and without using temporary variable.
6. Solve quadratic equation for different sets of inputs.
7. Use of Switch….Case statements
8. Generation of prime and Fibonacci series
9. Evaluate the COSINE series using for, while and do..while loops
10. Matrix operations
    1. Addition
    2. Transpose
    3. Multiplication
11. Evaluate the sin(x) series using functions and recursive functions
12. Read a string and find solution to remove the duplicates of a given string from the given sentence
Create an array of structures for a list of items with the following details

<table>
<thead>
<tr>
<th>Item_Code</th>
<th>Item_Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>Paste – Colgate</td>
</tr>
<tr>
<td>102</td>
<td>Paste – Pepsodent</td>
</tr>
<tr>
<td>102</td>
<td>Paste – Close-up</td>
</tr>
<tr>
<td>101</td>
<td>Soap: Cinthol</td>
</tr>
<tr>
<td>101</td>
<td>Soap: Lux</td>
</tr>
<tr>
<td>101</td>
<td>Soap: Hamam</td>
</tr>
<tr>
<td>101</td>
<td>Soap: Dove</td>
</tr>
</tbody>
</table>

Arrange the set of items in ascending order of its Item_Code and descending order of its Item_Name as given below

<table>
<thead>
<tr>
<th>Item_Code</th>
<th>Item_Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Soap: Lux</td>
</tr>
<tr>
<td>101</td>
<td>Soap: Hamam</td>
</tr>
<tr>
<td>101</td>
<td>Soap: Dove</td>
</tr>
<tr>
<td>101</td>
<td>Soap: Cinthol</td>
</tr>
<tr>
<td>102</td>
<td>Paste – Pepsodent</td>
</tr>
<tr>
<td>102</td>
<td>Paste – Colgate</td>
</tr>
<tr>
<td>102</td>
<td>Paste – Close-up</td>
</tr>
</tbody>
</table>

14. Use of Structure to define a user defined data types, input the data and write the data into the file
15. Use of pointers and array of pointers
16. Functions with static data types
17. Write command line program to implement the following DOS commands using files
   - Del
   - Copy
P102 ENGINEERING GRAPHICS

Unit 0

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning

Unit I

Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and Planes

Unit II

Projection of Solids and Sections of Solids.

Unit III

Development of surfaces - Intersection of surfaces (cylinder-cylinder, cylinder-cone)

Unit IV

Isometric projections and Orthographic projections

Unit V

Computer Aided Drafting: Introduction to Computer Aided Drafting hardware - Overview of application software - 2D drafting commands (Auto CAD) for simple shapes - Dimensioning.

Text Books

Reference Books
P103 BASIC ELECTRICAL AND ELECTRONICS LAB

ELECTRICAL LAB
1. Study of tools and accessories
2. Study of joints
3. Staircase wiring
4. Doctor’s room wiring
5. Godown wiring
6. Tube Light and Fan connection
7. Lamp controlled from three different places-wiring

ELECTRONICS LAB
1. Rectifiers
   Construction of half wave and full wave rectifiers with and without filters – Calculation of ripple factors.

2. Frequency Response of RC Coupled Amplifiers
   Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.

3. Verification of Kirchoff’s Voltage and Current Laws
   Determine the voltage and current in given circuits using Kirchoff”s laws theoretically and verify the laws experimentally.

4. Study of Logic Gates
   1. Verification of Demorgan’s theorems
   2. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops - JK, RS, T and D
   3. Implementation of digital functions using logic gates

5. Study of CRO
   1. Measurement of AC and DC voltages
   2. Frequency and phase measurements (using Lissajou’s figures)

6. Study of Transducers
   1. Displacement and load measurements with transducers
   2. Temperature measurement with thermocouple
P107 NCC / NSS

NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 45 hours.
4. The above activities will be monitored by the respective faculty incharge and the First Year Coordinator.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behaviour. If a candidate Fails, he/she has to repeat the course in the subsequent years
6. Pass in this course is mandatory for the award of degree.
UNIT-I:

UNIT-II:
Function of a complex variable: Functions of complex variable - continuity, derivatives and analytical function, Cauchy - Riemann equations sufficient conditions for analytically - Harmonic and Orthogonal properties of the real and imaginary parts – conformal mapping - Bilinear transformations.

UNIT-III:
Complex Integration: Cauchy’s integral formula - Taylor’s and Laurent series. Residue theorem, contour integration rounds the unit circle and semi circle.

UNIT-IV:

UNIT-V:
Fourier Transform: Definition and properties. Fourier Integral, the limit of Fourier series, Inverse Fourier Transform.

Text Books:

Reference Books:

UNIT-I:
Liquid state – Equation of state of liquids, structure of liquids – vacancy model, vapour pressure, heat of vapourisation, Trouton’s rule.

UNIT-II:

UNIT – III:

UNIT – IV:
Chemical kinetics – effect of temperature on reaction rates, Arrhenius equation, Energy of activation theories of reaction rates- Collision theory, absolute reaction rate theory and Lindebergs theory of unimolecular reaction.

UNIT- V:
Text books:


Reference Books:

UNIT - I:
Concept of mechanics of deformable bodies-Behaviour of mild steel under
tension-stress and strain - elastic constants and their relationships-equivalent
modulus-factor of safety-Principal planes and principal stresses (two
dimensional) - Mohr’s circle representation.

UNIT - II:
Bending moment and shear force diagrams for cantilever, simply supported
and over hanging beams-Bending of beams: theory of simple bending-neutral
axis-stress distribution across a section due to bending moment and shear force-
thin cylindrical shells.

UNIT - III:
Deflection of beams: Equation of deflection curve-slope and deflection by
double integration method-Moment area method -conjugate beam method.

UNIT - IV:
Torsion: Torsion of solid and hollow circular shafts-combined beind and
torision-springs:Leaf springs-closed and open coiled helical springs.

UNIT - V:
Columns:Thoery of columns-combined beinding and direct stresses-concept of
structural stability-long columns:Euler’s theory of buckling load-Rankine-
Gardon formula-Jhonson’s formula-column with initial curvature.

Text Books:

Reference Books:
UNIT-I:

UNIT-II:

UNIT-III:
Thevenin , Norton , Maximum power transfer ,Super position theorems for DC circuits only. Resonance –Parallel resonance-Introduction to 3-phase system –Two watt meter method of power measurement.

UNIT-IV:
Analog Electronics:Operational Amplifiers-Ideal Characteristics-741 IC details-Inverting and non-Inverting amplifier –scale changers-Inverter –Instrumentation amplifier-CMRR-Block diagram of 555 ic-Astable,monostable multivibraytors using 555IC-Different types of ADC.

UNIT-V:
Introduction to Boolean Algebra-combination circuits-Simplification –Karnaugh map-NAND-NOR implementation –counters –UPDOWN counters-Ring counters-Multiplexes –De multiplexes-Digital to Analog convention Technique

Text Books:

Reference Books:
UNIT-I:
Introduction to Chemical engineering calculations, units and dimensions, mole and molecular weight, properties of gases, vapors, liquids, solutions and solids, gas laws, partial pressures, vapor pressures, saturation and equilibria, Raoult's law, partial saturation and humidity.

UNIT-II:
Material balances without chemical reactions, stoichiometry and unit operations-distillation, absorption, stripping, extraction, leaching, crystallization, drying, and psychrometry. Recycle, purge and bypass calculations.

UNIT-III:
Material balances involving chemical reactions, simple oxidation reaction, calculations involving combustion of gaseous, liquid and solid fuels. Recycle, purge and bypass calculations.
Introduction to unsteady state material balances.

UNIT-IV:
Energy balance - heat capacity and calculation of enthalpy changes, Enthalpy changes for phase transitions, evaporation, clausius - clapeyron equation,

UNIT-V:
Energy balances with chemical reaction - heat of reaction and adiabatic flame temperature calculations.

Text Books:


Reference Books:

UNIT-I:
Fluid Statics - Pressure concept, Hydrostatic equilibrium, measurement of fluid pressure, manometers, buoyancy.
Fluid Dynamics - shear rate, shear stress, viscosity, newtonian and non-newtonian fluids, laminar and turbulent flow, Reynolds number and transition from laminar to turbulent flow.
Dimensional Analysis

UNIT-II:
Basic equations of fluid flow, mass and momentum balance equations, Bernoulli’s equation, Laminar flow of incompressible fluids in pipes, couette flow, flow through parallel plates, flow through noncircular conduits, Hagen - Poiseulle equation, Correction of Bernoulli’s equation for fluid friction, friction factor, friction loss from sudden expansion or contraction of cross section.
Transportation and metering of fluid flow - Orificemeter, venturimeter, Rotameter, Wiers and notches, pumps and compressors, performance and characteristics of reciprocating, centrifugal and airlift pumps.

UNIT-III:
Turbulent flow - Velocity fluctuations in turbulent flow, statistical nature of turbulence, Reynold’s stresses, empirical theories, eddy viscosity, Prandtl’s mixing length, Velocity distribution for turbulent flow, relationship between friction factor and reynold’s number, Reynold’s number and friction factor for non-newtonian fluids.

UNIT-IV:
Flow past immersed bodies - Boundary layer, laminar and turbulent boundary layer, drag and drag coefficient, Stokes law and terminal settling velocity.
Flow of fluids through a bed of solids - Darcy’s law, Ergun’s equation, Fluidisation, Slurry and pneumatic transport.

UNIT-V:
Flow of Compressible fluids - sonic velocity, mach number, flow through variable area conduits, equations for isentropic flow, equations for adiabatic frictional flow, equations for isothermal frictional flow.
Text Books:


Reference Books:

List of Experiments:

1. Study of simple eutectic formed by naphthalene-biphenyl system.
2. Rate constant of hydrolysis of ethyl acetate by an acid.
3. Partition coefficient of iodine between carbon tetra chloride and water.
4. Partition coefficient of benzoic acid between benzene and water.
5. Determination of molecular weight from depression of freezing point.
6. Adsorption of acetic acid in charcoal – Freundlich adsorption isotherm.
7. Critical solution temperature of phenol – water system.
8. Conductometry titration – mixture of hydrochloric acid and acetic acid vs sodium hydroxide.
10. Determination of lead by conductometry titration.
List of Experiments:

I  Test on Metals (Ferrous and Non-ferrous)

1.  Tension tests: To find Yield stress, Ultimate stress, Percentage elongation and reduction of area of cross-section, Young’s Modulus and Barba’s constants

2.  Double shear test: 180° bend test

3.  Hardness test: Vickesrs, Brinell and Rockwell

4.  Torsion test: Wires and Rods

5.  Impact test: Charpy and Izo

6.  Ductility test: Erichsen cupping test

7.  Fatigue test (Demonstration)

II  Test on Plastics

III  Test on Springs
List of Experiments:

1. Performance characteristics of transformers through OC and SC test.
2. Load test on single-phase transformer.
3. Load test on DC shunt motor.
4. Load test on single phase IM.
5. OCC of DC generator.
7. Verification of logic gates.
8. Verification of Thevinin and Norton theorem.
9. Verification of superposition theorem.
10. Series and parallel resonance.
UNIT-I:

UNIT-II:

UNIT-III:
Fourier series solution for one dimensional heat flow equation – Fourier series solutions for two dimensional heat flow equations under steady state conditions (Cartesians and polar forms)

UNIT-IV:
Applied Statistics: Curve fitting by the method of least squares-fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNIT-V:
Small Samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances – Chi-square test for goodness of fit and independence of attributes.

Text Books:

Reference Books:
UNIT-I:

UNIT-II:

UNIT- III:

UNIT- IV:

UNIT - V:
Heterocyclic compounds- Preparation and properties of furan, thiophene, pyrrole and pyridine. Dyes – colour and constitution, Classification of dyes by structure, preparation of azo dyes – methyl orange, congo red, triaryl amine dyes – malachite green, phenolphthalein, fluorescein, Anthraquinone dyes – alizarin and indigo dye. Classification of dyes based on application.
Text Books:

Reference Books:
UNIT-I:
The behavior of fluids - PVT properties of fluids, equations of state, ideal and nonideal gas, the and compressibility factor, critical properties, generalised equations of state.

UNIT-II:
First law of thermodynamics - Types of energy, work, heat and energy changes, application of first law to different processes.
Second law of thermodynamics and its applications - Entropy, reversible and irreversible processes, Carnot cycle, T-S diagrams, enthalpy of mixing and disorder, refrigeration and liquefaction.

UNIT-III:
Thermodynamic properties and relations among them, mathematical relationships among basic properties, Maxwell relations, changes in properties, temperature and pressure effects, thermodynamic diagrams, construction of thermodynamic diagrams.

UNIT-IV:
Solution properties - Partial molal properties and chemical potential, concept of fugacity and activity and their calculations, ideal and nonideal solutions, Gibbs - Duhem equations, property change of mixing and excess properties.

UNIT-V:
Phase equilibria - Phase rule, fundamentals of vapour - liquid equilibria, Vanlaar, Margules and Wilson equations for binary mixture, liquid - liquid, solid - liquid and solid - vapour equilibria, Introduction to group contribution methods (UNIFAC).

Text Books:
2. K.V.Narayanan, “A textbook of Chemical Engineering Thermodynamics”,
Reference Books:

CH T44 PROCESS HEAT TRANSFER

UNIT-I:
Steady state conduction - Fouriers law, thermal conductivity, conduction through composite multilayer plane walls, spherical walls and cylindrical walls, insulation and critical thickness of insulation, heat conduction in rods with heat generation. Heat transfer in extended surfaces - equation for heat transfer in rectangular and cylindrical fins, fin effectiveness and fin efficiency. Unsteady state heat conduction - lumped parameter model, Derivation of unsteady state equation with boundary condition (Solution not included)

UNIT-II:

UNIT-III:
Heat transfer to fluids with phase change - heat transfer from condensing vapours, drop wise and film wise condensation, Nusselt equation for vertical and horizontal tubes, condensation of superheated vapours, effect of non-condensable gasses on rate of condensation. Heat transfer to boiling liquids - mechanism of boiling, nucleate boiling and film boiling.

UNIT-IV:
Radiation heat transfer - Emissive power, Black body radiation, Emissivity, Stefan - Boltzman law, Plank’s law, radiation between surfaces, View factor calculations - view factor for infinitely parallel grey planes, view factor from a plane to a hemisphere, Radiation in absorbing gases.

UNIT-V:
Heat exchange equipments - Double pipe and shell and tube heat exchangers, concept of log mean temperature difference (LMTD), LMTD correction factor, overall heat transfer coefficient, dirt factor, heat exchanger effectiveness. Evaporators - single effect and multiple effect evaporators, boiling point rise, capacity and economy of multiple effect evaporators, evaporation equipments.
Text Books:


Reference Books:

CH T45 MASS TRANSFER I

UNIT I:

UNIT II:
Mass transfer in turbulent flow, eddy diffusion, mass transfer coefficients, film theory, penetration theory and surface renewal theories of mass transfer, analogies of mass, heat and momentum transfer - Reynolds, Prandtl and Chilton - Coulburn analogies, estimation of mass transfer coefficient in wetted wall column, correlations for the calculation of mass transfer coefficients.

UNIT III:
Theory of interface mass transfer, Individual and overall mass transfer coefficients, steady state cocurrent and countercurrent mass transfer processes, stages and stage efficiencies, cross flow and counter current cascades of stages, Kremser equations for the calculation of number of theoretical stages.

UNIT IV:
Equipments for gas-liquid contact operations – Gas dispersed – Sparged vessels, Mechanically agitated vessels, Tray towers; Liquid Dispersed – Venturi Scrubber, Wetted Wall Tower, Spray Tower, packed Towers; Correlations for Mass Transfer Coefficients.

UNIT V:
Gas Absorption - Tray tower absorber, absorption factor, calculation number of theoretical stages, Murphree efficiency - point efficiency, tray efficiency and overall tray efficiency, calculation of actual number of trays. Packed tower absorber - HETP, HTU and NTU calculations Non-isothermal absorber, absorption with chemical reaction.
Text Books:


Reference Books:

UNIT-I:

UNIT-II:
Size reduction - Energy relationships in size reduction, size reduction equipment and selection, closed circuit and open circuit operation. Size enlargement - Principle of granulation, briquetting, pelletisation, flocculation, typical equipments used.

UNIT-III:
Classification - Application of Stoke’s equation, types of classifiers - gravity settling, settling tanks, elutriation, double cone classifier, rake classifier, bowl classifier. Centrifugal separation - Principles, separation of solids from fluids, separation of immiscible liquids, continuous centrifuges, super centrifuges, design of basket centrifuges, cyclones and hydro cyclones. Gas cleaning - Gravity and momentum separators, cyclone separators, design of cyclones, liquid washing, electrostatic precipitators.

UNIT-IV:
Solid - Liquid separation-Filtration, flow through filter cake and filter media, compressible and incompressible filter cakes, filtration equipments - selection, operation and design of filters and optimum cycle of operation, filter aids. Thickening - Batch and continuous thickeners, design of continuous thickeners.

UNIT-V:
Froth flotation - Principles and theories of collection, flotation cell and typical circuit. Magnetic separation, Electrical separation. Sorting (separation of solids) - principles of jiggers, types of jiggers, performance characteristics, principles of flowing film concentrators, tabling, heavy liquid and heavy media separation. Mixing and agitation - Mixing of liquids (with or with out solids) which are viscous but are pourable after mixing, mixing of liquids (with solids) which form stiff pastes, mixing of powders, selection of suitable mixers, power requirement for mixing.
Text Books:


Reference Books:

1. Organic preparations:

Preparations of compounds involving the following reactions
(a) Oxidation           (b) Reduction           (c) Bromination
(d) Nitration                  (e) Acetylation          (f) Hydrolysis

2. Organic qualitative analysis:

The following classes of compounds are to be analysed
(a) Aldehydes           (b) Ketones            (c) Acids
(d) Amides              (e) Esters             (f) Amines
(g) Ethers              (h) Alcohols           (i) Hydrocarbons
(j) Sugar               (k) Phenols
List of Experiments:

1. Laminar flow of Newtonian and non Newtonian fluids
2. Flow through pipes and fittings
3. Flow through annulus
4. Orifice meter
5. Venturi meter
6. Rotameter
7. Weirs and notches
8. Packed bed
9. Fluidized bed
10. Centrifugal pump characteristics
Assembly drawing of the following:

1. Globe valve
2. Ball Valve
3. Spring Loaded Safety valve
4. Gate valve
5. Non-return valve
6. Centrifugal Pump
7. Gear Pump
8. Stuffing Box
9. Rivetted joints and Flanges
SP P44 PHYSICAL EDUCATION

Physical education is compulsory for all the undergraduate students:

1. The above activities will include games and sports / extension lectures.
2. Two hours / week will be allocated for physical education in the 3rd and 4th semesters. The student participation shall be for a minimum period of 45 hours in both the semesters put together.
3. The above activities will be monitored by the Director of Physical Education.
4. Pass / Fail will be determined on the basis of Participation, Attendance, Performance and Behaviour. If a candidate Fails, he /she has to Repeat the course in Subsequent years.
5. Pass in this course is mandatory for the award of degree.
UNIT-I:

UNIT-II:

UNIT-III:

UNIT-IV:

UNIT-V:
Text Books:


Reference Books:

UNIT-I:
Vapour liquid equilibria - Raoult’s law, relative volatility, vapour liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams.
Principle of distillation - flash distillation, differential or simple distillation, steam distillation, multistage continuous rectification, calculation of number of ideal stages by Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio.

UNIT-II:
Number of ideal stages by Mc.Cabe - Thiele method, effect of operating conditions on the number of ideal stages, Murphree stage and overall efficiency, calculation of actual number of stages, batch distillation with reflux, packed bed distillation, NTU and HTU calculations.

UNIT-III:
Introduction to Multicomponent distillation - bubble point and dew point calculations, flash distillation, continuous rectification, key components, minimum number of plates, minimum reflux ratio, Azeotropic and Extractive distillation.

UNIT-IV:
Liquid - liquid extraction - ternary liquid liquid equilibrium, solvent characteristics, equipments for liquid liquid extraction, stage wise contact - cross current and counter current extraction, continuous contact extraction, packed bed extraction with reflux.

UNIT-V:
Leaching - Leaching by percolation through stationary solid beds, moving bed leaching, counter current multiple contact (shank’s system), equipments for leaching operation, multi stage continuous cross current and counter current leaching, stage calculations, stage efficiency.
Text Books:


Reference Books:


CH T53 CHEMICAL REACTION ENGINEERING I

UNIT-I:
Chemical equilibria - Free energy and chemical reactions, feasibility of chemical reaction, calculation of free energy of homogeneous reactions, equilibrium constants and evaluation from thermodynamic data, effect of different variables on reaction equilibria, calculation of equilibrium composition for single and multiple reactions, equilibria of heterogeneous reactions.

UNIT-II:
Kinetics of homogeneous reactions - introduction, single and multiple reactions, elementary and nonelementary reactions, rate equations, kinetic models for nonelementary reactions, testing kinetic models, temperature dependence of rate - Arrhenius, collision and activated complex theories, Interpretation of batch reactor data for single and complex reactions under constant volume and variable volume conditions, differential and integral analysis, half life period.

UNIT-III:
Design of single homogeneous reactors - ideal reactors, design equations for ideal batch reactor, PFR and CSTR, size comparison of single reactors, optimum reactor size problems.

UNIT-IV:
Multiple reactor systems - plug flow reactors in series and / or parallel, CSTRs in series, reactors of different types in series, recycle reactor, auto catalytic reactions, optimum recycle ratio for an auto catalytic reaction.
UNIT-V :
Multiple reaction systems - series and parallel reactions in CSTRs and PFRs, product distribution, fractional yields, maximization of fractional yield in multiple reactions, series - parallel reactions

Text Books:


Reference Books:

UNIT-I:
Fuels - Classification, Properties, tests and analysis.
Solid Fuels - Coal, origin, classification, storage and handling, carbonization, gasification and briquetting - gasification of biomass.

UNIT-II:
Liquid fuels - Petroleum based fuels, synthetic fuels, alcohol and blended fuels, storage and handling.
Gaseous fuels - Water gas, carbureted water gas, producer gas, coal gas and natural gas.

UNIT-III:
Combustion - Air requirement for solid, liquid and gaseous fuels, Combustion equipment
Solar energy, Wind energy, Tidal energy

UNIT-IV:
Geothermal energy, Magneto hydrodynamics, Nuclear energy.
Energy Management - Principles need, initiating and managing an energy management program.

UNIT-V:
Energy audit – elements, and concepts, types of energy audits, energy audit with respect to industries like sugar, paper etc.,
Energy Conservation - Thermodynamics of energy conservation, cogeneration, waste heat recovery technologies. Industrial insulation - material selection, economical thickness

Text Books:

Reference Books:
UNIT-I:
Water Conditioning methods, Demineralisation, Precipitation Process.
Industrial Gases: Carbon dioxide, Nitrogen, Hydrogen, Oxygen and Acetylene

UNIT-II:
ALKALIES:
Chlor-alkali Industries: Manufacture of Soda ash, Manufacture of Caustic Soda and chlorine-common salt.

ACIDS:
Sulphur and Sulphuric acid: Mining of Sulphur and manufacture of Sulphuric acid. Manufacture of hydrochloric acid and Nitric Acid

UNIT-III:
CEMENT, GLASS AND PAPER
Cement: Types and Manufacture of Portland cement, Glass: Manufacture of Glasses and Special Glasses, Ceramics: Refractories, Production of pulp, paper and Rayon

UNIT-IV:
SUGARS AND PAINTS:
Manufacture of sugar, starch and starch derivatives-Manufacture of paints – Pigments. Vegetable oil, Cottonseed Oil and Soybean Oil by Solvent Extraction.

UNIT-V:
FERTILISERS:
Nitrogen Fertilisers: Synthetic Ammonia, Urea, Ammonium chloride, CAN, Ammonium Phosphate- Phosphorus fertilizers: Phosphate rock, Phosphoric Acid, Super Phosphate and Triple Super phosphate –MAP, DAP.

Text Books:

Reference Books:
UNIT-I:  
Role of a process Engineer, Process documentation, flow sheets – types, preparation, flow sheet presentation, symbols, line and equipment symbols, Piping and Equipment identification, Standards and codes, time planning and Scheduling.

UNIT-II:  

UNIT-III:  
Pumps classification and types, Pump performance characteristics and selection of pumps, packing and mechanical seals, pumping systems design, pump priming. Fans, blowers, compressor, ejectors and mechanical vacuum systems

UNIT-IV:  

UNIT-V:  
Utilities of a chemical plant, Boilers, Cooling tower, DM water plants, Industrial water Treatment, Turbines, Chillers, Process Safety and Pressure relieving devices, Storage tanks.

Text Books:  

Reference Books:  
List of Experiments:

1. Stefan’s tube experiment- diffusivity of vapour in air
2. Liquid liquid diffusion- diffusivity of salt in water
3. Surface Evaporation
4. Sublimation of naphthalene ball
5. Packed bed absorber
6. Hydrodynamic /flooding characterization of packed tower
7. Hydrodynamic /flooding characterization of tray tower
8. Adsorption isotherm
9. Multistage adsorption
10. Vapour liquid equilibrium
CH P52 HEAT TRANSFER LABORATORY

List of Experiments:

1. Heat Transfer through Composite Wall
2. Transient Heat Conduction
3. Heat Transfer in a Shell and Tube Heat Exchanger
4. Heat Transfer through Packed Bed
5. Heat Transfer in a Double Pipe Heat Exchanger
6. Heat Transfer in a Vertical Condenser
7. Heat Transfer in a Horizontal Condenser
8. Heat Transfer in Helical Coils
9. Heat Transfer with Natural Convection
10. Heat Transfer by Radiation
List of Experiments:

1. Screen effectiveness
2. Jaw crusher
3. Ball mill
4. Drop weight crusher
5. Beaker decantation
6. Air elutriation
7. Vacuum leaf filter
8. Plate and frame filter press
9. Batch sedimentation
10. Terminal settling velocity-Stokes law
UNIT – I:
ART OF COMMUNICATION
Verbal and non-verbal communication – Barriers to communication – Importance of Body language – Effective listening – Feedback

UNIT – II:
INTRODUCTION TO SOFT SKILLS
Attitude - self confidence – Leadership qualities – Emotional Quotient – Effective time management skills – surviving stress – Overcoming failure – professional ethics – interpersonal skills

UNIT – III:
WRITING
Importance of writing – Written Vs spoken language – Formal and Informal styles of writing – Resources for improving writing – Grammar and usage – Vocabulary building – SWOT analysis

UNIT – IV:
SPEAKING PRACTICE

UNIT – V:
APTITUDE
Verbal and numerical aptitude.

Reference Books:

2. Aggarwal, R.S., “Quantitative aptitude”.
MA T61 NUMERICAL METHODS AND SPECIAL FUNCTIONS

UNIT I:
Gamma And Beta Functions: Bessel functions and legendre polynomials - Series solutions – Generating functions – Recurrence relations and orthogonal property.

UNIT II:
Solution of algebraic and transcendental equations simultaneous linear algebraic equations and matrix inversion:

UNIT III:

UNIT IV:

UNIT V:
Text Books:


Reference Books:

UNIT-I:
Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, effect of pressure and temperature on adsorption isotherms, Freundlich equation.
Adsorption operation - stage wise operations, steady state moving bed adsorbers, unsteady state fixed bed adsorbers, break through curves, rate of adsorption in fixed beds, design of fixed bed adsorbers, fundamentals of chromatographic separations. Ion exchange - Principle of Ion exchange, techniques and applications.

UNIT-II:
Humidification operations - humidity chart, adiabatic saturation curves, wet bulb temperature and measurement of humidity, Lewis relation, equipments for humidification operations, water cooling towers and spray chambers.
Theory and calculation of humidification processes - gas liquid interaction, conditions in the top and bottom of cooling towers, design of cooling towers and dehumidifiers.

UNIT-II:
Drying - equipments for batch and continuous drying of solids, principles and theories of drying - drying rate curve, critical and equilibrium moisture content, calculation of drying time under constant drying conditions.
Mechanism of batch drying - cross-circulation drying, through circulation drying.
Continuous drying - material and energy balances in continuous dryers, rotary dryer - design of rotary dryer.

UNIT-IV:
Crystallization - principles of crystallization, types of crystals, nucleation theories, crystal growth and $\Delta L$ law, particle size distribution of crystals, Yields, heat and material balances in crystallization, equipments for crystallization.

UNIT-V:
Membrane separation processes - classification of membrane separation processes, separation of gasses by membrane processes, flow patterns in membrane separators - cross flow and counter current flow models for gas separation by membranes, effect of processing variables on gas separation by membranes, separation of multi-component gas mixtures by membranes.
Separation of liquids by membrane processes - dialysis, pervaporation, reverse osmosis, ultrafiltration.
Text Books:


Reference Books:

UNIT-I:
Non-isothermal reactions - temperature effects on chemical reaction rates, design procedures for adiabatic and non-isothermal operation of batch and flow reactors, optimum temperature progression, operating temperature for favorable product distribution in multiple reactions, reactor stability.

UNIT-II:

UNIT-III:
Fluid-solid noncatalytic reactions - shrinking core model, determination of the rate controlling step, conversion in reactors with constant fluid composition, conversion in reactors with variable fluid composition - fixed bed reactor, moving bed reactor. Gas-liquid non-catalytic reactions - models for transfer at gas-liquid interface, enhancement factor, Hatta number, Derivation of overall rate equation for first order irreversible reaction and instantaneous reaction, design of packed bed reactors for gas-liquid non-catalytic reactions (simple cases).

UNIT-IV:

UNIT-V:
Reaction and diffusion in porous catalysts - effectiveness factor, Thiele modulus, non-isothermal effectiveness factor, Global rate equations. Heterogeneous catalytic reactors - Fixed bed reactors, fluidized bed reactors, slurry reactors, Trickle bed reactors, design aspects with some simple examples.
Text Books:


Reference Books:

CH T64 PROCESS DESIGN OF CHEMICAL EQUIPMENTS

In the university examination, the students are required to answer one out of two questions from each one of the two units. Use of ‘Chemical Engineering Handbook’, R.H. Perry and Don Green, Mc.Graw Hill is permitted in the examination.

UNIT-I:
Detailed process design of the following heat transfer equipments:
Heat exchangers - Double pipe heat exchangers, Shell and Tube heat exchangers.
Condensers - Horizontal condenser, Vertical condenser.
Evaporators - Multiple effect evaporators with forward feed and backward feed arrangements (calculations involving boiling point rise).

UNIT-II:
Detailed Process design of the following mass transfer equipments:
Absorption towers - plate tower and packed tower absorption columns.
Distillation towers - plate tower and packed tower distillation columns.
Humidification towers - Humidifiers, Dehumidifiers, cooling towers.
Drying – Rotary dryers.

Text Books:

Reference Books:
List of Experiments:

1. Simple distillation
2. Steam distillation
3. Packed bed distillation
4. Ternary liquid equilibria
5. Liquid-Liquid equilibrium-immiscible phases
6. Liquid-Liquid extraction
7. Cross current leaching
8. Counter current leaching
9. Tray dryer
10. Cooling tower
List of Experiments:

1. Isothermal Batch reactor – Determination of order and reaction rate constant
2. Semibatch reactor- Determination of conversion and reaction rate constant
3. Determination of activation energy
4. CSTR- Determination of conversion and reaction rate constant
5. PFR- Determination of conversion and reaction rate constant
6. PFR and CSTR in series- Comparision of conversion
7. Three CSTRs in series- Comparision of conversion
8. Residence Time Distribution in CSTR
9. Residence Time Distribution in packed bed reactor
10. Heterogeneous catalytic reaction
List of Experiments

1. Analysis of Oils and Fats
2. Analysis of Metals
3. Silica content in cement
4. Analysis of Fertiliser
5. Pigment analysis
6. Flame Photometer
7. Characterization of liquid fuel Diesel and Kerosene
   (Smoke point, Flash point, Cloud point, Aniline point, Pour point, Viscosity)
8. Viscometer
9. Colorimeter
10. Proximate analysis of solid fuels
HS P64 GENERAL PROFICIENCY II

UNIT-I:
Composition Analysis:
Technical and Non-technical Passages (GRE Based); Differences in American and British English; Analyzing Contemporary Issues; Expanding Terminology

UNIT-II:
Writing
Job Application Letter Writing – Resume Writing

UNIT-III:
Oral Skills

UNIT-IV:
Adapting to Corporate Life
Corporate Etiquette – Grooming and Dressing.

UNIT-V:
Aptitude
Verbal and Numerical aptitude.

Reference Books:
UNIT- I:
Introduction - Control system, components of a feed back control system, Lags in the control system - transfer lag, transportation lag, Pneumatic PID controller , control valve – valve characteristics
Laplace transforms - properties of laplace transform, solution of linear differential equations using laplace transform techniques, piecewise continuous functions

UNIT- II:
Dynamic behaviour of systems - derivation of transfer functions for first and second order systems, liquid level, temperature, pressure, flow and concentration control processes, linearisation of nonlinear systems, interacting and non-interacting systems.
Transient response of first and second order systems, natural frequency, damping factor, overshoot, decay ratio, rise time and settling time.

UNIT- III:
Transient analysis of control systems - block diagram algebra, overall transfer function of closed loop control systems, regulator and servo problems, transient response of first and second order systems with P, PI and PID controller.
Definition of stability of control systems, Routh test , limitations of Routh test, Pade’s approximation of time delay systems.

UNIT- IV:
Root-locus technique - rules for plotting the root locus diagram, application of root locus to control systems.
Introduction to frequency response - Bode diagrams, Bode diagrams for first and second order systems, P, PI, PID controllers, transportation lag. Bode stability criteria, phase margin and gain margin, Nichols chart, Ziegler - Nichols Optimum controller settings.

UNIT- V:
Nyquist stability criteria, calculation of phase margin, gain margin, peak gain and resonant frequency using nyquist plot.
Introduction to advanced control techniques - feed forward control, cascade control, ratio control, adaptive control, inferential control, selective control.
Text Books:

Reference Books:
CH T72 MECHANICAL DESIGN OF CHEMICAL EQUIPMENTS

In the university examination students are required to answer one out of two questions. Use of the following books is permitted in the examination.

2. IS specification for shell and tube heat exchanger - IS 4503.

Mechanical design of cylindrical vessels and closures for internal and external pressure, design of tall vertical vessels, design of horizontal vessels.

Mechanical design and drawing of the following chemical equipments:

1. Shell and Tube heat exchangers
2. Evaporators and crystallizers
3. Distillation and absorption columns
4. Reactors
5. Storage tanks - horizontal, vertical and spherical

Text Books:


Reference Books:

UNIT-I:
Plant location layout and Material Handling;
Plant Location: Influencing factors – evaluation of location alternatives (Simple problems) – Plant layout: Classification of production systems – principles of layout – basic types of layout -line balancing – Material Handling: functions – principles – Classification of material handling equipments ( only classification and no description) – factors to be considered in selection of material handling equipments.

UNIT-II:
Production, Planning and Control:

UNIT-III:
Material and Human Resource Management:

UNIT-IV:
Total quality Management (TQM) :

UNIT-V:
Text Books:


Reference Books:

CH P71 COMPUTER AIDED PROCESS DESIGN LABORATORY

Detailed Process Design (Computer Aided Approach) of the following equipments:

1. Double Pipe Heat Exchanger
2. Shell and Tube Heat Exchanger
3. Horizontal Condenser
4. Vertical Condenser
5. Multiple Effect Evaporator with forward feed and Bacward feed
6. Plate type absorption Tower
7. Packed type absorption Tower
8. Plate type Distillation column
9. Packed type Distillation column
10. Cooling Tower
CH PW7 PROJECT WORK (PHASE I)

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of Electronics and Instrumentation Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. The evaluation is based on continuous internal assessment by an internal assessment committee for 100 marks.

CH P72 SEMINAR

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for a total of 100 marks.

CH P73 INDUSTRIAL VISITS / TRAINING

During the course of study from 3rd to 7th semester each student is expected to undertake a minimum of four industrial visits or undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of seventh semester for 100 marks.
CH T81 TRANSPORT PHENOMENA

(In the university examination, the students are required to answer two out of three questions from each one of the units I and II, one out of two questions from unit III. Table containing the Transport Phenomena equations is permitted in the examination.)

UNIT- I:
Transport in laminar flow or in solids in one dimension - Shell balances for momentum, energy and mass transfer, unidimensional velocity, temperature and concentration profiles.

UNIT- II:
Transport in an arbitrary continuum - equations of change for momentum, energy and mass transfer in Cartesian, cylindrical and spherical coordinates, simple solutions in one dimension.

UNIT- III:
Transport in laminar flow or in solids with two independent variables - unsteady state viscous flow, heat conduction and diffusion, two dimensional viscous flow, heat conduction and diffusion, simple solutions.

Text Books:

Reference Books:
UNIT- I:
Time value of money - simple and compound interest - discrete, nominal and continuous rate of return and their relationships, issue and evaluation of bonds, concept of equivalence.

UNIT- II:
Depreciation and Amortization - classification of depreciation and methods of uniform, rapid and slow write off techniques and their comparison, depreciation accounting procedures, taxes and insurance, implication of taxes in selecting alternates.

UNIT- III:
Economics of selection of alternates - criteria, annual cost, present worth, rate of return, capitalized cost methods, extra investment analysis, mutually exclusive basis, replacement economy.

UNIT- IV:
Cost estimation - equipment costs, cost indices, William’s point sixth rule, methods of estimation of fixed capital, product cost estimation. Bookkeeping - ledgers and journals, financial statements, balance sheet, principles and application of project execution techniques, PERT and CPM, preparation of project feasibility reports, selection of plant location and layout.

UNIT- V:
Optimization - procedure involving single and two variables, optimum number of units required for maximum profit and minimum cost, determination of optimum parameters in selected unit operations - fluid flow (optimum pipe diameter), heat transfer (optimum thickness of insulation), evaporation, filtration, break-even analysis.

Text Books:

Reference Books:
UNIT- I:
Man and Environment, Types of pollution, Pollution control aspects, Pollution monitoring and analysis of pollutant.
Air pollution: Sources and effects, particulate control, control of gaseous pollutants (SO$_2$, NO$_x$, oxides of carbon, hydrocarbon pollutants), Air Quality Management.

UNIT- II:
Water Pollution:
Types of water pollution, sources, water pollution control.
Waste water treatment technologies and Recycle.

UNIT- III:
Solid waste management: Sources, processing methods, waste disposal methods, energy recovery from solid waste.

UNIT- IV:
Noise Pollution: Hazardous noise exposure, noise measuring instruments and noise pollution control technology.
Regulations: ISO 14000, 9000, pollution Acts and Regulations.

UNIT- V:
Case Study:
Pollution (Air, Water & Solid) control in the following process industries - Fertilizers, Petroleum Refinery and Petrochemical, Pulp and Paper, Cane Sugar, Tannery, Distilleries and Pharmaceutical Industry.

Text Books:

Reference Books:
List of Experiments:

1. Time constant of a thermometer
2. Transient response of a mercury manometer
3. Transient response of a pressure vessel system
4. Transient response of a mixing vessel
5. Transient response of an interacting liquid level system
6. Transient response of a non-interacting liquid level system
7. Control valve characteristics
8. On–Off Control system behaviour
9. Closed loop behaviour of control system (Level/ Temperature control loop)
10. Simulation of closed loop control systems
CH PW8 PROJECT WORK (PHASE II)

Project work phase II will be an extension of the project work started in the seventh semester. On completion of the work, a project report should be prepared and submitted to the department. The project work and the report will be evaluated by an internal assessment committee for 50 marks. The external university examination, which carries a total of 50 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

CH P82 COMPREHENSIVE VIVA

The student will be tested for his understanding of the basic principles of the core chemical engineering subjects. The internal assessment for a total of 50 marks will be made by an internal assessment committee. The committee will conduct two written examinations of objective type or short questions type from all the core subjects. The external university examination, which carries a total of 50 marks, will be a viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the university.
The course should cover the following topics by way of Seminars, Expert Lecturers and Assignments.

1. Engineering Ethics – Moral Issues, Ethical theories and their uses
2. Engineering as Experimentation – Code of Ethics
3. Engineer’s Responsibility for Safety
4. Responsibilities in Rights
5. Global issues of engineering ethics

Reference Books:

CH E61 PETROLEUM REFINERY ENGINEERING

UNIT- I:
Introduction – genesis, occurrence, exploration, drilling of crude oil. Composition and Evaluation of crude oil and testing of petroleum products.
Refining of petroleum – Atmospheric and vacuum distillation.

UNIT- II:
Refining of petroleum – Atmospheric and vacuum distillation.
Pretreatment of crude oil and transportation.

UNIT- III:
Cracking processes - Thermal cracking, Vis-breaking, Coking.
Catalytic cracking (FCC), Hydro cracking, Rebuilding processes, bitumen blowing.

UNIT- IV:
Treatment techniques for removal of sulphur compounds to improve performance, Storage and stability.
Product treatment processes - various solvent treatment processes, Dewaxing, Clay treatment and Hydro fining.

UNIT- V:
Cracking of naphtha and gas for the production of ethylene, propylene isobutylene and butadiene. Production of acetylene from methane
Catalytic Reforming of petroleum feed stocks. Extraction of Aromatics.

Text Books :

Reference Books:
UNIT I:

UNIT II:
The kinetics of enzyme catalyzed reactions - the enzyme substrate complex and enzyme action, simple enzyme kinetics with one and two substrates, determination of elementary step rate constants. Isolation and utilisation of Enzymes - production of crude enzyme extracts, enzyme purification, applications of hydrolytic enzymes, other enzyme applications, Enzyme production - intercellular and extra cellular enzymes.

UNIT III:
Metabolic pathways and energetics of the cell, concept of energy coupling, ATP and NAD, Photosynthesis, Carbon metabolism, EMP pathway, Tricabocyclic cycle and electron transport chain, aerobic and anaerobic metabolic pathways, transport across cell membranes, Synthesis and regulation of biomolecules.

UNIT IV:
Typical growth characteristics of microbial cells, Factors affecting growth, Batch and Continuous cell growth, nutrient media, enrichment culture, culture production and preservation
Immobilisation Technology - Techniques of immobilisation, Characteristics and applications, Reactors for immobilized enzyme systems

UNIT V:
Introduction to bio reactors, types, Continuously Stirred aerated tank bioreactors, Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power consumption, Fermentation-methods and applications, Downstream processionig and product recovery in bio processes
Text Books:


Reference Books:

UNIT-I:

UNIT-II:

UNIT-III:

UNIT-VI:

UNIT-V:

Text Books:

Reference Books:
CH E64 DRUGS AND PHARMACEUTICAL TECHNOLOGY

UNIT- I:

UNIT- II:

UNIT- III:

UNIT- IV:

UNIT- V:

Text Books:

Reference Books:
UNIT- I:
Nuclear energy fundamentals: Atomic structure, and radio isotopes, radio activity, nuclear fission, nuclear fission reactors. History of reactor development, reactors for power production.

UNIT- II:
Nuclear reactions and radiations:

UNIT- III:
Nuclear reactor theory:
The neutron cycle, critical mass, neutron diffusion, the diffusion equation, flux distribution in a spherical and rectangular core, slowing down of neutrons, reactor period, transient conditions and reflectors.

UNIT- IV:
Engineering Considerations of Nuclear Power:
Extension of theory to design, design criteria, selection of materials, reactor fuel, moderator materials, coolant system, reactor control and operation, fuel preparation, reprocessing of spent fuel.

UNIT- V:
Environmental effects and safety:
Radiation hazards, radiation monitoring, radio waste treatment systems, reactor shielding.
General principles of reactor safety, reactor protection system, reliability and risk assessment.

Text Books:
2. Glenn Murphy, “Elements of Nuclear Engineering”, John Wiley and sons Inc.

Reference Books:
UNIT- I:
Introduction - Definitions and concepts, polymerisation reactions, polymer structure, functionality and degradation, Characterisation of polymers.

UNIT- II:
Different types of polymers - natural and modified natural products, synthetic polymers, addition and condensation products and their preparations.

UNIT- III:
Methods of polymerisation - mass, solution, emulsion and suspension polymerisation processes, reactions and equipments used.

UNIT- IV:
Polymer processing - Molding, cold and hot compression molding, injection and jet type molding, extruding, calendering and skiving.

UNIT- V:
Polymer processing - sheet forming, atmospheric and fluid pressure forming, lamination and impregnating, coating, expanding, casting, embedding, spinning and finishing.

Text Books:

Reference Books:
CH E72 PETROCHEMICAL TECHNOLOGY

UNIT- I:
General Introduction - History, economics and future of petrochemicals, energy crisis and petrochemical industry, sources and classification of petrochemicals.

UNIT- II:
First generation petrochemicals - alkanes - C1, C2, C3, C4 petrochemicals, alkenes - C2,C3,C4 petrochemicals, alkynes - C2,C3,C4 petrochemicals, B-T-X aromatics, diene based petrochemicals.

UNIT- III:
Second generation petrochemicals - synthesis gas, methanol, formaldehyde chloromethanes, ethanol, acetaldehyde, acetic acid, acetic anhydride, isopropyl alcohol, ethylene oxide, propylene oxide, acetone, vinyl chloride, phenol, aniline and styrene.

UNIT- IV:
Third generation petrochemicals - plastics, rubbers and fibres, olefinic polymers, polyethylene, polypropylene, polyisobutylene, diene polymers - polybutadiene, neoprene, polyisoprene, SBR, synthetic fibres.

UNIT- V:
Miscellaneous petrochemicals - petroleum proteins, synthetic detergents, resin and rubber chemicals, explosives - TNT and RDX.

Text Books:

Reference Books:
UNIT- I:

Review basics of electrochemistry: Faraday’s law - Nernst potential – Galvanic cells – Polaroography
The electrical double layer: It’s role in electrochemical processes – Electro capillary curve – Helmoltz layer – Guoy – Steven’s layer – fields at the interface.

UNIT- II:

Mass transfer in electrochemical systems: diffusion controlled electrochemical reaction – the importance of convention and the concept of limiting current. Mass transfer over potential or concentration polarization. Secondary current distribution – the rotating disc electrode.

UNIT- III:

Corrosion:

UNIT- IV:

Batteries:

Primary and secondary batteries – Lechlanche dry cell – alkaline manganese cell – Mercury cell – Reverse electrolyte cells like Mg-CuCl₂, Zn-PbO₂, Secondary cells like lead acid, Ni-Cd, Ni-Fe, Ago-Zn, Ago-cd, sodium-sulphur, Li-S, Fuel cells.

UNIT- V:


Text Books:


Reference Books:

UNIT- I:
Hazard identification methodologies, risk assessment methods - PHA, HAZOP, MCA, ETA, FTA, consequence analysis, probit analysis.

UNIT- II:
Hazards in work places - nature and type of work places, types of hazards, hazards due to improper house-keeping, hazards due to fire in multi-floor industries and buildings, guidelines and safe methods in the above situations.

UNIT- III:
Workers’ exposures to hazardous chemicals, TLVs of chemicals, physical and chemical properties of chemicals leading to accidents like fire explosions, ingestion and inhalation, pollution in work places due to dangerous dusts, fumes and vapours, guidelines and safe methods in chemicals handling, storage and entry into confined spaces.

UNIT- IV:
Hazards peculiar to industries like fertilizer, heavy chemicals, petroleum, pulp and paper, tanneries, dyes, paints, pesticides, glass and ceramics, dairy and sugar industries, guidelines for safeguarding personnel and safeguarding against water, land and air pollution in the above industries.

UNIT- V:

Text Books:


Reference Books:

CH E75 INDUSTRIAL BIOTECHNOLOGY

UNIT I:
Introduction: Basic concepts in biotechnology and historical development - Biotechnology as an interdisciplinary pursuit - Public perception of biotechnology - Biotechnology and developing world - Ethics of biotechnology - Future and scope of biotechnology.

UNIT II:
General requirements of Fermentation Process: An overview of aerobic and anaerobic fermentation processes and their application in industry; Basic design and construction of fermentor and its auxiliaries, sensors and monitoring instruments, media design and sterilization for fermentation processes.

UNIT III:
Solid and liquid substrate fermentation - Cheese production - Single cell protein (SCP) - Mushroom production - Soya sauce production - Leaching of metals - Vitamin C and vitamin B12 production - Sewage treatment - Biogas production - Ethanol from molasses.

UNIT IV:
Genetics and biotechnology: The role of genes within cells, elucidation of the genetic code, genetic elements that control gene expression, methods of creating recombinant DNA molecules, safety guidelines of recombinant DNA research, plasmid and phage vectors.

UNIT V:
Food and Medicine biotechnology: Biotechnology in relation to the food industry, types of micro-organisms Brewing and alcoholic brewerages - Wine production - Beer production. Antibiotics - Penicillin production, vaccines and monoclonal antibodies, human insulin production.

Text Books:

Reference Books:
CH E81 PROCESS FLOWSHEETING, DESIGN AND SYNTHESIS

UNIT I:
Overview of flowsheet synthesis, decomposition strategies for process flowsheet synthesis, precedence ordering, recycle partitioning, tearing, process flow sheet optimization.

UNIT II:
Basic concepts in process synthesis, heat exchanger network synthesis, Grand composition curves, pinch design approach to a network, stream splitting at the pinch, using grand composition curves to design refrigeration cycles.

UNIT III:
Heat integrated distillation processes, synthesis of distillation sequences.

UNIT IV:
Reactor network synthesis - geometric techniques for the synthesis of reactor networks, multiple reactions, recycle reactors, reactor network synthesis with target formulations, heat integration of reactors.

UNIT V:
Optimal design and scheduling of batch plants, characteristics of batch processes, scheduling of products and operations, multiproduct batch plants, multipurpose batch plants.

Text Books:


Reference Books :

UNIT I:
Introduction - models and model building, principles of model formulation, fundamental laws - continuity equation, energy equation, equations of motion, transport equations, equations of state, equilibrium and kinetics, classification of mathematical models.
Numerical solutions of model equations – Linear and non linear algebraic equations in one and more than one variables, ordinary differential equations in one and more than one variables.

UNIT II:
Lumped Parameter Models:
Formulation and solution techniques to be discussed for Vapour liquid equilibrium models, dew point and flash calculations for multicomponent systems, boiling operations, batch and continuous distillation models, tank models, mixing tank, stirred tank with heating, CSTR with multiple reactions. Non-isothermal CSTR - mutiplicity and stability, control at the unsteady state. Non-ideal CSTR models - multi-parameter models with dead space and bypassing, staged operations.

UNIT III:
Distributed Parameter Models (Steady State):
Formulation and solution of split boundary value problems - shooting technique, quasi-linearization techniques, counter current heat exchanger, tubular reactor with axial dispersion, counter current gas absorber, pipe line gas flow, tubular permeation process, pipe line flasher.

UNIT IV:
Unsteady State Distributed Parameter Models:

UNIT V:
Model Parameters Estimation :
Text Books:


Reference Books:

CH E83 ENVIRONMENTAL IMPACT ASSESSMENT AND CLEAN TECHNOLOGY

UNIT I:
Introduction and need for impact assessment. Legislation and pollution control acts and Regulations.
Methodologies – collection of data and analysis, cost benefit analysis.

UNIT II:
Application of Impact assessment methods in specific developmental projects, advantages, disadvantages of different methods, applicability of specific methods with examples.

UNIT III:
Impact assessment report contents for developmental projects like thermal power projects, refinery process and chemical process industries.

UNIT IV:

UNIT V:
Clean Technology Options: Clean technology and Clean up technology, materials reuse, waste reduction at source and clean synthesis.

Text Books:

Reference Books:
CH E84 NEW SEPARATION TECHNIQUES

UNIT I:
Adsorption separations - Review of fundamentals, mathematical modeling of column contactors, pressure swing adsorption, ion chromatography, affinity chromatography, gradient chromatography, parametric pumping, counter-current, simulated counter-current and multidimensional chromatography.

UNIT II:
Membrane separation processes – basic concepts, membrane modules, structure and characteristics of membranes, design considerations of Reverse Osmosis, Ultra Filtration, Electro Dialysis, Gas permeation membranes, Pervaporation, Nano filtration and micro filtration.

UNIT III:
Detailed theories for membrane separations – concentration polarization, gel formation and fouling, mathematical models for membrane systems with and without concentration polarization, Transport inside the membranes, solution diffusion membranes, porous membranes.

UNIT IV:
Surfactant based separations - fundamentals of surfactants at surfaces and in solution, liquid membrane permeation, and foam separations, micellar separations.

UNIT V:
Supercritical fluid extraction - Physicochemical principles, thermodynamic modeling, process synthesis and energy analysis.

Text Books:

Reference Books:
UNIT I:
Nature and organization of optimization problems, fitting models to data, method of least squares, factorial experimental designs, formulation of objective functions.

UNIT II:
Optimization theory and methods - basic concepts of optimization, optimization of unconstrained functions, one dimensional search, multivariable optimization.

UNIT III:
Linear programming and applications, nonlinear programming with constraints, optimization of staged and discrete processes.

UNIT IV:
Optimum recovery of waste heat, optimum shell and tube heat exchanger design, optimization of heat exchanger networks, optimization of multistage evaporators, optimization of liquid liquid extraction processes, optimal design and operation of staged distillation columns.

UNIT V:
Optimal pipe diameter, minimum work of gas compression, economic operation of fixed bed filter, optimal design of gas transmission network, optimal design and operation of chemical reactors.

Text Books:

Reference Books: