REGULATIONS AND SYLLABUS
( REGULATIONS 2000 )

B.Tech. DEGREE PROGRAMME
(8 SEMESTERS)

LEATHER TECHNOLOGY

ANNA UNIVERSITY
CHENNAI - 600 025.
APRIL 2000
REGULATIONS 2000
Degree of Bachelor of Engineering / Technology (Eight Semesters)
(APPROVED IN THE 42TH MEETING OF THE ACADEMIC COUNCIL HELD ON 25.09.1999)

PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) "Programme" means Degree Programme, that is B.E. / B.Tech. Degree Programme

ii) "Branch" means specialisation or discipline of B.E./ B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.

iii) "Course" means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.

iv) "Faculty" means a Faculty of the University, like Faculty of Civil Engineering, Faculty of Technology, etc. Each Faculty is headed by a Dean.

ADMISSION

R1a Candidates for admission to the first semester of the eight semester B.E./B.Tech. Degree Programme shall be required to have passed

i) the Higher Secondary Examination of the (10+2) curriculum (Academic stream) prescribed by the appropriate authority of Government of Tamil Nadu with
Mathematics, Physics and Chemistry as three of the four subjects of study prescribed under Part III. In the case of B.Tech. Industrial Bio-Technology, the subjects are Physics, Chemistry, Mathematics and/or Biology.

OR

i) any other examination of any University or authority accepted by the Syndicate of the University as equivalent thereto.

R.1b Candidates for admission through lateral entry into the third semester of the eight semester B.Tech. Degree Programme at M.I.T. Campus shall be required to have passed

the examination of a B.Sc. Degree of 10 + 2 + 3 or 11 + 1 + 3 pattern of a recognised University in any one of the following B.Sc. Degree Programmes having Mathematics and Physics as subjects of study: Mathematics / Physics / Chemistry / Applied Sciences / Electronics / Instrumentation / Computer Science.

OR

any other examinations of any University or authority accepted by the Syndicate of the University as equivalent thereto.

R.1c Sponsored/deputed candidates (Diploma holders) for admission to the 1st Semester of B. Semester B.E. Degree programme in Printing Technology shall be required to have passed the 3-year Diploma in Printing Technology (Letterpress/Lithography/Integrated) awarded by the State Board of Technical Education of

Government of Tamil Nadu or any other examination of any authority accepted by the Syndicate of the University as equivalent thereto. The institutions eligible to sponsor/depute the candidates and the minimum experience to be possessed by such candidates shall be as prescribed by the Syndicate of the University from time to time.

R.2a Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for plus two academic stream of the Tamil Nadu Board of Higher Secondary Education.

R.2b Notwithstanding the qualifying examination the lateral entry candidate might have passed, the candidate shall also write an entrance examination for admission: The entrance examination shall test the proficiency of the candidate in Mathematics, Physics, Chemistry, Applied Sciences, Electronics, Instrumentation and Computer Science at B.Sc. Degree level.

R.2c Sponsored/deputed candidates satisfying Rule 1c shall also write the entrance examination as per Rule 2a.

R.3. The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Syndicate of the University from time to time.

R.4. The candidate shall not have completed 21 years of age as on first of July of the year of application. In the case of lateral entry, the candidate shall not have completed
22 years of age as on 1st July of the year of application. For candidates belonging to SC/ST, the age limit is relaxable by 3 years.

R.4b There is no age limit for sponsored/deputed candidates satisfying Rule 1c, seeking admission to B.E. Printing Technology.

BRANCHES OF STUDY AND STRUCTURE OF THE PROGRAMME

R.5a Regulations 2000 is applicable to B.E./B.Tech. Degree Programme in various branches of Engineering and Technology, each distributed over 8 semesters with 2 semesters per Academic Year.

Faculty of Civil Engineering
1. B.E. Civil Engineering
2. B.E. Geo-Informatics.

Faculty of Electrical Engineering
1. B.E. Computer Science and Engineering
2. B.E. Electrical and Electronics Engineering
3. B.E. Electronics and Communications Engineering.

Faculty of Engineering (MIT)
1. B.Tech. Aeronautical Engineering
2. B.Tech. Automobile Engineering
3. B.Tech. Electronics Engineering
4. B.Tech. Instrumentation Engineering
5. B.Tech. Production Engineering
6. B.Tech. Rubber and Plastics Technology

Faculty of Mechanical Engineering
1. B.E. Industrial Engineering
2. B.E. Manufacturing Engineering
3. B.E. Mechanical Engineering
4. B.E. Mining Engineering
5. B.E. Printing Technology.

Faculty of Technology
1. B.Tech. Ceramic Technology
2. B.Tech. Chemical Engineering
3. B.Tech. Industrial Bio-Technology

R.5b Every Programme will have a curriculum with syllabi consisting of theory and practicals such as:
   i) General core courses comprising mathematics, basic sciences, engineering sciences, humanities and engineering arts.
   ii) Core courses of Engineering / Technology.
   iii) Elective courses for specialisation in related fields.
   iv) Workshop practice, computer practice, engineering graphics, laboratory work, industrial training, seminar presentation, project work, education tours, camps etc.
   v) NCC/NSS/NSO activities for character development.

R.5c Each course is normally assigned certain number of credits with 1 credit per lecture period per week, 1 credit per tutorial period per week, 1 credit for 2 periods of laboratory or practical or seminar or project work per week (2 credits for 3 or 4 periods of practical) and 1 or 2 credits for 4 weeks of industrial training during semester vacations.
R.5d Each semester curriculum shall normally have a blend of lecture courses not exceeding 6 and practical courses not exceeding 4.

R.5e For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. This minimum will lie between 181 and 190 credits depending on the branch.

R.5f The medium of instruction, Examinations and project report will be English, except for courses on languages other than English.

DURATION OF THE PROGRAMME

R.6 A student is ordinarily expected to complete the B.E./B.Tech. Programme in 8 semesters (6 semesters in the case of lateral entry student), but in any case not more than 12 semesters (10 semesters in the case of lateral entry student).

FACULTY ADVISER

R.7 To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department of the student will attach a certain number of students to a teacher of the Department who shall function as Faculty Adviser for those students throughout their period of study. Such Faculty Adviser shall advise the students and approve the courses to be taken by the students during each semester.

CLASS COMMITTEE

R.8a For all branches of study during first semester, a common Class Committee will be constituted by the Dean of Academic Courses. During other semesters, separate Class Committees will be constituted by the respective Heads of the Departments of the students.

R.8b Each common theory course offered to more than one discipline or group, shall have a “Course Committee” comprising all the teachers teaching the common course with one of them as nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department/Dean of Faculty/Dean of Academic Courses depending upon whether all the teachers teaching the common course belong to a Department/ a Faculty/ different Faculties.

R.8c The first semester Class Committee composition will be as follows:

i) Course Co-ordinators of all common courses.
ii) Teachers of all other individual courses.
iii) One Professor, preferably not teaching first semester class, appointed as Chairman, by Dean of Academic Courses.
iv) One male and one female first semester student from each Faculty to be nominated by the Dean of Academic Courses.
v) All first semester Faculty Advisers and all the Deans may opt to be special invitees.

R.8d The composition of the Class Committee for each branch from 2nd to 8th semester will be as follows:
i) Teachers of individual courses.
ii) One Professor or Assistant Professor preferably not teaching to the concerned class, appointed as Chairman by the Head of the Department.
iii) 2 students, preferably 1 male and 1 female student of the class, per group of 30 students or part thereof, to be nominated by the Head of the Department in consultation with the Faculty Advisers.
iv) All Faculty Advisers of the Class. Teacher in-charge of UG Programme and Head of the Department may opt to be special invitees.

R.8e The Class Committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of class commencement, in which the type of assessments, like test, assignment, assignment based test etc., will be decided for the first second and third assessments. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

During these three meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching learning process.

R.8f The Class Committee, excluding the student members and the invited members, shall meet within two weeks from the last day of the End-Semester Examination to analyse the performance of the students in all the components of assessments and decide the grade ranges for each course. The grading ranges for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned teacher.

REGISTRATION AND ENROLMENT

R.9a Every student shall submit a completed Registration form indicating the list of courses intended to be credited during the next semester. This Registration will be done a week before the last working day of the current semester. Late registration with the approval of Dean of Faculty along with a late fee will be done up to the last working day.

R.9b At the beginning of the semester, before the date of class commencement, every student shall confirm the Registration by paying the prescribed fees for the semester and enroll for the courses. Late enrolment, with the approval of Dean of Faculty along with a late fee, will be done up to 2 weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

R.9c The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

WITHDRAWAL FROM A COURSE

R.9d A student can withdraw from a course at any time before the second assessment with the approval of Dean of Faculty on the recommendation of the Head of the Department of the student.
**TEMPORARY BREAK OF STUDY FROM A PROGRAMME**

R.9e A Student can take a one time temporary break of study covering the current semester and/or next semester period with the approval of the Dean of Academic Courses, at any time before the start of third assessment of the current semester, within the maximum period of 12 or 10 Semesters as the case may be.

**CREDIT LIMIT FOR ENROLMENT AND MOVEMENT TO HIGHER SEMESTER**

R.10a A student can enroll only for a maximum of 30 credits during a Semester period including arrears courses.

R.10b The following minimum credits should be earned by a student to register for the higher semester courses:

<table>
<thead>
<tr>
<th>TO REGISTER FOR COURSES</th>
<th>MINIMUM CREDITS TO BE EARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Semester</td>
<td>No minimum</td>
</tr>
<tr>
<td>3rd Semester</td>
<td>10 in 1st Semester Courses alone</td>
</tr>
<tr>
<td>4th Semester</td>
<td>12 in 2nd Semester Courses alone</td>
</tr>
<tr>
<td>5th Semester</td>
<td>12 in 3rd Semester Courses alone</td>
</tr>
<tr>
<td>6th Semester</td>
<td>12 in 4th Semester Courses alone</td>
</tr>
<tr>
<td>7th Semester</td>
<td>12 in 5th Semester Courses alone</td>
</tr>
<tr>
<td>8th Semester</td>
<td>12 in 6th Semester Courses alone</td>
</tr>
</tbody>
</table>

Those who do not satisfy the above minimum credit requirements, may register and enrol for arrears courses only.

**SUMMER TERM COURSES**

R.11a A student can register for a maximum of two courses only during Summer Term, if such courses are offered by the concerned department.

R.11b The Head of the Department, in consultation with the Department Consultative Committee and with the approval of Dean (Academic Courses) may arrange for the conduct of a few courses during summer term, depending on availability of teachers during summer and subject to a minimum of five students registering for such courses.

R.11c However in the case of a student completing 8th Semester and having arrears in the earlier Semesters in a maximum of two courses, summer courses may be offered, even if less than five students are registering for the course.

R.11d The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a summer term course or for substitute examination.
ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

R.12a Every theory course shall have a total of four assessments during a semester as given below:

<table>
<thead>
<tr>
<th>Assessment No.</th>
<th>Course coverage in weeks</th>
<th>Duration in hours</th>
<th>Weightage of max. marks %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>1 to 4</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>Test 2</td>
<td>5 to 8</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>Test 3</td>
<td>9 to 12</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>End-Sem. Exam</td>
<td>1 to 16</td>
<td>3 hours</td>
<td>50</td>
</tr>
</tbody>
</table>

R.12b The pattern of question for at least one of the Tests shall be the same as stipulated for the End-Semester Examination by the Board of Studies/Academic Council. Teachers handling course in the third to eighth semesters are given the option to substitute a maximum of two tests with other suitable alternate type of evaluation approved in the class committee. The details of such a scheme shall be announced to the students and informed to the Dean of Academic courses at the beginning of the Semester. However, for the first and second semester, all assessments will be in the form of tests.

R.12c Every practical course will have 75% weightage for continuous assessment and 25% for End-Semester examination.

R.12d In the case of Industrial Training, the student shall submit a report which will be evaluated along with an oral examination by a Committee of Teachers constituted by the Head of the Department. A progress report from the industry will also be taken into account for evaluation.

R.12e In the case of project work and mini project work, a committee of Teachers constituted by the Head of the Department will carry out continuous assessment. Based on the project report submitted by the student, an oral examination (Viva-Voce) will be conducted as the End-Semester examination, for which one External Examiner will also be included in the Committee of Teachers.

R.12f Assessment of seminars and comprehension will be carried out by a committee of teachers constituted by the Head of the Department.

SUBSTITUTE EXAMINATIONS

R.13a A student who has missed, for valid reasons, an assessment test/examination may be permitted to write a substitute test/examination. However, permission to take up a substitute test/examination will be given under exceptional circumstances, such as accident or admission to a hospital due to illness.

R.13b A student who misses any assessment test/examination in a course should apply for the substitute test/examination within a week from the date of missed assessment, using the prescribed application form for the purpose. Late applications will not be entertained. The decision on the application will be taken by the Head of the Department.
of the Department offering the course in the case of first
three assessments and by the Dean of Faculty in the
case of End-Semester examination (fourth assessment).
However, if a student applies for the substitute test/
examination for the second time in a semester, the
decision will be taken by the Dean of Faculty. The Head
of the Department Dean of Faculty can use his discretion
in granting permission, recording reasons for his
decision. If permitted, the substitute test/examination
for any assessment will be held in about two weeks from
the date of missed assessment. The substitute test (from
missed assessments 1 to 3) will be conducted by the
concerned teacher. However, the substitute examination
(for missed end-semester examination) will
be conducted centrally.

PASSING AND DECLARATION OF EXAMINATION RESULTS
AND GRADE SHEET

R.14a All assessments of a course will be done on absolute
marks basis. However, the Class Committee which shall
meet within 2 weeks after the End-Semester
examinations, shall analyse the relative performance of
students in all assessments of a course and decide the
letter grade ranges for that course. The letter grades
and the corresponding grade points are as follows:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>S</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>U</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Points</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

"W" denotes withdrawal from the course.

R.14b A student who earns a minimum of 5 grade points in a
course is declared to have successfully completed the
course. Such a course cannot be repeated by the
student.

R.14c The results, after awarding of grades, shall be signed by
the Class Committee Chairman, Head of the Department
and Dean of Faculty and declared by the Dean of Faculty.

R.14d Within 2 weeks from the commencement of classes for
the next semester a student can apply for revaluation of
his/her end semester examination answer papers in a
course, on payment of a prescribed fee, through proper
application to the Dean of Faculty. The Dean shall
constitute a revaluation committee consisting of
Chairman of Class Committee as convener, the teacher
of the course and a senior member of faculty
knowledgeable in that course. The Committee shall meet
within a week, revalue the answer paper and submit its
report to the Dean of Faculty for consideration and
decision.

R.14e After results are declared, Grade Sheets will be issued
to each student which will contain the following details.
The list of courses enrolled during the semester including
summer term courses, if any, and the grade scored. The
Grade Point Average (GPA) for the semester and the
Cumulative Grade Point Average (CGPA) of all courses
enrolled from first semester onwards. GPA is the ratio
of the sum of the products of the number of credits of
courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses if any.

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

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. "U", "I" and "W" grades will be excluded for calculating GPA and CGPA.

R.14f After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA:

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class with Distinction</td>
<td>8.50 and above</td>
</tr>
<tr>
<td>First Class</td>
<td>6.50 and above but below 8.50</td>
</tr>
<tr>
<td>Second Class</td>
<td>below 6.50</td>
</tr>
</tbody>
</table>

ATTENDANCE REQUIREMENT AND COURSE REPETITION

R.15a A student shall attend a minimum of 75% of the contact periods offered in any registered course, to become eligible to appear for the end-semester examination in that course, failing which the student shall be prevented from taking the end-semester examination and shall be awarded 'I' grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

R.15b Instructor of each course shall take attendance till five calendar days prior to the last instruction day in the semester and report through the Head of the Department to the Dean of Faculty the names of students who have attendance less than 75% in that course. The Dean shall then announce the names of all students prevented from writing the end-semester examinations in various courses.

R.15c A student should repeat a core course, wherein 'U' or 'I' or 'W' grade was awarded. If the student is awarded 'U' or 'I' or 'W' grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

ELECTIVE CHOICE; OPTION TO DO PROJECT ALONE IN FINAL SEMESTER

R.16a Apart from the various elective courses listed in the curriculum for each branch of specialisation, the student can choose a maximum of 2 electives from any other specialisation under any Faculty, during the entire period of study, with the approval of the Head of the Parent Department and the Head of the other Department offering the course.

R.16b In the curriculum of 8th Semester, along with the project work, if 2 elective courses alone are listed, then the Dean of Faculty may permit a student, as per approved guidelines, on the recommendation of the Head of the Department, to do a full semester major industrial project...
work. In such a case, the above 2 elective courses or any other 2 elective courses in lieu thereof have to be enrolled during any semester including the summer proceeding or succeeding the project work.

INDUSTRIAL VISIT

R.16c Every student is required to undergo one Industrial visit for every theory course offered, starting from the third semester of the Programme.

PERSONALITY AND CHARACTER DEVELOPMENT

R.17a All students shall enroll, on admission, in any one of the personality and character development programmes the NCC/NSS/NSO and undergo practical training for about 80 hours and attend a camp of about ten days.

National Cadet Corps (NCC) will have about 20 parades

National Service Scheme (NSS) will be social service activities in and around Chennai.

National Sports Organisation (NSO) will have Sports, Games, Drills and Physical exercises.

While the training activities will normally be during week ends, the camp will normally be during vacation period.

R.17b Every student shall put in a minimum of 80% attendance in the practical training and attend the camp compulsorily. Normally this is to be completed during the first year. For valid reasons, the Dean of Students may permit a

student to complete this requirements in the second year. However, before enrolling for 5th Semester (7th Semester in the case of Mining Engineering and of lateral entry), a student should have completed the training and produced a certificate from the appropriate authority of NCC/NSS/NSO for having satisfactorily completed the prescribed training and camp.

R.17c Rule 17a and 17b are not applicable to the sponsored/ deputed Candidates satisfying Rule 1c admitted to B.E. in Printing Technology.

DISCIPLINE

R.18a Every student is required to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

R.18b Any act of indiscipline of student reported to the Dean of Faculty will be referred to a Discipline and Welfare Committee nominated by the Syndicate from time to time, for taking appropriate action.

ELIGIBILITY FOR THE AWARD OF DEGREE

R.19a A student shall be declared to be eligible for the award of the B.E./B.Tech. Degree provided the student has:

i) Successfully completed all the required courses in the programme curriculum and earned the number of credits prescribed for the specialisation within a maximum period of 12 semester (10 semesters for Lateral Entry) from the date of admission, including break of study.
ii) Completed the NCC/NSS/NSO requirements.

iii) No dues to the Institution, Library, Hostels, NCC, NSS, NSO, etc.

iv) No disciplinary action pending against the student.

R.19b The award of the Degree must have been approved by the Syndicate of the University.

POWER TO MODIFY

R.20 Notwithstanding all that has been stated above, the University has the right to modify the above regulations from time to time.

---

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM 131</td>
<td>Chemistry I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>GE 131</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>LT 1</td>
<td>Language Elective I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA 131</td>
<td>Mathematics I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH 131</td>
<td>Physics I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Practical

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE 132</td>
<td>Computer Practice I</td>
</tr>
<tr>
<td>GL 133</td>
<td>Workshop Practice</td>
</tr>
</tbody>
</table>

Total 25

---

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 131</td>
<td>Chemistry II</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>EE 151</td>
<td>Electrical Engineering</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EC 152</td>
<td>Electronics Engineering</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>LT 2</td>
<td>Language Elective II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA 132</td>
<td>Mathematics II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH 134</td>
<td>Physics II</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Code No.</td>
<td>Course Title</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>GE 135</td>
<td>Computer Practice II</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GE 134</td>
<td>Engineering Graphics</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td></td>
<td><strong>III SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory</td>
<td>CH 232 Electrical Machines and Drives</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PH 232 Materials Science</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA 231 Mathematics III</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>CH 234 Mechanical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CH 235 Mechanics of Solids</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CH 236 Organic Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Practical</td>
<td>CH 238 Electrical Engineering Lab.</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>CT 233 Materials Science Lab.</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CH 239 Mechanical Engineering Lab.</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td><strong>IV SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory</td>
<td>MA 036 Statistics and Linear Programming</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>CH 242 Physical Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>LT 241 Chemistry and Technology of Leather Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>LT 242 Principles of Unit Operations and Processes in Leather Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>LT 243 Principles of Material Testing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>LT 244 Computer Applications in Leather Technology</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td></td>
<td><strong>VI SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory</td>
<td>MA 038 Numerical Methods</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>LT 341 Practice of Leather Manufacture II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>LT 342 Theory and Mechanism of Inorganic Tannages</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>LT 343 Theory and Practice of Post Tanning and Finishing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>LT 344 Leather Goods and Garment Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>LT 345 Science and Technology of Leather Auxiliaries</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Code No.</td>
<td>Course Title</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>LT 346</td>
<td>Material Testing and Analysis Lab. III</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>LT 347</td>
<td>Tannery Works Practice III</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>

**VII SEMESTER**

<table>
<thead>
<tr>
<th>Theory</th>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 431</td>
<td>Process Economics and Industrial Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E 431 ***</td>
<td>Elective II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>LT 431</td>
<td>Principles of Plant Design for Leather and Chemical Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>LT 432</td>
<td>Tannery Waste Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>LT 433</td>
<td>Organisation and Management of Leather Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>LT 434</td>
<td>Footwear Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Practical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>LT 435</td>
<td>Processing Machinery Lab.</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>LT 436</td>
<td>Tannery Works Practice - IV</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>LT 437</td>
<td>Seminar and Comprehension</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>

**VIII SEMESTER**

<table>
<thead>
<tr>
<th>Theory</th>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>E 436 ***</td>
<td>Elective III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E 441 ***</td>
<td>Elective IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF DEGREE:** 184

**ELECTIVE LIST**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>GE 034</td>
<td>Creativity, Innovation and New Product Development</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>HS 034</td>
<td>Technical Tamil</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>HS 035</td>
<td>Technical German I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>HS 036</td>
<td>Technical German II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>HS 037</td>
<td>Technical Japanese I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>HS 038</td>
<td>Technical Japanese II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>HS 039</td>
<td>Technical French I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>HS 041</td>
<td>English I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>HS 042</td>
<td>English II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>LT 034</td>
<td>Science of Leather Supplements and Synthetics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>LT 035</td>
<td>Animal Byproducts Utilisation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>LT 036</td>
<td>Advanced Physics and Chemistry of Leather - E</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>LT 037</td>
<td>Process Control and Automation in Leather Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>LT 038</td>
<td>Leather Finishing Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>LT 039</td>
<td>Technology of Leather</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>LT 040</td>
<td>Supplements &amp; Synthetics Advances in Leather</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>LT 041</td>
<td>Costing and Value Engineering in Leather</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
18. LT 042 Technology of Tannery Byproducts Utilisation
19. LT 043 Advanced Physics and Chemistry of Leather II
   (Prerequisite: Elective 039) 3 0 0 3
20. LT 044 Leather Biotechnology 3 0 0 3
21. LT 045 Energy Management in Leather Industries 3 0 0 3
22. LT 046 Safety in Leather Industry 3 0 0 3
23. LT 047 Total Quality Management in Process Industries 3 0 0 3
24. LT 048 Environmental Impact Assessment (EIA) Studies on Leather Chemicals and Leather Processing 3 0 0 3

---

MA 131 MATHEMATICS I 3 1 0 4

1. MATRICES 9
   The characteristic equation, Eigen values and eigen vectors of a real matrix, some properties of eigen values, Cayley-Hamilton theorem, Reduction of a real matrix to a diagonal form, Orthogonal matrices-properties, reduction of a quadratic form to a canonical form by orthogonal transformation.

2. GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS 9
   Curvature- cartesian and polar coordinates- Circle of curvature, involutes and volutes, Envelopes - Properties of the envelopes - Envelopes of normal to a curve.

3. FUNCTIONS OF SEVERAL VARIABLES 9
   Total differential - Derivative of implicit functions, Partial derivative of a function of two functions, Taylor’s expansion for a function of two variables, Maxima and minima, Jacobians, Differentiation under the integral sign.

4. MULTIPLE INTEGRALS 9
   Double integration in cartesian and polar coordinates, change of order of integration, triple integration in cartesian coordinates, Gamma and Beta functions - properties, Area as a double integral.

5. DIFFERENTIAL EQUATIONS 9
   Simultaneous linear equations with constant coefficients, Homogeneous linear equations of Euler type - Equations reducible to homogeneous form, Linear equations of second order with variable coefficients, Method of reduction of order, Transformation of the equation by changing the dependent variable, Method of variation of parameters.

L : 45 T : 15 Total= 60
REFERENCES:

PH 131 PHYSICS - I

1. PROPERTIES OF MATTER

Elasticity - Stress - strain diagram - factors affecting elasticity - Twisting couple on a wire - shaft - Torsion pendulum - Depression of a cantilever - Young’s modulus by cantilever - Uniform and non-uniform bending - I shape girder - production and measurement of high vacuum - Rotary pump - Diffusion pump - Pirani Gauge - Penning gauge - Viscosity - Oswald Viscometer - Comparison of viscosities.

2. ACOUSTICS


3. HEAT AND THERMODYNAMICS


4. OPTICS


5. LASER AND FIBRE OPTICS

Principle of lasers - Laser characteristics - Ruby - NdYAG, He-Ne, CO2 and semi conductor lasers - propagation of light through optical fibres - types of optical fibres - applications of optical fibres as optical waveguides and sensors.

6. PRACTICALS

1. Young’s modulus by nonuniform bending
2. Rigidity modulus and moment of inertia using Torsion pendulum
3. Viscosity of a liquid by Poiseuille’s method
4. Wavelength determination using grating by Spectrometer
5. Particle size determination by Laser
6. Thermal conductivity of Lees’ disc
7. Thickness of wire by Air wedge
8. Thermo emf measurement by potentiometer

TEXT BOOK


REFERENCE


L : 30 T : 15 P : 30 Total = 75
CM-131 CHEMISTRY

1. CHEMICAL THERMODYNAMICS
   - Definition of free energy and spontaneity - Maxwell relations - Gibb's - Helmholz equation - Van't Hoff's equation - Stoichiometry and energy balances in chemical reactions.

2. DYNAMICS OF CHEMICAL PROCESSES
   - Basic concepts - composite reactions (opposing, parallel and consecutive reactions) - collision theory - thermodynamic formulation of reaction rates - unimolecular reactions - chain reactions (stationary and non stationary) - enzyme kinetics - Michaelis - Menten equation.

3. ELECTRODICS
   - Types of electrodes and cells - Nernst equation - emf measurement and its applications - Principles of chemical and electrochemical corrosion control (sacrificial anode and impressed current methods).

4. WATER
   - Water quality parameters - definition and expression - estimation of hardness (EDTA method) and alkalinity (titrimetry) - water softening (zeolite) - demineralisation (ion-exchangers) and desalination (RO) - domestic water treatment.

5. POLYMERS
   - Monomer - functionality - degree of polymerisation - classification based on source and applications - addition, condensation and copolymerisation - mechanism of free-radical polymerisation - thermoplastics and thermostetting plastics - injection moulding, blow moulding and extrusion processes.

PRACTICALS

1. WATER ANALYSIS
   - Determination of hardness, alkalinity, DO, Fe (spectrophotometry) and Na & K (Flame photometry).
4. **PROPERTIES OF SURFACES AND SOLIDS**  
Determination of Areas and Volumes - First moment of area and the centroid - second and product moment of plane area - Parallel axis theorem and perpendicular axis theorems - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia - relation to area moments of inertia.

5. **FRICTION**  
Frictional force - Laws of Coloumb friction - Simple Contact friction - Rolling resistance - Belt friction.

6. **DYNAMICS OF PARTICLES**  

7. **ELEMENTS OF RIGID BODY DYNAMICS**  
Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid body - work energy equation.

**TEXT BOOKS**


**REFERENCE**


**GE 132 COMPUTER PRACTICE - I**

1. **FUNDAMENTALS OF COMPUTERS AND OPERATING SYSTEMS:**

2. **OFFICE AUTOMATION**

   a) Word Processing  
   b) Data Base Management System  
   c) Spread Sheet Package  
   d) Presentation Software

**TEXT & REFERENCE BOOKS**


**GE 133 - WORKSHOP PRACTICE**

1. Tools and equipments used in Smithy, Carpentry, fitting, foundry, welding and sheet metal.

**LIST OF EXPERIMENTS**

1. Sheet Metal: Fabrication of tray, cone etc. with sheet metal.
3. Fitting: Practice in chipping, filing, drilling, making vee, square and drill tail joints.
5. Foundry: Preparation of simple moulds like flange, gear, V-grooved pulley etc.
6. Smithy: Demonstration for making simple parts like keys, bolts, etc.

P : 30 Total = 30

SEMESTER - II

MA 132 MATHEMATICS II 3 1 0 4

1. VECTOR CALCULUS 9
Gradient, Divergence, Curl - Line and surface integrals - Green's Gauss divergence and Stokes theorems - Verification and applications.

2. ANALYTIC FUNCTIONS 9
C-R Equations - Properties and analytic functions - Determination of harmonic conjugates and analytic function - conformal mapping - mapping properties of \( w = z+a, \frac{1}{z}, az, z^2 \) and bilinear transformation.

3. COMPLEX INTEGRATION 9

4. EMPIRICAL STATISTICS 9

5. STATISTICAL INFERENCE 9
Sampling distribution - testing of hypothesis - level of significant - confidence limits tests based on normal distribution, t-distribution and Chi-square distribution.

L : 45 T : 15 Total = 60

REFERENCES:

CH 131 CHEMISTRY II 2124

1. ENVIRONMENTAL POLLUTION 8

2. FULES 10

3. BINDING MATERIALS 6
Cement and lime - Types - Composition and characteristics - Chemistry of setting and hardening - Grading and analysis - Adhesives - Types - Characteristics: Epoxides, urethanes, polyvinyl alcohol and polyvinyl acetate.
4. POLYMERIC MATERIALS
Polytetrafluoroethylene, Polymides (nylon 6, nylon 66, 6, T.Kevlar)
Polyesters (polyethylene terephthalate, polybutylene terephthalate,
 aromatic polyesters) polycarbonate, polyacetals, polysulphones
(augmentation only, manufacturing details not required)
Composites: Matrix resins - Reinforcements - Applications.

5. INDUSTRIAL INORGANIC COMPOUNDS
Zeolites: Types - Applications - Ion exchange - Adsorbent - Separation process Catalyst.
Pigments: Titanium dioxide - Lithophone - Zinc Oxide - Iron oxide
-Ultramarine.
Refractory: Silicon carbide - aluminium oxide - Ultramarine.
Refractory: Silicon carbide - Aluminium oxide.
Lubricants: silicone oil - Lithium grease - Graphite - Molybdenum sulphide.

6. PRACTICALS
Phenol water system - Kinetics of Ester Hydrolysis - Distribution Coefficient - Pigment Analysis: Lead and Titanium - Melting point and Molecular weight Determination - Estimation of Percentage Composition of Glycerol (Viscometric method)

L = 30 T + 15 P - 30 Total = 75

REFERENCE


EC 152 ELECTRONICS ENGINEERING

1. SEMICONDUCTORS AND RECTIFIERS
Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - P-type and N-type - P-N junction - VI characteristic of PN junction diode - Zener diode
-Zener diode characteristic - Half wave and full wave rectifiers - Voltage regulation.

2. TRANSISTORS AND AMPLIFIERS
Bipolar junction transistor - CB, CE, CC - Configurations and characteristics - Biasing circuits - Elementary treatment of voltage amplifier - Class A, B and C power amplifiers - Principles of tuned amplifiers.

3. POWER AND CONTROL ELECTRONIC DEVICES
Field Effect Transistor - Configurations and characteristics - FET amplifier - SCR, Diac, Trac, UJI - characteristics and simple applications - switching transistors - concept of feedback - negative feedback - application in temperature and motor speed control.

4. SIGNAL GENERATORS AND LINEAR IC'S
Sinusoidal oscillators - positive feedback - RC phase shift, Hasley, Colpitt's, Wien bridge Oscillators - multivibrators - operational amplifier - adder, multiplier, integrator and differentiators - Integrated circuits.

5. DIGITAL ELECTRONICS
Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra - Exclusive or gate - Half and Full adders - flip
flops - registers and counters - A/D, D/A conversion - Digital computer principle.

TEXT BOOK

REFERENCE
1. Mehta, V.K., Principles of Electronics, S.Chand and Company Ltd., 1994

EE 151 ELECTRICAL ENGINEERING

1. ELECTRICAL CIRCUITS
   9
   Ohms Law - Kirchhoffs Laws - steady state solution of D C Circuits
   - Introduction to AC circuits - Waveforms and RMS value - power and power factor, single phase and 3 phase balanced circuits.

2. ELECTRICAL MACHINES
   15
   Principles of operation and characteristics of D C machines, Transformers (single phase and three phase) - Synchronous Machines - 3 Phase and single phase induction motors - (op. Principles).

3. ELECTRICAL MEASUREMENTS
   6
   Moving coil and moving iron instruments (ammeter and voltmeter) Dynamometer type watt meters and energy meters (op. Principles).

L : 30 P : 30 Total = 60

TEXT BOOK
5. NON DESTRUCTIVE TESTING

Liquid penetrant, Magnetic particle and eddy current methods - X-ray radiography - Fluorescency - Gamma ray radiography - Ultrasonic scanning methods - Ultrasonic flaw detector - Thermography.

6. PRACTICALS 30

1. Meter Bridge - Temp. Coefficient
2. Field along the axis of coil - Determination of H
3. Carey Foster's Bridge - Resistivity
4. X-ray diffraction - calculation of cell parameters
5. Newton's rings - Wavelength measurement
6. Spectrometer - Dispersive power of a prism
7. Rigidity modulus - static torsion
8. Ammeter & voltmeter calibration using potentiometer

TEXT BOOK

L : 30  T : 15  P : 30  Total = 75

REFERENCES


GE 134 ENGINEERING GRAPHICS 1 0 3 3

1. PRINCIPLES OF GRAPHICS 4 + 12

Two dimensional geometrical construction - Conic sections, involutes and cycloids - Representation of three dimensional objects - Principles of projections - standard codes of principles.

GE 135 COMPUTER PRACTICE - II 1 0 3 3

1. MULTIUSER OPERATING SYSTEM 4

Unix: Introduction - Basic commands - vi editor - filters - Input/ output redirection - piping - transfer of data between devices - shell scripts.
2. FUNDAMENTALS OF NETWORKING
Working on a networked environment - Accessing different machines from one node - Concept of E-mail - Use of internet.

3. HIGH LEVEL LANGUAGE PROGRAMMING

L: 15 P: 45 Total = 60

TEXT & REFERENCE BOOK

CH 233 ELECTRICAL MACHINES AND DRIVES 3 0 0 3

1. ELECTRIC CIRCUITS
Definition - ohm's law - series parallel circuit - parallel circuit - Division of current - Kirchoffs law; Superposition and Thevenin's Theorem; Star-delta transformation; Simplification of networks.

2. A.C.CIRCUITS
Alternating Voltage: Need for A.C.Voltage; Sinusoidal A.C. Voltage; R,RL and RLC networks; Impedance angle; Power and Power factor; Actual and apparent power; Resonance in A.C.Circuits; Series, parallel and series-parallel resonance; Vector Liagram (Phasor Diagram); Complex algebra applied to sinusoids; Three phase circuits; Three phase loading: Balanced loads; Simple problems.

3. D.C.MACHINES
Lenz's law of electromagnetic induction; Fleming's rule, Principle of operation of D.C.Machines; Kinds of D.C.machines; Emf equation of D.C. generators; Speed control of D.C. motor; Starters; Application of D.C. Machines.

4. A.C.MACHINES
Principle of operation of A.C.Machines : Transformer; single and three phase induction motors; Alternators; Synchronous motors; Equivalent circuit, Regulation and efficiency of single phase transformer; Slip—torque characteristics induction motors; starting of induction motors. Emf equation, Regulation and synchronisation of alternators; Synchronous condenser; Hunting in synchronous motor; Single phase induction motors and their applications.

5. DRIVES
Industrial requirements and Ward Leonard System of Drives. Servo—Motors; Basic theory and applications.

L = 45 Total = 45

TEXT
1. PHASE DIAGRAMS AND PHASE TRANSFORMATIONS

Gibb's Phase rule – Unary and binary phase diagrams – \( \text{Al}_2\text{O}_3 \), \( \text{Cr}_2\text{O}_3 \), \( \text{Pb-Sn} \), \( \text{Ag-Pt} \) and \( \text{Fe-Fe}_5\text{C} \) Systems-Lever rule – Invariant regions – TTT diagrams-Microstructural Changes-Nucleation and growth – Martensitic transformations – Solidification and Crystallisation – Glass transition-Reocrystallisation and grain growth—Nanophase materials.

2. MECHANICAL PROPERTIES


3. ELECTRICAL AND MAGNETIC PROPERTIES


4. SEMICONDUCTING AND DIELECTRIC PROPERTIES


5. THERMAL AND OPTICAL PROPERTIES

Specific heat capacity – Thermal conductivity – Thermal expansion – Fibre optic materials and their applications – Display materials – LED and LCD.

REFERENCES


MA 231 MATHEMATICS III

1. FOURIER SERIES

Dirichlet’s conditions, General Fourier series, Half range sine and cosine series, Parseval’s identity, Harmonic Analysis.

2. FOURIER TRANSFORMS

Fourier integral representation, Fourier transform pairs, Properties, Fourier sine and cosine Transforms, Transforms of simple functions, Transforms of derivatives, The convolution integrals of Fourier, Application to one dimensional wave and diffusion equations.

3. LAPLACE TRANSFORMS

Transforms of simple functions, Basic operational properties, Transforms of derivatives and integrals, Periodic functions, Convolution theorem, Inverse transforms, Initial and final value theorems, Applications of Laplace transforms to linear ordinary differential equations.
4. PARTIAL DIFFERENTIAL EQUATIONS
Formation, Solution of standard types of first order equation and Lagrange's Linear Equation, Linear partial differential equations of second and higher order with constant coefficients.

5. BOUNDARY VALUE PROBLEMS
Classification of second order partial differential equations, Transverse vibrations of a string, One-dimensional heat equation and two-dimensional heat flow, Fourier series solutions in cartesian coordinates.

TEXT BOOK

REFERENCES

CH 234 MECHANICAL ENGINEERING
1. LAWS OF THERMODYNAMICS
Basic concepts and hints; Zeroth law; First Law of Thermodynamics—Statement and application; Steady flow energy equation; Second law of Thermodynamics—Statement; Limitations; Heat Engine; Heat Pump, Available energy, Kelvin—Plank statement and Clausius statement; Equivalence entropy; Reversibility; Entropy charts; Third law of Thermodynamics—Statement.

2. HEATING AND EXPANSION OF GASES
Expressions for: work done; Internal energy, Hyperbolic and polytropic processes; Free expansion and Throttling.

3. AIR STANDARD EFFICIENCY
 Carnot cycle; Siblings Cycle; Joule Cycle; Otto Cycle; Diesel Cycle; Dual combustion Cycle.

4. I.C. ENGINES
Engine nomenclature and classifications; SI Engine; CI Engine; Four Stroke cycle; Two stroke cycle; Performance of I.C. Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.

5. STEAM AND ITS PROPERTIES
Properties of steam; Dryness fraction; Latent heat; Total heat of wet steam; Superheated steam. Use of steam tables; Volume of wet steam; Volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle; Modified Rankine cycle.

6. STEAM ENGINES AND TURBINES
Hypothetical indicator diagram of steam engine; Working of a simple steam engine; steam turbines—Impulse and Reaction types—Principles of operation.

7. SIMPLE MECHANISM
Kinematic Link, Kinematic Pair Kinematic Chain; Slider Crank mechanism and inversions; Double slider crank mechanism and inversions.

8. FLY WHEEL
Turning moment Diagram; Fluctuation of Energy; Design of fly wheel.
9. DRIVES
Belt and rope drives; Velocity ratio, slip; Ratio of tensions; Length of belt; Maximum HP; simple compound and Epicyclic gear trains.

10. BALANCING
Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

CH 235 MECHANICS OF SOLIDS

1. STRESS, STRAIN AND DEFORMATIONS OF SOLIDS
Rigid bodies and deformable solids - forces on solids and supports - equilibrium and stability - strength and stiffness - tension, compression and shear stresses - Hook's law and simple problems - compound bars - thermal stresses - elastic constants and Poisson's ratio - welded joints - design.

2. TRANSVERSE LOADING ON BEAMS
Beams - support conditions - types of beams - transverse loading on beams - shear force and bending moment in beams - analysis of cantilevers, simply supported beams and overhanging beams - relationships between loading, S.F. and B.M. in beams and their applications - S.F. & B.M. diagrams.

3. DEFLECTIONS OF BEAMS
Double integration method - Macaulay's method - Area - moment theorems for computation of slopes and deflections in beams - conjugate beam method.

4. STRESSES IN BEAMS
Theory of simple bending - assumptions and derivation of bending equation (M/I = (F/Y = E/R) - analysis of stresses in beams - loads carrying capacity of beams - proportioning beam sections - leaf springs - flitched beams - shear stress distribution in beams - determination of shear stress in flanged beams.

5. TORSION
Torsion of circular shafts - derivation of torsion equation (T = G/R = GqL) - stresses and deformation in circular and hollow shafts - stresses and deformation in circular and hollow shafts - stepped shafts - shafts fixed at both ends - stresses in helical springs - deflection of springs - spring constant.

6. COLUMNS
Axially loaded short columns - columns of unsymmetrical sections - Euler's theory of long columns - critical loads for prismatic columns, with different end conditions - effect of eccentricity.

TEXT
CH 238 ORGANIC CHEMISTRY
(3003) (Common to Chemical, Textile and Leather Technology Branches)

New Syllabus suggested: Credits 3 (45 Hours duration)

1. CARBOHYDRATES

- Introduction - Monosaccharides - Important reactions - Polysaccharides - Starch and Cellulose - Derivatives of Cellulose - Carboxy Methyl cellulose and gun cotton - structural aspects of cellulose

2. ORGANO METALLIC COMPOUNDS

- Grignard reagents and their synthetic utility - Organo Silicon compounds

3. OILS, FATS AND WAXES

- Analysis of oils and fats - classification of waxes

4. HETEROCYCLIC COMPOUNDS

- Furan, Thiophene, Pyrrole, Pyridine, and Indole - Their important derivatives

5. DYES AND DYEING

- Colour and constitution
  - Synthesis of some important azodyes (Methyl orange, Methyl red and Congo red)
  - Synthesis of Triphenylmethane dyes (Malachite green, Para Rosmarine Anthraquinone dyes (Alizarin)
  - Phthalic dyes - Eosin preparation
  - Introduction to Natural and Reactive dyes

6. AMINO ACIDS AND PROTEINS

- Classification of proteins - Tests for proteins - Denaturation - structural aspects of wool.

CH 238 ELECTRICAL ENGINEERING LAB
(0042)

LIST OF EXPERIMENTS:

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load characteristics of D.C. compound generator.
4. Load test on D.C. shunt motor.
5. Study of D.C. motor starters.
7. Load test on single phase transformer.
8. Load test on 3-phase squirrel cage induction motor.
10. Load test on 3-phase slip ring induction motor.
12. Synchronization and V-curves of alternator.

P = 60 Total = 60

REFERENCE BOOKS


L = 45 Total = 45
PART - A
1. q & s of glass optical method
2. Rigidity modulus - Static Torsion
3. Young’s modulus and Poisson’s ratio of glass
4. Electrical conductivity of insulating materials
5. Dielectric constant and dielectric loss
6. Refractive index of glass
7. Dispersion of light through glass
8. Thermal conductivity of insulators (Lee’s disc)
9. Thermal Expansion
10. Thermocouple

PART - B
1. Cement analysis: insolubles, mixed oxides and calcium content
2. Moisture content of raw materials
3. Estimation of CO₂ in carbonates
4. Estimation of MnO₂
5. Estimation of iron oxide

CH 239 MECHANICAL ENGINEERING LAB
1. Port timing diagram
2. Valve timing diagram
3. Study of 2,4 stroke I.C. Engine
4. Study of steam engine and Gearbox
5. Load test on 4 stroke Villiers Petrol Engine
6. Load test on 4 stroke Lister Diesel Engine
7. Load test on 4 stroke P.S.G. Diesel Engine
8. Compression test
9. Deflection test
10. Hardness test (Rockwell and Brinell)
11. Spring test
12. Study on behaviour of columns
13. Torsion test
14. Impact test

P = 60 Total = 60

SEMESTER IV
MA 036 STATISTICS AND LINEAR PROGRAMMING
1. PROBABILITY AND RANDOM VARIABLES
   Probability concepts, Random variables, Moments, Moment Generating function, Binomial Poisson, Geometric, Negative binomial, Exponential Gamma, Weibull distributions, Functions of random variable, Chebyshev inequality.
2. TWO-DIMENSIONAL RANDOM VARIABLES
   Marginal and conditional distributions, Covariance, Correlation and regression, Transformation of random variables, Central limit theorem.
3. DESIGN OF EXPERIMENTS AND QUALITY CONTROL
   Completely randomized design, Randomized block design Latin square design, Process control, Control charts of measurements and attributes, Tolerance limits.
4. LINEAR PROGRAMMING
   Formulation of linear programming problem graphical solution simplex algorithm artificial variable and the M-method, degeneracy, alternative optima and unbounded solution.
5. FURTHER TOPICS IN LINEAR PROGRAMMING
   Duality, primal-dual computations, transportation model and algorithm, Assignment model and Hungarian technique of solution, Imbalance, cost Maximization alternative optima in transportation and assignment method.

L = 45  T = 15  Total = 60

REFERENCE

CH 242 PHYSICAL CHEMISTRY 3 0 0 3

1. ELECTROCHEMISTRY


2. CHEMICAL KINETICS


3. PHASE RULE

Definition – Derivation – Application of phase rule to water system – Thermal Analysis – Cooling curves – Two Component system – Eutectic and compound formation.

4. ADSORPTION AND CATALYSIS

Physical and chemical adsorption – Types of adsorption isotherm. BET method, Gibbs equation, Homogeneous catalysis – Heterogeneous catalysis, acid – base catalysis, Enzyme catalysis – Applications of catalysts in industries.

5. COLLOIDS


6. PHOTOCHEMISTRY

Laws of Photochemistry, Quantum efficiency, Photochemical reactions, Actinometry, Kinetics and mechanism of Hydrogen – Bromine reaction.

REFERENCES


LT 241 CHEMISTRY AND TECHNOLOGY OF LEATHER MANUFACTURE 3 0 0 3

1. HIDES AND SKINS AND PRESERVATION


2. PRETANNING PROCESSES

Principles involved in soaking, liming, deliming, drenching, bating, pickling, depickling and degreasing.

3. TANNING PROCESSES

Various types of tanning materials - Vegetable and Mineral tanning salts - Principles involved in vegetable and chrome tanning and their mechanism in brief and combination tannages.
4. POST TANNING PROCESSES 6
Principles involved in neutralisation, dyeing and fatliquoring. Various
drying techniques. Utilisation of tannery by-products.

5. FINISHING TECHNIQUES 6
Types of auxiliaries and finishes used and general machinery
employed in leather production.

REFERENCES
1. Sarkar, K.T., Theory and Practice of Leather Manufacture
Ajoy Sorcor, Madras, 1981.
2. Koteswara Rao, C., and Ollivanan, M.S., Lecture Notes on
dyeing and finishing of leathers, CLRI, Madras, 1983.
3. Dutta, S.S., Introduction to the Principles of Leather
Manufacture, Indian Leather Technologists Association,
Calcutta, 1980.
4. Thorstenson, T.C., Practical Leather Technology, Robert E.

LT 242 PRINCIPLES OF UNIT OPERATIONS
AND PROCESSES IN LEATHER
MANUFACTURE 3 0 0 3

1. CONCEPTS & METERING OF FLUIDS 4
Concepts of Unit operations and Processes, Fundamentals: Unit
and Dimensions, Material and Energy Balances: Fluid statics and
dynamics, Compressible and incompressible fluids, Newtonian
and Non-Newtonian fluids, Measurement of pressure drop and fluid
velocity. Pumps, Compressor, Blowers.

2. HEAT TRANSFER 4
Fundamentals of Heat Transfer, Heat transfer equipment, Heat
exchangers, Evaporators and Condensers and Simple Design
Calculations.

3. MASS TRANSFER 12
Diffusion: Binary diffusion, concept of mass transfer coefficients
and interface mass transfer and stagewise contact.
Distillation: Principle of distillation, Application of distillation in
leather chemicals and auxiliaries processing.
Extraction: Extraction principles, Leaching and Extraction
equipment and their application in leather chemicals manufacture.
Drying: Drying characteristics, theory and mechanism of drying,
estimation of drying rate, design and performance of industrial
driers for leather and chemicals.
Humidification: Humidity charts, methods of humidification and
dehumidification, Equipment and their design aspects; Humidity
control in leather processing.

4. MECHANICAL SEPARATIONS 3
Size reduction: Theory and equipment: application in leather
chemical processing.
Clariication: Principles of clarification, Liquid-Liquid, Liquid-solid
and Liquid-gas separations, Application in leather processing
and effluent treatment.
Mixing: Basic theory and application in leather and leather
chemical processing.

5. PRINCIPLES OF UNIT PROCESSES 3
General concepts for unit processes; Development of process
flow sheets with reference to leather and leather chemical
industries design, control safety pollution abatement. Principles of
halogeneration, esterification, hydrolisis, oxidation, hydrogenation,
Polymerization, sulphation and sulphonation, diazotization and coupling.

6. WATER AND INORGANIC CHEMICALS 5
Treatment of water for domestic and industrial purposes,
manufacture of sodium chloride, sodium sulphide, sodium sulphite
and bisulphite, soda ash, caustic soda, lime, sulphuric and
hydrochloric acids.
7. TANNING AGENTS
Vegetable tannins and Vegetable tannin extracts, Basic Chromium Sulphate, Aluminium, Zirconium, Titanium and Iron salts for leather processing.

8. OILS, FATS AND DETERGENTS
Oils and fats; their nature and products derived from oils and fats, Fatty Acids and Alcohols, waxes and Fatliquors.

9. SYNTHETIC BINDERS
Based on Acrylics, Polyamides, polyesters, polyurethanes, polypropylnis.

10. DYES AND INTERMEDIATES & SURFACE COATING AGENTS
Raw materials; important unit processes; Types of dye intermediates and dyes; pigments, lacquers.

REFERENCES

LT 243 PRINCIPLES OF MATERIAL TESTING - I
1. MICROSCOPY & BACTERIOLOGY
Mechanical and optical parts of compound microscope, images formed, defects in eye pieces and their rectification etc. Preparation of microscopical slides, fixing, embedding, sectioning, staining and mounting. Fibre structure and assessment - Orientation of fibre structure in curing, soaking, liming, pickling, tanning etc. Optimal condition of fibre structures in various types of leathers. Assessment of finished leather, heavy leathers and light leathers. Structure of bacterial cell, nutritional requirements, culture media, sterilization, staining of bacterial cells. Effect of environmental factors on bacterial growth, enzymes of bacteria, biochemical properties of bacteria, control of bacterial growth. Testing of bacterial action on raw hides and skins and in the different stages of Leather Manufacture.

2. ANALYSIS OF VARIOUS LEATHER CHEMICALS AND AUXILIARIES/PROCESS LIQUORS
Salt, lime, sodium sulphide, ammonium salts, deliming acids, baits, neutralizing agents, oils and fats, sulphated oils, soap, fatliquors and other auxiliaries like resin binders, wax emulsions, etc. Principles of analytical methods employed in analysis of water. Analysis of Soak liquor, Lime liquor and Pickle liquor.

3. ANALYSIS OF TANNING AGENTS
Vegetable tanning materials and extracts, chrome extracts and liquors, zirconium and aluminium tanning agents, formaldehyde.

4. MYCOLOGY & ENTOMOLOGY
REFERENCES
1. Sarkar, P.K., 'Analytical Chemistry of Leather Manufacture',
2. 'Official methods of Analysis', Society of Leather
   McGraw Hill Book Company, Inc., New York, Toronto,
   London.
4. Mackie and McCartney, 'Hand Book of Bacteriology',
   Edited by Robert Cruickshank, E & S Livingstone Ltd.
   Edinburgh and London.
5. Tanner, F.W., 'Practical Bacteriology', John Wiley & Sons

LT 244 COMPUTER APPLICATION PACKAGES
FOR LEATHER TECHNOLOGY

1. COMPUTER PROGRAMMING LANGUAGES
   OPERATING SYSTEMS
   An overview of operating systems. - DOS, Unix, OS/2, MS-Windows
   Review of Programming languages - Basic, C & Fortran.

2. DATA PROCESSING
   Introduction to spread sheets. Analysis of data, Graphical
   representations.

3. OFFICE AUTOMATION & PRESENTATION
   SOFTWARES
   - Word Processing, Presentation Softwares
     Professional Report generation using the above.
   - Audio visual presentations using Multimedia

4. DATABASE AND ITS APPLICATIONS
   - Basic structures Retrieval of data for Reports, query and other
     formats and their export to other applications.

5. CAD SYSTEMS FOR LEATHER & LEATHER
   PRODUCTS
   - Pattern grading & Cutting for Footwear and Garments.
   - Design & Development of Leather Products.
   - Computerised colour matching system - its Principle & application.

REFERENCE:
1. Jerry, O., Parker, Gary, L., Breneman * Spreadsheet
   Chemistry* Prentice Hall, Englewood Cliffs, New Jersey-
2. Taxali, R.K., dBase IV made simple* Tata McGraw Hill,
3. Reference Manuals for CAD systems for Footwear and
   Garments

LT 245 MATERIAL TESTING AND ANALYSIS
LAB - 1

A. CHEMISTRY LAB
   Water Analysis
   a. Chloride content
   b. Sulphate content
   c. Iron content

ANALYSIS OF COMMON SALT
   Analysis of Lime
   a. Purity of lime
   b. Total bases

ANALYSIS OF SODIUM SULPHIDE
   Analysis of Used Lime Liquor
   a. Sodium sulphide content
   b. Salt content

ANALYSIS OF DELIMING AGENTS
   a. Analysis of ammonium salts
   b. Analysis of Organic acids

   Analysis of Bate
   Analysis of Pickle Liquor
Analysis of Vegetable Tanning Materials
   a. Qualitative analysis
   b. Quantitative analysis

ANALYSIS OF OILS
   a. Moisture
   b. Acid value
   c. Saponification value
   d. Iodine value
   e. Unsaponifiables

ANALYSIS OF SULPHATED OILS
   a. Moisture
   b. pH
   c. Acid value
   d. Total alkality
   e. Stability
   f. Organically combined - OSO₃ Na & SO₃ Na groups

ANALYSIS OF SOAPS - MOISTURE, TFM, SAP VALUE, FREE ALKALI

B. MICROSCOPY LAB (Demonstration only and not for examination)
   a. Setting up of a compound microscope
   b. Preparation of microscopical slides By paraffin embedding method and By freezing method
   c. Identification of hides and skins from their histological structures and from their grain pattern- Buffalo, Cow, Sheep and Goat
   d. Microscopical assessment of fibre structure during the process - Soaking, liming, pickling and tanning of finished leather - sole leather.

LT 246 TANNERY WORKS PRACTICE - I

Assortment of hides and skins
   Training in the various unit operations such as curing, beamhouse, tanning, finishing etc.
   Practical training in various machines employed in the tannery.
   Preparation of chrome leysors by different procedures.

42

Manufacture of wet-blue hides and skins and their assortment. Manufacture of E.I. hides and skins

MA 037 SPECIAL FUNCTIONS, DIFFERENCE EQUATIONS AND Z TRANSFORM

1. IMPROPER INTEGRALS AND SERIES SOLUTIONS

Improper integrals - Gamma and Beta functions. Series solutions - Ordinary point, regular singular point of second order linear ordinary differential equation, series solution to a second order linear ordinary differential equation about an ordinary point and a regular singular point.

2. BESSEL FUNCTIONS

Bessel's equation, Bessel functions, recurrence relations, orthogonality property, generating function, equations reducible to Bessel's equation, modified Bessel functions. Applications to boundary value problems.

3. LEGENDRE POLYNOMIALS

Legendre's equation, Legendre Polynomials, Rodrigue's formula generating function, recurrence relations, orthogonality property. Applications to boundary value problems.

4. HERMITE AND LAGUERRE POLYNOMIALS

Hermite and Laguerre equations and their solutions - Polynomials, Rodrigue's formula, generating functions, recurrence relations, orthogonality property.

5. DIFFERENCE EQUATIONS AND Z TRANSFORM

Linear difference equation with constant coefficients, elementary properties of z transform applications of z transform, application of z transform to difference equations.

L = 45 T = 15 Total = 60

43
REFERENCE

1. Narayan, S.Manivachagam Pillay and Ramanaiah, G., 

LT 331 THEORY OF SKIN PROTEINS AND PRETANNING OPERATIONS 3 0 0 3

1. PROTEINS 12
   General and Physical Chemistry of proteins with special reference to hide proteins. Chemical constitution of hides and skins; Reactions of proteins with acids, bases and salts; Structure and chemical features of collagen; Reactive groups; Cross linking.

2. POLYMORPHISM & AGGREGATION PHENOMENA OF COLLAGEN 6
   Topocollagen molecule; Sub-units of collagen; Types of collagen; Structure and function. Kinetics of fibril formation; precipitated forms of collagen; Electron microscopy of the collagen fibre; Biosynthesis.

3. THERMAL TRANSITION AND DEGRADATION OF COLLAGEN 7
   Denaturation temperature; Mechanism of denaturation process; Thermal shrinkage; Factors influencing melting transition. Degradation of collagen - collagenases; Physico - chemical properties methodology, mechanism of action.

4. PRETANNING PROCESSES 12
   Chemistry and principles of different pretanning processes - Soaking, liming, deliming, bating, pickling, depickling and degreasing.

5. PRACTICE AND QUALITY CONTROL 8
   Different methods of pretanning processes as applied to light, heavy and industrial leathers. Process control in pretanning operations.

REFERENCE:


LT 332 PRACTICE OF LEATHER MANUFACTURE - I 3 1 0 4

1. GENERAL TANNING PRACTICES & SOLE LEATHERS 12

2. INDUSTRIAL LEATHERS 12
   Belting leathers, honing leathers, picking band leathers, picker as Apron leathers. Hydraulic and pneumatic leathers such as hand pump leathers, deep bore well leathers.

L = 45 Total 45
3. SPORTS GOOD LEATHERS

Sports good leathers such as football, Rugby balls, Volley balls, hockey balls, Cricket balls, etc. Glove leathers for wicket keepers, boxing gloves etc. Harness, Saddlery, Bridle leathers.

4. LIGHT LEATHERS

Full chrome, retan, hunting-suede, softy nappa and burnishable upper leathers from cattle hides. Printed and shrunken grain leathers. Dressing of E.I. kips into upper, lining, bags and for leather goods, hides and their dressing into Kattai, Bunwar Upper and Case hides, Chrome tanned buffalo upper, upholstery and printed leathers.

5. METHOD OF FINISHING

Formulation and methods of application of different dyes, pigments, leather auxiliaries like casein and acrylic binders, silicone and slip agents. Pretanning syntans, neutralising syntans etc. in the manufacture and finishing of the above leathers. Methods of drying of above leathers. Different types of finished leathers made from bag tanned leathers. Processing of splits for shoe suedes garments suede, grain finished leather and specialty finishes.

REFERENCES:


4. LT 333 THEORY AND MECHANISM OF ORGANIC TANNAGES

1. Vegetable tannins - definition and classification, occurrence
2. Chemistry of hydrolysable tannins - gallo-tannins, ellagi tannins - their structural aspects including ellagi tannin dimers, trimers, etc., Chemistry of condensed (flavanoid) tannins - proanthocyanidins, dimers, trimers and other oligomers.
3. Tannins as well as non-tannins, polyphenolic constituents present in popular indigenous tanning materials like avaram, konam, wattal, cutch, babul, myrobalan, etc.
4. Physico-chemical properties of tannins, non-tannins and their effect on the physical properties of leathers. Manufacture of vegetable tannin extracts.

REFERENCES:

2. Rodd, "Chemistry of carbon compounds", Vol. III-D, Chapter on "Hydrolsable tannins".


LT 334  PRINCIPLES OF MATERIAL TESTING II  3 0 0 3

1.  CHEMICAL ANALYSIS

Chemical analysis of pelts and leathers; Analysis of limed and pickled pelts and chemical testing of vegetable tanned/ chrome tanned/aluminum tanned/zirconium tanned/formaldehyde tanned/ combination tanned leathers.

2.  INSTRUMENTAL METHODS OF ANALYSIS

USED IN LEATHER CHEMISTRY

Potentialometry, non-aqueous titration, conductometry; chromatography, spectrophotometry and colorometry, ion exchange resins, electrophoresis - principles and their application in analysis of leather and leather auxiliaries.

3.  PHYSICAL TESTING OF LEATHERS

Statistical testing - sampling position for physical testing of leathers. Different methods employed for physical testing of leathers - principles involved. Static and Dynamic methods. Non-destructive testing of leathers.

4.  STANDARDS AND QUALITY CONTROL

Quality control in leather processing, Rectification of defects in hides, skins and leathers, control of yield, colour and finish of leathers, etc. Physical and chemical characteristics (specifications) of various types of leathers.

L = 45 Total 45

REFERENCES:


ELECTIVE I

As per the choice of students

LT 335  MATERIALS TESTING AND ANALYSIS LAB - II

CHEMICAL ANALYSIS

Analysis of Chrome tanning agents

a. Moisture
b. O2O3 content
c. Acid combined with chromium
d. Basicity: Proctor and Lehigh basicities
e. Distribution of acid groups combined with chromium
f. Degree of citation

Acids and Salts in Vegetable Tannin Extracts by Different Methods
Analysis of Alum Tanning Agents
Analysis of Formaldehyde By Different Methods
Chemical Analysis of Vegetable/Chrome/ Aluminim / Combination Tanned Leathers
Analysis of PCP and Acrylicamines

48

49
BACTERIOLOGY (Demonstration only and not for examination)

i. Preparation of various culture media
ii. Staining of bacteria
iii. Enumeration of bacteria in hides and skins and in tan liquors
iv. Biochemical properties of bacteria
v. Isolation and identification of fungi in leathers
vi. Mildew resistance test for leathers
vii. Identification of insect and parasitic damages

P = 60 Total 60

LT 336 TANNERY WORKS PRACTICE II

0 0 4 2

Manufacture of vegetable tanned sole leathers
   i. by pit
   ii. by rapid tanning methods
Manufacture of chrome and waxed chrome sole leathers
Manufacture of waterproof sole leathers
Processing of harness and saddlery leathers
Lining leathers from different raw materials and tannages
Book binding leathers
Chamois leathers

P = 60 Total 60

MA 038 NUMERICAL METHODS

3 1 0 4

1. SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS

Method of false position, Newton-Raphson method, solution of a linear system by Gaussian, Gauss-Jordan, Crout, Jacobian and Gauss-Seidel methods, Eigen values of a matrix by power and Jacobian methods.

2. INTERPOLATION AND APPROXIMATION

Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central differences, Least square polynomial approximation.

P = 60 Total 60

3. NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation with interpolation polynomials. Numerical integration by Trapezoidal rule, Simpson's rule, Romberg's rule, two point Gauss formula and three point Gauss formula, Double integrals using Trapezoidal and Simpson's rule.

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS


5. BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation and wave equation and two dimensional Laplace and Poisson equations.

L = 45 P = 15 Total = 30

REFERENCE

LT 341 PRACTICE OF LEATHER MANUFACTURE  - II

1. Finished Leathers and Composition of finishes Tanned leathers/semi finished leathers El leathers - Wet blue-Wet white - properties of these leathers - short description of their manufacture. 12
   Function of different ingredients - Newer approaches in finishing. Problems encountered in finishing and their solutions.

2. Finished leathers from goat skins Glaze Aid - Resin uppers - Glazed uppers - Lining leathers - Shoe sueded - Garment sueded - Details of processing techniques. 12

3. Finished leathers from hair sheep and wool sheep skin. El and Wet blue leathers various types of finished leathers from them - sheep nappa, suede garments, upper-lining, diaphragm leathers, glove leathers, assortment of leathers.

4. Upgradation of leathers & Special effects Retannages - Embossing - Special effects by screen and block printing - Roller coating and other modern equipment. Tie and dye leathers, Burnishable leathers and oil pull up leathers. 12

5. Specialty leathers - exotic leathers and furs Morocco, pleated leathers, book binding and chamois leathers; reptiles: crocodiles, lizards, etc. Dressing of fur skins.

L = 50 T = 10 Total 60

REFERENCE:
3. CLRI Process Bulletins.

LT 342 THEORY AND MECHANISM OF INORGANIC TANNING

1. INTRODUCTION TO COORDINATION CHEMISTRY METAL IONS IN TANNING 12
   Werner's theory of coordination, origins of coordinative interactions, role of d and f orbitals, definition of ligands, nucloephilicity of ligands and electronegativity of donor atoms, chelation and masking, ligand field stabilization energy and introduction of factors controlling molecular stability of transition metal complexes. Historical introduction to mineral tanning, Role of Aluminium (III) salts, transition metal in mineral tanning, historical overview of mineral tanning using chromium, zirconium, iron, silica and poly phosphates.

2. AQUEOUS CHEMISTRY OF CHROMIUM 8
   Electronic configuration and its implications, common oxidation states of chromium, redox stabilities of chromium (VI) and chromium (III) salts, redox potentials and their interconversion, protolysis, kinetic inertness of chromium (III), basicity, oxidation and polymerisation, Stiasny's series, Mc Glandish precipitation point.

3. FACTORS CONTROLLING CHROME TANNING 8
   Single and double bath chrome tannages and their relative merits and demerits, preparation of Basic chromium sulphate salt, reaction parameters influencing composition of BCS, kinetics of chrome tanning, diffusion and complexation, effects of float volume, pH, basicity, masking, temperature, drum speed, ageing chrome tanned substrates.

4. MECHANISM OF CHROME TANNAGE 9
   Theories of chrome tanning: absorption, coating, electrostatic and hydrogen bond interactions and coordinative forces involved in chrome tanning, indirect evidence for chrome binding sites in protein, hydrothermal stability of chrome-collagen compound, chromium induced structural changes in collagen.
5. OTHER INORGANIC TANNAGES

Aqueous chemistry of aluminium (III), zirconium (IV) and titanium (IV) and its relevance to mineral tanning, chemistry of silicates and phosphates and their tanning mechanisms, mechanistic classification of inorganic tannages and their relevance to combination tanning.

L = 45 Total 45

REFERENCES:

LT 343 THEORY AND PRACTICE OF POST TANNING AND FINISHING 3 0 0 3

1. DYES AND DYEING OF LEATHER

Classification of dyes based on their chemical nature and also according to their application, their properties, blending of dyes, theory and practice of colour matching, theory and mechanism of dyeing, chemistry and application of dyeing auxiliaries such as leveling agents, wetting agents, dispersing agents and dye fixatives.

2. FATLIQUORS AND FATLIQUORING

Fatliquors based on natural oils, their chemistry and preparation, sulphation, sulphonation and sulphitiation of oils and their properties, synthetic fatliquors, preparation and properties. Mechanism of Fatliquoring. Surfactants and their role.

3. RETANNING AGENTS

Chemistry of retanning agents and mechanism of retanning. Bleaching agents and mordants.

4. PIGMENTS

Classification of pigments, chemistry and methods of preparation of pigments, aqueous pigment pastes, properties required of pigments.

5. TOP COATING AGENTS

Chemistry and preparation of nitrocellulose, lacquers, lacquer emulsion, coloured lacquers, wax emulsions, silicons emulsions, chemistry and properties required of synthetic polymers, impregnating agent, binders, chemistry of polyurethane lacquers, binders and finishes - their properties. Composition of tested of leather finishes.

L = 45 Total 45

REFERENCES:

LT 344 LEATHER GOODS AND GARMENTS TECHNOLOGY 3 0 0 3

1. MATERIAL

Classification of Leather Goods and Garments Selection of Materials, grading and assorting of leathers for leather goods & garments; Property requirements for leather and lining materials; Accessories for Leather goods & garments.

2. CUTTING AND CLICKING

Introduction of hand cutting ; Preparation of knives & tools; Clicking machines - mechanical and pneumatic/hydraulic; Pattern interlocking/testing for material optimisation.
3. ASSEMBLY & STITCHING

Introduction to various sewing machines - Flat bed; cylinder bed & special type m/cs; different feed mechanisms: Basic sewing practice; Various types of Assembly techniques for Leather Goods and Garments.

4. PATTERN DESIGNING

Basic design development - measurements / Sizing chart for men women & children; - Adoption of styles to basic blocks; Pattern development for leather goods; Pattern grading for Leather Garments; CAD applications for Leather Goods and Garment design & production.

5. ORGANISATION & MANAGEMENT

Feasibility reports for leather goods and garment production; Machinery requirement/plant layout; Process scheduling and line balancing; Quality control measures in leather products manufacture; Packaging methods & practices; Costing, pricing and marketing procedures - for domestic, international markets.

REFERENCES:


LT 345 SCIENCE & TECHNOLOGY OF LEATHER AUXILIARIES 3 0 0 3

Definition and function of leather auxiliaries, role of wetting agents, syntans, fatliquors, dyes, pigments, binder, top coats, feel modifiers and matting agents in leather processing.

Surface tension and principles of wetting, importance of HLB, Chemical classification of wetting agents.

Chemical classification of syntans, sulphonation of naphthalene, phenols, Naphthols; Phenol formaldehyde condensation reactions and Novolac, characterisation and photo oxidation mechanisms of phenolic terms, chemistry of light fast syntans, chemistry of amino resins and PU, Unit operations in syntan manufacture.

Theory of leather lubrication, composition of fatliquors, Functionalisation of oils for surface active function, chemical classification natural and synthetic oils, sulphation, sulphonation, sulphitation reactions of oils, role of double bonds and iodine value in functionalisation of oils, sulphones, chlorination, sulphonation, transesterification, maleinisation, phosphorylation reactions for fatliquor preparation. Stability of emulsions, grain and particle sizes of emulsions, factors controlling grain sizes of emulsions. Introduction to fatliquor manufacturing technology.

Theory of colour, chromophoric groups and their optical absorption, structural features of dyes, factors affecting hue and colour, intensely acid, basic and reactive dye classification, Introduction to the chemistry and technology of dye manufacture.

Definition of pigments, groups of polymer bases for colour. Classification, formulations of pigments, particle size, refractive index, density, opacity criteria for the choice of pigment bases, Different techniques in particle size reduction and importance of particle size on functional properties of pigment formulation. Functional definition of binders, chemical classification of binders, acrylic, protein, polyurethane, introduction to manufacturing of binder formulations.

Different types of top coat formulations, choice of polymers for surface protection, role of plasticizers, internal and external plasticizers.

Principles of feel modification of polymer surfaces, types of feel modifiers and matting agents.

L = 45 Total 45
REFERENCES:


LT 346 MATERIALS TESTING AND ANALYSIS

LAB - III

0 0 4 2

a. Tensile Strength and Elongation at break
b. Tongue tear strength
c. Stitch tear and slit tear strengths
d. Grain crack and bursting strength
e. Static/Dynamic water absorption
f. Wet/Dry rub fastness
g. Shrinkage temperature measurement
h. Water vapour permeability
i. Abrasion resistance
j. Lastometer test
k. Density
l. Drape test

Instrumental methods of analysis

a. Chromatography
   i. TLC
   ii. Paper
   iii. GC
   iv. HPLC
b. Spectrophotometry and Colorimetry
c. Electrophoresis
d. Conductivity titration

Lab Preparation and Testing of
a. Fattiquors
b. Syntans
c. Lacquers and emulsions
d. Binders
e. Waxes

LT 347 TANNERY WORKS PRACTICE - III 0 0 4 2

Different types of leathers using raw/wet blue E.I. Cow and buffalo hides, calf skins.

Belting leathers
Cycle saddle leathers
Picking band leathers
Pickers
Apron leathers
Football leathers
Cricket ball leathers
Hockey ball leathers
Volley ball leathers
Upholstery leathers
Shoe Upper leathers
Aniline and semi-aniline calf/side leathers
Box and Willow leathers
Zug grain upper leathers
Nappa Upper
Patent leathers
Shrunken grain leathers
Mesh leathers
Katsai and Burned leathers
Suede upper leathers
Burnishable upper leathers
PART A

1. Principles of Management and Organisation

Planning, organisation, staffing, coordination, directing, controlling, communicating, organisation as a process and a structure, types of organisations.

2. Production and Management

Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning, routing; scheduling, despatching; costs and costs control, inventory and inventory control.

3. Quality and Quality Control

Elements of quality control; role of control charts in production and quality control.

PART B

1. Engineering Economics for Process Engineers

2. Interest, Investment Costs and Cost Estimation

Time value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital; invested capital and profitability.

3. Profitability, Investment Alternative and Replacement

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

4. Annual Reports and Analysis of Performance

Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

5. Economic Balance

Different unit operations with single and multiple variables.

REFERENCE


LT 431 Principles of Plant Design for Leather and Chemical Processing

1. Principles, Illustrations and Methodology of the Following with Reference to their Application in the Leather and Chemical Processing

Process Design
Process flowsheeting
Material and energy flows and networks
Process engineering flow schemes
Codes, Standards and Fabrication processes
Utilities/Offsite facilities
Implant safety
Selection of Materials of construction
2. **BASIC DESIGN OF PROCESS EQUIPMENTS & LAYOUT PRINCIPLES**

Basic Design of process Equipments:
- Stirred reactors (gas liquid and liquid - solid systems)
- Tanning drums and supporting units
- Forced circulation leather dryer
- Distillation units
- Principles of layout for Tanneries and Chemical Process Units
- Factors to be considered for layout selection
- Types of layouts and their design basis

3. **PROCESS CONTROL FOR TANNERIES AND CHEMICAL PROCESS UNITS**

- Principles and types
- Typical control strategies
- Piping and Instrumentation diagrams

4. **UTILITIES AND OFFSITE FACILITIES FOR TANNERIES AND CHEMICAL PROCESS UNITS**

- Estimation of loads
- Nature and type of facilities

5. **PRE CONSTRUCTION COST ESTIMATION**

- Fixed and working capital requirements
- Manufacturing costs
- Break-even and profitability analysis
- Cash flow analysis

L = 45 Total 45

**REFERENCES:**

5. "Tannery design" - CLRI Publication.

**LT 432 TANNERY WASTE MANAGEMENT**

1. **PERSPECTIVES**

- Leather industries and environmental implications, Legislations on environmental protection, standards for discharge of liquid effluents, air emissions into environment.

2. **TANNERY EFFLUENTS**

- Sources of generation of liquid and solid wastes in tanneries, Characterisation of liquid wastes, assessment of critical parameters of pollution (solids, BOD, COD, nutrients, metals and phenolics).

3. **PRINCIPLES OF TREATMENT OF TANNERY WASTE-WATER AND DESIGN OF EFFLUENT TREATMENT PLANTS**

- Units of operation in controlling solids at primary stages of treatment, units of operation in controlling dissolved organics at secondary stages of treatment, units of operation in controlling pollutants at tertiary stage.

4. **SOLID WASTE MANAGEMENT**

- Composition of solid wastes - physical, chemical and biological characteristics. Principles of treatment and disposal of solid wastes.

5. **IN-PLANT MANAGEMENT FOR REDUCTION OF POLLUTION**

- House-keeping, segregation of waste streams. Recovery and reuse of valuable waste materials found in liquid effluents including chromium, sulphides etc.

L = 45 Total 45
REFERENCES:

1. Thomas, C. Thortensen, Fundamentals of Pollution Control for the Leather Industry.

LT 433 ORGANISATION AND MANAGEMENT OF LEATHER MANUFACTURE

2. Location, lay-out and selection of machinery for tanneries for manufacturing different types of leathers. Estimates of investment, costings and feasibility reports. Levels of Industry - Cottage, small, medium and large scale. Demand, capacity and production estimates - Employment of these levels of industry. Employment generation - training and training institutes at state and central -Govt. organisation and private organisations - Labour Laws for tanneries. Technology and Modernisation.

LT 434 FOOTWEAR TECHNOLOGY

1. ANATOMY OF HUMAN FOOT

Skeletal structure of foot - Muscles and Fascia - Structural stability - Contribution of Bones and Muscles for stability in both static and dynamic postures - Foot abnormalities - An introduction.
2. FOOT COMFORT AND FOOTCARE

Comfort parameters - Perspiration - thermal studies - Pressure points in the shoes - shock absorption - physical and mechanical properties of materials like stress vs. strain, vapour permeability - thermal and electrical conductivity - compressibility - friction etc.

3. FOOTWEAR MANUFACTURE

Introduction to sizing systems - Basic concepts of Design and pattern cutting - Material Selection - Grading - Clicking - Preparation - Closing - Shoe room operations - upper lasting.


5. Shoe dressings and shoe polishes - their composition and application.

REFERENCES:


ELECTIVE II

As per the choice of students

LT 435 PROCESSING MACHINERY LAB.

Calculation of pitch contact angle, lead angles of helical blades and specifications of bladed cylinders of cutting and sticking action. Fixing of blades in bladed cylinders

Study of different types of Fleshing machine mechanisms (Roller Machines)

Assembling and testing of Mechanical Clutch Mechanism
Adjustment and setting up Feed rollers, Grip rollers of Roller Machines

ADJUSTMENT OF SPLITTING MACHINE - I

The scraper plate or ringjays plate
Fitting of Band Knife
Adjustment of Chisel attachment

ADJUSTMENT OF SPLITTING MACHINE - II

Setting up of ring rollers
Fixing and adjustment of feed table
Grinding of knife and emery wheels

STUDY OF DIFFERENT TYPES OF SHAVING MACHINES

Grinding Mechanisms and Grinding operation
Adjustment of feed roller and setting the machine for shaving

STUDY OF DIFFERENT TYPES OF STAKING MACHINES

Adjustment of staking head
Adjustment of pressure in different machines
Operation of different types of machines

PRACTICAL STUDY OF DIFFERENT B M, B, BUFFING MACHINES

Fixing of paper in 10 inches throat buffing machines
Fixing of papers in lightning buffing machine
Adjustments of thickness, tambar and operation of lightning buffing machine

STUDY OF DIFFERENT TYPES OF DRYERS

Operation of vacuum dryers and study of different controls, vacuum pump, Hydraulic system, feeding of leather, etc.

P = 60 Total 60
DIFFERENT TYPES OF LEATHERS USING RAWWET BLUE/E.I. GOAT AND SHEEP SKINS:

- Crushed kid leathers
- Glazed kid leathers
- Gold and silver kid
- Nubuck leathers
- Dress glove and utility glove leathers
- Aniline and semi-aniline upper leathers
- Resin upper leathers
- Nappa/split upper leathers
- Suede upper leathers
- Suede garment leathers
- Grain garment leathers
- Tie and dye leathers
- Mesh leathers
- Diaphragm leathers
- Roller leathers
- Skins with hair on
- Shearlings
- Dressing of rabbit skins
- Reptile leathers

LT 437 SEMINAR & COMPREHENSION

0 0 4 2

The object of the seminar & comprehension test is to assess the overall level of proficiency and the scholastic attainment of the student in the various subjects studied during the degree course.

ELECTIVE III

3 0 0 3

As per the choice of students

ELECTIVE IV

3 0 0 3

As per the choice of students

PROJECT WORK

Each student is required to submit a Report on the project assigned to him by the Department. The report should be based on the information available in the literature or data determined in the laboratory/industry. The object of the project is to make use of the knowledge gained by the student at various stages of the degree programme. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the student at the end of the programme.

VIVA VOCE

The object of the viva-voce examination is to determine whether the objectives of the Project work have been met by the student as well as to assess the originality and initiative of the student as demonstrated in the Project Work.

ELECTIVES

LT 034 SCIENCE OF LEATHER SUPPLEMENTS AND SYNTHETICS

3 0 0 3

1. Chemistry of the most common polymeric materials used in leather industry as supplements.

2. POLYMERISATION FUNDAMENTALS

Concept of a macromolecule, natural and synthetic polymer, modes of polymerisation, radical, condensation, stereo regular polymerisation, polymerisation kinetics, mechanism, anionic and cationic polymerisation.

Polymers with linear, branched and cross-linked structures, thermoplastic and thermostet polymers, bulk, solution, suspension and emulsion polymerisation.
3. ANALYSIS AND TESTING OF POLYMERS

Molecular weight and distributions of polymers, different methods of molecular weight determinations, colligative properties, viscometry, light scattering techniques, thermal analysis of polymer, crystallinity and glass transitions and other mechanical properties, spectral analysis such as IR, UV, and NMR of polymers.

4. POLYMERS FOR LEATHER APPLICATION

Polymers for leather processing, syntans, filling agents, base coats, top coats and adhesives. L = 45 Total 45

REFERENCES:


LT 035 ANIMAL BYPRODUCTS UTILISATION

1. Types of animal byproducts - from abattoirs, meat processing plants, poultry, fishing and other sources including fallen animals. Present methods of collection, processing and utilisation in developing countries vis-a-vis developed countries: conservation techniques and concept of two tier technology. Protein meals from animals by-products including fallen animals and their significance in livestock feeds. L = 45 Total 45

2. DIFFERENT METHODS OF RENDERIN

Bone products and their utilisation. Keratinous proteins - various sources keratinous based products and their uses.
1. INTRODUCTION

The control and automation in leather processing is a critical aspect of the industry. This section briefly describes the various operations involved in tanning and dyeing, including the measurement and control of temperature, pressure, and pH. It highlights the necessity for control and discusses the advantages and disadvantages of process control applications in tanning.

2. INDUSTRIAL INSTRUMENTATION

Modern leather processing involves the use of various instruments and control systems. These instruments include pH meters, temperature sensors, pressure gauges, and flow meters. This section covers the basics of industrial instrumentation, focusing on their selection and use in leather processing.

3. PROCESS CONTROL IN LEATHER PROCESSING

Process control in leather processing is crucial for maintaining quality and consistency. This section covers the implementation of control systems in leather tanning and dyeing operations, including the selection of appropriate control strategies.

4. ROLE OF COMPUTERS IN PROCESS CONTROL

The integration of computers in leather processing has revolutionized the industry. This section discusses the role of computers in process control, including software tools and computer-aided design (CAD) systems.

REFERENCES:

1. Eckman, D. P., Industrial Instrumentation.
LT 038 LEATHER FINISHING TECHNOLOGY 3 0 0 3

1. PIGMENTS

Inorganic and organic pigments, Nacreous (Pearlescent) and interference pigments - their representation code in the colour index. Different forms of pigments' powders and pastes. Evaluation and control of their brilliance, opacity, particle size, resistance to solvent, heat and light and colour matching.

2. POLYMERIC MATERIALS AND THEIR DISPERSION FORMS

General introduction to addition, condensation, natural polymers, Casein, cellulose nitrate, cellulose acetate, acrylins, vinyls and urethanes - lacquers - solvents and thinners - emulsion and emulsifiers. Lacquer emulsion - evaluation and control.

3. PRINCIPLES OF FINISHING, FINISH FORMULATION AND THEIR APPLICATION


4. NOVEL FINISHING TECHNIQUES

Role of newer equipments like autospray, roller coats, continuous embossing machines, dom busch, finiflex, etc. Methods such as oil pull-up, waxy burnishable, antique, grain suede, screen printing, roller printing, tie and dye finishings. Also Pearl finishing, easy-care and patent finishing.

5. SPLIT PROCESSING AND UPGRADEATION

For Shoe suede, garment suede, grain finished leather and specialty finishes. Processing technologies and finishing techniques specially suited for the purpose.

L = 45 Total 45

REFERENCES:


LT 039 TECHNOLOGY OF LEATHER SUPPLEMENTS & SYNTHETICS 3 0 0 3

1. Technology of the most common polymeric materials used in leather industry as supplements. Polymer and Rubber industries in India

2. Manufacture of industrially important polymers for plastics, fibres and elastomers - Polyethylene, polypropylene, polyvinyl chloride, polyvinyl alcohol, polyactylonitrile, polystyrene, polyurethane, fluoro-carbon polymers, epoxy resins, polysilnides, polyesters, allyld resins, silicone polymers, celluloses.

3. Fabrication of polymeric materials, compounding and mixing, casting, extrusion, fibre spinning, molding, coating, foam fabrication.

4. Testing of polymers. Mechanical and thermal testing.


L = 45 Total 45
REFERENCE:


LT040 ADVANCES IN LEATHER CHEMICALS AND AUXILIARIES
(Prerequisite: Elective 038)

1. VEGETABLE TANNINS & SYNTANS
   Chemistry of vegetable tannins, extraction criteria for vegetable tannins, solid-liquid ratio for extraction, chemical modification and blending of vegetable tannins.

2. MINERAL TANNING SALTS
   Types of mineral tanning salts, chemistry of Basic chromium sulphate preparation, basicity and masking systems, factors influencing exhaustion of chromium (III) during tanning.
   Acid-base properties of Aluminium (III), Zirconium (IV) and Titanium (IV) salts, masking systems for Aluminium (III), Zirconium (IV), Titanium (IV), Phenol-formaldehyde syntans, their molecular weight and colour fastness limitations, concept of light fast and heat stable syntans, molecular weight and particle size distribution and their relationship to fibre packing in leather processing.

3. DYSES AND PIGMENTS
   Anionic and cationic fatiquors, importance of free oil to emulsifier ratio, Theory of leather lubrication, criteria for choice of oil formulations for fatiquors.

Dyes, pigments and colourants, Colour measurement techniques, factors influencing fastness properties of dyes, pigments and colouring substances.

4. FINISHING AUXILIARIES & PRESERVATIVES
   Finishing auxiliaries and importance of surface feel modification, feel modifiers and the role of slip agents, fillers and matting agents and concept of modification of refractive index of finish films. Protein preservation, chemical classification of preservatives for leather, formulation of preservatives, and role and function of hydrophobicity/hydrophilicity in preservation.

REFERENCE:

2. SAP Board of Consultants and Engineers, Synthetic resins and their industrial applications, Small Business Publications No.57.

LT041 COSTING AND VALUE ENGINEERING IN LEATHER

1. INTRODUCTION TO VALUE ENGINEERING
   a. Value and value analysis
   b. Identification of its function/end use

2. OBJECTIVES OF VALUE ANALYSIS
   a. Importance in import substitution

3. VALUE ANALYSIS AT DIFFERENT STAGES
   a. Techniques of value analysis

4. VALUE ANALYSIS PROEDURE
   a. The information phase
   b. The analytical phase
   c. Recommendation
   d. Implementation
5. ORGANISATION FOR VALUE ANALYSIS
   a. Organisation structure
   b. Responsibilities of individual departments

PROJECT WORK
   Application of value analysis - A case study
   L = 45 Total 45

REFERENCES:

LTO42 TECHNOLOGY OF TANNERY BY PRODUCTS UTILIZATION 3 0 0 3

1. AN OVERVIEW
   Types of tannery by products available in India. Their nature and composition. Present methods of collection and utilisation. Recovery of salt from the same. Its treatment and re-use. Theoretical and practical aspects of recovery of chrome. Protein and biogas from the same.

2. BEAM-HOUSE PRODUCTS
   Recovery of fat, proteins, chemicals and glue and their use. Pet Treats, finished splits, gloves, washers etc.

3. LEATHER SHAVINGS AND TRIMMINGS
   Chemistry and processing into hydrolysates, glue gelatin, syntans, fertilizers, processing into leather and acoustic boards.

4. NATURE OF TANNERY HAIR
   Chemistry and processing into protein meal, hydrolysates and their uses - Conversion into felta and other utility products.

5. PROCESS STUDIES
   Glue and protein meal from tannery fleshings. Quality evaluation of glue and protein meal, pet treats from limed stock recovery of salt from used salt - Analytical procedures of protein meals.

REFERENCE:
5. Cowe, M.C. et. al. 'Environment and Tannery' Centre Technique de Cult, Lyon, France.

LTO43 ADVANCED PHYSICS AND CHEMISTRY OF LEATHER II 3 0 0 3
   (Prerequisite: Elective 036)

1. Macro and microcomposition of skin and influence of hydration and water structure on the pore size pattern in skin. Functional sites in protein for interactions with vegetable and pretannining materials. Electrophilic and nucleophilic reactions at protein sites.
2. Types of transport of fluids into solid matrices
3. Molecular level processes and changes in soaking, liming, deliming, bating, pickling, tanning, dyeing and Fatliquoring.

4. Dimensional changes and microstructural variations of skins during soaking, liming, deliming, bating, pickling, tanning, retanning, Fatliquoring and drying as well as finishing with resin and casein finishes.

5. Surface science application to leather. Surface charge and energy of full chrome and chrome retanned leather. Emulsions in leather processing and the surface charge and potential of leather finish films, adhesion mechanisms, influence of opacity, refractive index and scattering coefficient of pigments and pigment formulations and factors controlling the stability of leather finish films.

REFERENCES:


1. PROTEINS AND NUCLEIC ACID & ENZYMOLGY

2. GENETIC ENGINEERING (RECOMBINANT DNA TECHNOLOGY)

3. BIOTECHNOLOGY FOR HIDES/SKINS IMPROVEMENT

4. WASTE MANAGEMENT AND UTILISATION OF COLLAGENOUS TISSUES FOR BIOMEDICAL AND OTHER APPLICATIONS

REFERENCES:


LT 045 ENERGY MANAGEMENT IN LEATHER INDUSTRIES

1. ENERGY SOURCES

Conventional Energy sources - Non-Renewable energy sources - Coal, oil - Exploitation of natural energy resources and present trend - Need for energy conservation - Energy and future mankind.
Non-conventional energy sources - Renewable energy sources - Solar, wind, hydrot, tidal energy - Potential of renewable energy source - Future energy sources.

2. ENERGY SOURCES OF LEATHER INDUSTRIES

Normal energy sources utilised in leather industries - Utilisation pattern of various energy sources. Energy intensive leather industries - Tannery - footwear - Leather products sectors.

3. ENERGY MANAGEMENT

Need for optimisation of energy utilisation - Production and energy utilisation. Process improvements for energy conservation - Use of energy efficient equipments for all applications - energy conservation by effective maintenance techniques - House keeping and energy utilisation - Creating awareness of energy conservation among employees and various methods.

4. ENERGY AUDITS

Definition of energy audit - Need for regular energy audit in leather industries - Methodology. Various steps involved in energy audits - Implementation of audit recommendations.

5. ADOPTION OF RENEWABLE ENERGY SOURCES

Application of renewable energy sources in leather industries - Solar energy - Process hot water - Leather dyeing - Salt and chrome recovery - Wind energy - Pumping - rural drum operations.

L = 45 Total 45

REFERENCES:

LT 046 SAFETY IN LEATHER INDUSTRY

SAFETY PHILOSOPHY

Legal framework of safety & health in India
International conventions and trends
Responsibilities and enforcement mechanism
Need for safety & health (cost/benefit rational; safety, environment and productivity triangle)

HAZARD IDENTIFICATION AND ASSESSMENT

Role of industrial hygiene
Hazard classification (hazard categories and groups)
Hazard identification and assessment (tools and methods)

SAFETY IN USE OF HAZARDOUS SUBSTANCES AT WORK

Chemical and biological hazards in the work place in the leather industry
Health effects of chemical and biological exposure
Hazard information systems on hazardous substances (material
safety data sheets, labelling
Workplace exposure monitoring and evaluation
Hazard prevention and control measures (storage, handling and disposal) in the leather industry.

PRODUCTIVE MACHINE SAFETY IN THE LEATHER INDUSTRY 8

Safety hazards of machinery, machine tools and electrical installations
Hazard prevention and safeguarding of machinery (guards, machine controls, ergonomics)
Role of preventive maintenance

WORK ECOLOGY AND ERGONOMICS 9

Safe workstation design and layout
Manual handling of material
Lighting (standards, use of natural and artificial illumination)
Climate control (standards, temperature/humidity, improving general ventilation)
Noise management (standards, prevention and protection)
Safety of factory premises and installations (railings, flooring, safe structures)
Welfare measures
Personal protection and hygiene (selection, use, maintenance)

EMERGENCY PREVENTION AND PREPAREDNESS 7

Planning for emergencies
Control of fire and explosion
Dealing with medical emergencies

SAFETY & HEALTH MANAGEMENT AND PROMOTION 3

Promoting safety & health practices at the workplace (training, safety and warning signs)
Role and responsibilities of managers, supervisors and workers

L = 45 Total 45

REFERENCES:


LT047 TOTAL QUALITY MANAGEMENT IN PRODUCTION INDUSTRIES 3003

1. EVOLUTION OF QUALITY CONCEPTS AND THEIR OVERVIEW 9
   - Development of various quality control and quality assurance concepts.
   - Concept of product quality
   - Concept of quality control system
   - Introduction to ISO 9000 and TQM and TQM

2. ISO 9000 9
   - ISO 9000 genesis, advantages, documentation, procedures etc.
   - ISO 9000 Vs. classical quality control concept
   - System evaluation
   - System development
   - System implementation and maintenance
   - ISO 9000 and ISO 14000 standards

3. TQM 9
   - Total quality management concept
   - Internalisation of quality
   - Customer driven quality activity
   - TQM development for TQM
   - Ideal TQM system

4. QUALITY ASSURANCE TOOLS 9
   - Statistical methods
   - Quality costing

84
- FMEA and FMECA
- Fish bone method

5. ISO 9000 AND TQM PROCESS INDUSTRIES
   - CASE STUDY
   - Impediments in implementing ISO, TQM & solutions
   - Model quality assurance system for leather
   - ISO 14000

L = 45 Total 45

REFERENCE:


LT 048 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDIES ON LEATHER CHEMICALS AND LEATHER PROCESSING

1. LEGISLATIONS ON ENVIRONMENTAL POLLUTION CONTROL AND MANAGEMENT

Environmental Legislations in India, Europe, USA and Canada. Development of Legislations, Standards and guidelines.

2. OBLIGATIONS OF INDUSTRIES TO CONTROL ENVIRONMENTAL POLLUTION


3. OCCUPATIONAL HEALTH HAZARDS AND INDUSTRIES

Factory Act 1987 of India, Occupational health and safety requirements and standards of ILO, compliance of rules and guidelines of Factory Act applicable to industries.

4. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND AUDIT (EA)

Principles of environmental impact assessment and audit guidelines and legislature requirements for siting of industrial units in estates/complex. Preparatory procedures for EIA study, evaluation of impact on air, water and land environment.

5. ENVIRONMENTAL AUDIT (EA)

Principles of environmental auditing, cleaner technologies in industrial processes and evaluation of processes. Auditing techniques in preparation of EA.

6. ENVIRONMENTAL MANAGEMENT PLAN

Monitoring of ambient environment, including air, water and land, noise liquid and solid waste management.

L = 45 Total 45

REFERENCES:

1. INTRODUCTION
The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

2. PROJECT SELECTION AND EVALUATION
Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

3. NEW PRODUCT DEVELOPMENT
Research and new product development - Patents - patent search - Patent laws - International code for patents - Intellectual property rights (IPR)

4. NEW PRODUCT PLANNING
Design of prototype - testing - quality standards - marketing research - introducing new products.

REFERENCES

TEXT BOOKS
1. A.K. PARANTHAMANAR, Nalla Tamil Eldha Venduma, Pari Nilayam, Chennai

REFERENCES
2. Kala Niyam, Quarterly of Anna University, Chennai (Journal articles).
4. Dr. RAGHAV CHELLAPEN, Kalaichottakam.

HS 035 TECHNICAL GERMAN-I

1. INTRODUCTION

Special and comparative features of German with English, Hindi and Tamil - German Alphabets, pronunciation.

2. THEMA

Name, Land, Wohnort - Stadum, Beruf - Familie, Geschwister, Alter - Tagesablauf, termine - Einladung - Stellensuche, Berufswahl - Einkaufen.

3. GRAMMATIK


4. UEBUNGEN

Partner uebungen - Schriftliche Uebungen - Aussprache Uebungen - Kontrolluebungen - Text generation.

5. DIALOGUE

Oral - Written.

6. GLOSSARY

Technical Words

TEXT BOOK

LEHRZIEL DEUTSCH (Deutsch als Fremdsprache) - Grundstufe 1
From MAX Hueber Verlag.

HS 036 - TECHNICAL GERMAN - II

1. INTRODUCTION

German Idioms and Phrases

2. THEMA


3. GRAMMATIK

Ort und Richtung - Reflexive Verben, Verben mit Praepositional object - Perfect - Praeteritum - Adjective - Komparation, Genetic, Wortbildung - Nebensatze.

4. UEBUNGEN

Partner uebungen - Schriftliche Uebungen - Aussprache Uebungen - Kontrolluebungen - Text generation.

5. DIALOGUE

Oral - Written

6. GLOSSARY

Technical Words

L = 45 T = 15

TEXT BOOK

LEHRZIEL DEUTSCH (Deutsch als Fremdsprache) - Grundstufe 1
From MAX Hueber Verlag.

HS 037 TECHNICAL JAPANESE-I

1. Introduction to Japanese Alphabets - Hiragana, Katakana and Kanji - Group 1,2,3 & 4 Syllabus - Writing Practice - Pronunciation - Word Order - Greetings - Receiving a visit and exchange of pleasantries - Kanji Practice.

3. Classification of particles - Ga, Ka, Wa, O, E, Ni, etc. - aural comprehension - Reading comprehension - noun-1 Wa, noun-2 desu - Demonstrative pronouns - kore, sore, are and dore - kono, sono, ano and dono - kochira - sochira - achira and dochira - particle - No, kara, ni and de - question-tsu - conversational grammar - so desu ka - Na, I adjectives perfect and imperfect question words - Doo and Ikaga - particle - To, ne and yo - Kanji practice.

4. Desu as a substitute for a verb - demonstrative pronouns - sono and sore - Group 1 particles - De, O, Made and Ka - conjunction - soshibe - Questin words - doro, nori, doko, hito, dore, dochira, doyatte, ikutsu, ikura, Words for degrees - gurai or kurai - Phrase - Saa-Anoo - numerals - counters and numbers - humble form of desu and aimasu - Kanji practice.

5. Verbs ending in-te or de - classification of Te forms and Musu forms - verb modifiers - koo, soo, aa and doo - Set phrase - Onegaishimasu - Sumimasen - Adverbs - Mazu, sore kara and saigo ni - formation of the - Te form of I adjective and desu - Kanji practice.

TEXT BOOKS

3. YAN-SAN Serial - Video tapes, Japan.

HS 038 TECHNICAL JAPANESE - II 3 1 0 4

1. Demonstrative Pronouns - Are - Interjection - Ee - Quoted Sentences-omoieme - Non polite form of verbs - Group 1
HS 039 TECHNICAL FRENCH - I
1. Alphabets - Pronunciation - Masculine and Feminine Genders only - Numbers - Indefinite and definite articles - Plurals - Verbs to be and to have
9
2. Present tense - Affirmative, interrogative and negative sentences - Adjectives - Adverbs - Prepositions - Possessive Pronoun - Personnel Pronoun - Indirect Object
9
9
9
9

TEXT BOOKS

REFERENCES
1. CENTRE D'ETUDES FRANCAISES, Functional French for Scientists and Technologists, Jawaharlal Nehru University, New Delhi, 1986.

HS 041 ENGLISH I
1. LISTENING
7
Listening comprehension - listening for specific information - note-taking - use of charts and diagrams.

2. SPEAKING
7
Defining - describing objects - describing uses/functions - comparing - offering suggestions - analysing problems and providing solutions - expressing opinions (agreement/disagreement) predicting - expressing possibility/certainty - framing questions - providing answers - pronunciation practice (word stress).
4. WRITING

Sentence definition - static description - comparison and contrast -
classification of information - recommendations - highlighting
problems and providing solutions - format and informal letter writing
- using flow-charts/diagrams - paragraph writing - editing.

5. FOCUS ON LANGUAGE

Word formation with prefixes and suffixes - discourse markers and
their functions - degrees of comparison - expressions relating to
recommendations and comparisons - active and passive voice
- antonyms - tense forms - gerunds - condition sentences - modal
verbs of probability and improbability - acronym and abbreviations
- compound nouns and adjectives - spelling - punctuation.

TEXT BOOK

1. "English for Engineers and Technologists", Volume I. Authors
   : Humanities and Social Science Department, Anna
   University, Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH

1. Narayanaswami, V.R. Strengthen Your Writing, Orient
   Longman Ltd., Chennai 1996 (Revised Edition)
2. Pickett and Laster, Technical English, Writing, Reading and
3. Swan, Michael, Basic English Usage, Oxford University
TEXT BOOK

1. "English for Engineers and Technologists", Orient Longman, 1990 Volume II. Authors: Humanities and Social Sciences Department, Anna University, Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH II

REGULATIONS AND SYLLABUS

(REGULATIONS 2000)

B. Tech. Degree Programme (8 Semesters)

TEXTILE TECHNOLOGY

ANNA UNIVERSITY
CHENNAI - 600 025
APRIL 2000
REGULATIONS
AND
SYLLABUS

(REGULATIONS 2000)

B.Tech. DEGREE PROGRAMME
(8 SEMESTERS)

TEXTILE TECHNOLOGY

ANNA UNIVERSITY
CHENNAI - 600 025.
APRIL 2000
REGULATIONS 2000

Degree of Bachelor of Engineering / Technology (Eight Semesters)

(APPROVED IN THE 42nd MEETING OF THE ACADEMIC COUNCIL HELD ON 25.09.1999)

PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) “Programme” means Degree Programme, that is B.E. / B.Tech. Degree Programme

ii) “Branch” means specialisation or discipline of B.E. / B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.

iii) “Course” means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.

iv) “Faculty” means a Faculty of the University, like Faculty of Civil Engineering, Faculty of Technology, etc. Each Faculty is headed by a Dean.

ADMISSION

R1a Candidates for admission to the first semester of the eight semester B.E./B.Tech. Degree Programme shall be required to have passed

i) the Higher Secondary Examination of the (10 +2) curriculum (Academic stream) prescribed by the appropriate authority of Government of Tamil Nadu with
Mathematics, Physics and Chemistry as three of the four subjects of study prescribed under Part III. In the case of B.Tech. Industrial Bio-Technology, the subjects are Physics, Chemistry, Mathematics and/or Biology.

OR

i) any other examination of any University or authority accepted by the Syndicate of the University as equivalent thereto.

R.1b Candidates for admission through lateral entry into the third semester of the eight semester B.Tech. Degree Programme at M.I.T. Campus shall be required to have passed

ii) the examination of a B.Sc. Degree of $10 + 2 + 3$ or $11 + 1 + 3$ pattern of a recognised University in any one of the following B.Sc. Degree Programmes having Mathematics and Physics as subjects of study:

OR

any other examinations of any University or authority accepted by the Syndicate of the University as equivalent thereto.

R.1c Sponsored/deputed candidates (Diploma holders) for admission to the 1st Semester of 6 Semester B.E. Degree programme in Printing Technology shall be required to have passed the 3-year Diploma in Printing Technology (Letterpress/Lithography/Integrated) awarded by the State Board of Technical Education of

Government of Tamil Nadu or any other examination of any authority accepted by the Syndicate of the University as equivalent thereto. The institutions eligible to sponsor/depute the candidates and the minimum experience to be possessed by such candidates shall be as prescribed by the Syndicate of the University from time to time.

R.2a Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for plus two academic stream of the Tamil Nadu Board of Higher Secondary Education.

R.2b Notwithstanding the qualifying examination the lateral entry candidate might have passed, the candidate shall also write an entrance examination for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics, Chemistry, Applied Sciences, Electronics, Instrumentation and Computer Science at B.Sc. Degree level.

R.2c Sponsored/deputed candidates satisfying Rule 1c shall also write the entrance examination as per Rule 2a.

R.3 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Syndicate of the University from time to time.

R.4a The candidate shall not have completed 21 years of age as on first of July of the year of application. In the case of lateral entry, the candidate shall not have completed
22 years of age as on 1st July of the year of application. For candidates belonging to SC/ST, the age limit is relaxable by 3 years.

R.4b There is no age limit for sponsored/deputed candidates satisfying Rule 1c, seeking admission to B.E. Printing Technology.

BRANCHES OF STUDY AND STRUCTURE OF THE PROGRAMME

R.5a Regulations 2000 is applicable to B.E./B.Tech. Degree Programme in various branches of Engineering and Technology, each distributed over 8 semesters with 2 semesters per Academic Year.

Faculty of Civil Engineering
1. B.E. Civil Engineering
2. B.E. Geo-Informatics.

Faculty of Electrical Engineering
1. B.E. Computer Science and Engineering
2. B.E. Electrical and Electronics Engineering
3. B.E. Electronics and Communications Engineering.

Faculty of Engineering (MIT)
1. B.Tech. Aeronautical Engineering
2. B.Tech. Automobile Engineering
3. B.Tech. Electronics Engineering
4. B.Tech. Instrumentation Engineering
5. B.Tech. Production Engineering
6. B.Tech. Rubber and Plastics Technology

Faculty of Mechanical Engineering
1. B.E. Industrial Engineering
2. B.E. Manufacturing Engineering
3. B.E. Mechanical Engineering
4. B.E. Mining Engineering
5. B.E. Printing Technology.

Faculty of Technology
1. B.Tech. Ceramic Technology
2. B.Tech. Chemical Engineering
3. B.Tech. Industrial Bio-Technology

R.5b Every Programme will have a curriculum with syllabi consisting of theory and practicals such as

i) General core courses comprising mathematics, basic sciences, engineering sciences, humanities and engineering arts.

ii) Core courses of Engineering/Technology.

iii) Elective courses for specialisation in related fields.

iv) Workshop practice, computer practice, engineering graphics, laboratory work, industrial training, seminar presentation, project work, education tours, camps etc.

v) NCC/NSS/NSO activities for character development.

R.5c Each course is normally assigned certain number of credits with 1 credit per lecture period per week, 1 credit per tutorial period per week, 1 credit for 2 periods of laboratory or practical or seminar or project work per week (2 credits for 3 or 4 periods of practical) and 1 or 2 credits for 4 weeks of industrial training during semester vacations.
R.5d Each semester curriculum shall normally have a blend of lecture courses not exceeding 6 and practical courses not exceeding 4.

R.5e For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. This minimum will lie between 181 and 190 credits depending on the branch.

R.5f The medium of instruction, Examinations and project report will be English, except for courses on languages other than English.

DURATION OF THE PROGRAMME

R.6 A student is ordinarily expected to complete the B.E./B.Tech. Programme in 8 semesters (6 semesters in the case of lateral entry student), but in any case not more than 12 semesters (10 semesters in the case of lateral entry student).

FACULTY ADVISER

R.7 To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department of the student will attach a certain number of students to a teacher of the Department who shall function as Faculty Adviser for those students throughout their period of study. Such Faculty Adviser shall advise the students and approve the courses to be taken by the students during each semester.

CLASS COMMITTEE

R.8a For all branches of study during first semester, a common Class Committee will be constituted by the Dean of Academic Courses. During other semesters, separate Class Committees will be constituted by the respective Heads of the Departments of the students.

R.8b Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them as nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department/Dean of Faculty/Dean of Academic Courses depending upon whether all the teachers teaching the common course belong to a Department/ Faculty/ different Faculties.

R.8c The first semester Class Committee composition will be as follows:

i) Course Co-ordinators of all common courses.
ii) Teachers of all other individual courses.
iii) One Professor, preferably not teaching first semester class, appointed as Chairman, by Dean of Academic Courses.
iv) One male and one female first semester student from each Faculty to be nominated by the Dean of Academic Courses.
v) All first semester Faculty Advisers and all the Deans may opt to be special invitees.

R.8d The composition of the Class Committee for each branch from 2nd to 6th semester will be as follows:
i) Teachers of individual courses.

ii) One Professor or Assistant Professor preferably not teaching to the concerned class, appointed as Chairman by the Head of the Department.

iii) 2 students, preferably 1 male and 1 female student of the class per group of 30 students or part thereof, to be nominated by the Head of the Department in consultation with the Faculty Advisers.

iv) All Faculty Advisers of the Class, Teacher in-charge of UG Programme and Head of the Department may opt to be special invitees.

R.8e The Class Committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of class commencement, in which the type of assessments, like test, assignment, assignment based test etc., will be decided for the first second and third assessments. The second meeting will be held with in a week after the date of first assessment report, to review the students' performance and for follow up action. The Third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

During these three meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

R.8f The Class committee, excluding the student members and the invited members, shall meet within two weeks from the last day of the End-Semester Examination to analyse the performance of the students in all the components of assessments and decide the grade ranges for each course. The grading ranges for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned teacher.

REGISTRATION AND ENROLMENT

R.9a Every student shall submit a completed Registration form indicating the list of courses intended to be credited during the next semester. This Registration will be done a week before the last working day of the current semester. Late registration with the approval of Dean of Faculty along with a late fee will be done up to the last working day.

R.9b At the beginning of the semester, before the date of class commencement, every student shall confirm the Registration by paying the prescribed fees for the semester and enroll for the courses. Late enrollment, with the approval of Dean of Faculty along with a late fee, will be done up to 2 weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

R.9c The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

WITHDRAWAL FROM A COURSE

R.9d A student can withdraw from a course at any time before the second assessment with the approval of Dean of Faculty on the recommendation of the Head of the Department of the student.
TEMPORARY BREAK OF STUDY FROM A PROGRAMME

R.9e A Student can take a one time temporary break of study covering the current semester and/or next semester period with the approval of the Dean of Academic Courses, at any time before the start of third assessment of current semester, within the maximum period of 12 or 10 Semesters as the case may be.

CREDIT LIMIT FOR ENROLMENT AND MOVEMENT TO HIGHER SEMESTER

R.10a A student can enroll only for a maximum of 30 credits during a Semester period including arrears courses.

R.10b The following minimum credits should be earned by a student to register for the higher semester courses.

<table>
<thead>
<tr>
<th>TO REGISTER FOR COURSES</th>
<th>MINIMUM CREDITS TO BE EARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Semester</td>
<td>10 in 1st Semester Courses alone</td>
</tr>
<tr>
<td>3rd Semester</td>
<td>12 in 2nd Semester Courses alone</td>
</tr>
<tr>
<td>4th Semester</td>
<td>12 in 3rd Semester Courses alone</td>
</tr>
<tr>
<td>5th Semester</td>
<td>12 in 4th Semester Courses alone</td>
</tr>
<tr>
<td>6th Semester</td>
<td>12 in 5th Semester Courses alone</td>
</tr>
<tr>
<td>7th Semester</td>
<td>12 in 6th Semester Courses alone</td>
</tr>
</tbody>
</table>

Those who do not satisfy the above minimum credit requirements, may register and enroll for arrears courses only.

SUMMER TERM COURSES

R.11a A student can register for a maximum of two courses only during Summer Term, if such courses are offered by the concerned department.

R.11b The Head of the Department, in consultation with the Department Consultative Committee and with the approval of Dean (Academic Courses) may arrange for the conduct of a few courses during summer term, depending on availability of teachers during summer and subject to a minimum of five students registering for such courses.

R.11c However, in the case of a student completing 8th semester and having arrears in the earlier semesters in a maximum of two courses, summer courses may be offered, even if less than five students are registering for the course.

R.11d The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a summer term course or for substitute examination.
ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

R.12.a Every theory course shall have a total of four assessments during a semester as given below:

<table>
<thead>
<tr>
<th>Assessment No.</th>
<th>Course coverage in weeks</th>
<th>Duration in hours</th>
<th>Weightage of max. marks %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>1 to 4</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>Test 2</td>
<td>5 to 8</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>Test 3</td>
<td>9 to 12</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>End-Sem. Exam</td>
<td>1 to 16</td>
<td>3 hours</td>
<td>50</td>
</tr>
</tbody>
</table>

R.12b The pattern of question for at least one of the Tests shall be the same as stipulated for the End-Semester Examination by the Board of Studies/Academic Council. Teachers handling course in the third to eighth semesters are given the option to substitute a maximum of two tests with other suitable alternate type of evaluation approved by the class committee. The details of such a scheme shall be announced to the students and informed to the Dean of Academic courses at the beginning of the Semester. However, for the first and second semester, all assessments will be in the form of tests.

R.12c Every practical course will have 75% weightage for continuous assessment and 25% for End-Semester examination.

R.12d In the case of Industrial Training, the student shall submit a report which will be evaluated along with an oral examination by a Committee of Teachers constituted by the Head of the Department. A progress report from the industry will also be taken into account for evaluation.

R.12e In the case of project work and mini project work, a committee of Teachers constituted by the Head of the Department will carry out continuous assessment. Based on the project report submitted by the student, an oral examination (Viva-Voce) will be conducted as the End-Semester examination, for which one External Examiner will also be included in the Committee of Teachers.

R.12f Assessment of seminars and comprehension will be carried out by a committee of teachers constituted by the Head of the Department.

SUBSTITUTE EXAMINATIONS

R.13a A student who has missed, for valid reasons, an assessment test/examination may be permitted to write a substitute test/examination. However, permission to take up a substitute test/examination will be given under exceptional circumstances, such as accident or admission to a hospital due to illness.

R.13b A student who misses any assessment test/examination in a course should apply for the substitute test/examination within a week from the date of missed assessment, using the prescribed application form for the purpose. Late applications will not be entertained. The decision on the application will be taken by the Head.
of the Department offering the course in the case of first three assessments and by the Dean of Faculty in the case of End-Semester examination (fourth assessment). However, if a student applies for the substitute test/examination for the second time in a semester, the decision will be taken by the Dean of Faculty. The Head of the Department/Dean of Faculty can use his discretion in granting permission, recording reasons for his decision. If permitted, the substitute test/examination for any assessment will be held in about two weeks from the date of missed assessment. The substitute test (from missed assessments 1 to 3) will be conducted by the concerned teacher. However, the substitute examination (for missed end-semester examination) will be conducted centrally.

PASSING AND DECLARATION OF EXAMINATION RESULTS AND GRADE SHEET

R.14a All assessments of a course will be done on absolute marks basis. However, the Class Committee which shall meet within 2 weeks after the End-Semester examinations, shall analyse the relative performance of students in all assessments of a course and decide the letter grade ranges for that course. The letter grades and the corresponding grade points are as follows:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>S</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>U</th>
<th>I</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Points</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevention from End-Semester examination.

"F" denotes failure in the course.

R.14b A student who earns a minimum of 5 grade points in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student.

R.14c The results, after awarding of grades, shall be signed by the Class Committee Chairman, Head of the Department and Dean of Faculty and declared by the Dean of Faculty.

R.14d Within 2 weeks from the commencement of classes for the next semester a student can apply for revaluation of his/her end semester examination answer papers in a course, on payment of a prescribed fee, through proper application to the Dean of Faculty. The Dean shall constitute a revaluation committee consisting of Chairman of Class Committee as convenor, the teacher of the course and a senior member of faculty knowledgeable in that course. The Committee shall meet within a week, revalue the answer paper and submit its report to the Dean of Faculty for consideration and decision.

R.14e After results are declared, Grade Sheets will be issued to each student which will contain the following details. The list of courses enrolled during the semester including summer term courses, if any, and the grade scored. The Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of
courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses if any.

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

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. "U", "I" and "W" grades will be excluded for calculating GPA and CGPA.

R.14f After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA.

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class with Distinction</td>
<td>6.50 and above</td>
</tr>
<tr>
<td>First Class</td>
<td>6.50 and above but below 8.50</td>
</tr>
<tr>
<td>Second Class</td>
<td>below 6.50</td>
</tr>
</tbody>
</table>

ATTENDANCE REQUIREMENT AND COURSE REPETITION

R.15a A student shall attend a minimum of 75% of the contact periods offered in any registered course, to become eligible to appear for the end-semester examination in that course, failing which the student shall be prevented from taking the end-semester examination and shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

R.15b Instructor of each course shall take attendance till five calendar days prior to the last instruction day in the semester and report through the Head of the Department to the Dean of Faculty the names of students who have attendance less than 75% in that course. The Dean shall then announce the names of all students prevented from writing the end-semester examinations in various courses.

R.15c A student should repeat a core course wherein "U" or "I" or "W" grade was awarded. If the student is awarded "U" or "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

ELECTIVE CHOICE; OPTION TO DO PROJECT ALONE IN FINAL SEMESTER

R.16a Apart from the various elective courses listed in the curriculum for each branch of specialisation, the student can choose a maximum of 2 electives from any other specialisation under any Faculty, during the entire period of study, with the approval of the Head of the Parent Department and the Head of the other Department offering the course.

R.16b In the curriculum of 8th Semester, along with the project work, if 2 elective courses alone are listed, then the Dean of Faculty may permit a student, as per approved guidelines, on the recommendation of the Head of the Department, to do a full semester major industrial project.
work. In such a case, the above 2 elective courses or any other 2 elective courses in lieu thereof have to be enrolled during any semester including the summer, preceding or succeeding the project work.

INDUSTRIAL VISIT

R.16c Every student is required to undergo one industrial visit for every theory course offered, starting from the third semester of the Programme.

PERSONALITY AND CHARACTER DEVELOPMENT

R.17a All students shall enroll, on admission, in any one of the personality and character development programmes the NCC/NSS/NSO and undergo practical training for about 80 hours and attend a camp of about ten days.

National Cadet Corps (NCC) will have about 20 parades

National Service Scheme (NSS) will be social service activities in and around Chennai.

National Sports Organisation (NSO) will have Sports, Games, Drills and Physical exercises.

While the training activities will normally be during week ends, the camp will normally be during vacation period.

R.17b Every student shall put in a minimum of 80% attendance in the practical training and attend the camp compulsorily. Normally this is to be completed during the first year. For valid reasons, the Dean of Students may permit a

student to complete this requirements in the second year. However, before enrolling for 5th Semester (7th Semester in the case of Mining Engineering and of lateral entry), a student should have completed the training and produced a certificate from the appropriate authority of NCC/NSS/NSO for having satisfactorily completed the prescribed training and camp.

R.17c Rule 17a and 17b are not applicable to the sponsored/deputed Candidates satisfying Rule 1c admitted to B.E. in Printing Technology.

DISCIPLINE

R18.a Every student is required to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

R.18b Any act of indiscipline of student reported to the Dean of Faculty will be referred to a Discipline and Welfare Committee nominated by the Syndicate from time to time, for taking appropriate action.

ELIGIBILITY FOR THE AWARD OF DEGREE

R.19a A student shall be declared to be eligible for the award of the B.E./B.Tech. Degree provided the student has:

(i) Successfully completed all the required courses in the programme curriculum and earned the number of credits prescribed for the specialisation within a maximum period of 12 semester (19 semesters for Lateral Entry) from the date of admission, including break of study.
ii) Completed the NCC/NSS/NSO requirements.
iii) No dues to the Institution, Library, Hostels, NCC, NSS, NSO, etc.
iv) No disciplinary action pending against the student.

R.19b The award of the Degree must have been approved by the Syndicate of the University.

POWER TO MODIFY

R.20 Notwithstanding all that has been stated above, the University has the right to modify the above regulations from time to time.

-----

ANNA UNIVERSITY
DEGREE OF BACHELOR OF TECHNOLOGY
(8 SEMESTER PROGRAMME)
Branch: TEXTILE TECHNOLOGY

SEMESTER I

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1</td>
<td>LANGUAGE ELECTIVE I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA131</td>
<td>MATHEMATICS I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH131</td>
<td>PHYSICS I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>CM131</td>
<td>CHEMISTRY I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>GE131</td>
<td>ENGINEERING MECHANICS</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE132</td>
<td>COMPUTER PRACTICE I</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GE133</td>
<td>WORKSHOP PRACTICE</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
<td>5</td>
<td>11</td>
<td>25</td>
</tr>
</tbody>
</table>

SEMESTER II

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>LANGUAGE ELECTIVE II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA132</td>
<td>MATHEMATICS II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>EC152</td>
<td>ELECTRONIC ENGINEERING</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>EE151</td>
<td>ELECTRICAL ENGINEERING</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PH134</td>
<td>PHYSICS II</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>CH131</td>
<td>CHEMISTRY II</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE134</td>
<td>ENGINEERING GRAPHICS</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GE135</td>
<td>COMPUTER PRACTICE II</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
<td>4</td>
<td>12</td>
<td>27</td>
</tr>
<tr>
<td>Code No.</td>
<td>Course Title</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>MA231</td>
<td>MATHEMATICS III</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH232</td>
<td>MATERIAL SCIENCE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EE261</td>
<td>BASIC INSTRUMENTATION</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CH234</td>
<td>MECHANICAL ENGINEERING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH235</td>
<td>MECHANICS OF SOLIDS</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH236</td>
<td>ORGANIC CHEMISTRY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH237</td>
<td>CHEMISTRY LAB III</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CH238</td>
<td>ELECTRICAL ENG. LAB.</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CH239</td>
<td>MECHANICAL ENGINEERING LAB</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>17</td>
<td>1</td>
<td>14</td>
<td>25</td>
</tr>
</tbody>
</table>

**SEMIESTER IV**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA036</td>
<td>STATISTICS AND LINEAR PROGRAMMING</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CH248</td>
<td>POLYMER CHEMISTRY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH244</td>
<td>PHYSICAL CHEMISTRY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT331</td>
<td>COMPUTER APPLICATION</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>TT332</td>
<td>SPUN YARN TECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT333</td>
<td>TECHNOLOGY OF WEAVING PREPARATION</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT334</td>
<td>MAN-MADE FIBRE PRODUCTION</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH249</td>
<td>POLYMER ANALYSIS AND TESTING</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>17</td>
<td>3</td>
<td>3</td>
<td>22</td>
</tr>
</tbody>
</table>

**SEMIESTER V**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA037</td>
<td>SPECIAL FUNCTIONS, DIFFERENTIAL EQUATIONS AND Z TRANSFORMS</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>TT335</td>
<td>PROCESS CONTROL IN SPINNING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT336</td>
<td>TECHNOLOGY OF FABRIC MANUFACTURE</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT337</td>
<td>FABRIC STRUCTURE</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>TT337</td>
<td>PHYSICAL STRUCTURE AND PROPERTIES OF FIBRES</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT339</td>
<td>CHEMICAL PROCESSING OF TEXTILE MATERIALS I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TT340</td>
<td>CLOTH ANALYSIS</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>1</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Code No.</td>
<td>Course Title</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH431</td>
<td>PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT448</td>
<td>KNITTING TECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ELECTIVE I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ELECTIVE II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ELECTIVE III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ELECTIVE IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRACTICAL</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TT449</td>
<td>YARN MANUFACTURE LAB</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>TT450</td>
<td>FABRIC MANUFACTURE LAB</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>TT451</td>
<td>COMPREHENSION</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>TT452</td>
<td>INDUSTRIAL TRAINING</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

| TOTAL     |                                                  | 18| 0 | 9 | 25|

| THEORY  |                                                  |   |   |   |   |
| ELECTIVE V                                   | 3 | 0 | 0 | 3 |
| ELECTIVE VI                                  | 3 | 0 | 0 | 3 |

<table>
<thead>
<tr>
<th>PRACTICAL</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TT453</td>
<td>PROJECT WORK</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>6</td>
</tr>
</tbody>
</table>

| TOTAL     |                                                  | 6 | 0 | 18| 12|

| TOTAL CREDITS: 183 |

---

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT034</td>
<td>FIBRE AND TEXTILE COMPOSITES</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT035</td>
<td>TEXTURED YARN TECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT036</td>
<td>SILK YARN TECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT037</td>
<td>THEORY OF STAPLE FIBRE OPENING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT038</td>
<td>MECHANICS OF STAPLE FIBRE YARN TWISTING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT039</td>
<td>TECHNOLOGY OF STAPLE FIBRE YARN DRAFTING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT040</td>
<td>LONG STAPLE SPINNING PROCESS</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT041</td>
<td>MECHANICS OF TEXTILE STRUCTURES</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT042</td>
<td>MECHANICS OF TEXTILE MACHINERY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT043</td>
<td>PROCESS CONTROL IN WEAVING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT044</td>
<td>ADVANCES IN FABRIC PREPARATION</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT045</td>
<td>BONED FABRICS</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT046</td>
<td>CHEMISTRY AND PHYSICS OF DYES</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT047</td>
<td>THEORY OF DYEING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT048</td>
<td>SYNTHETIC FIBRE COLOURATION</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT049</td>
<td>ECO-FRIENDLY DYES AND CHEMICALS</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT050</td>
<td>WORK STUDY IN TEXTILE INDUSTRY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT051</td>
<td>ENERGY MANAGEMENT IN TEXTILE INDUSTRY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT052</td>
<td>COSTING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT053</td>
<td>TEXTILE MILL PLANNING AND MANAGEMENT</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT054</td>
<td>CAD AND CAM IN TEXTILES</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TT055</td>
<td>QUALITY ASSURANCE IN GARMENT INDUSTRY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HS034</td>
<td>TECHNICAL TAMIL</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
### LANGUAGE ELECTIVES

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS035</td>
<td>TECHNICAL GERMAN I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS036</td>
<td>TECHNICAL GERMAN II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS037</td>
<td>TECHNICAL JAPANESEI</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS038</td>
<td>TECHNICAL JAPANESEIII</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS039</td>
<td>TECHNICAL FRENCH I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS040</td>
<td>TECHNICAL FRENCH II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS041</td>
<td>ENGLISH I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS042</td>
<td>ENGLISH II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>GE034</td>
<td>CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

---

### MA 131 MATHEMATICS I

1. **MATRICES**

The characteristic equation, Eigen values and Eigen vectors of a real matrix, some properties of Eigen values, Cayley-Hamilton theorem. Reduction of a real matrix to a diagonal form. Orthogonal matrices-properties, reduction of a quadratic form to a canonical form by orthogonal transformation.

2. **GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS**

Curvature- cartesian and polar coordinates- Circle of curvature, involutes and volutes. Envelopes - Properties of the envelopes - Envelopes of normal to a curve.

3. **FUNCTIONS OF SEVERAL VARIABLES**


4. **MULTIPLE INTEGRALS**

Double integration in cartesian and polar coordinates, change of order of integration, triple integration in cartesian coordinates Gamma and Beta functions - properties. Area as a double integral.

5. **DIFFERENTIAL EQUATIONS**

REFERENCES:

PH 131 PHYSICS - I

1. PROPERTIES OF MATTER

Elasticity - Stress - strain diagram - factors affecting elasticity - Twisting couple on a wire - shaft - Torsion pendulum - Depression of a cantilever - Young's modulus by cantilever - Uniform and non-uniform bending - I shape girder - production and measurement of high vacuum - Rotary pump - Diffusion pump - Pirani Gauge - Penning gauge - Viscosity - Oswald Viscometer - Comparison of viscosities.

2. ACOUSTICS


3. HEAT AND THERMODYNAMICS


4. OPTICS


5. LASER AND FIBRE OPTICS

Principle of lasers - Laser characteristics - Ruby - NdYAG, He-Ne, CO₂ and semi conductor lasers - propagation of light through optical fibre - types of optical fibres - applications of optical fibres as optical waveguides and sensors.

6. PRACTICALS

1. Young's modulus by nonuniform bending
2. Rigidity modulus and moment of inertia using Torsion pendulum
3. Viscosity of a liquid by Poiseuille's method
4. Wavelength determination using grating by Spectrometer
5. Particle size determination by Laser
6. Thermal conductivity of Lees' disc
7. Thickness of wire by Air wedge
8. thermo emf measurement by potentiometer

TEXT BOOK


REFERENCE


L : 30 T : 15 P : 30 Total = 75

CM-131 CHEMISTRY I

1. CHEMICAL THERMODYNAMICS

Definition of free energy and spontaneity - Maxwell relations - Gibbs - Helmholtz equation - Van't Hoff equations - stoichiometry and energy balances in chemical reactions.

2. DYNAMICS OF CHEMICAL PROCESSES

Basic concepts - composite reactions (opposing, parallel and consecutive reactions) - collision theory - thermodynamic formulation of reaction rates - unimolecular reactions - chain reactions (stationary and non-stationary) - enzyme kinetics - Michaelis - Menten equation.

3. ELECTRODICS

Types of electrodes and cells - Nerst equation - emf measurement and its applications - Principles of chemical and electrochemical corrosion control (sacrificial anode and impressed current methods).

4. WATER

Water quality parameters - definition and expression - estimation of hardness (EDTA method) and alkalinity (titrimetry) - water softening (zeolite) - demineralisation (ion-exchangers) and desalination (RO) - domestic water treatment.

5. POLYMERS

Monomer - functionality - degree of polymerization - classification based on source and applications - addition, condensation and copolymerisation - mechanism of free-radical polymerisation - thermoplastics and thermosetting plastics - injection moulding, blow moulding and extrusion processes.

PRACTICALS

1. WATER ANALYSIS

Determination of hardness, alkalinity, DO, Fe (spectrophotometry) and Na & K (flame photometry).

2. ELECTROCHEMISTRY AND CORROSION EXPERIMENTS

3. POLYMER EXPERIMENTS

L : 30 T : 15 P : 30 Total = 75

REFERENCE BOOKS

GE 131 ENGINEERING MECHANICS

1. BASICS
   Introductions - Units and Dimensions - Laws of Mechanics - Vectors - Vectorial representation of forces and moments - Vector operations

2. STATICS OF PARTICLES
   Coplanar forces - Resolution and composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - equivalent systems of forces - Principle of transmissibility - single equivalent force.

3. EQUILIBRIUM OF RIGID BODIES
   Free body diagram types of supports and their reactions - requirements of stable equilibrium - Equilibrium of rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.

4. PROPERTIES OF SURFACES AND SOLIDS
   Determination of Areas and Volumes - First moment of area and the centroid - second and product moments of plane area - Parallel axis theorems and perpendicular axis theorems - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia - relation to area moments of inertia.

5. FRICTION
   Frictional force - Laws of Coulomb friction - Simple Contact friction - Rolling Resistance - Belt Friction.

6. DYNAMICS OF PARTICLES

7. ELEMENTS OF RIGID BODY DYNAMICS
   Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid body - work energy equation.

L : 45 T : 15 Total = 60

TEXT BOOKS

REFERENCE
GE 132 COMPUTER PRACTICE  - II  1 0 3 3

1. FUNDAMENTALS OF COMPUTERS AND OPERATING SYSTEMS:  4


2. OFFICE AUTOMATION  2

a) Word Processing
b) Data Base Management System
5
c) Spread Sheet Package 2
d) Presentation Software 2

L : 15  P : 45  Total = 60

TEXT & REFERENCE BOOKS


GE 133 - WORKSHOP PRACTICE  0 0 4 2

Tools and equipments used in Smithy, Carpentry, fitting, foundry, welding and sheet metal.

LIST OF EXPERIMENTS

1. Sheet Metal: Fabrication of tray, cone etc. with sheet metal.
2. Welding: Arc welding of butt joint, lap joint, Tee fillet etc, Demonstration of gas welding.

3. Fitting: Practice in chipping, filing, drilling, making vee, square and dovetail joints.
5. Foundry: Preparation of simple moulds like flange, gear, V-grooved bfiley etc.
6. Smithy: Demonstration for making simple parts like keys, bolts, etc.

SEMESTER - II

MA 132 MATHEMATICS II  3 1 0 4

1. VECTOR CALCULUS  9

Gradient, Divergence, Curl - Line and surface integrals - Green’s Gauss divergence and Stokes theorems - Verification and applications.

2. ANALYTIC FUNCTIONS  9

C-R Equations - Properties and analytic functions - Determination of harmonic conjugates and analytic function - conformal mapping - mapping properties of \( w = z + a \), \( 1/z \), \( az \), \( z^2 \) and bilinear transformation.

3. COMPLEX INTEGRATION  9

Cauchy’s theorem - Cauchy’s integral formula - Taylor and Laurent’s series - Singularities and classification - residues, Cauchy’s residue theorem - Contour integration around circular and semi-circular contours (excluding poles on the real axis).
4. EMPIRICAL STATISTICS


5. STATISTICAL INFERENCE

Sampling distribution - Testing of hypothesis - Level of significance - Confidence limits - Tests based on normal distribution, t-distribution and Chi-square distribution.

L: 45 T: 15 Total = 60

REFERENCES:


EC 152 ELECTRONICS ENGINEERING

1. SEMICONDUCTORS AND RECTIFIERS

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - P-N junction - V-I characteristics of PN junction diode - Zener diode - Zener diode characteristic - Half wave and full wave rectifiers - Voltage regulation.

2. TRANSISTORS AND AMPLIFIERS

Bipolar junction transistor - CB, CE, CC - Configurations and characteristics - Biasing circuits - Elementary treatment of voltage amplifier - Class A, B and C power amplifiers - Principles of tuned amplifiers.

3. POWER AND CONTROL ELECTRONIC DEVICES

Field Effect Transistor - Configurations and characteristics - FET amplifier - SCR, Diac, Triac, UJT - Characteristics and simple applications - Switching transistors - Concept of feedback - Negative feedback - Application in temperature and motor speed control.

4. SIGNAL GENERATORS AND LINEAR IC'S


5. DIGITAL ELECTRONICS


L: 30 P: 30 Total = 60

TEXT BOOK

EE 151 ELECTRICAL ENGINEERING

1. ELECTRICAL CIRCUITS

Ohm’s Law - Kirchhoff’s Laws - steady state solution of D.C. Circuits - Introduction to AC circuits - Waveforms and RMS value - power and power factor, single phase and 3 phase balanced circuits.

2. ELECTRICAL MACHINES

Principles of operation and characteristics of D.C. machines, Transformers (single phase and three phase) - Synchronous Machines - 3 Phase and single phase induction motors - (op. Principles).

3. ELECTRICAL MEASUREMENTS

Moving coil and moving iron instruments (Ammeter and voltmeter) - Dynamometer type watt meters and energy meters (op. Principles).

TEXT BOOK


PH 134 PHYSICS II

1. ELECTROSTATICS AND ELECTROMAGNETISM

Electric field and potential - Gauss theorem - Applications - dielectrics - capacitance - energy stored in a dielectric medium - types of capacitors - Loss of energy due to sharing of charges by the capacitors - electrical conductivity in conductors - Carey Foster’s bridge - Maxwell’s equations - Free space wave equation - Characteristic impedance.

2. QUANTUM PHYSICS

Development of quantum theory - Dual nature of matter and radiation - Compton effect - Pair production - Uncertainty principle - Equivalence of mass and energy Schrodinger’s wave equation - Particle in a box - Electrons in a metal.

3. ATOMIC AND NUCLEAR PHYSICS

4. ELEMENTARY CRYSTALLOGRAPHY

Crystalline and non-crystalline materials - Bravais lattices - Crystal systems - Symmetry elements - Simple crystal structures - Packing factors for sc, bcc, fcc, hcp structures - Miller indices - Imperfections in crystals - Bragg's law and X-ray diffraction methods - to study crystal structures.

5. NON DESTRUCTIVE TESTING

Liquid penetrant, Magnetic particle and eddy current methods - X-ray radiography - Fluoroscopy - Gamma ray radiography - Ultrasonic scanning methods - Ultrasonic flaw detector - Thermography.

6. PRACTICALS

1. Meter Bridge - Temp. Coefficient
2. Field along the axis of coil - Determination of H
3. Carey Foster's Bridge - Resistivity
4. X-ray diffraction - calculation of cell parameters
5. Newton's rings - Wavelength measurement
6. Spectrometer - Dispersive power of a prism
7. Rigidity modulus - static tension
8. Ammeter & voltmeter calibration using potentiometer

TEXT BOOK


REFERENCES


CH 131 CHEMISTRY II

1. ENVIRONMENTAL POLLUTION


2. FULES


3. BINDING MATERIALS

Cement and lime - Types - Composition and characteristics - Chemistry of setting and hardening - Grading and analysis - Adhesives - Types - Characteristics - Epoxides, urethanes, polyvinyl alcohol and polyvinyl acetate.
4. POLYMERIC MATERIALS

Polytetrafluoroethylene, Polyamides (nylon 6, nylon 66, T. Kelvar), Polyesters (polyethylene terephthalate, polybutylene terephthalate, aromatic polyester), polycarbonate, polyacetals, polyurethanes (applications only, manufacturing details not required) Composites: Matrix resins - Reinforcements - Applications.

5. INDUSTRIAL INORGANIC COMPOUNDS


Refractory: Silicon carbide - aluminium oxide - Ultramarine.


Refractory: Silicon carbide - Aluminium oxide

Lubricants: silicone oil - Lithium grease - Graphite - Molybdenum sulphide.

6. PRACTICALS

Phenol water system - Kinetics of Ester Hydrolysis - Distillation Coefficient - Pigment Analysis: Lead and Titanium - Melting point and Molecular weight Determination - Estimation of Percentage Composition of Glycerol (Viscometric method)

L = 30 T = 15 P = 30 Total = 75

GE 134 ENGINEERING GRAPHICS

1. PRINCIPLES OF GRAPHICS

Two dimensional geometrical construction - Conic sections, involutes and cycloids - Representation of three dimensional objects - Principles of projections - standard codes of principles.

2. ORTHOGRAPHIC PROJECTIONS

Projections of points, straight lines and planes - Auxiliary projections - Projection and sectioning of solids - Intersection of surfaces - Development of surfaces.

3. PICTORIAL PROJECTIONS

Isometric projections - Perspectives - Free hand sketching.
4. COMPUTER GRAPHICS

Hardware - Display technology - Software - Introduction to drafting software.

L : 15 P : 45 Total = 60

TEXT BOOK

REFERENCE
1. William M. Neumann and Robert F. Sproul, Principles of
2. Warren J. Lazzarder and John M. Duff, Fundamentals of
   Engineering Drawing, Prentice Hall of India Private Ltd,
3. Natarajan, K.V., Text Book of Engineering Drawing, Private
   Publication, Madras 1990.
4. Mathur, M.L. and Vaishwanar, R.S. Engineering Drawing

GE 135 COMPUTER PRACTICE - II

1. MULTIUSER OPERATING SYSTEM

Unix: Introduction - Basic commands - vi editor - filters - Input/ output redirection - piping - transfer of data between devices - shell scripts.

2. FUNDAMENTALS OF NETWORKING

Working on a networked environment - Accessing different machines from one node - Concept of E-mail - Use of Internet.

L : 15 P : 45 Total = 60

3. HIGH LEVEL LANGUAGE PROGRAMMING


TEXT & REFERENCE BOOK
1. Stephen J. Kocher & Patrick H. Wood, Exploring the UNIX
   system, , Techmedia, 1999.
2. Maurice J. Bach, The design of UNIX Operating Systems,
3. Ramos, Computer Networking Concepts, Prentice Hall of
   India, 1999.
4. Balagurusamy, Programming in ANSI C Tata McGraw Hill,
   1999.
5. Kernighan and Ritchie, The C Programming Language
7. Kubi, C and UNIX Programming: A Conceptual Perspective,

MA 231 MATHEMATICS - III

1. FOURIER SERIES

Dirichlet's conditions, General fourier Series, Half range sine and cosine series, Parseval's identity, Harmonic Analysis.

2. FOURIER TRANSFORMS

Fourier integral representation, Fourier transform pairs, Properties, Fourier sine and cosine Transforms, Transforms of simple functions, Transforms of derivatives, The convolution integrals of Fourier, Application to one dimensional wave and diffusion equations.
3. LAPLACE TRANSFORMS

Transforms of simple functions, Basic operational properties.

4. PARTIAL DIFFERENTIAL EQUATIONS

Formation, Solution of standard types of first order equation and Lagrange's Linear Equation, Linear partial differential equations of second and higher order with constant coefficients.

5. BOUNDARY VALUE PROBLEMS

Classification of second order partial differential equations, Transverse vibrations of a string, One-dimensional heat equation and two-dimensional heat flow, Fourier series solutions in cartesian coordinates.

REFERENCES:


PH 232 MATERIALS SCIENCE

1. PHASE DIAGRAMS AND PHASE TRANSFORMATIONS

Gibb’s Phase rule - Unary and binary phase diagrams - $\text{Al}_2\text{O}_3$, $\text{Cr}_2\text{O}_3$, Pb-Sn, Ag-Pt and Fe-Fe$_3$C Systems-Lever rule - Invariant reactions - TTT diagrams-Microstructural Changes-Nucleation and growth - Martenitic transformations - Solidification and Crystallisation - Glass transition-Recrystallisation and grain growth—Nanophase materials.

2. MECHANICAL PROPERTIES


3. ELECTRICAL AND MAGNETIC PROPERTIES


4. SEMICONDUCTING AND DIELECTRIC PROPERTIES

Elemental and compound semiconductors and their properties - Hall effect - Experimental arrangement - Applications - Different types of polarisation processes - Frequency and temperature effects on polarisation - Dielectric constant - Dielectric loss - Different types of dielectric breakdown - Ferroelectric materials.
5. THERMAL AND OPTICAL PROPERTIES

Specific heat capacity – Thermal conductivity – Thermal expansion-Fibre optic materials and their applications – Display materials – LED and LCD.

REFERENCES


EE 251 BASIC INSTRUMENTATION

1. INTRODUCTION TO MEASUREMENT

Instrument classification, standards, static and dynamic characteristics, calibration, measurement errors.

2. TRANSDUCERS

Classification of transducers, strain gauges, RTD, thermocouples, piezo electric transducers, LVDT. Turbine and electromagnetic flowmeters, level transducers ultrasonic and fibre optic transducers, elastic sensors, viscosity, moisture and pH sensors, Digital transducers.

3. SIGNAL CONDITIONING AND DISPLAY

LCR bridge circuits, Instrumentation amplifiers active filters, principles of S/H, A/D and D/A converters Multiplexing and data acquisition. LED, LCD and CRT displays.

4. INSTRUMENTS FOR MEASUREMENT OF PHYSICAL VARIABLES

Principles of measuring Instruments for temperature, pressure, flow, level, displacement, velocity and acceleration, viscosity, moisture and pH. Principle of multimeters and CRO.

5. LABORATORY EXPERIMENTS

Familiarization of Basic measuring Instruments, Bridge circuits Instrumentation amplifiers, A/D converters, active filters, strain gauge circuits. Characteristics of LVDT, RTD, Thermo couple and LDR, Pressure to current converters.

TEXT:


REFERENCES

1. **LAWS OF THERMODYNAMICS**

Basic concepts and hints: Zeroth law; First Law of Thermodynamics—Statement and application; Steady flow energy equation; Second law of Thermodynamics—Statement; Limitations Heat Engine; Heat Pump, Available energy, Kelvin—Plank statement and Clausius statement; Equivalence: Entropy, Reversibility: Entropy charts; Third law of Thermodynamics—Statement.

2. **HEATING AND EXPANSION OF GASES**

Expressions for work done; Internal energy, Hyperbolic and polytropic processes; Free expansion and Throttling.

3. **AIR STANDARD EFFICIENCY**

Carnot cycle; Stirling Cycle; Joule Cycle; Otto Cycle; Diesel Cycle; Dual combustion Cycle.

4. **I.C. ENGINES**

Engine nomenclature and classifications; SI Engine; CI Engine; Four Stroke cycle; Two stroke cycle; Performance of I.C. Engine; Brake thermal efficiency; Indicated Thermal Efficiency. Specific fuel consumption.

5. **STEAM AND ITS PROPERTIES**

Properties of steam: Dryness fraction; latent heat; Total heat of wet steam; Superheated steam. Use of steam tables; volume of wet steam; Volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour; Expansion of vapour, Rankine cycle, Modified Rankine cycle.

6. **STEAM ENGINES AND TURBINES**

Hypothetical indicator diagram of steam engine; Working of a simple steam engine; steam turbines—Impulse and Reaction types—Principles of operation.

7. **SIMPLE MECHANISM**

Kinematic Link, Kinematic Pair Kinematic Chain; Slider Crank mechanism and inversions; Double slider crank mechanism and inversions.

8. **FLY WHEEL**

Turning moment Diagram; Fluctuation of Energy; Design of fly wheel.

9. **DRIVES**

Belt and rope drives; Velocity ratio; slip; Ratio of tensions; Length of belt; Maximum HP; simple compound and Epicyclic gear trains.

10. **BALANCING**

Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

**TEXT**

1. STRESSES, STRAIN AND DEFORMATIONS OF SOLIDS
Rigid bodies and deformable solids - forces on solids and supports - equilibrium and stability - strength and stiffness - tension, compression and shear stresses - Hooke's law and simple problems - compound bars - thermal stresses - elastic constants and poisson's ratio - welded joints - design.

2. TRANSVERSE LOADING ON BEAMS
Beams - support conditions - types of beams - transverse loading on beams - shear force and bending moment in beams - analysis of cantilevers, simply supported beams and overhanging beams - relationships between loading, S.F. and B.M. in beams and their applications - S.F. & B.M. diagrams.

3. DEFLECTIONS OF BEAMS
Double integration method - Macaulay's method - Area - moment theorems for computation of slopes and deflections in beams - conjugate beam method.

4. STRESSES IN BEAMS
Theory of simple bending - assumptions and derivation of bending equation (M/I = σ/Y = E/α) - analysis of stresses in beams - loads carrying capacity of beams - proportioning beam sections - leaf springs -itched beams - shear stress distribution in beams - determination of shear stress in flanged beams.

5. TORSION
Torsion of circular shafts - derivation of torsion equation (τJ = C/R = GqL) - stresses and deformation in circular and hollow shafts - stresses and deformation in circular and hollow shafts - stepped shafts - shafts fixed at both ends - stresses in helical springs - deflection of springs - spring constant.

6. COLUMNS
Axially loaded short columns - columns of unsymmetrical sections - Euler's theory of long columns - critical loads for prismatic columns, with different end conditions - effect of eccentricity.

L = 45 Total = 45

TEXT


CH 236 ORGANIC CHEMISTRY
(Common to Chemical, Textile and Leather Technology Branches)

New Syllabus suggested - Credits 3 (45 Hours duration)

1. CARBOHYDRATES
Introduction - Mono and Disaccharides - Important reactions - Polysaccharides - Starch and Cellulose - Derivatives of Cellulose - Carboxy Methyl cellulose and gun cotton - structural aspects of cellulose

2. ORGANO METALLIC COMPOUNDS
Grignard reagents and their synthetic utility - Organo Silicon compounds.

3. OILS, FATS AND WAXES
Analysis of oils and fats - classification of waxes
4. HETEROCYCLIC COMPOUNDS

Furan, Thiophene, Pyrrole, Pyridine, and Indole – Their important derivatives

5. DYES AND DYEING

Colour and constitution
- Synthesis of some important azo dyes (Methyl orange, Methyl red and Congo red)
- Synthesis of Triphenylmethane dyes (Malachite green, Para Rosaniline Anthraquinone dyes (Alizarin)
- Phthaline dyes - Eosin preparation
- Introduction to Natural and Reactive dyes

6. AMINO ACIDS AND PROTEINS


7. PHARMACEUTICAL CHEMISTRY

Synthesis of antimalarial drugs - Isopentaquine and chloroguanine
- Antibacterial drugs – Synthesis of sulphanilamide, sulphapyridine

REFERENCE BOOKS


CH 237 CHEMISTRY PRACTICALS – III

1. Ore assay analysis
2. Pigment Analysis
3. Industrial Waste Water Analysis
4. Estimation of Phenol
5. Analysis of fertilizer
6. Sugar Analysis
7. Polymer Analysis

P = 60 Total = 60

CH 238 ELECTRICAL ENGINEERING LAB

LIST OF EXPERIMENTS:

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator
3. Load characteristics of D.C. compound generator
4. Load test on D.C. shunt motor
5. Study of D.C. motor starters
6. O.C. and S.C. tests on single phase transformer
7. Load test on single phase transformer
8. Load test on 3 - phase squirrel cage induction motor
9. Study of 3 - phase induction motor starters
10. Load test on 3 - phase slip ring induction motor
11. O.C. and S.C. tests on 3 - phase alternator
12. Synchronization and V-curves of alternator

P = 60 Total = 60
1. Port timing diagram
2. Valve timing diagram
3. Study of 2.4 stroke I.C. Engines
4. Study of steam engine and Gearbox
5. Load test on 4 stroke Villiers Petrol Engine
6. Load test on 4 stroke Lister Diesel Engine
7. Load test on 4 stroke P.S.G. Diesel Engine
8. Compression test
9. Deflection test
10. Hardness test (Rockwell and Brinell)
11. Spring test
12. Study on behaviour of columns
13. Torsion test
14. Impact test

P = 60 Total = 60

SEMESTER IV

1. PROBABILITY AND RANDOM VARIABLES 7
   Probability concepts, Random variables, Moments, Moment
   Generating function, Binomial Possion, Geometric, Negative
   Bionomial, Exponential Gamma, Weibull distributions, Functions of
   random variable, Chebychev inequality.

2. TWO-DIMENSIONAL RANDOM VARIABLES 10
   Marginal and conditional distributions, Covariance, Correlation and
   regression, Transformation of random variables, Central limit
   theorem.

3. DESIGN OF EXPERIMENTS AND QUALITY
   CONTROL 10
   Completely randomized design, Randomized block design Latin
   square design, Process control, Control charts of measurements
   and attributes, Tolerance limits.

4. LINEAR PROGRAMMING 10
   Formulation of linear programming problem graphical solution
   simplex algorithm, artificial variable and the M-method, degeneracy,
   alternative optima and unbounded solution.

5. FURTHER TOPICS IN LINEAR PROGRAMMING 8
   Duality, primal-dual computations, transportation model and
   algorithm, Assignment model and Hungarian technique of solution,
   imbalance, cost Maximization alternative optima in transportation
   and assignment method.

REFERENCE
1. Miller, and Freund, J.E., Probability and Statistics for
2. Kapur, J.N. and Saxena, H.C., Mathematical statistics,
   S.Chand & Company Ltd.
3. Taha, H.A., Operations Research, An Introduction,
   Research, Sultan Chand and sons.

CH 239 MECHANICAL ENGINEERING LAB 0 0 4 2

CH 248 POLYMER CHEMISTRY 3 0 0 3

1. BASIC CONCEPTS OF POLYMER SCIENCE 4
   Monomer, functionality, degree of polymansion, Polymer
   classification based on source and applications, Raw materials,
   source and their derivation.

2. SYNTHESIS OF POLYMERS 6
   Mechanism of polymansion, Addition condensation, Methods
   of polymansion, bulk, solution, emulsion and suspension.
3. CHARACTERISATION OF POLYMERS

Average molecular weight, property of polymers - structure of polymers. Effect of molecular structure on properties - crystallinity - orientation - glass transition (T) and melting behaviour (T) and solubility of polymers. Mechanical, optical, thermal, electrical, chemical and weather resistant characteristics.

4. POLYMERIC MATERIALS


5. PROCESSING ADDITIVES AND METHODS

Nucleating agents, UV stabilisers, anti-microbial, antistatics, blushing agents, coupling agents, flame retardants, heat stabilizers; release agents, viscosity control additives. Extrusion - Film extrusion - extrusion coating powder coating - spinning method.

Total = 45

REFERENCES


CH 242 PHYSICAL CHEMISTRY

1. ELECTROCHEMISTRY


2. CHEMICAL KINETICS


3. PHASE RULE

Definition – Derivation – Application of phase rule to water system – Thermal Analysis – Cooling curves – Two Component system – Eutectic and compound formation.

4. ADSORPTION AND CATALYSIS

Physical and chemical adsorption – Types of adsorption isotherm, BET method, Gibbs equation, Homogeneous catalysis – Heterogeneous catalysis, acid – base catalysis, Enzyme catalysis – Applications of catalysts in industries.

5. COLLOIDS

6. PHOTOCHEMISTRY

L = 45  Total = 45

REFERENCES

TT 231 COMPUTER APPLICATION IN TEXTILE TECHNOLOGY
1. THE BASICS OF SYSTEMS ANALYSIS
Study of systems and the development of system requirements

2. SYSTEMS ANALYSIS IN TEXTILE MANUFACTURING
The scope for the application of computers to the processes of Spinning, Weaving and Chemical treatment. Identification of areas for the application of computers in finance and administration.

3. EXISTING SOFTWARE
Overview of spreadsheets, word processing programs and data base management software and their application to the field of Technology. Software for colour matching, cotton blending, product mix decisions, PERT, CPM, LP etc.

4. DESIGNING APPLICATIONS
Design and development of programs for various Textile applications

5. COMPUTER PRACTICALS

REFERENCES
1. Enick, N.L., Work study and Time study in Textiles

TT232 SPUN YARN TECHNOLOGY
1. GINNING
Description and working of different types of gins; selection of right type of gins; Ginning performance on yarn quality.

2. BLOWROOM MACHINES
Objects, principle and description of opening, cleaning and blending machines used in blowroom.
3. CARD
Objects and principle of carding; detailed study of flat card; card clothing; drives and production calculation.

4. DRAWFRAME
Tasks of drawframe; drafting systems used in modern drawframes; draft and production calculation.

5. COMBER
Comber preparation; objects and principle of combing; sequence of combing operation; combing efficiency and production calculation.

6. SPEEDFRAME
Objects of speed frame; working of speedframe; bobbin builder mechanism; draft, twist and production calculations.

7. YARN SPINNING
Principle of yarn production in ring, rotor, friction and air-jet spinning machines; working of ringframe; cop building; design features of important elements used in ring spinning; draft, twist and production calculations in ringframe.

8. YARN TWO-FOLDING
Merits of two-folding of yarns; methods followed for two-folding; selection of twist level for two-folding; calculation of resultant count of two-folded yarns.

Total: 45

2. WARping


3. SIZING


4. DRAWING-IN


REFERENCE


TT 234 MAN-MADE FIBRE PRODUCTION 3 0 0 3

1. INTRODUCTION


2. POLYMER MANUFACTURE

Introduction on fundamentals of polymer chemistry. Production of viscose, polyester, nylon 6, nylon66, polyacrylonitrile and polypropylene polymers.

3. PRODUCTION OF MELT SPUN FILAMENT YARNS

Fluid flow and melt spinning. Manufacture of PET polyester, nylon6 and polypropylene filament yarns.

4. PRODUCTION OF WET AND DRY SPUN FILAMENT YARNS

Manufacture of viscose Rayon. Wet and dry spinning of polyacrylonitrile filament yarns.

5. POST SPINNING PROCESS

Spin finishes. Drawing and heat setting. Texturisation-False twist texturing. Staple fibre production. Tow to top converters

TOTAL = 45
REFERENCES


CH 249 POLYMER ANALYSIS AND TESTING

2. Determination of density of textile fibres.
4. Thermal characteristics.
5. Solubility.
7. Evaluation of spin finishes on commercial fibres.
8. Determination of chemical constitution of fibres.

MA 037 SPECIAL FUNCTIONS, DIFFERENCE EQUATIONS AND Z TRANSFORM

Improper integrals and series solutions

- Ordinary point, regular singular point of second order linear ordinary differential equation, series solution to a second order linear ordinary differential equation about an ordinary point and a regular singular point.

BESSEL FUNCTIONS

Bessel's equation, bessel functions, recurrence relations, orthogonality property, generating function, equations reducible to Bessel's equation, modified Bessel functions. Applications to boundary value problems.

LEGENDRE POLYNOMIALS

Legendre's equation, Legendre Polynomials, Rodrigue's formula generating function, recurrence relations, orthogonality property. Applications to boundary value problems.
HERMITE AND LAGUERRE POLYNOMIALS

Hermite and Laguerre equations and their solutions - Polynomials, Rodrigue's formula, generating functions, recurrence relations, orthogonality property.

DIFFERENCE EQUATIONS AND Z TRANSFORM

Linear difference equation with constant coefficients, elementary properties of z transform, applications of z transform, application of z transform to difference equations.

L = 45  T = 15  Total = 60

REFERENCE


TT335 PROCESS CONTROL IN SPINNING 3-0-3

1. LEVELLING

Different levelling methods adopted in the spinning machines to achieve better uniformity of the products; influence of the uniformity of the intermediate products on the yarn quality; effect of machine and processing parameters on product uniformity; importance of fibre-mix homogeneity on yarn quality; types and levels of mixing in the preparatory processes; assessment of fibre-blend variations.

2. NEP AND HOOK REMOVAL

Causes of nep and hook formation in the fibre opening processes; removal of neps in the carding and combing machines; fibre hook straightening during the preparatory operations; measurement of neps and hooks.

3. WASTE CONTROL

Control of waste in blowroom, card and combers; influence of machine and processing parameters on waste removal; controlling the lint content in waste; cleaning efficiency and cleaning intensity.

4. STATIC GENERATION

Generation of static electricity, its influence on spinning processing; control of static generation.

5. PRODUCTION CONTROL

Factors affecting the production limits of the spinning machinery; achieving maximum production in the given machinery; new concepts in achieving higher production in the spinning machinery; role of machinery maintenance and humidity control on production efficiency; computation of the productivity indices.

6. YARN QUALITY ANALYSIS

Analysis of within length and between length variations and spectrogram; yarn faults classifications; causes and remedies for yarn defects.

7. MAN-MADE FIBRE PROCESSING

Processing conditions required for man-made fibres like polyester, viscose in the spinning machinery.

Total = 45
REFERENCES


TT 336  TECHNOLOGY OF FABRIC MANUFACTURE I

1. INTRODUCTION

Outline of weaving process. Different types of looms.

2. SHEDDING MOTIONS


3. SHUTTLE PICKING AND BEAT UP


4. SECONDARY AND AUXILIARY MOTIONS

Take up and let-off motions used in power looms. Cloth formation. Warp protector and weft fork motion. Plain loom accessories.

5. PROCESS CONTROL IN WEAVING


REFERENCE


TT 337  FABRIC STRUCTURE

1. INTRODUCTION

Cloth geometry, cover factor. Theory of colour use of point paper.

2. STANDARD WEAVES

Plain and its derivatives, Twill and derivatives. Satin and sateen, honey comb, brighton honeycomb, mock leno, huck-a-back, crepe distorted weaves, Bedford cords, wefts and piquets, Backed fabrics.
3. SPECIAL WEAVES
Extra warp, Extra weft, Double cloth, Gauze and Leno, pile fabrics, Damasks, ply fabrics.

4. SPECIAL JACQUARDS
Application of special jacquards

5. PRINCIPLES OF ORNAMENTATION
Various types of Ornamentation, Designing pattern for weaving on jacquards, Lappet and swivel system for ornamentation.

REFERENCES

TT 338 PHYSICAL STRUCTURE AND PROPERTIES OF FIBRES

1. STRUCTURE OF FIBRES
Structure of textile natural and man-made fibres physical, chemical and morphology.

2. INVESTIGATION OF FIBRE STRUCTURE
Electron microscopy - Sample preparation techniques, X-ray diffraction methods - Infra-red radiation techniques.

3. MOISTURE ABSORPTION STUDY IN FIBRES

4. MECHANICAL PROPERTIES OF FIBRES

5. OPTICAL AND FRICTIONAL PROPERTIES
Lustre Index - Refractive index - Birefringence - Factors influencing Birefringence - Refractive index measuring techniques - polarised light method - wave length method. Role of friction in fibre processing - measurement of friction.

6. ELECTRICAL AND THERMAL PROPERTIES

Total = 45
REFERENCES


TT 339 CHEMICAL PROCESSING OF TEXTILE MATERIALS 1 3 0 0 3

STRUCTURE AND PROPERTIES 5
Chemical structure and chemical properties of textile fibres

PREPARATION FOR COLOURATION AND FINISHING 20
Singeing, desizing-hydrolytic and oxidative techniques, scouring, mercerization, bleaching and heat setting

PROCESSING MACHINES 15
Loose stock processing machines, hank and package processing machines, yarn singeing machines, gas singeing machines for woven and tubular knits, shearing and raising machines, kers,
The following cloth samples are to be analysed for design, structure and other quality particulars:

1. Extra warp and extra weft
2. Gaberdine
3. Quilts
4. Pile fabrics
5. Velvet and velveteen
6. Gauze
7. Leno
8. Double and treble cloth
9. Crepe
10. Long cloth and Mull Shirting
11. Canvas
12. Towelling fabric
13. Tapestry and Upholstery
14. Cord fabrics
15. Denim

Numerical differentiation with interpolation polynomials. Numerical integration by Trapezoidal rule, Simpson's rule, Romberg's rule, two point Gauss formula and three point Gauss formula. Double integrals using Trapezoidal and Simpson's rule.


Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation and wave equation and two dimensional Laplace and Poisson equations.

REFERENCE


TT 341 TECHNOLOGY OF FABRIC MANUFACTURE II

1. PREPARATIONS FOR HIGH SPEED WEAVING 3

Yarns quality requirements for high speed automatic shuttle looms and shuttle less loom. Warp and weft preparation for high speed looms.

2. AUTOMATIC SHUTTLE LOOMS 12


3. SHUTTLELESS LOOMS 15

Principles of weft insertions in shuttle less looms. Weft accumulators and selvedges used in shuttleless looms. Mechanism of weft insertion by projectile, rapier, air jet and water jet. Techno economics of shuttleless weft insertion systems. Multi face weaving systems. Quick style change.

4. WEAVING WITH DIFFERENT TYPES OF YARNS 7

Preparation and weaving of open end yarns, blended yarns, filament yarns. Data systems.

5. BONDED FABRICS 8


REFERENCE


TT 342 CHEMICAL PROCESSING OF TEXTILE MATERIALS II 3 0 0 3

1. DYEING 15

Introduction to theory of dyeing, properties and application of direct, azoic, vat, sulphur, reactive, acid, mordant, metal-complex, disperse and basic dyes. Dyeing of blends.
2. PRINTING  
Methods and styles of printing, printing machines, printing paste constituents, printing with direct, reactive, acid and disperse dyes and pigments.

3. FINISHING  
Introduction. Calendering, starching, creping, softening, crease proofing, anti shrinking, felting, non-felting.

4. TESTING  
Fastness properties of dyed and printed goods. Assessment of finishes imparted to textiles.

5. FINISHING OF KNITS, GARMENT PROCESSING  

Total 45

REFERENCES

Total = 45
REFERENCES


TT344 NEW SPINNING TECHNOLOGIES 3 0 0 3

1. CONDENSED YARN SPINNING

Principle of condensed yarn spinning; working of different models of condensed yarn spinning; advantages of this method over conventional ring spinning method.

2. ROTOR SPINNING

Description of the working of the rotor spinning method; requirements of the raw materials; preparation of the sliver for rotor spinning; yarn formation and its structure; yarn withdrawal and winding; rotor design and its implications on production and yarn quality; production limits; comparison with ring spinning.

3. FRICTION SPINNING

Detailed study of the DREF-2, DREF-3 and the master spinner machines working on the principle of friction spinning; the use of raw materials; application of these machines for different end products; the economics; technological limitations.

4. AIR-JET SPINNING

Description of the yarn production in air-jet spinning machine; feasibility of higher draft applied in this machine; structure and quality of the air-jet spun yarn; raw material requirement; production of yarn in PLYR spinning process applying similar principle; comparison with other spinning methods.

5. OTHER SPINNING TECHNOLOGIES

Working details of the production of double-rave yarns and wrap yarns; use of raw materials; economics of these methods of yarn production; yarn characteristics and their applications.

REFERENCE


TT 345 GARMENT TECHNOLOGY

1. GARMENT CLASSIFICATION

Men, Women, Children - Uniforms selection - Specifications.

2. DRESS AND DESIGNING

Pattern development - Marker planning - requirements - methods - spreading and cutting methods - Grading.

3. SEWING

Seams - Stitches - Sewing machine feeding systems - Sewing needles - Sewing threads - Fibre types - construction - finishes - Thread sizes - Thread packages - Basic sewing machine and its associated work aids.

4. COMPONENTS AND TRIMS


5. PRESSING

Categories of pressing - equipment - pleating.

6. GARMENT PROCESSING

Garment dyeing, Printing and finishing, Protective garments.

References


TT 346 CHEMICAL PROCESSING LAB

1. Scouring of cotton
2. Cotton bleaching with hypochlorites
3. Cotton bleaching with hydrogen peroxide
4. Degumming of silk
5. Dyeing of cotton with direct dyes
6. Dyeing of cotton with reactive dyes
7. Dyeing of cotton with sulphur dyes
8. Dyeing of cotton with azoic dyes
9. Dyeing of cotton with vat dyes
10. Dyeing of silk with acid and metal complex dyes
11. Dyeing of PET polyester
12. Dyeing of nylon
13. Dyeing of polyacrylonitrile
14. Identification of class of dyes
15. Printing with pigments
16. Determination of whiteness index dye up-take and AB Value

TT 347 TEXTILE TESTING LAB

1. Fibre length and length uniformity.
2. Fibre fineness and maturity.
3. Fibre strength.
4. Fibre moisture study.
5. Silver and roving hank study.
6. Yarn count.
7. Yarn loa strength.
10. Yarn twist (ply).
11. Yarn evenness.
12. Yarn impact strength.
15. Fabric Tensile strength.
16. Fabric tear strength.
17. Fabric stiffness.
18. Fabric crease recovery.
20. Fabric Air Permeability.
22. Fabric Drape.
23. Fabric colour fastness.
24. Crimp study in fabrics.
25. GSM study in fabrics.
3. PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

4. ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE

Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

5. ECONOMIC BALANCE

Different unit operations with single and multiple variables.

L = 45  Total = 45

REFERENCE


TT448 KNITTING TECHNOLOGY

1. INTRODUCTION

Comparison between knitted and woven fabrics. Warp knitting and weft knitting. Knitting needles.

68

2. CIRCULAR KNITTING


3. FLAT KNITTING


4. WARP KNITTING


REFERENCE


69

TT449 YARN MANUFACTURE LAB 0 0 3 2

1. Study of ginning machines.
2. Study of blowroom machinery.
3. Settings and production calculations in blowroom.
5. Card - Settings.
7. Draft calculation in Drawframe.
8. Study of comber preparatory machines.
10. Draft calculation in comber.
11. Construction details of speedframe.
13. Twist calculation in speedframe.
15. Construction details of ringframe.
17. Twist calculation in ringframe.
18. Study of builder motion mechanism in ringframe.

TT450 FABRIC MANUFACTURE LAB 0 0 3 2

1) Study of drum winding machine
2) Study of pm winding machine
3) Evaluation of splicer
4) Study of warping machine
5) Sizing warp yarns
6) Tappet shedding
7) Dobby shedding
8) Jacquard shedding
9) Shuttle picking mechanism
10) Shuttle checking mechanisms
11) Beat up mechanism
12) Take up mechanism
13) Negative let off mechanism
14) Positive let off mechanism
15) Warp protector mechanism
16) Wett fork mechanism
17) Study of pm changing mechanism
18) Study of warp stop motion
19) Terry fabric weaving
20) Study of drop box loom
21) Study of plain, interlock and rib knitting machine.

TT 451 COMPREHENSION 0 0 3 2

The object of comprehension test is to assess the overall level of proficiency and the scholastic attainment of the student in the various subjects during the degree course.

TT452 INDUSTRIAL TRAINING 0 0 0 1

At the end of fourth semester or sixth semester each student should undergo in-plant training in Textile Industry. The total training period should not be less than 15 days. Students have to submit a report before the seventh semester examination. Professor in-charge U.G. programme will evaluate the report and award credits.

TT453 PROJECT WORK 0 0 1 8 6

Each student is required to submit a report on the project assigned to him by the department. The report should be based on the information available in the literature or data generated in the laboratory/industry. The object of the project is to make use of the knowledge gained by the students at the various stages of degree
course. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the student at the end of the course.

TT 034 FIBRE AND TEXTILE COMPOSITES  
5. Manufacture of high performance fibres.  

Total = 45

REFERENCES


TT 035 TEXTURED YARN TECHNOLOGY  
1. Need for bulking of synthetic fibres - texturing - basic definition and classifications - Development in high speed spinning - poy  
2. Heat setting - need - factors involved - types of setting - effects on fibre morphology and mechanical properties - fundamentals of thermo - mechanical texturing - Helanca process.  
4. Basics of air jet texturing - types of yarns produced - feed material structure and properties of air jet texturing machines, nozzles, evaluation of air jet textured yarn - Vs spun, and filament false twist textured yarns.  
5. Stuffer box and edge crimping methods - principles, limitations, and applications - knit-de-knit and gear crimping methods, Bio component filament texturing - texturing of polypropylene and jute fibres - Cheno - mechanical and thermo - mechanical texturing.  

Total = 45
REFERENCES

2. Winter school on Man-made fibres -production, processing, structure, properties and applications Vol 1, 1988 Edited by V.B. Gupta.
5. Workshop on Texturisation - Book of papers Anna University Textile Dept. Dec '81
6. 'Synthetic Yarn Production' By Demir &EI -beherly Prentice -Hall inc 1996.

TT 036 SILK YARN TECHNOLOGY

1. INTRODUCTION

Raw materials - cocoons, Mysore seed cocoons, bivoltine, cross breed. Transportation and display of cocoons. Selection and purchase of cocoons in the open auction. Purchase of bivoltine hybrids, silk recovery. Stilling - drying and conditioning of cocoons - storage and preservation sorting.

2. REELING

Definition - cocoon cooking - mono pan - three pan and pressurised cooking - floating and sunken system.

3. RE-REELING AND PACKING

Raw silk - properties and uses of raw silk - raw silk testing and quality control - International standards and ISI standards.

4. Marketing of silk yarn, silk throwing and twisting, silk weaving, silk degumming, wet processing.

5. Spun silk yarn production.

Total 45

REFERENCE


TT037 THEORY OF STAPLE-FIBRE OPENING

1. FIBRE INDIVIDUALIZATION

The necessity of fibre individualization in the fibre opening processes, effect of fibre-group size on yarn uniformity, minimum requirements to achieve fibre individualization: basic approach for fibre individualization in the opening machines.
2. PRINCIPLE OF FIBRE OPENING IN BLOWROOM 12

The principle of fibre opening in the blowroom machines; calculation of tuft size reduction in openers based on machine and processing parameters; limitation of fibre opening in blowroom machinery; control of tuft size variation and fibre rupture during opening.

3. ROLE OF CARDING MACHINE 12

The function of licker-in in card; degree of opening in licker-in; the mechanics of fiber opening in the carding area; study of effect of fundamental factors like wire point design and density, speeds, settings and transfer coefficient on fibre individualization; calculation of useful parameters to assess the carding performance; card grinding on carding efficiency.

4. CARDING PROACTIVITY 8

Relationship between carding productivity and degree of fibre individualization; limiting factors of carding productivity; new concepts to improve carding productivity.

5. CLEANING 5

Role of fibre opening on fibre cleaning; the factors affecting fibre cleaning in the blowroom and carding machines; control of air suction for efficient cleaning.

REFERENCE


TT038 MECHANICS OF STAPLE-FIBRE DRAFTING 3 0 0 3

1. IDEAL DRAFTING 6

Definition of ideal drafting; conditions required to achieve ideal drafting in a roller drafting system; deviations from ideal drafting situation during actual drafting conditions.

2. DRAFTING WAVE 12

Definition of drafting wave; condition for drafting wave formation during roller drafting; estimation of the magnitude of the irregularity caused by the occurrence of the drafting wave; forces acting on a fibre during drafting at different positions in a drafting zone; methods to avoid drafting wave formation; role of apron in controlling drafting wave formation.

3. ROLLER SLIP 10

Definition of roller slip; conditions for the formation of forward and backward slips in the roller drafting systems; measures to avoid roller slip occurrence.

4. OTHER DRAFTING IRREGULARITIES 7

The causes for roller slip movement and roller speed variation during drafting and their effect on products irregularly; control of the irregularity formed from these sources.
5. COMPARISON

Comparison of roller drafting system with wire point drafting system; application of wire point drafting in card and rotor spinning machine; comparison of roller drafting in crawframe, combing preparatory, comb, speedframe, ringframe, ringcan spinning, condenser yarn spinning and in air-jet spinning machine; influence of draft on spinning triangle size and the subsequent effect on machine performance and product quality.

Total = 45

REFERENCE


TTC39 TECHNOLOGY OF STAPLE-FIBRE YARN TWISTING 3 0 0 3

1. FUNDAMENTALS OF TWISTING 8

Mechanics of imparting strength to a staple-fibre strand by twisting; meaning of twist multiplier and the basis of selection of required twist; principle of false twisting; fundamental requirements to create real twist in the strand.

2. TWISTING IN RING SPINNING 10

Principle of twist insertion in ring spinning; limitations of ring twisting; mechanics of balloon formed during twisting; influence of twisting on spinning triangle size and the subsequent effect on yarn quality and spinning performance; design features of rings and travellers used for twisting different types of yarns.

3. TWISTING IN OPEN-END SPINNING 10

Principle of twist insertion in open-end spinning; application of this principle in rotor spinning and friction spinning machines; advantages of this method of twisting over ring twisting method; comparison of yarn tension developed during twisting in these two machines.

4. TWISTING IN AIR-JET SPINNING 7

Principle of twist formation in air-jet spinning; advantage of using two air nozzles; the merits and demerits of this method of twisting; application of this method of twisting in PLYfil yarn production.

5. TWO-FOR-ONE TWISTING 5

Principle of two-for-one twisting; the advantages of this method of twisting; working of two-for-one twistier.

6. OTHER TWISTING METHODS 5

Twisting of yarns in double-rove fed spinning machines; operating principle involved in the twisting of wrap-spun yarns; technological and economic interrelationships in these methods of twisting; role of twisting in fancy yarn production.

Total = 45

TT 040 LONG-STAPLE SPINNING PROCESS

1. FIBRE CLEANING AND BLENDING

Impurities in the long-staple fibre like wool and their removal; methods adopted to process raw flax and jute; blending methods followed for long-staple fibres.

2. FIBRE INDIVIDUALISATION

Fibre individualisation in the carding machine; working principle and details of different types of carding machine - worsted carding, semi-worsted carding, woolen carding, flax carding and jute carding; card clothing and its maintenance; carding performance.

3. COMBING

Objective of combing; basic principle of combing; details of wool combing preparation and combing operation; worsted top finishing.

4. DRAWING

Principle of long-staple drafting: effect of doubling; drafting irregularities; working details of worsted, semi-worsted, jute and flax drafting; operating principle of roving machine.

5. YARN SPINNING

Mule spinning - drafting, twisting, backing-off, winding on; description of centrifugal spinning; Flyer spinning; Ring spinning - twisting, rings and travellers; condenser yarn spinning; cap spinning; open end spinning - general features of rotor and friction spinning as applicable to long-staple fibres; Self twist spinning system.

Total = 45

REFERENCE

1. **YARN GEOMETRY**

The idealized helical yarn structure; yarn count and twist factors; twist contraction, packing of fibres in yarns; measurement of yarn diameter; ideal migration, tracer fibre technique; characterisation of migration behaviour; migration in blended yarns; mechanism of migration; effect of various parameters on migration behaviour.

2. **MECHANICS OF CONTINUOUS FILAMENT YARNS**

Analysis of tensile behaviour; prediction of breakage; analysis of yarn mechanics by energy method; observed extension and breakage of continuous filament yarns; mechanics of torque in filament yarns.

3. **MECHANICS OF STAPLE FIBRE YARNS**

Theoretical analysis; fibre obliquity and slippage; influence of fibre length, linearity and friction; strength of blended yarns - Hamburger's model.

4. **WOVEN FABRIC GEOMETRY AND DEFORMATION**

Elements of woven fabric geometry; Pierce and Oldfoss's models; jamming of threads; cover factor; crimp interchange in woven fabrics; modification to Pierce model - race track, saw tooth and bilinear models; form factor; degree of set; extension behaviour of woven fabric; prediction of modulus; tensile properties in bias direction; other fabric deformation - shear, buckling, bending and compression; fabric handle; use of finite element analysis.

5. **NONWOVENS AND KNITTED STRUCTURES**

Geometry of plain knitted structure; mechanics of nonwoven fabrics.

**REFERENCE**


**TT 042 MECHANICS OF TEXTILE MACHINERY**

1. **MACHINE DESIGN**

Design of cams, gear trains, clutches and brakes. Practical applications in textile machines.

2. **ROTARY MOTION**

3. SPINNING MACHINES 12
Auto levellers, differentials and variable speed drives, traveller and balloon dynamics, design of machine components.

4. PREPARATORY MACHINES 2
Yarn winding calculations.

5. WEAVING MACHINES 12
Kinematics of shedding, picking and beat up. Let off and take up mechanisms.

TOTAL = 45

REFERENCES


TT043 PROCESS CONTROL IN WEAVING 3 0 0 3

1. INTRODUCTION 3
Scope of process control in weaving and preparation to weaving.

2. WINDING 10

3. WARPING 5

1. SIZING 12

5. DRAWING-IN 3
Selection and care of reeds, healds and drop pins. Control of cross ends and extra ends.

6. WEAVING 12

Total 45

REFERENCE


TT 044 ADVANCES IN FABRIC PREPARATION 3 0 0 3

2. Development in grey preparation. 11
3. Recent developments in mercerisation of cotton textiles. 10
4. Development in grey preparation machines. 11
5. Energy saving in preparatory process. 5

Total = 45

REFERENCES
1) Advances in Textile Chemical Processing, IT, Dehl., 1981.

TT 045 BONDED FABRICS 3 0 0 3

1. INTRODUCTION 5
Definitions and classification of bonded fabrics. Historical development; Fibres used; Production and sales.

2. WEB FORMING 15
Making the spun fibre web by dry method and by wet method; Web laying; Webs manufacture from filaments; Uniformity of web.

3. BONDING 20
Bonded fabric production by needling, stitching, water jet consolidation, thermal and by chemical methods; Production of bonded fabrics by spun bonding and melt blown process; Structure property relationship in bonded fabrics; Effect of process parameters.

4. END USES 5
Various and uses of bonded fabrics.

Total = 45

REFERENCE

TT 046 CHEMISTRY AND PHYSICS OF DYES 3 0 0 3
1. Chemistry of direct, vat, azoic, reactive, basic, acid and disperse dyes. 18
2. Chemistry of pigments 8
3. Definition of colour, perception of colour, colour mixing laws, metamerism. 7
4. Colour order systems, colour difference measurements, colour assessment in textiles; optical theory for colour matching. 7
5. Effect of dye particle size on light scattering. 5
TOTAL = 45
REFERENCES


TT 047 THEORY OF DYEING

1. Physical chemistry, essential to dyeing theory. 10
2. Thermodynamics of dye sorption. 10
3. Influence of fibre structure on dye up take. 13
4. Diffusion and rates of dyeing 5
5. Dye-fibre bonds. 7

Total = 45

REFERENCES


TT 048 SYNTHETIC FIBRE COLOURATION

1. Mechanism of dyeing synthetic fibres; effect of fibre structure on dye up-take. Dyeing of PET polyester, nylon, polyacrylonitrile and polypropylene. 10

REFERENCES


TT 049 ECO FRIENDLY DYES AND CHEMICALS

2. Alternative dyes and chemicals - structure - identification by chromatographic techniques. 12
3. Finishes - banned items - allowable dosages - alternatives to finishes. 9
4. Dry cleaning agents - pigments - bleaching agents - solvents - guidelines to dyestuff manufacturers. 12

Total = 45
REFERENCES

TT050 WORK STUDY IN TEXTILE INDUSTRY 3 0 0 3
1. Method study, procedure process chart, Flow and handling of materials, movement of workers, string diagram, method and movements in the work place. 12
2. Principles of motion economy; SIMO chart, work measurement procedures, time study-equipment and forms - Job breaking down into units. 18
3. Rating, Scales, Factors, human Factor; Working condition - allowances-use of time standards-estimating - standardisation. 15

Total = 45

REFERENCES
1. Introduction to work study: ILO Geneva 1989
4. Chuter A.J: "Introduction to clothing production management" Black well science 1985

TT 051 ENERGY MANAGEMENT IN TEXTILE INDUSTRY 3 0 0 3
1. Source of energy; limitations of natural sources. 6
2. New technologies for energy; unexploited energy resources and problems in their exploitation. 10
3. Total energy concept energy consumption in spinning, weaving and processing; conservation of energy in such processes. 10
4. Techniques of energy saving; modification of technology or techniques towards saving in energy. 10
5. Scope of utilisation of byproducts for energy production; captive power generation and its economics. 9

Total = 45

REFERENCES

TT 052 COSTING 3 0 0 3
1. Principles and objects of costing; different methods of costing; job costing, marginal costing; standard costing. 14
2. Costing and budget controls; material cost control; labour cost control and overhead control.  
3. Depreciation on land, buildings and machines; methods of computing depreciation.  
5. Methods of calculating pay back period, return on investment discounted cash flow.  
   Total = 45

REFERENCES


TT053 TEXTILE MILL PLANNING AND MANAGEMENT  

1. PRINCIPLES OF MANAGEMENT  
   Planning, organisation, coordination, directing, controlling  
   Total = 303

2. PROJECT REPORT  
   Preparation of projects, location layout; selection of site for textile mills, Building structure, balancing of machinery for spinning and weaving  
   Total = 8

3. MAINTENANCE OF MACHINERIES  
   Schedule for maintenance, lubricants; type and characteristics of lubricants.  
   Total = 4

4. LIGHTING, VENTILATION AND AIR CONDITIONING  
   Lighting requirements for textile mills - space for lighting-humidification and ventilation-R.H requirements-Air conditioning-various systems of air conditioning and humidification-motors electrical power and drives of various textile machinery.

5. MATERIAL AND MAN MANAGEMENT  
   Material handling in textile mills: selection and training of operatives workload of operatives.

6. FINANCIAL MANAGEMENT  
   Total = 45

REFERENCES

1. Shukla M.C Business Organisation and Management, sultan chand and sons 1975  
REFERENCES


TT 055 QUALITY ASSURANCE IN GARMENT INDUSTRY

1. Design satisfaction tests. 4
2. Fabric specification - cloth defects - four point system - shrinkage potential. 5
3. Garment specification - manufacturing specification - name of operation and associated details in respect of sewing, dyeing and washing of garments. 10
4. Style features - trims specification - stitch specification - size scale - garment dimensions and tolerances. 7
5. Quality of trims and accessories 4
6. Defects in garments and their remedies - A, B and C zones in a garment with respect to defects.  


8. Laboratory testing for quality and performance.  

Total = 45

REFERENCE


HS 034 - TECHNICAL TAMIL

1. REVIEW OF BASIC GRAMMER  

Sentence structure - Tense, case, gender voice and number common errors in usage and their corrections - Errors in conjunction - Spelling and traditional usage.

2. READINGS FROM TECHNICAL WRITINGS IN TAMIL  

Critical study of selected passages from technical writings in Tamil (selected Articles from Kalanjiyam may be prescribed from time to time.

3. TRANSLATION FROM ENGLISH TO TAMIL  

Principles of Translation - Coinage of Technical terms and exercises in Translation.

4. TAMIL AND COMPUTERS  


5. CREATIVE WRITING IN TECHNICAL TAMIL  

Style of Technical language, Exercises in writing technical passages in Tamil articles, description of technical matters

TEXT BOOKS

1. A.K. PAFANTHAMANAR, Nalla Tamil Elutha Venduma, Pan Nilayam, Chennai

REFERENCES

2. Kalanjiyam, Quarterly of Anna University, Chennai (Journal articles).  
4. DR. RADHA CHELLAPEN, Kalancholilakam.
HS 035 TECHNICAL GERMAN - I

1. INTRODUCTION
Special and comparative features of German with English, Hindi and Tamil German Alphabets, pronunciation.

2. THEMA
Name, Land, Wohnung, Sehenswürdigkeit, Geschwister, Alter, Tagesablauf, Terminplanung, Stellenanzeige, Berufswahl, Einkauf

3. GRAMMATIK
Personal pronouns, Verb, Vorstellung, Ort, Possessive pronouns, Verb - "sein"/"haben", Unmarked Artikel, Negation - "nicht"
- "kein"/"keine", bestimmter Artikel, starke Verben, trennbare Verben, Imperativ Modal Verb, Verben Akkusativ

4. UEBUNGEN
Partner Übungen, Schriftliche Übungen, Aussprache Übungen, Kontrollübungen, Text generation

5. DIALOGUE
Oral/Written

6. GLOSSARY
Technical Words

TEXT BOOK:
Lernziel Deutsch (Deutsch als Fremdsprache) - Grundstufe 1
From Max Hueber Verlag

HS 036 TECHNICAL GERMAN - II

1. INTRODUCTION
German Idioms and Phrases

2. THEMA
Geschichte, Auf der Post, Auskunft, Fest, Heirat, Kinder Studium, Ausbildung, Erziehung, Jugend, Deutschsprachige Länder, Europa, Arbeitswelt, Urlaub

3. GRAMMATIK
Dativ, Ort, und Richtung, Reflexive Verben, Verben mit Prasens, Präposition/objekt, Perfect, Praetentum, Adjective, Komparation, Genitive, Wortbildung, Nebensätze

4. UEBUNGEN
Partner Übungen, Schriftliche Übungen, Aussprache Übungen, Kontrollübungen, Text generation

5. DIALOGUE
Oral/Written

6. GLOSSARY
Technical Words

TEXT BOOK
Lernziel Deutsch (Deutsch als Fremdsprache) - Grundstufe 1
From Max Hueber Verlag
1. Introduction to Japanese Alphabets - Hiragana, Katakana and Kanji - Group 1, 2, 3 & 4 syallables - writing practice - pronunciation - word order - greetings - receiving a visitor and exchange of pleasantries - Kanji Practice.


3. Classification of particles - Ga, Ka, Wa, O E, Ni etc - aural comprehension - Reading comprehension - noun 1, Wa, noun 2 desu - Demonstrative pronouns - kore, sore, are and dore - kono, sono, ano and dono - Kochira - sochira - ochira and dochira - particle - No, kara, ni and de - question-Itsu - conversational grammar - soo desu ka - Na, I adjectives perfect and imperfect - question words - Doo and Ikiga - particle - To, ne and yo - Kanji practice.


5. Verbs ending in -te or de - classification of Te forms and Masu forms - verb modifiers - koo, soo sa and doo - Set phrase - Onegai shimasu - Sumimasen - Adverbs-Mazu, sore kara and saigo ni - formation of the - Te form of I adjective and desu - Kanji practice.

L: 45 T: 15 Total = 60

TEXT BOOKS:


3. Yan-san Serial - Video tapes, Japan.

HS 038 TECHNICAL JAPANESE - II

1. Demonstrative pronouns - re - Interjection - Ee - Quoted Sentences - omoi desu - Non-polite form of verbs - Group I ending in -eri or iru - Group 2 verbs ending in -u - Non-polite forms of I-adjectives - non polite form of desu, deshou, daroo - Suffix - sugiru - expression of reason-tame (ni) - Counters - Hon and - Do - Kanji practice.


5. Comparative sentences - no hoo ga and yori - Negative comparative sentences - Negative request - Adverbs of extent - Korina ni, sonna ni and anna ni - Te form of transitive verb and -
and - Passive sentence - neutral passive sentence - technical vocabulary related to Engineering and Technology - Preparation of technical reports.

L: 45  T: 15  Total = 60

TEXT BOOKS

3. Yan-san Serial - Video tapes, Japan.

HS 039 TECHNICAL FRENCH - I

1. Alphabets - Pronunciation - Masculine and Feminine Genders only - Numbers - Indefinite and definite articles - Plurals - Verbs to be and to have.

L: 45  T: 15  Total = 60

TEXT BOOKS


REFERENCE

2. Comparative, superlative sentences - recent past - immediate future - grammatical analysis.
3. 3104
4. Translation from English to French - Translation from French to English - Texts from Physics and Chemistry
5. Translation from English to French - Translation from French to English - Texts from Basic Engineering

L: 45  T: 15  Total = 60

HS 040 TECHNICAL FRENCH - II


9

2. Comparative, superlative sentences - recent past - immediate future - grammatical analysis.

9

3. Translation from English to French - Translation from French to English - Texts from Physics and Chemistry

9

4. Translation from English to French - Translation from French to English - Texts from Basic Engineering

9


9

L: 45  T: 15  Total = 60

TEXT BOOKS

1. Mauger, G. - Cours de Langue et de Civilisation Francaises, Hachette-Paris 1986
REFERENCES

1. Centre D'etudes Francaises, Functional French for Scientists and Technologists, Jawaharlal Nehru University, New Delhi, 1986.

HS 041 ENGLISH I

1. LISTENING

Listening comprehension - listening for specific information - note taking - use of charts and diagrams.

2. SPEAKING

Defining - describing objects - describing uses/functions - comparing - offering suggestions - analysing problems and providing solutions - expressing opinions (agreement/disagreement) predicting - expressing possibility/certainty - framing questions - providing answers - pronunciation practice (word stress).

3. READING

Skimming - scanning - detailed reading - predicting content - interpreting charts and tables - identifying stylistic features in texts - evaluating texts - understanding discourse coherence - guessing meaning from the context - note-making/transferring information.

4. WRITING

Sentence definition - static description - comparison and contrast classification of information - recommendations - highlighting problems and providing solutions - formal and informal letter writing - using flow-charts/diagrams - paragraph writing - editing.

5. FOCUS ON LANGUAGE

Word formation with prefixes and suffixes - discourse markers and their functions - degrees of comparison - expressions relating to recommendations and comparisons - active and passive voice - antonyms - tense forms - gerunds - condition sentences - modal verbs of probability and improbability - acronyms and abbreviations - compound nouns and adjectives - spelling - punctuation.

L: 45  T: 15  Total = 60

TEXT BOOK

1. "English for Engineers and Technologists", Volume I. Authors: Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH


HS 042 ENGLISH II

1. LISTENING

Listening comprehension - listening for specific information - note taking - using non-verbal devices.
2. SPEAKING

Describing processes - stating purpose - offering opinions, suggestions and recommendations - summarising - reporting - free discussion of chosen topics - pronunciation practice (word stress, consonant clusters - homonyms).

3. READING

Skimming - scanning - note-making - understanding the organisation of texts - discourse cohesion - predicting and evaluating content - evaluating style - inferring meaning - study - reading - interpreting tables, flow-charts.

4. WRITING

Extended definition - process description - cause and effect analysis - stating choice and justifying it - safety instructions check list - letter of application - data sheet/resume.

5. FOCUS ON LANGUAGE AND FUNCTIONS

Word formation - synonymy - prepositions - adverbs - passive voice - sequence words/discourse markers - connective adverbs - numerical expressions - expansion of abbreviations - rules for writing SI units - language of instructions, check-lists, cause and effect, purpose and means - indefinite adjectives of number and quantity - spelling and punctuation.

L : 45 T : 15 Total = 60

TEXT BOOK

1. "English for Engineers and Technologists", Orient Longman, 1990 Volume II. Authors: Humanities and Social Sciences Department, Anna University. Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH II


GE 034 CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT

1. INTRODUCTION

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brainstorming - different techniques.

2. PROJECT SELECTION AND EVALUATION

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

3. NEW PRODUCT DEVELOPMENT


4. NEW PRODUCT PLANNING

Design of prototype - testing - quality standards - marketing research - introducing new products.

L = 30 P = 30
1. LABORATORY

Creative design - Model Preparation - Testing - cost evaluation
- Patent application.

REFERENCES

REGULATIONS
AND
SYLLABUS

(REGULATIONS 2000)

B. TECH. DEGREE PROGRAMME
(8 SEMESTERS)

CERAMIC TECHNOLOGY

ANNA UNIVERSITY
CHENNAI - 600 025.
APRIL 2000
## DEGREE OF BACHELOR OF TECHNOLOGY
### BRANCH – CERAMIC TECHNOLOGY
### CURRICULUM AND SYLLABUS

### SEMESTER I

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM 131</td>
<td>Chemistry I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>GE 131</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>L1</td>
<td>Language Elective I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA 131</td>
<td>Mathematics I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH 131</td>
<td>Physics I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>GE 132</td>
<td>Computer Practice I</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GE 133</td>
<td>Workshop Practice</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
<td>5</td>
<td>11</td>
<td>25</td>
</tr>
</tbody>
</table>

### SEMESTER – II

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 131</td>
<td>Chemistry II</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>EC 152</td>
<td>Electronics Engineering</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>EE 151</td>
<td>Electrical Engineering</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>L2</td>
<td>Language Elective II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH 134</td>
<td>Physics II</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>MA 132</td>
<td>Mathematics II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>GE 134</td>
<td>Engineering Graphics</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GE 135</td>
<td>Computer Practice II</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16</td>
<td>4</td>
<td>12</td>
<td>27</td>
</tr>
</tbody>
</table>
### SEMESTER III

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 231</td>
<td>Mathematics – III</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CT 231</td>
<td>Principles of Metallurgy</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 232</td>
<td>Elements of Ceramics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH 233</td>
<td>Electrical Machines and Drives</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH 234</td>
<td>Mechanical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH 235</td>
<td>Mechanics of Solids</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### PRACTICAL

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT 233</td>
<td>Materials Science Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CH 238</td>
<td>Electrical Engineering Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CH 239</td>
<td>Mechanical Engineering Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>1</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>

### SEMESTER – IV

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 056</td>
<td>Statistics and Linear Programming</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CT 241</td>
<td>Polymer chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 242</td>
<td>Ceramic Raw Materials</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 243</td>
<td>Ceramic Powder Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 244</td>
<td>Whiteware and Heavy Clayware</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH 245</td>
<td>Instrumental Methods of Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### SEMESTER -V

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT 331</td>
<td>Thermodynamics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 332</td>
<td>Fuels and Energy Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 333</td>
<td>Ceramic Fabrication</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>CT 334</td>
<td>Ceramic Science</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 335</td>
<td>Principles of Glass Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 336</td>
<td>Refractories - I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### PRACTICAL

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT 337</td>
<td>Whiteware and Heavy Clayware Lab</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>CT 338</td>
<td>Chemical Analysis of Ceramic Raw Materials</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CT 339</td>
<td>Industrial Training - (4 Weeks during Summer)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>0</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Code</td>
<td>Course Title</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>THEOREY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA 038</td>
<td>Numerical Methods</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CT 341</td>
<td>Furnace Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 342</td>
<td>Glass Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 343</td>
<td>Glaze Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 344</td>
<td>Phase Equilibria in Ceramics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 345</td>
<td>Refractories - II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT 346</td>
<td>Glass Technology Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CT 347</td>
<td>Glaze Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>1</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH 431</td>
<td>Process Economics and Industrial Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 431</td>
<td>Quality Control in Ceramic Industries</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CT 432</td>
<td>Cement and Concrete</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E1***</td>
<td>Elective - I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E2***</td>
<td>Elective - II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E3***</td>
<td>Elective - III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 187

LIST OF ELECTIVES
Language Electives (For I & II Semester only)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 035</td>
<td>Technical German I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 036</td>
<td>Technical German II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 037</td>
<td>Technical Japanese I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 038</td>
<td>Technical Japanese II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------</td>
<td>---------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS 039</td>
<td>Technical French I</td>
<td>3 1 0 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS 040</td>
<td>Technical French II</td>
<td>3 1 0 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS 041</td>
<td>English I</td>
<td>3 1 0 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS 042</td>
<td>English II</td>
<td>3 1 0 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS 034</td>
<td>Technical termi</td>
<td>2 0 2 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE 034</td>
<td>Creativity, Innovation and New Product Development</td>
<td>2 0 2 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ELECTIVES FOR CERAMIC TECHNOLOGY BRANCH (OTHER THAN I YEAR B.TECH)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT 034</td>
<td>Advanced Structural Ceramic Materials</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 035</td>
<td>Advanced Ceramic Processing Technology</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 036</td>
<td>Special Coating Technology</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 037</td>
<td>Microwave Processing of Ceramics</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 038</td>
<td>Electronic Ceramics</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 039</td>
<td>Nuclear and Space Ceramics</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 040</td>
<td>Special Glasses</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 041</td>
<td>Fibres and Composites</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 042</td>
<td>Bio-Ceramics</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 043</td>
<td>Monolithics and Castables</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 044</td>
<td>Abrasives</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 045</td>
<td>Plant Equipment And Furnace Design</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 046</td>
<td>Computer Aided Design</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 047</td>
<td>Mechanical Behaviour of Ceramics</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CH 044</td>
<td>Process Automation</td>
<td>3 0 0 3</td>
</tr>
<tr>
<td>CT 048</td>
<td>Materials Management</td>
<td>3 0 0 3</td>
</tr>
</tbody>
</table>

**MA 131 MATHEMATICS I**

1. **MATRICES**

The characteristic equation, Eigen values and Eigen vectors of a real matrix, some properties of Eigen values, Cayley-Hamilton theorem, Reduction of a real matrix to a diagonal form, Orthogonal matrices-properties, reduction of a quadratic form to a canonical form by orthogonal transformation.

2. **GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS**

Curvature - cartesian and polar coordinates- Circle of curvature, involutes and volutes, Envelopes - Properties of the envelopes - Envelopes of normal to a curve.

3. **FUNCTIONS OF SEVERAL VARIABLES**

Total differential - Derivative of implicit functions, Partial derivative of a function of two functions, Taylor's expansion for a function of two variables, Maxima and minima, Jacobians, Differentiation under the integral sign.

4. **MULTIPLE INTEGRALS**

Double integration in cartesian and polar coordinates, change of order of integration, triple integration in cartesian coordinates, Gamma and Beta functions - properties, Area as a double integral.

5. **DIFFERENTIAL EQUATIONS**

Simultaneous linear equations with constant coefficients, Homogeneous linear equations of Euler type - Equations reducible to homogeneous form, Linear equations of second order with variable coefficients, Method of reduction of order, Transformation
of the equation by changing the dependent variable, Method of variation of parameters.

REFERENCES:


PH 131 PHYSICS - I

1. PROPERTIES OF MATTER
   Elasticity - Stress - strain diagram - factors affecting elasticity - Twisting couple on a wire - shaft - Torsion pendulum - Depression of a cantilever - Young's modulus by cantilever - Uniform and non-uniform bending - I shape girder - production and measurement of high vacuum - Rotary pump - Diffusion pump - Pirani Gauge - Penning gauge - Viscosity - GwealD Viscometer - Comparison of viscosities.

2. ACOUSTICS

3. HEAT AND THERMODYNAMICS

4. OPTICS

5. LASER AND FIBRE OPTICS
   Principle of lasers - Laser characteristics - Ruby - NdYAG, He-Ne, CO₂ and semi conductor lasers - propagation of light through optical fibre - types of optical fibres - applications of optical fibres as optical waveguides and sensors.

6. PRACTICALS

   1. Young's modulus by nonuniform bending
   2. Rigidity modulus and moment of inertia using Torsion pendulum
   3. Viscosity of a liquid by Poiseuelle's method
   4. Wavelength determination using grating by Spectrometer
   5. Particle size determination by Laser
   6. Thermal conductivity of Lees' disc
   7. Thickness of wire by Air wedge
   8. Thermo emf measurement by potentiometer

TEXT BOOK

REFERENCE


CM-131 CHEMISTRY I

1. CHEMICAL THERMODYNAMICS
   Definition of free energy and spontaneity - Maxwell relations - Gibbs Helmholtz equation - Van't Hoff equations - stoichiometry and energy balances in chemical reactions.

2. DYNAMICS OF CHEMICAL PROCESSES
   Basic concepts - composite reactions (opposing, parallel and consecutive reactions) - collision theory - thermodynamic formulation of reaction rates - unimolecular reactions - chain reactions (stationary and non stationary) - enzyme kinetics - Michaelis-Menten equation.

3. ELECTRODICS
   Types of electrodes and cells - Nernst equation - emf measurement and its applications - Principles of chemical and electrochemical corrosion control (sacrificial anode and impressed current methods).

4. WATER
   Water quality parameters - definition and expression - estimation of hardness (EDTA method) and alkalinity (titrimetry) - water softening (roscite) - demineralisation (ion-exchangers) and desalination (RO) - domestic water treatment.

5. POLYMERS
   Monomer - functionality - degree of polymerisation - classification based on source and applications - addition, condensation and copolymerisation - mechanism of free-radical polymerisation - thermoplastics and thermosetting plastics - injection moulding, blow moulding and extrusion processes.

PRACTICALS

1. WATER ANALYSIS
   Determination of hardness alkalinity, DO, Fe (spectrophotometry) and Na & K (Flame photometry)

2. ELECTROCHEMISTRY AND CORROSION EXPERIMENTS

3. POLYMER EXPERIMENTS

REFERENCE BOOKS


GE 131 ENGINEERING MECHANICS

1. BASICS
   Introductions - Units and Dimensions - Laws of Mechanics - Vectors - Vectorial representation of forces and moments - Vector operations
   4 + 1

2. STATICS OF PARTICLES
   Coplanar forces - Resolution and composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - equivalent systems of forces - Principle of transmissibility - single equivalent force.
   6 + 2

3. EQUILIBRIUM OF RIGID BODIES
   Free body diagram types of supports and their reactions - requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.
   5 + 2

4. PROPERTIES OF SURFACES AND SOLIDS
   Determination of Areas and Volumes - First moment of area and the centroid - second and product moments of plane area - Parallel axis theorems and perpendicular axis theorems - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia - relation to area moments of inertia.
   9 + 3

5. FRICTION
   Frictional force - Laws of Coulomb friction - Simple Contact friction - Rolling Resistance - Belt Friction.
   3 + 1

6. DYNAMICS OF PARTICLES
   12 + 4

7. ELEMENTS OF RIGID BODY DYNAMICS
   Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid body - work energy equation.
   6 + 2

TEXT BOOKS

REFERENCE

GE 132 COMPUTER PRACTICE - I

1. FUNDAMENTALS OF COMPUTERS AND OPERATING SYSTEMS:

2. OFFICE AUTOMATION
   a) Word Processing
   b) Data Base Management System 5
   c) Spread Sheet Package 2
   d) Presentation Software 2

L : 15 P : 45 Total = 60

TEXT & REFERENCE BOOKS

GE 133 - WORKSHOP PRACTICE

LIST OF EXPERIMENTS
1. Sheet Metal: Fabrication of tray, cone etc. with sheet metal.
2. Welding: Arc welding of butt joint, lap joint, Tee fillet etc., Demonstration of gas welding.
3. Fitting: Practice in chipping, filing, drilling, making vee, square and dovetail joints.
5. Foundry: Preparation of simple moulds like flange, gear, V-grooved pulley etc.
6. Smithy: Demonstration for making simple parts like keys, bolts, etc.

P : 30 Total = 30

SEMESTER - II

MA 132 MATHEMATICS II

1. VECTOR CALCULUS
   Gradient, Divergence, Curl - Line and surface integrals - Green’s Gauss divergence and Stokes theorems - Verification and applications.
   9

2. ANALYTIC FUNCTIONS
   C-R Equations - Properties and analytic functions - Determination of harmonic conjugates and analytic function - conformal mapping - mapping properties of \( w = z + a \), \( 1/z \), \( az \), \( z^2 \) and bilinear transformation.
   9

3. COMPLEX INTEGRATION
   Cauchy’s theorem - Cauchy’s integral formula - Taylor and Laurent’s series - Singularities and classification - residues, Cauchy’s residue theorem - Contour integration around circular and semi - circular contours (excluding poles on the real axis).
   9
4. EMPIRICAL STATISTICS


5. STATISTICAL INFERENCE

Sampling distribution - Testing of hypothesis - Level of significance - Confidence limits tests based on normal distribution, t-distribution and Chi-square distribution.

REFERENCES:

CH 131 CHEMISTRY II

2 1 2 4

1. ENVIRONMENTAL POLLUTION


2. Fuels

Classification of fuels - Caloric value - Determination - Coal - Ranking and analysis - Carbonisation of coal - Coal tar products - Metallurgical coke - Classification of petroleum - Fractional distillation - Cracking - Reforming - Petrol - Diesel - Coal gas - Natural gas - Producer gas - LPG - Biogas.

3. BINDING MATERIALS

Cement and lime - Types - Composition and characteristics - Chemistry of setting and hardening - Grading and analysis - Adhesives - Types - Characteristics - Epoxides, urethanes, polyvinyl alcohol and polyvinyl acetate.

4. POLYMERIC MATERIALS

Polytetrafluoroethylene, Polymides (nylon 6, nylon 66, T, Kelvar) - Polyesters (polyethylene terephthalate, polybutyleneterephthalate, aromatic polyester) - Polycarbonate, polycetals, polyols (applications only, manufacturing details not required).

Composites: Matrix resin - Reinforcements - Applications.

5. INDUSTRIAL INORGANIC COMPOUNDS


Refractory: Silicon carbide - Aluminium oxide - Ultramarine.


Refractory: Silicon carbide - Aluminium oxide.

Lubricants: silicone oil - Lithium grease - Graphite - Molybdenum sulphide.
6. PRACTICALS

Phenol water system - Kinetics of Ester Hydrolysis - Distribution Coefficient - Pigment Analysis - Lead and Titanium - Melting point and Molecular weight Determination - Estimation of Percentage Composition of Glycerol (Viscometric method)

\[ L = 30 \quad T = 15 \quad P = 30 \quad \text{Total} = 75 \]

REFERENCE

5. Miles D.C. and Briston J.H. Polymer Technology, Chemical Publishing Co., Inc.,

EC 152 ELECTRONICS ENGINEERING

1. SEMICONDUCTORS AND RECTIFIERS

- Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - P-N junction - Virtual characteristic of PN junction diode - Zener diode - Zener diode characteristic - Half wave and full wave rectifiers - Voltage regulation.

2. TRANSISTORS AND AMPLIFIERS

- Bipolar junction transistor - CB, CE, CC - Configurations and characteristics - Biasing circuits - Elementary treatment of voltage amplifier - Class A, B and C power amplifiers - principles of Tuned amplifiers.

3. POWER AND CONTROL ELECTRONIC DEVICES

- Field Effect Transistor - Configurations and characteristics - FET amplifier - SCR, DIAC, TRIAC, UJI - characteristics and simple applications - switching transistors - concept of feedback - negative feedback - application in temperature and motor speed control.

4. SIGNAL GENERATORS AND LINEAR IC'S

- Sinusoidal oscillators - positive feedback - RC phase shift, Hasley, Colpitt's, Wien bridge Oscillators - multivibrators - operational amplifier - adder, multiplier, integrator and differentiators -integrated circuits.

5. DIGITAL ELECTRONICS


TEXT BOOK


REFERENCE

1. Mehta, V.K., Principles of Electronics, S.Chand and Company Ltd., 1994
EE 151 ELECTRICAL ENGINEERING

1. ELECTRICAL CIRCUITS
   Ohms Law - Kirchhoff’s Laws - steady state solution of D C Circuits
   - Introduction to AC circuits - Waveforms and RMS value - power
   and power factor, single phase and 3 phase balanced circuits.

2. ELECTRICAL MACHINES
   Principles of operation and characteristics of D C machines,
   Transformers (single phase and three phase) - Synchronous
   Machines - 3 Phase and single phase induction motors - (op.
   Principles).

3. ELECTRICAL MEASUREMENTS
   Moving coil and moving iron instruments (Ammeter and voltmeter)
   Dynamometer type watt meters and energy meters (op. Principles).

TEXT BOOK

   Delhi, 1990
2. Del Toro, Electrical Engineering Fundamentals, Prentice Hall

REFERENCE

1. Jimmie J.Cathey and Nasar S.A., Basic Electrical
   Engineering, Schaum outline series in Engineering, McGraw
2. Deshpande, N.V., Electrical Machines, A.A.Wheeler and
6. PRACTICALS

1. Motor Bridge - Temp. Coefficient
2. Field along the axis of coil - Determination of H
3. Carey Foster's Bridge - Resistivity
4. X-ray diffraction - calculation of cell parameters
5. Newton's rings - Wavelength measurement
6. Spectrometer - Dispersive power of a prism
7. Rigidity modulus - static torsion
8. Ammeter & voltmeter calibration using potentiometer

TEXT BOOK

REFERENCES

GE 134 ENGINEERING GRAPHICS

1. PRINCIPLES OF GRAPHICS

Two dimensional geometrical construction - Conic sections, involutes and cycloids - Representation of three dimensional objects - Principles of projections - standard codes of principles.

2. ORTHOGRAPHIC PROJECTIONS

Projections of points, straight lines and planes - Auxiliary projections - Projection and sectioning of solids - intersection of surfaces - Development of surfaces.

3. PICTORIAL PROJECTIONS

Isometric projections - Perspectives - Free hand sketching.

4. COMPUTER GRAPHICS

Hardware - Display technology - Software - Introduction to drafting software.

TEXT BOOK

REFERENCE

GE 135 COMPUTER PRACTICE - II

1. MULTIUSER OPERATING SYSTEM

Unix: Introduction - Basic commands - vi editor - filters - Input/output redirection - piping - transfer of data between devices - shell scripts.

2. FUNDAMENTALS OF NETWORKING

Working on a networked environment - Accessing different machines from one node - Concept of E-mail - Use of Internet.
3. LAPLACE TRANSFORMS:

Transforms of simple functions, Basic operational properties, Transforms of derivatives and integrals, Periodic functions, Convolution theorem, Inverse transforms, Initial and final value theorems; Applications of Laplace transforms to linear ordinary differential equations.

4. PARTIAL DIFFERENTIAL EQUATIONS:

Formation, Solution of standard types of first order equation and Lagrange's Linear Equation, Linear partial differential equations of second and higher order with constant coefficients.

5. BOUNDARY VALUE PROBLEMS:

Classification of second order partial differential equations, Transverse vibrations of a string, One-dimensional heat equation and two-dimensional heat flow, Fourier series solutions in cartesian coordinates.

REFERENCES:

1. BASICS OF METALLURGY

Introduction to metallurgy, metals, metallic ores and their sampling, preparation and extraction of metals.

2. HEAT TREATMENT


3. SURFACE TREATMENT

Surface hardening processes, carburizing, nitriding, flame hardening.

4. CASTING AND POWDERING

Industrial melting of metals and alloys - cast iron, aluminium alloys, copper based alloys, furnaces used. Different types of casting processes. Powdering - production, mixing compaction and sintering - applications.

5. MICROGRAPHY

Grinding, polishing, etching, etc. Metallurgical optical microscope and electron microscope.

BOOKS FOR REFERENCE:

REFERENCE:

CH 233 ELECTRICAL MACHINES AND DRIVES 3 0 0 3

1. ELECTRIC CIRCUITS
   Definition – ohm's law – series / parallel circuit – parallel circuit –
   Division of current – Kirchoff's law; Superposition and Thevenin's
   Theorem; Star-delta transormation; Simplification of networks.

2. A.C.CIRCUITS
   Alternating Voltage; Need for A.C. Voltage; Sinusoidal A.C. Voltage;
   R.RL. and RLC networks; Impedance angle; Power and Power
   factor; Actual and apparent power; Resonance in A.C.Circuits;
   Series, parallel and series-parallel resonance; Vector Diagram
   (Phasor Diagram); Complex algebra applied to sinusoids; Three
   phase circuits; Three phase loading; Balanced loads;
   Simple problems.

3. D.C.MACHINES
   Lenz's law of electromagnetic induction; Fleming's rule, Principle
   of operation of D.C.Machines; Kinds of D.C.machines; Emf
   equation of D.C. generators; Speed control of D.C. motor; Starters;
   Application of D.C. Machines.

4. A.C.MACHINES
   Principle of operation of A.C.Machines: Transformer; single and
   three phase induction motors, Alternators; Synchronous motors;
   Equivalent circuit, Regulation and efficiency of single phase
   transformer, up—torque characteristics induction motors; starting
   of induction motors. Emf equation, Regulation and synchronisation
   of alternators; Synchronous condenser; Hunting in synchronous
   motor; Single phase induction motors and their applications.

5. DRIVES
   Industrial requirements and Ward Leonard System of Drives.
   Servo—Motors; Basic theory and applications.

TEXT

2. Uppal, S.L., Text Book of Electrical Engineering, Khanna
   Publishers, (1975)
3. Theraja, D.L., Text Book of Electrical Technology, Nirja
   publishers (1995)
4. Marimuthu, P., Basic Electrical and Electronic Engg.,

CH 234 MECHANICAL ENGINEERING 3 0 0 3

1. LAWS OF THERMODYNAMICS
   Basic concepts and hints; Zeroth law; First Law of Thermodynamics
   — Statement and application; Steady flow energy equation; Second
   law of Thermodynamics—Statement; Limitations. Heat Engine;
   Heat Pump, Available energy, Kelvin—Plank statement and
   Clausius statement; Equilibrium concept; Reversibility: Entropy
   charts; Third law of Thermodynamics—Statement.
2. HEATING AND EXPANSION OF GASES: 5
Expressions for work done; Internal energy, Hyperbolic and polytropic processes; Free expansion and Throttling.

3. AIR STANDARD EFFICIENCY 5
Carnot cycle; Stirling Cycle; Joule Cycle; Otto Cycle; Diesel Cycle; Dual combustion Cycle.

4. I.C. ENGINES 4
Engine nomenclature and classifications; SI Engine: CI Engine; Four Stroke cycle; Two stroke cycle; Performance of I.C. Engine; Brake thermal efficiency; Indicated Thermal Efficiency. Specific fuel consumption.

5. STEAM AND ITS PROPERTIES 4
Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Superheated steam. Use of steam tables; volume of wet steam; Volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour. Rankine cycle; Modified Rankine cycle.

6. STEAM ENGINES AND TURBINES 3
Hypothetical indicator diagram of steam engine; Working of a simple steam engine; steam turbines—Impulse and Reaction types—Principles of operation.

7. SIMPLE MECHANISM 3
Kinematic Link, Kinematic Pair, Kinematic Chain; Slider Crank mechanism and inversions; Double slider crank mechanism and inversions.

8. FLY WHEEL 4
Turning moment Diagram; Fluctuation of Energy; Design of fly wheel.

9. DRIVES 5
Belt and rope drives; Velocity ratio; slip; Ratio of tensions; Length of belt; Maximum HP; simple, compound and Epicyclic gear trains.

10. BALANCING 2
Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

L = 45 Total = 45

TEXT


CH 235 MECHANICS OF SOLIDS 3 0 0 3

1. STRESS, STRAIN AND DEFORMATIONS OF SOLIDS 8
Rigid bodies and deformable solids - forces on solids and supports - equilibrium and stability - strength and stiffness - tension, compression and shear stresses - Hooke’s law and simple problems - compound bars - thermal stresses - elastic constants and poisson’s ratio - welded joints - design.
2. TRANSVERSE LOADING ON BEAMS

Beams - support conditions - types of beams - transverse loading on beams - shear force and bending moment in beams - analysis of cantilevers, simply supported beams and overhanging beams - relationships between loading, S.F. and B.M. in beams and their applications - S.F. & B.M. diagrams.

3. DEFLECTIONS OF BEAMS

Double integration method - Macaulay’s method - Area - moment theorems for computations of slopes and deflections in beams - conjugate beam method.

4. STRESSES IN BEAMS

Theory of simple bending - assumptions and derivation of bending equation (M/I = F/Y = E/R) - analysis of stresses in beams - loads carried by beams - proportioning beam sections - leaf springs - hinged beams - shear stress distribution in beams - determination of shear stress in flanged beams.

5. TORSION

Torsion of circular shafts - derivation of torsion equation (T/J = C/R) - stresses and deformation in circular and hollow shafts - stepped shafts - shafts fixed at both ends - stresses in helical springs - deflection of springs - spring constant.

6. COLUMNS

Axially loaded short columns - columns of unsymmetrical sections - Euler’s theory of long columns - critical loads for prismatic columns with different end conditions - effect of eccentricity.

L = 45, Total = 45

32
LIST OF EXPERIMENTS:

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load characteristics of D.C compound generator.
4. Load test on D.C. shunt motor.
5. Study of D.C. motor starters.
7. Load test on single phase transformer.
8. Load test on 3-phase squirrel cage induction motor.
10. Load test on 3-phase slip ring induction motor.
12. Synchronization and V-curves of alternator.

P = 60 Total = 60

PORT TIMING DIAGRAM

1. Valve timing diagram.
2. Study of 2-stroke I.C. Engines.
4. Load test on 4 stroke Villiers Petrol Engine.
5. Load test on 4 stroke Lister Diesel Engine.
7. Compression test.
8. Deflection test.
9. Hardness test (Rockwell and Brinnell).
10. Spring test.
11. Study on behaviour of columns.
12. Torsion test.

P = 60 Total = 60

PROBABILITY AND RANDOM VARIABLES

Probability concepts, Random variables, Moments, Moment Generating function, Binomial Poisson, Geometric, Negative binomial, Exponential, Gamma, Weibull distributions, Functions of random variable, Chebychev inequality.

TWO-DIMENSIONAL RANDOM VARIABLES

Marginal and conditional distributions, Covariance, Correlation and regression, Transformation of random variables, Central limit theorem.

DESIGN OF EXPERIMENTS AND QUALITY CONTROL

Completely randomized design, Randomized block design, Latin square design, Process control, Control charts of measurements and attributes, Tolerance limits.

LINEAR PROGRAMMING

Formulation of linear programming problem graphical solution: simplex algorithm - artificial variable and the M-method, degeneracy, alternative optima and unbounded solution.

FURTHER TOPICS IN LINEAR PROGRAMMING

Duality, primal-dual computations, transportation model and algorithm, Assignment model and Hungarian technique of solution, imbalance, cost Maximization alternative optima in transportation and assignment method.

L = 45  T = 15 Total = 60
REFERENCE


CT 241 POLYMER CHEMISTRY

1. BASIC CONCEPTS OF POLYMERS


2. ANALYSIS AND TESTING OF POLYMERS


3. POLYMER FORMING


4. PROPERTIES

Glass transition temperature (Tg) - factors influencing Tg - finding Tg. Relaxation processes- viscoelasticity - tensile properties – creep – fatigue - mechanical damping - impact strength - friction - fracture.

5. POLYMER APPLICATIONS IN CERAMICS

Binders, bonds, foams and other applications- Polyvinyl alcohol, cellulose, polyester resins, epoxy resines, silicones and other heat resisting polymers.

BOOKS FOR REFERENCE:


CT 242 CERAMIC RAW MATERIALS

1. GENERAL GEOLOGY AND MINERALOGY

Formation of rocks, their characteristics and classification into igneous, sedimentary and metamorphic group - formation of mineral deposits - physical and chemical properties of minerals - composition, colour, streak, lusture, fracture, cleavage, hardness, density and tenacity - elements of optical mineralogy.

2. CLAYS

Clay minerals - clay structures - kaolinite and montmorillonite groups - geology of clay deposits, their classification, china clay, ball clay, fire clay, building clay etc. - beneficiation of clays - mica, chlorite, illite group - talc - pyrophyllite, wollastonite group - chemical properties - physical properties.
3. FLUXES
Soda and potash feldspar - other feldspars - nepheline syenite - geology of formation - physical and chemical properties - beneficiation.

4. SILICA AND SILICATE MINERALS
Silica - polymorphic modification - silica structure - physical and chemical properties of silica - silicate chemistry - minerals - sillimanite - kyanite - andalusite - availability in India and their uses in ceramic industry.

5. OTHER RAW MATERIALS
Geology of bauxite, magnesite, dolomite, chrome, limestone, rutile, zircon, beryllia minerals - properties and uses. Total = 45

BOOKS FOR REFERENCE:

CT 243 CERAMIC POWDER PROCESSING: 3 0 0 3

1. QUARYING OF CERAMIC RAW MATERIALS:
Wining of clays - quarrying of non plastic materials - transportation - different clay washing methods - electro osmosis plant - beneficilation of non plastic materials - advantages - synthetic raw materials.

2. SIZE REDUCTION:

3. MECHANICAL SEPARATION:
Screening and screening equipment - effectiveness of screen, gravity settling, sedimentation, thickening - magnetic separation - theory of filtration - batch and continuous filters - filter press - cyclone separation - air classifier.

4. MIXING AND CONVEYING OF MATERIALS:
Mechanism of mixing - different type of mixers - batch and continuous mixers - pan mixer - shaft mixer - U mixer - muller mixer and other mixers - blenders - agitators - conveying techniques of solids and liquids - conveyors and elevators - different type of pumps - storage methods of different ceramic powders.

5. POWDER CHARACTERISATION:

BOOKS FOR REFERENCE:

CT 244 WHITEWARE AND HEAVY CLAYWARE   3 0 0 3

1. CLASSIFICATION OF WHITEWARE PRODUCTS   8

Triaxial bodies: porcelain, stoneware, earthenware, majolica, terracotta, artware - physical properties of mixers - role of water

2. WHITEWARE   10

Manufacture of floor and wall tiles - artware - dental porcelain - bone china - chemical porcelain - abrasion resistance porcelain - high and low tension insulators - low loss insulators - cordierite - cooking ware - table ware - glass ceramics

3. HEAVY CLAY WARE   9

Raw materials - methods of winning and handling - classification of building materials - manufacture of building bricks, hollow bricks, acid resistant bricks and other bricks - roof tiles, paving tiles-sewer pipes

4. FINE CERAMICS   10


5. TESTS AND QUALITY CONTROL   8

IS specification - LOI, plasticity, strength, thermal shock resistance, abrasion resistance, porosity, acid and alkali resistance - chipping resistance - optical absorption and reflectance - electrical and thermal conductivity

BOOK FOR REFERENCE:
1. Allen Dixdale, Pottery Science, Ellis Horwood Ltd., NY, 1986
6. Terstra, Ceramic processing, Chapman and Hall, 1995

CH 245 INSTRUMENTAL METHODS OF ANALYSIS   3 0 0 3

1. INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS   9

ELECTROMAGNETIC RADIATION: Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, absorbance & transmittance and their relationship, Permitted energy levels for the electrons of an atom and simple molecules, Classification of instrumental methods based on physical properties.

QUANTITATIVE SPECTROSCOPY: Beer - Lambert’s law, Limitations, Deviations (Real, Chemical, instrumental).
Nesslerimetry, Dubosq colourimetry, Estimation of inorganic ions such as Fe, Ni and estimation of Nitrite using Beer – Lambert’s Law.

2. MOLECULAR SPECTROSCOPY

Various electronic transitions in organic and inorganic compounds affected by UV, Visible and infra red radiations. Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Woodward-Fischer rules for the calculation of absorption maxima (dienes and carbonyl compounds), Effects of auxochromes and effects of conjugation on the absorption maxima, Instrumentation for UV, VISIBLE and IR spectrometries (Source, Optical parts and Detectors), Multicomponent analysis, Photometric titration (Experimental set-up and various types of titrations), Applications of UV, VISIBLE and IR spectrometries.

3. ATOMIC SPECTROSCOPY

Atomic absorption spectrophotometry: Principle, Instrumentation and Applications, Various interferences observed in AAS (Chemical radiation and excitation).

4. POLARIMETRY AND REFRACTOMETRY

Principle, Instrumentation and Applications

5. ELECTROMETRIC METHODS OF ANALYSIS

Introduction to electrometric methods, difference between redox and acid – base reactions, types of cells, schematic representation of cells, single electrode potential, laboratory reference electrodes (Standard hydrogen, saturated calomel, Ag – AgCl and inert electrodes), ion-selective electrodes. Potentiometry: Nernst equation, experimental set-up and measurement of pH; Conductometry-Measurement of conductance, experimental set-up and various titrations (strong and weak acid/base).

6. XRD ANALYSIS

Introduction, Mosley’s law, Different emission and diffraction methods, various X-ray detectors.

7. THERMAL METHODS

Thermogravimetry: Instrumentation, factors affecting the shapes of thermograms, applications, thermograms of some important compounds (CuSO₄·5H₂O, CaC₂O₄·2H₂O etc).

Differential thermal analysis: Principle, Instrumentation and applications, differences between DSC and DTA. Applications of DSC (Inorganic and Polymer samples).

8. CHROMATOGRAPHIC METHODS

Classification of chromatographic methods, Column, Thin layer, Paper, Gas, High Performance Liquid Chromatographical methods (Principle, mode of separation and Technique). Separation of organic compounds by column and Thin layer, mixture of Cu, Co and Ni by Paper, separation of amino acids by paper, estimation of organic compounds by GC and HPLC.

L = 45 Total = 45

REFERENCE:

5. A.I.Vogel’s Quantitative Inorganic analysis V Edition

**CT 245 EQUIPMENT DRAWING**

**1. SIZE REDUCTION EQUIPMENTS**

Jaw crusher, gyratory crusher, roller mill, attrition mill, ball mill, fluid energy mill.

**2. DRYERS**

Tray dryer, rotary dryer, spray dryer, drum dryer, flash dryer.

**3. FILTERS**

Filter press, rotary vacuum filter, belt filter, cyclones.

**4. SHAPING MACHINES**

Preshaping machine, jiggering and jolly machine, bumping machine, finishing machine.

**5. FURNACES AND KILNS**

Blast furnace, open-hearth furnace, batch kiln, tunnel kiln.

**BOOKS FOR REFERENCE:**


---


**CT 246 PHYSICAL TESTING OF CERAMIC RAW MATERIALS**

5. Plasticity by Atterberg number.
6. Plasticity by pfefferkom index.
7. Particle size and distribution of clays.
8. Estimation of soluble salts in clays.
10. Size reduction and sieve analysis.

**CT 331 THERMODYNAMICS**

**1. BASIC CONCEPTS:**

Fundamental laws and concepts of engineering thermodynamics, thermodynamic functions and their relationship - auxiliary function, enthalpy, Gibb's free energy, Helmoltz free energy, chemical potential, Maxwell's equation.

**2. PROPERTIES:**

Thermodynamic charts and tables of thermodynamic properties of solids, liquids and gases and applications; compression-expansion, heat engine cycles, steam and gas turbines, nozzles, refrigeration cycles.
3. BEHAVIOUR OF GASES AND SOLUTIONS:

Ideal gases, non-ideal gases - laws, PVT relationships of non-ideal gas problems, compressibility factors, fugacity and fugacity coefficients of real gases - Partial molar properties, ideal solutions, Gibb's-Duhum equation, regular solutions, free energy - composition diagrams for ideal and regular solutions, criteria for stability.

4. BEHAVIOUR OF SOLIDS:

Thermodynamics of point defects - chemical diffusion in the solid state, diffusion coefficient, diffusion mechanisms, steady state and non-steady state diffusional processes - Reactions in the solid state, formation of microstructure, solid state galvanic cells, the degradation of ceramic oxides at elevated temperatures.

5. PHASE EQUILIBRIA:


Total = 45

BOOKS FOR REFERENCE:


CT 332 FUELS AND ENERGY ENGINEERING

1. SOLID FUEL


2. LIQUID FUEL

Origin and composition of natural oil - refining process of liquid petroleum products - synthetic liquid fuels - calorific value - storage and handling of liquid fuels.

3. GASEOUS FUEL


4. COMBUSTION PROCESS

Air requirement - combustion processes of solid, liquid and gaseous fuels - control of combustion process - testing of fuels.

5. HEAT TRANSFER

Heat transfer to charge by conduction, convection and radiation in a kiln - heat loss through kiln walls, opening, cooling etc. - heat balance and thermal efficiency - heat recovery - recuperator and regenerators.

Total = 45

CT 333 CERAMIC FABRICATION PROCESSES 3 0 0 3

1. BODY PREPARATION 9


2. WET FORMING PROCESS 10


3. DRY FORMING PROCESS 8


4. DRYING AND FINISHING 9


5. FIRING 9


BOOKS AND REFERENCES

Total = 45

1. James S Reed, Principles of Ceramic Processing, John Wiley & Sons, NY, 1988
4. Tepstra, Ceramic Processing, Chapman and Hall, 1995

CT 334 CERAMIC SCIENCE 3 0 0 3

1. MECHANICAL PROPERTIES OF FINISHED WARE 9

Stress, strain, young’s modulus, critical strain, strength, porosity, effect of grain size on strength – filters, higher young’s modulus – glazing – principal reason – stress in glaze and body due to thermal expansion difference, variation of modulus of rupture with temperature – impact strength – edge chipping
2. THERMAL PROPERTIES
Specific heat capacity - thermal expansion - thermal conductivity - thermal diffusivity - thermal shock resistance - effect of temperature differences on firing the body - critical strain

3. OPTICAL PROPERTIES
Basic relationships - loss of intensity - scattering of light by a spherical bubble - boundary reflectance and surface gloss - opacity and translucency - absorption and colour - applications

4. ELECTRICAL PROPERTIES
Definitions - resistivity, composition of bodies - insulators - electronic conduction - variation of resistivity with temperature - Rasch-Hinrichsen equation - effect of porosity, moisture and frequency - dielectric strength - permittivity - dielectric loss - low thermal expansion bodies - conducting glazes

5. MAGNETIC PROPERTIES
Susceptibility - permeability - flux density - types of magnetism and their origin - electronic structure and magnetic moment - spin structure and ferro magnetism - exchange interaction and super exchange interaction - hysteresis loop and magnetic domain - domain structure.

BOOKS FOR REFERENCE:

Total = 45

CT 355 PRINCIPLES OF GLASS MANUFACTURE

1. PREPARATION OF GLASS BATCH
Selection of glass composition - major and minor ingredients - melting and fabrication characteristics - property dependence on composition - effect of cullet content on quality and melting of glass

2. GLASS MELTING PROCESS
Physico-chemical reaction occurring during glass melting - dissolution of solids in melt - refining and solubility of gases - homogenisation - volatilisation - effect of preheating

3. FABRICATION PROCESSES:
Conditioning of glass - feeding - glass forming machines for flat glass, bulb, bottles, hollow ware - viscosity of glass at various stages - viscosity temperature relationship - effect of composition on the working characteristics

4. ANNEALING AND TEMPERING:
Release of stress - annealing constant - annealing schedules for slabs, plates and containers - tempering - detection and measurement of strain - strength of glass

5. TESTING AND QUALITY CONTROL:
Raw materials - defects in glass - fabrication defects - testing of container glass - Testing of flat glass

BOOKS FOR REFERENCE:

Total = 45

CT 336 REFRACTORIES - I

1. INTRODUCTION TO REFRACTORIES : 9

Production, demand, and growth pattern of refractories in India - layout of a modern refractory plant - fundamental properties of refractories - Indian and International standards - factors for selection and use of refractories - test and quality control procedures.

2. SILICA REFRACTORIES : 9

Raw materials and composition - manufacturing process steps - quality of raw material and process parameter on quartz inversion - glassy phase and other microstructural features - porosity, strength, RUL dependence on microstructure - specifications of silica refractories - semi-silica refractories.

3. ALUMINA - SILICA REFRACTORIES : 9

AlO₃ - SiO₂ phase diagram - clay, pyrophyllite, sillimanite, grog, bauxite and diaspore as raw materials - manufacturing processes - microstructure and properties.

4. BASIC REFRACTORIES : 9

Magnesite, dolomite and chrome based refractories - raw materials and composition - manufacturing processes - microstructure and properties.

5. SPECIAL REFRACTORIES : 9

Alumina - mullite - carbide based and nitride based refractories - cordierite - zirconia - fusion cast refractories, slide gate, purging refractories, continuous casting refractories - ceramic fibres.

BOOKS FOR REFERENCE:

3. Akira Nishikawa, Technology of Monolithic Refractories, Pitkin, Japan Co. Ltd., Tokyo, 1984

CT 337 WHITEWARE AND HEAVY CLAYWARE LAB

1. Crushing of raw materials: Felspar, quartz etc. in a Jaw crusheer / roller crusher
2. Ball milling
3. Sieve analysis
4. Determination of electrolyte demand
5. Slip preparation
6. Preparing mould using plaster of paris
7. Forming of different shapes
8. Dry shrinkage - bulk and apparent densities - porosity measurements
9. Biscuit Firing
10. Fired shrinkage - densities - water absorption
11. Mechanical properties; MOR, CCS, abrasion resistance - impact test, warpage
12. Chemical tests - acid and alkali resistance

CT 338 CHEMICAL ANALYSIS OF CERAMIC RAW MATERIALS 0 0 4 2

Chemical analysis of the following ceramic raw materials

1. Sand
2. Clays
3. Feldspar
4. Kyanite
5. Stiluminate
6. Calcite
7. Dolomite
8. Magnesite
9. Bauxite
10. Iron oxide

MA 038 NUMERICAL METHODS 3 1 0 4

1. SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 1 0

Method of false position, Newton-Raphson method, solution of a linear system by Gaussian, Gauss-Jordan, Crout, Jacobi and Gauss-Seidel methods; Eigen values of a matrix by power and Jacobi methods.

2. INTERPOLATION AND APPROXIMATION 8

Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central differences-Least square polynomial approximation.

3. NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation with interpolation polynomials. Numerical integration by Trapezoidal rule, Simpson's rule, Romberg's rule, two point Gauss formula and three point Gauss formula, Double integrals using Trapezoidal and Simpson's rule.

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8


5. BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 10

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation and wave equation and two dimensional Laplace and Poisson equations.

L: 45 P: 15 Total = 30

REFERENCE

CT 341 FURNACE TECHNOLOGY

1. COMBUSTION PROCESS:

Combustion, Reaction of combustion process - mechanism of combustion - combustion energy calculations of solid, liquid and gaseous fuels.

2. KILN ACCESSORIES:

Equipment for solid fuel combustion - types and classification of burners used for liquid and gaseous fuels - nature of flames; laminar, turbulent, premixed and diffusion flames - burning velocity.

3. FURNACE DESIGN:

Factors for consideration - draught establishment - natural induced draught - measurement of draught - chimney calculation - heat transfer in kiln - safety aspect - types of refractories and insulating materials used in furnaces.

4. KILNS AND FURNACES:

Classification of kilns - open top kiln - up draught and down draught kilns - bottle kilns - muffle kilns - chamber kilns - Hoffman's kiln - tunnel kiln - rotary kiln - glass tank furnaces - blast furnaces - electric furnaces - open hearth furnaces.

5. TEMPERATURE MEASUREMENTS:

Segnet cones - Hot Croot's bars - Buller's ring - electrical resistance pyrometer - thermocouple pyrometer - radiation pyrometers - temperature recorders

Total = 45

CT 342 GLASS ENGINEERING

1. LAY OUT OF A GLASS PLANT:


2. POT MELTING:

Types of glasses suitable for pot melting - shape, size, body composition and making of pots - design and construction of pot furnace - batch charging, refining and time-temperature schedule.

3. GLASS MELTING TANK FURNACES:

Types of tank furnaces - construction - operation - electric tank furnaces.

4. FORMING PROCESSES:


BOOKS FOR REFERENCE:

5. ANNEALING:
Design, construction and operation of continuous annealing lehr.

BOOKS FOR REFERENCE:

CT 343 GLAZE TECHNOLOGY

1. INTRODUCTION TO GLAZE:
Definitions - Composition of glaze - classification of different types of glazes - engobe - frit preparation - frit rules - compounding of lead and leadless glazes, alkaline glazes, calcareous glazes, and felspathic glazes.

2. RAW MATERIALS AND PROCESSING:

3. GLAZING TECHNIQUES AND SPECIAL GLAZES:
Glazing techniques - dipping, pouring, spraying, brushing, dusting and other techniques - special glazes - matt glazes, snake skin glazes, cracked glazes, salt glazes and other glazes.

4. PROPERTIES AND DEFECTS:
Glaze body reactions - interface layers - thermal characterisations - glaze defects and remedies - crazing, peeling, crawling, rolling, blisters, pinholes, dunting, etc. - mechanical, optical and chemical properties of glazes.

5. DECORATION:
Classification of decoration methods - advantages - different decorating techniques - painting, spraying, stenciling, stamping, printing, lithographic transferring, silk screen printing, dusting, engobing, liquid gold decoration and other decoration techniques.

BOOKS AND REFERENCES:
5. Terpstra, Ceramic processing, Chapman and Hall, 1995

CT 344 PHASE EQUILIBRIA IN CERAMICS

1. CONCEPTS OF HEAT CAPACITY:
Free energy and entropy - Gibbs - Helmholtz equation; equilibrium constant and heat of reaction; Clausius-Clapeyron
equation; partial free energy. Gibb's phase rule and its interpretation; condensed system - one component system - polymorphic transformation, P-T diagram of silica.

2. BINARY PHASE DIAGRAMS: 9

Lever rule - complete solubility - eutectic and peritectic reactions - partial solid solubility - congruent and incongruent melting compounds - liquid immiscibility - binary diagrams - SiO₂ - Na₂O, SiO₂ - Al₂O₃, MgO - Al₂O₃, SiO₂ - ZrO₂.

3. TERTIARY PHASE DIAGRAMS: 9

Different types - Lever rule and crystallisation paths - tertiary diagrams - Na₂O - Al₂O₃ - SiO₂, K₂O - Al₂O₃ - SiO₂, MgO - Al₂O₃ - SiO₂, CeO - Al₂O₃ - SiO₂.

4. PHASE TRANSFORMATION: 9


5. EXPERIMENTAL DETERMINATION: 9

Microscopic method - thermal analysis - X-ray methods - other techniques.

Total = 45

BOOKS FOR REFERENCE:

3. Floyd A. Hammel, Phase equilibria in ceramic systems, Marcel Dekker 1994

CT 345 REFRACTORIES - II 3 0 0 3

1. REFRACTORIES FOR IRON AND STEEL INDUSTRY: 9

Coke oven, blast furnace, twin hearth, LD converter - continuous casting - electric arc furnace, induction furnaces - reheating furnaces - slide plate system - nozzle, shroud/SDN - ladle and tundish lining practices - monolithics - gumming technique - refractory, slag and metal interactions.

2. REFRACTORIES FOR CEMENT AND NON-FERROUS INDUSTRIES: 9

Wet/dry process for cement making - preheater and precalcinator and zone lining - alkali and wear resistance - refractory requirement and use in copper, aluminium and hydrocarbon industry - use of monolithics.

3. REFRACTORIES FOR GLASS INDUSTRY: 9

Design of glass tanks for container, sheet, lamp, float glasses - refractory practices in sidewall, throat, forehearth and roof of glass tanks - regenerator systems - alumina and AZS fused - cast refractories - glass corrosion resistance, oxidation, seed potential tests - glass defects and analysis - feeder expandables.
4. REFRACTORIES FOR CERAMIC INDUSTRY:
Kiln furniture - types - properties requirement - silicon carbide, mullite, cordierite, alumina, zirconia - mullite, zirconia types - kiln design - LTM concept - fast firing technology

5. REFRACTORIES FOR ENERGY CONSERVATION:
Insulation refractories - types - ceramic fiber products - design and installation - ceramic coatings - case studies in ceramic fiber usage.

Total = 45

BOOKS FOR REFERENCE:

3. Akira Nishikawa, Technology of Monolithic Refractories, Pibrico, Japan Co. Ltd., Tokyo, 1984

CT 346 GLASS TECHNOLOGY LAB

1. Batch formulation
2. Melting of glass with or without firing agent
3. Rate of dissolution of glass sand in soda glass
4. Forming of glass shapes
5. Annealing schedule and strain test

6. Density determination
7. Refractive index of glass
8. Thermal Expansion
9. Softening point
10. Strain test
11. Thermal shock
12. Chemical durability test
13. Impact test
14. Glass defects testing
15. Colouration of glass

Total = 45

CT 347 GLAZE LAB

1. Preparation of glaze slip
2. Formulation and melting of frits
3. Fusion studies
4. Particle size and particle size distribution of glaze.
5. Determination of consistency of glaze slip.
6. Preparation of colour glazes
7. Application of glazes
8. Glass firing
9. Decoration
10. Crazing analysis
11. Measurement of thickness of glaze
12. Microstructure of glazes
13. Abrasion resistance
14. Acid resistance
15. Resistance by boiling acid
16. Resistance by boiling alkali

CH 431 PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT
PART A

1. PRINCIPLES OF MANAGEMENT AND ORGANISATION

Planning, organisation, staffing, coordination, directing, controlling, communicating, organisation as a process and a structure; types of organisations.

2. PRODUCTION AND MANAGEMENT

Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning, routing, scheduling; despatching; costs and costs control, inventory and inventory control.

3. QUALITY AND QUALITY CONTROL

Elements of quality control, role of control charts in production and quality control.

PART B

4. ENGINEERING ECONOMICS FOR PROCESS ENGINEERS

5. INTEREST, INVESTMENT COSTS AND COST ESTIMATION

Time value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital; invested capital and profitability.

6. PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

7. ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE

Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

8. ECONOMIC BALANCE

Different unit operations with single and multiple variables.

REFERENCE


CT 431 QUALITY CONTROL IN CERAMIC INDUSTRIES

1. CONCEPTS OF STANDARDISATION

Historical development of standards – aims, techniques, management, formulation, implementation of company standards – economic benefits of standardisation.
2. INDIAN STANDARDS FOR CERAMIC MATERIALS:

IS specification — specification for different raw materials — test procedures — products — tiles — sanitaryware — insulators — chemical resistant wares — structural ceramic materials — refractories.

3. CONCEPTS OF QUALITY:

Quality engineering — planning for quality and reliability — quality standards — specification of inspection methods, setting of standard quality levels — introduction to ISO — 9000 — design of quality experiments using statistics — analysis of variance.

4. STATISTICAL QUALITY CONTROL:

Objectives of statistical quality control — inspection and its importance — difference between inspection and quality control. Basic statistical methods — techniques of quality control — control charts for attributes — control chart for variables.

5. RELIABILITY AND MAINTAINABILITY:


BOOKS FOR REFERENCE:

1. H.Lal, Total quality management — a practical approach, Wiley eastern, 1990
3. Jerome D. West, Ferdinand K. Leoy — A management guide to PERT/CPM.


CT 432 CEMENT AND CONCRETE 3 0 0 3

1. CEMENT:

Classification and processing, types of cements — compositions — raw materials and manufacturing process — cement components — selection — proportioning and blending — chemistry of cement and manufacturing

2. QUALITY CONTROL:

Microscopic and x-ray investigation of clinker minerals — effects of alkalis, fluorides, phosphates, sulphur compounds etc. on the precalcined clinker constitution

3. DIFFERENT TYPES OF CEMENTS:


4. CONCRETE:

Types of concrete aggregates — heavy, normal and light weights, light weight concretes — design, production, properties and uses — reinforced concrete — castables — polymer admixture — flyash cement — fire resistant cement
5. PROPERTIES OF CONCRETE AND CEMENTS: Strength - permeability, creep, thermal expansion, shrinkage, moisture movement, penetration of ray and abrasion resistance - electrical properties - fire resistance of concrete

Total = 45

BOOKS FOR REFERENCE:


CT 433 SEMINAR AND COMPREHENSION

The object of the comprehension test is to assess the overall level of proficiency and the scholastic attainment of the student in the various subjects studied during the degree course.

CT 434 ADVANCED INSTRUMENTAL ANALYSIS OF CERAMICS

Analysis of trace elements using spectrophotometer, flame photometer, atomic absorption spectrometer
Infrared analysis of raw materials and fired ware
Thermal analysis: TGA, DTA and DSC
Surface area measurement: Anderson pipette and BET Microscopy: Optical microscopy and electron microscopy
Mechanical Properties: MOE, MOR, fracture toughness, hardness (vicker's and knoop), creep, wear and friction - abrasion resistance

CT 444 PROJECT WORK

Each student is required to submit a report on the project assigned to him by the department. The report should be based on the information available in the literature or data obtained in the laboratory/industry.

The object of the project is to make use of the knowledge gained by the student at various stages of the degree course. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the student at the end of the course.
CT 034 ADVANCED STRUCTURAL CERAMIC MATERIALS

1. OXIDE CERAMICS:
   Zirconia - alumina - silica - magnesia - titania - thoria - mullite.

2. CARBIDES:
   Silicon carbide - boron carbide - tungsten carbide - titanium carbide.

3. NITRIDES:
   Silicon nitride - boron nitride - titanium nitride - aluminum nitride.

4. CARBON COMPOUNDS:
   Carbon fibres and carbon composites - Manufacturing methods - properties - applications.

5. OTHER CERAMICS:
   Borides - silicides - sialon.

TOTAL = 45

BOOKS FOR REFERENCE:

1. Mc Colm, Ceramic Science for Material Technologists, Blackie & Sons Ltd., Glasgow, 1983.


CT 035 ADVANCED CERAMIC PROCESSING TECHNOLOGY

1. POWDER PROCESSING:
   Spray drying - co-precipitation - freeze drying - sol-gel - CVD - jet milling - SHS processing

2. FORMING:
   Injection moulding - doctor blade processing, pressure casting, isostatic pressing, near net shape forming - gel casting.

3. ADVANCED SINTERING:
   Hot pressing - Hot isostatic Pressing - reaction bonded sintering - microwave sintering

4. SINTERING MECHANISMS:
   Sintering mechanism, solid state sintering - liquid phase sintering - grain growth - vitrification - nucleation and crystallisation - development of microstructure and its control by sintering.

5. CERAMIC MACHINING AND SURFACE FINISHING:
   Surface grinding and mechanical polishing - non-abrasive finishing - ceramic coating - joining of ceramics - metal-ceramic joints

TOTAL = 45
BOOKS FOR REFERENCES:
6. Terpstra, Ceramic processing, Chapman and Hall, 1995

CT 036 SPECIAL COATING TECHNOLOGY

1. RAW MATERIALS:
   - Major and minor ingredients - classification - fundamental consideration - batch calculations - metal bases - types of metals used for coating - non-metal bases ceramics

2. ENAMEL COATING:
   - Cleaning methods for iron and steel, sheet metals - chemical cleaning - electrolytic cleaning - pickling - sand blasting - de-enamelling - repairing - cleaning treatment for aluminium alloys and base metals - frit making - additives - application - firing.

3. VAPOUR PHASE COATINGS:
   - PVD - basic evaporation process - evaporation techniques - sputtering - ion plating - CVD processes - CVD reactor - CVD kinetics - product and process route.

4. SPECIAL COATINGS:

5. PROPERTIES AND APPLICATIONS:
   - Thermal, mechanical, optical and chemical properties – hardness, wear and erosion resistance – high temperature properties – applications - defects and remedies

Total = 45

BOOKS FOR REFERENCE:

CT 037 MICROWAVE PROCESSING OF CERAMICS

1. INTRODUCTION:
   - Dielectric behaviour of materials - power dissipation - propagation factor and skin depth - heat and mass transfer phenomena - temperature distribution - wall loss
2. **MICROWAVE HEATING CIRCUIT**: 9

Power sources - klystron and magnetron - operating characteristics - protection system - high frequency breakdown phenomena - automatic control of the process - automation tuning and matching

3. **APPLICATOR TYPES**: 9

Travelling wave applicators - multimode applicators - single mode resonant applicators - power transfer - uniformity of heating

4. **INDUSTRIAL APPLICATIONS**: 9

Microwave drying - microwave sintering - application to laboratory models and pilot system - comparison with conventional heating

5. **HAZARDS AND SAFETY**: 9

Exposure standards - industrial - frequency band - leakage from industrial equipment - batch system - continuous flow system - safety precautions.

**Total = 45**

**BOOKS FOR REFERENCES**:

1. Metaxas, A.C and Meredith, R.J., Industrial Microwave Heating, Peter Peregrinus Ltd., UK, 1983

**CT 038 ELECTRONIC CERAMICS**: 3003

1. **CERAMIC INSULATORS AND CAPACITORS**: 10

Porcelain insulators - triaxial, stellite, non-feldspatic types - composition, properties and uses - dielectric strength - dielectric breakdown mechanisms - factors affecting dielectric strength - dielectric constant and loss - polarisation - different types of polarisation - effect of frequency and temperature.

Capacitance - ferroelectric behaviour - barium titanate - effect of solid solutions - additives - film capacitors, single layer discrete capacitors - multilayer capacitors - barrier layer capacitors - basic principles and fabrication processes.

2. **FERROELECTRIC CERAMICS**: 9

Piezo-electricity - barium titanate, properties, ferroelectricity, manufacture of barium titanate based ceramics - properties of ferroelectric ceramics - hysteresis loop - PZT -PLZT materials, compositional systems, processing and fabrication - mixed oxide and chemical precipitation processes - hot pressing set up.

3. **MAGNETIC CERAMICS**: 9

Classification of magnetic materials - domain theory - ferromagnetism - spinel ferrites - structure, types of ferrites - manganese, zinc ferrites, hexagonal ferrites - gametals - standard ceramic processing and fabrication techniques.

4. **SUPERCONDUCTIVITY**: 8

Introduction to superconductors - high Tc superconductivity, perfect diamagnetism, BCS theory, new ceramic, super conductors, different systems, their structure and superconducting behaviour

5. **VARI Stokes AND FUEL CELLS**: 9

ZnO varists - electrical characteristics, fabrication of ZnO varists, microstructure - mechanism of varistor behaviour - gas sensors and fuel cells - applications.

**Total = 45**
BOOKS FOR REFERENCE:
5. Per Frick, D., Superconductivity, American Institute of Physics, 1992.

CT 039 NUCLEAR AND SPACE CERAMICS 3 0 0 3

1. FUNDAMENTALS OF NUCLEAR PHYSICS:
   Atomic Structure - atomic number - mass number - isotopes - nuclear energy and nuclear forces, binding energy - nuclear stability - radioactivity - nuclear reactions - nuclear fission - nuclear fusion

2. NUCLEAR REACTORS:
   Types of reactors - ordinary water moderated reactors - heavy water, cooled and moderated reactors - design, construction and control of nuclear reactors - moderators - coolants - reflectors and structural materials.

3. FUELS:
   Methods of production and properties, uranium oxide, thorium oxide, beryllium oxides - encapsulation, nuclear fuel cycle, spent fuel characteristics, reprocessing technique.

4. RADIATION PROTECTION:
   Types of wastes - disposal - ICRP recommendations - radiation hazards and prevention - radiation dose units

5. SPACE CERAMICS:
   Material aspects of missile and satellite re-entry - aerospace nuclear propulsion technology, auxiliary space power devices - rocket nozzle technology - the space environment and its effects.

Total = 45

BOOKS FOR REFERENCE:

CT 040 SPECIAL GLASSES 3 0 0 3

1. HEAT RESISTANTE AND TOUGHENED GLASSES:
   Borosilicate glasses - pyrex and Jena type, composition - fabrication of laboratory ware - vycor glass - toughened glass.

2. OPTICAL GLASSES:
   Manufacture of crown and flint glass - opthalmic glass filters - photochromic glass - laser glass - electrochromic glasses.

3. FIBRE GLASS:
   Glass composition - glass wool - manufacturing processes and applications.

4. OPTICAL FIBRES:
   Optical properties of fibres - silica based glass fibres - GRIN lenses and components - chalcogenide, chalcophalide and halide glasses - applications in optical communication and optical components.
5. GLASS CERAMICS:
Glass composition - heat treatment schedule - crystal nucleation in glass - nucleation agent - microstructure and properties - applications - machinable glass ceramics

Total = 45

BOOKS FOR REFERENCE:

CT 041 FIBRES AND COMPOSITES 3 0 0 3

1. GLASS FIBRES:
Oxide and non oxide glass - fibre manufacturing process - wool forming process - continuous glass fibres - fibre morphology - mechanical properties of glass fibres - fibre application.

2. REFRACTORY FIBRES:
Alumina - alumino silicate - zirconia fibres - manufacturing, properties and applications - carbon and graphite fibres manufacturing techniques - properties and application

3. WHISKERS:
Background on whisker growth - whisker growth - whisker nucleation and growth - SiC and SiN whiskers - VLS synthesis and properties - whisker reinforced ceramics.

4. COMPOSITES:
Different types of composites - metal/polymer/ceramic matrix composites - particulate and fibre reinforcement - processing methods - microstructure.

5. PROPERTIES AND APPLICATIONS:
Elastic and strength properties - fracture behaviour of ceramic matrix composites - high temperature creep and fatigue - high temperature stability - wear and friction - applications.

BOOKS FOR REFERENCE:
5. Ceramic processing, Terpstra, Chapman and Hall, 1995

CT 042 BIO-CERAMICS 3 0 0 3

1. MATERIALS IN MEDICINE:

2. CALCIUM PHOSPHATE AND HYDROXYAPATITE CERAMICS:
Chemistry of calcium phosphate bioceramics - preparation, mechanical properties and biological performance of beta tricalcium phosphate, tetragonal calcium phosphate, biphasic calcium phosphate, hydroxyapatite and other orthophosphates - calcium
phosphate, bone cements - preparation, properties, setting behaviour and biocompatibility

3. BIOACTIVE GLASSES AND GLASS-CERAMICS:
Surface active glasses - bioglass - preparation, mechanical properties, bonding mechanism to living tissue - interfacial bonding - doped bioactive glasses - high strength bioactive glass-ceramics - mechanical and biological properties - bone bonding mechanism, mechanism of surface apatite formation - compositional dependence

4. BIOACTIVE COMPOSITES:
Hydroxyapatite composites with zirconia, alumina and titania ceramics - preparation, properties - SiC whisker reinforced HAP and bioactive glass ceramics, zirconia toughened bioactive glass ceramics, bioglass - hydroxyapatite composites - carbon composites

5. BIOACTIVE COATING:
Importance of bioactive coatings - hydroxyapatite coated metal implants - coating methods, characterisation and properties, bioglass and bioactive glass ceramics coating over metals and alloys

BOOKS FOR REFERENCE:

TOTAL = 45

CT 043 MONOLITHICS AND CASTABLES

1. TYPES AND APPLICATION TREND:
Types of monolithic refractories - castable, ramming mass, gunning, plastic mass and special mortars - consumption trend worldwide and nationwide - Advantages of monolithics over shaped refractories and constraints in application techniques

2. CONVENTIONAL CASTABLE:
Calcium aluminate cement - surface area, setting time, their effect on castable application engineering - Types of CA cements - Volume of CA cement and their effect - Properties of castables: water for consistency, working moisture, bulk density, specific gravity, CCS, MOR, hot MOR, spalling - firing shrinkage and thermal conductivity for insulation castable - Particle size, comparison of Hot and cold properties - Temperature as a function of strength enhancement of castables - strength loss at Intermediate temperature range of CC

3. MEDIUM AND LOW CEMENT CASTABLES:
Flow properties - Additives to enhance flow - specialised application techniques - Physical, mechanical and thermomechanical properties - Moisture level and proper application - Advantages over conventional castables

4. SPECIAL MONOLITHIC REFRACTORIES:
No cement castables and ultra low cement castables - phosphate bonded castable - silicate bonded castable - insulation castable - bubble alumina and other porosity imparting combustible matter (Polystyrene and sawdust etc)

5. APPLICATION AND TESTING TECHNIQUES:
Casting, moulding, precast shapes, pouring, gunning, gunning machines and gunning techniques - vibrocasting technique for LFC and MCC - Anchoring system - different types of anchor and fixing techniques - specialised anchoring systems for stationary and mobile systems - preheating schedules for new lined castable structures - Tests - Flowability, explosion, Corrosion, spalling, abrasion resistance and NDT

TOTAL = 45
REFERENCE:

CUT 044 ABRASIVES 3003

1. INTRODUCTION:

Abrasive; Classification - coated abrasives - bonded abrasives - raw materials - important commercial minerals and their characteristics (hardness, fracture toughness) - crushing and grinding abrasives - Backings - groups of backing, properties, adhesives

2. MANUFACTURING PROCESS

(COATED ABRASIVES):

Various coating steps - making machine - closed coating - open coating - finishing or converting operation - fluxing, slitting, sheet cutting, disc cutting, belt making, skiving - quality control and testing - principle of working of coated abrasive

3. BACK-UPS:

Contact wheels - cloth contact wheels, rubber contact wheels, hardness, face, serrations, shape, wheel diameter, speed, belt tension, dressing and protection of contact wheels - their characteristics - drums, rolls, pads and platens - type characteristics, choice and uses

4. BONDED ABRASIVES:

Cutting wheels - cutting action - factors depending, bonds - kinds of bonds - vitrified, silicate, resinoid, shellac, rubber, oxochloride (of Mg) - functions of abrasive grains, bonds and structures

5. FUNDAMENTALS OF GRINDING AND POLISHING:

Principles of metal removing and heat generation - Abrasives - alumina, SIC, alumina-zirconia, diamond-cubic boron nitride - grinding chips - grade selection - wheel wear - chemical grinding aids - different types of grinding - cylindrical grinding, centerless grinding, surface grinding, internal grinding - Polishing - polishing grains, adhesives, selection of grain size, polishing wheel, best results

Total = 45

BOOKS FOR REFERENCE:
2. Coated Abrasives - Modern Tool of Industry Coated Abrasive Manufacturer's Institute, Cleveland, Ohio, 1982.

CUT 045 PLANT EQUIPMENT AND FURNACE DESIGN 3003

1. PLANT DESIGN:

Proper location of the plant - factors to be considered, factory buildings - lay outs with necessary details

2. ASSEMBLING:

Assembling of economics, engineering and industrial data, calculations and data necessary for the process route - electrical, piping instruments, motors, compressors etc - flow diagrams - process, design and overall technical report
3. EQUIPMENT DESIGN:
Design principles - crushers, filter press, sieves, pug mill, different types pug moulds - tunnel, chamber and electrical cans

4. FURNACE DESIGN:
Design of furnaces - tank furnace, tunnel kiln, chamber kiln, muffle furnace, open hearth furnace, stack calculations - chimney foundations. Essential operations - firing, charging, melting, preheating - air, gas, fuel, flame systems, furnace high temperature measurements and temperature control instruments

5. FURNACE CONSTRUCTION:
Furnace life and selection of proper refractories, thermal currents and atmosphere, safe firing schedule. Basic knowledge about furnace construction, capacity, fuel and firing efficiencies - design, construction and thermal calculation of one of the furnaces.

BOOKS FOR REFERENCE:

Total = 45


CT 046 COMPUTER AIDED DESIGN

1. INTRODUCTION:
Introduction to microprocessors - input, output and memory devices - interfacing concepts. Evolution of OS - functions and characteristics. Fundamentals of computer aided design - requirements of Hardware and Software - the design process steps - morphology of design.
1. ELASTICITY:
Elastic constants - effect of atomic structure and microstructure - response to stress - elastic deformation of isotropic and crystalline materials - measurement techniques

2. FRACTURE MECHANICS:
Theoretical strength and stress concentrations - linear elastic fracture mechanics - microstructural aspects - fracture testing technique - impact resistance - toughness - wear

3. STRENGTH AND ENGINEERING DESIGN:
Strength testing - microstructural aspects - time dependent strength behaviour - experimental techniques - SPT diagram

4. CREEP BEHAVIOUR OF CERAMICS:
Dislocation creep - diffusion creep - microstructural dependence - multicomponent system testing techniques - creep deformation maps

5. THERMAL SHOCK BEHAVIOUR OF CERAMICS:
Thermal stress - thermal shock resistance parameters - thermal stresses and cracking - detection of cracks - testing techniques - application.

BOOKS FOR REFERENCE:

REFERENCE:
REFERENCES:


HS 034 - TECHNICAL TAMIL

1. REVIEW OF BASIC GRAMMER

Sentence structure - Tense, case, gender voice and number
common errors in usage and their corrections - Errors in
conjunction - Spelling and traditional usage.

2. READING FROM TECHNICAL WRITINGS

Critical study of selected passages from technical writings in Tamil
(selected Articles from Kalanigam may be prescribed from time
to time.

3. TRANSLATION FROM ENGLISH TO TAMIL

Principles of Translation - Coinage of Technical terms and
exercises in Translation.

4. TAMIL AND COMPUTERS

Issues in DTP - Keyboard layout - typewriter, phonetic keyboards
- Internal coding - ISCII and other formats - Advantages and
Disadvantages - Sorting, Morphological Analysis - Difficulties in
spell checking - Research in Computerization of Tamil, Practical
Work processing in Tamil, Spelling correction and sorting.
5. CREATIVE WRITING IN TECHNICAL TAMIL

Style of Technical language, Exercises in writing technical passages in Tamil articles, description of technical matters

L + P = 60

TEXT BOOKS

1. A.K. PARANTHAMANAR, Nalla Tamil Elutha Venduma, Pari Nileyam, Chennai

REFERENCES

2. Kalanigam, Quarterly of Anna University, Chennai (Journal articles).
4. DR. RADHA CHELLAPEN, Kalaichiliakam.

HS 035 TECHNICAL GERMAN - I

1. INTRODUCTION

Special and comparative features of German with English, Hindi and Tamil German Alphabets, pronunciation.

2. THEMA

Name, Land Wohnort Sudium, Beruf Familie, Geschwister, Alter Tagesablauf, Termine Einladung Stellensuche, Berufswahl Einkauf

3. GRAMMATIK


4. UEBUNGEN

Partner ubungen Schriftliche Uebungen Aussprache Uebungen Kontrolluebungen Text Generations

5. DIALOGUE

Oral Written

6. GLOSSARY

Technical Words

L : 45 T : 15 Total = 60

TEXT BOOK:

Lernziel Deutsch (Deutsch als Fremdsprache) - Grundstufe 1 From Max Hueber Verlag

HS 036 TECHNICAL GERMAN - II

1. INTRODUCTION

German Idioms and Phrases

2. THEMA

Geschenke, Auf der Post Auskunft-Fest Heimat, Kinder Studium Ausbildung Erziehung, Jugend Deutschsprachige Laender, Europa Arbeitwelt, Urlaub

3. GRAMMATIK

Dativ Ort und Richtung Reflexive Verben, Verben mit Praepositionsalobjekt Perfect Praeteritum Adjective Konparation, Genitiv, Wortbildung Nebensatz

4. UEBUNGEN

Partner ubungen Schriftliche Uebungen Aussprache Uebungen Kontrolluebungen Text Generations

5. DIALOGUE

Oral Written

6. GLOSSARY

Technical Words

L : 45 T : 15 Total = 60

TEXT BOOK

Lernziel Deutsch (Deutsch als Fremdsprache) - Grundstufe 1 From Max Hueber Verlag
1. Introduction to Japanese Alphabets - Hiragana, Katakana, and Kanji - Group 1, 2, 3 & 4 syllables - writing practice - pronunciation - word order - Greetings - receiving a visitor and exchange of pleasantries - Kanji Practice. 9

2. Basic structure of sentences - Classification of verbs - Polite form of verbs - irregular verbs - Particle-E - Time expressions - question sentences - Japanese numerals - Kanji practice. 9

3. Classification of particles - Ga, Ka, Wa, O, E, Ni, etc - aural comprehension - Reading comprehension - noun-1 We, noun-2 desu - Demon- strative pronouns - kore, sore, are and dare - kono, sono, ano and dono - kochira - sochira - achara and dochira - particle - No, kara, ni and de - question-itsu - conversational - grammar - soo desu ka - Na, I adjectives perfect and imperfect - question words - Doo and kuga - particle - To, ne and yo - Kanji practice. 9

4. Desu as a substitute for a verb - demonstrative pronouns - sono and sare Group 1 particles - De, O, Mado and Ka - conjunction - soshite - Quest- ion words - dare, nani, doko, itsu, dare, dochira, doyatte, Ikutsu, Ikura - Words for degrees - gurai or kurai - Phrase - Saa - Ano-numerals - counters and numbers - humble form of desu and anmasu - Kanji practice. 9

5. Verbs ending in -te or de - classification of Te forms and Masu forms - verb modifiers - koo, soo aa and doo - Set phrase - Onegaiimasu - Sumimasen - Adverbs-Mazu, sono kara and saigo - ni - formation of the - Te form of I adjective and desu - Kanji practice. 9

L: 45 T: 15 Total = 60

TEXT BOOKS:

3. Yan-san Serial - Video tapes, Japan.

92
HS 039 TECHNICAL FRENCH - I

1. Alphabets - Pronunciation - Masculine and Feminine Genders only - Numbers - Indefinite and definite articles - Plurals - Verbs to be and to have.


L : 45  T : 15  Total = 60

TEXT BOOKS:


REFERENCES

1. Centre D'études Francaises, Functional French for Scientists and Technologists, Jawaharlal Nehru University, New Delhi, 1966.


HS 040 TECHNICAL FRENCH - II


2. Comparative, superlative sentences - recent past - immediate future - grammatical analysis.

3. Translation from English to French - Translation from French to English Texts from Physics and Chemistry

94

4. Translation from English to French - Translation from French to English Texts from Basic Engineering


L : 45  T : 15  Total = 60

1. LISTENING

Listening comprehension - listening for specific information - note-taking - use of charts and diagrams.

2. SPEAKING

Defining - describing objects - describing uses/functions - comparing - offering suggestions - analysing problems and providing solutions - expressing opinions (agreement/disagreement) predicting - expressing possibility/certainty - framing questions - providing answers - pronunciation practice (word stress).
3. READING

- Skimming - scanning - detailed reading - predicting content
- Interpreting charts and tables - Identifying stylistic features in texts
- Evaluating texts - Understanding discourse coherence - Guessing meaning from the context - Note-making/transfering information.

4. WRITING

- Sentence definition - Static description - Comparison and contrast
- Classification of information - Recommendations - Highlighting problems and providing solutions - Formal and informal letter writing
- Using flow-charts/diagrams - Paragraph writing - Editing.

5. FOCUS ON LANGUAGE

- Word formation with prefixes and suffixes - Discourse markers and their functions - Degrees of comparison - Expressions relating to recommendations and comparisons - Active and passive voice - Antonyms - Tense forms - Gerunds - Condition sentences - Modal verbs of probability and improbability - Acronyms and abbreviations - Compound nouns and adjectives - Spelling - Punctuation.

L : 45  T : 15  Total = 60

TEXT BOOK

1. "English for Engineers and Technologists". Volume I. Authors: Humanities and Social Science Department, Anna University. Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH


L : 45  T : 15  Total = 60
1. "English for Engineers and Technologists", Orient Longman, 1990 Volume II. Authors: Humanities and Social Sciences Department, Anna University, Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH II

REGULATIONS AND SYLLABUS

( REGULATIONS 2000 )

DEAN
A.C. COLLEGE OF TECHNOLOGY
ANNA UNIVERSITY
CHENNAI - 600 025

B.Tech. DEGREE PROGRAMME
(8 SEMESTERS)

CHEMICAL ENGINEERING

ANNA UNIVERSITY
CHENNAI - 600 025.
APRIL 2000
REGULATIONS 2000
Degree of Bachelor of Engineering / Technology (Eight Semesters)
(Approved in the 42nd Meeting of the Academic Council Held on 25.09.1999)

PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) "Programme" means Degree Programme, that is B.E. / B.Tech. Degree Programme
ii) "Branch" means specialisation or discipline of B.E./ B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.
iii) "Course" means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.
iv) "Faculty" means a Faculty of the University, like Faculty of Civil Engineering, Faculty of Technology, etc. Each Faculty is headed by a Dean.

ADMISSION

R1a Candidates for admission to the first semester of the eight semester B.E./B.Tech. Degree Programme shall be required to have passed

i) the Higher Secondary Examination of the (10 +2) curriculum (Academic stream) prescribed by the appropriate authority of Government of Tamil Nadu with
Mathematics, Physics and Chemistry as three of the four subjects of study prescribed under Part III. In the case of B.Tech, Industrial Biotechnology, the subjects are Physics, Chemistry, Mathematics and/or Biology.

OR

any other examination of any University or authority accepted by the Syndicate of the University as equivalent thereto.

R.1b Candidates for admission through lateral entry into the third semester of the eight semester B.Tech. Degree Programme at M.I.T. Campus shall be required to have passed

the examination of a B.Sc. Degree of 10 + 2 + 3 or 11 + 1 + 3 pattern of a recognised University in any one of the following B.Sc. Degree Programmes having Mathematics and Physics as subjects of study:


OR

any other examinations of any University or authority accepted by the Syndicate of the University as equivalent thereto.

R.1c Sponsored/deputed candidates (Diploma holders) for admission to the 1st Semester of 8 Semester B.E. Degree programme in Printing Technology shall be required to have passed the 3-year Diploma in Printing Technology (Letterpress/Lithography/Integrated) awarded by the State Board of Technical Education of Tamil Nadu or any other examination of any University or authority acceptable to the Syndicate of the University as equivalent thereto. The candidate shall have completed 21 years of age as on first of July of the year of application. In the case of lateral entry, the candidate shall not have completed any other examination of any University or authority acceptable to the Syndicate of the University as equivalent thereto.

Government of Tamil Nadu or any other examination of any University or authority acceptable to the Syndicate of the University as equivalent thereto. The candidate shall have completed 21 years of age as on first of July of the year of application. In the case of lateral entry, the candidate shall not have completed any other examination of any University or authority acceptable to the Syndicate of the University as equivalent thereto.

R.2a Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for plus two academic stream of the Tamil Nadu Board of Higher Secondary Education.

R.2b Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics, Chemistry, Applied Sciences, Electronics, Instrumentation and Computer Science at B.Sc. Degree level.

R.2c Sponsored/deputed candidates satisfying Rule 1c shall also write the entrance examination as per Rule 2a.

R.3. The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Syndicate of the University from time to time.

R.4a The candidate shall have completed 21 years of age as on first of July of the year of application. In the case of lateral entry, the candidate shall not have completed any other examination of any University or authority acceptable to the Syndicate of the University as equivalent thereto. The candidate shall have completed 21 years of age as on first of July of the year of application. In the case of lateral entry, the candidate shall not have completed any other examination of any University or authority acceptable to the Syndicate of the University as equivalent thereto.
22 years of age as on 1st July of the year of application. For candidates belonging to SC/ST, the age limit is relaxable by 3 years.

R.4b There is no age limit for sponsored/deputed candidates satisfying Rule 1c, seeking admission to B.E. Printing Technology.

BRANCHES OF STUDY AND STRUCTURE OF THE PROGRAMME

R.5a Regulations 2000 is applicable to B.E./B.Tech. Degree Programme in various branches of Engineering and Technology, each distributed over 6 semesters with 2 semesters per Academic Year.

Faculty of Civil Engineering
1. B.E. Civil Engineering
2. B.E. Geo-Informatics.

Faculty of Electrical Engineering
1. B.E. Computer Science and Engineering
2. B.E. Electrical and Electronics Engineering
3. B.E. Electronics and Communications Engineering.

Faculty of Engineering (MIT)
1. B.Tech. Aeronautical Engineering
2. B.Tech. Automobile Engineering
3. B.Tech. Electronics Engineering
4. B.Tech. Instrumentation Engineering
5. B.Tech. Production Engineering
6. B.Tech. Rubber and Plastics Technology

Faculty of Mechanical Engineering
1. B.E. Industrial Engineering
2. B.E. Manufacturing Engineering
3. B.E. Mechanical Engineering
4. B.E. Mining Engineering
5. B.E. Printing Technology.

Faculty of Technology
1. B.Tech. Ceramic Technology
2. B.Tech. Chemical Engineering
3. B.Tech. Industrial Bio-Technology
4. B.Tech. Leather Technology

R.5b Every Programme will have a curriculum with syllabi consisting of theory and practicals such as
i) General core courses comprising mathematics, basic sciences, engineering sciences, humanities, and engineering arts.
ii) Core courses of Engineering / Technology
iii) Elective courses for specialisation in related fields.
iv) Workshop practice, computer practice, engineering graphics, laboratory work, industrial training, seminar presentation, project work, education tours, camps etc.
v) NCC/NSS/NSO activities for character development.

R.5c Each course is normally assigned certain number of credits with 1 credit per lecture period per week, 1 credit per tutorial period per week, 1 credit for 2 periods of laboratory or practical or seminar or project work per week (2 credits for 3 or 4 periods of practical), and 1 or 2 credits for 4 weeks of industrial training during semester vacations.
R.5d Each semester curriculum shall normally have a blend of lecture courses not exceeding 6 and practical courses not exceeding 4.

R.5e For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. This minimum will lie between 181 and 190 credits depending on the branch.

R.5f The medium of instruction, Examination: and project report will be English, except for courses on languages other than English.

DURATION OF THE PROGRAMME

R.6 A student is ordinarily expected to complete the B.E./B.Tech. Programme in 8 semesters (6 semesters in the case of lateral entry student), but in any case not more than 12 semesters (10 semesters in the case of lateral entry student).

FACULTY ADVISER

R.7 To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department of the student will attach a certain number of students to a teacher of the Department who shall function as Faculty Adviser for those students throughout their period of study. Such Faculty Adviser shall advise the students and approve the courses to be taken by the students during each semester.

CLASS COMMITTEE

R.8a For all branches of study during first semester, a common Class Committee will be constituted by the Dean of Academic Courses. During other semesters, separate Class Committees will be constituted by the respective Heads of the Departments of the students.

R.8b Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them as nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department/ Dean of Faculty/ Dean of Academic Courses depending upon whether all the teachers teaching the common course belong to a Department/ a Faculty/ different Faculties.

R.8c The first semester Class Committee composition will be as follows:

i) Course Co-ordinators of all common courses.

ii) Teachers of all other individual courses.

iii) One Professor, preferably not teaching first semester class, appointed as Chairman, by Dean of Academic Courses.

iv) One male and one female first semester student from each Faculty to be nominated by the Dean of Academic Courses.

v) All first semester Faculty Advisers and all the Deans may opt to be special invitees.

R.8d The composition of the Class Committee for each branch from 2nd to 8th semester will be as follows:
i) Teachers of individual courses.

ii) One Professor or Assistant Professor preferably not teaching in the concerned class, appointed as Chairman by the Head of the Department.

iii) 2 students, preferably 1 male and 1 female student of the class per group of 30 students or part thereof, to be nominated by the Head of the Department in consultation with the Faculty Advisers.

iv) All Faculty Advisers of the Class, Teacher in-charge of UG Programme and Head of the Department may opt to be special invitees.

R.6e The Class Committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of class commencement, in which the type of assessments, like test, assignment, assignment based test etc., will be decided for the first second and third assessments. The second meeting will be held with in a week after the date of first assessment report, to review the students performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students performance and for follow up action.

During these three meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

R.6f The Class committee, excluding the student members and the invited members, shall meet within two weeks from the last day of the End-Semester Examination to analyse the performance of the students in all the components of assessments and decide the grade ranges for each course. The grading ranges for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned teacher.

REGISTRATION AND ENROLMENT

R.9a Every student shall submit a completed Registration form indicating the list of courses intended to be credited during the next semester. This Registration will be done a week before the last working day of the current semester. Late registration with the approval of Dean of Faculty along with a late fee will be done up to the last working day.

R.9b At the beginning of the semester, before the date of class commencement, every student shall confirm the Registration by paying the prescribed fees for the semester and enroll for the courses. Late enrolment, with the approval of Dean of Faculty along with a late fee, will be done up to 2 weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

R.9c The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

WITHDRAWAL FROM A COURSE

R.9d A student can withdraw from a course at any time before the second assessment with the approval of Dean of Faculty on the recommendation of the Head of the Department of the student.
TEMPORARY BREAK OF STUDY FROM A PROGRAMME

R.9e A student can take a one time temporary break of study covering the current semester and/or next semester period with the approval of the Dean of Academic Courses, at any time before the start of third assessment of current semester, within the maximum period of 12 or 10 Semesters as the case may be.

CREDIT LIMIT FOR ENROLMENT AND MOVEMENT TO HIGHER SEMESTER

R.10a A student can enroll only for a maximum of 30 credits during a Semester period including arrears courses.

R.10b The following minimum credits should be earned by a student to Register for the higher semester courses.

<table>
<thead>
<tr>
<th>TO REGISTER FOR COURSES</th>
<th>MINIMUM CREDITS TO BE EARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Semester</td>
<td>No minimum</td>
</tr>
<tr>
<td>3rd Semester</td>
<td>10 in 2nd Semester Courses alone</td>
</tr>
<tr>
<td>4th Semester</td>
<td>12 in 3rd Semester Courses alone</td>
</tr>
<tr>
<td>5th Semester</td>
<td>12 in 4th Semester Courses alone</td>
</tr>
<tr>
<td>6th Semester</td>
<td>12 in 5th Semester Courses alone</td>
</tr>
<tr>
<td>7th Semester</td>
<td>12 in 6th Semester Courses alone</td>
</tr>
<tr>
<td>8th Semester</td>
<td>12 in 7th Semester Courses alone</td>
</tr>
</tbody>
</table>

Those who do not satisfy the above minimum credit requirements, may register and enroll for arrears courses only.

SUMMER TERM COURSES

R.11a A student can register for a maximum of two courses only during Summer Term, if such courses are offered by the concerned department.

R.11b The Head of the Department, in consultation with the Department Consultative Committee and with the approval of Dean (Academic Courses) may arrange for the conduct of a few courses during summer term, depending on availability of teachers during summer and subject to a minimum of five students registering for such courses.

R.11c However in the case of a student completing 8th semester and having arrears in the earlier semesters in a maximum of two courses, summer courses may be offered, even if less than five students are registering for the course.

R.11d The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a Summer term course or for substitute examination.
ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

R.12.a Every theory course shall have a total of four assessments during a semester as given below:

<table>
<thead>
<tr>
<th>Assessment No.</th>
<th>Course coverage in weeks</th>
<th>Duration in hours</th>
<th>Weightage of max. marks %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>1 to 4</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>Test 2</td>
<td>5 to 8</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>Test 3</td>
<td>9 to 12</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>End-Sem. Exam.</td>
<td>1 to 16</td>
<td>3 hours</td>
<td>50</td>
</tr>
</tbody>
</table>

R.12b The pattern of question for at least one of the Tests shall be the same as stipulated for the End-Semester Examination by the Board of Studies/Academic Council. Teachers handling courses in the third to eighth semesters are given the option to substitute a maximum of two tests with other suitable alternate type of evaluation approved in the class committee. The details of such a scheme shall be announced to the students and informed to the Dean of Academic courses at the beginning of the Semester. However, for the first and second semester, all assessments will be in the form of tests.

R.12c Every practical course will have 75% weightage for continuous assessment and 25% for End-Semester examination.

R.12d In the case of Industrial Training, the student shall submit a report which will be evaluated along with an oral examination by a Committee of Teachers constituted by the Head of the Department. A progress report from the industry will also be taken into account for evaluation.

R.12e In the case of project work and mini project work, a committee of Teachers constituted by the Head of the Department will carry out continuous assessment. Based on the project report submitted by the student, an oral examination (Viva-Voce) will be conducted as the End-Semester examination, for which one External Examiner will also be included in the Committee of Teachers.

R.12f Assessment of seminars and comprehension will be carried out by a committee of teachers constituted by the Head of the Department.

SUBSTITUTE EXAMINATIONS

R.13a A student who has missed, for valid reasons, an assessment test/examination may be permitted to write a substitute test/examination. However, permission to take up a substitute test/examination will be given under exceptional circumstances, such as accident or admission to a hospital due to illness.

R.13b A student who misses any assessment test/examination in a course should apply for the substitute test/examination within a week from the date of missed assessment, using the prescribed application form for the purpose. Late applications will not be entertained. The decision on the application will be taken by the Head.
of the Department offering the course in the case of first three assessments and by the Dean of Faculty in the case of End-Semester examination (fourth assessment). However, if a student applies for the substitute test/examination for the second time in a semester, the decision will be taken by the Dean of Faculty. The Head of the Department/Dean of Faculty can use his discretion in granting permission, recording reasons for his decision. If permitted, the substitute test/examination for any assessment will be held in about two weeks from the date of missed assessment. The substitute test (from missed assessments 1 to 3) will be conducted by the concerned teacher. However, the substitute examination (for missed end-semester examination) will be conducted centrally.

PASSING AND DECLARATION OF EXAMINATION RESULTS AND GRADE SHEET

R.14a All assessments of a course will be done on absolute marks basis. However, the Class Committee which shall meet within 2 weeks after the End-Semester examinations, shall analyze the relative performance of students in all assessments of a course and decide the letter grade ranges for that course. The letter grades and the corresponding grade points are as follows:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>S</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>U</th>
<th>I</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Points</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“W” denotes withdrawal from the course.

“F” denotes inadequate attendance and hence prevention from End-Semester examination.

“U” denotes failure in the course.

R.14b A student who earns a minimum of 5 grade points in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student.

R.14c The results, after awarding of grades, shall be signed by the Class Committee Chairman, Head of the Department and Dean of Faculty and declared by the Dean of Faculty.

R.14d Within 2 weeks from the commencement of classes for the next semester a student can apply for revaluation of his/her end semester examination answer papers in a course, on payment of a prescribed fee, through proper application to the Dean of Faculty. The Dean shall constitute a revaluation committee consisting of Chairman of Class Committee as convener, the teacher of the course and a senior member of faculty knowledgeable in that course. The Committee shall meet within a week, revalue the answer paper and submit its report to the Dean of Faculty for consideration and decision.

R.14e After results are declared, Grade Sheets will be issued to each student which will contain the following details. The list of courses enrolled during the semester including summer term courses, if any, and the grade scored. The Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of
courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses if any.

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

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. "U", "I" and "W" grades will be excluded for calculating GPA and CGPA.

R.14f After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA:

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class with Distinction</td>
<td>8.50 and above</td>
</tr>
<tr>
<td>First Class</td>
<td>6.50 and above but below 8.50</td>
</tr>
<tr>
<td>Second Class</td>
<td>below 6.50</td>
</tr>
</tbody>
</table>

ATTENDANCE REQUIREMENT AND COURSE REPETITION

R.15a A student shall attend a minimum of 75% of the contact periods offered in any registered course, to become eligible to appear for the end-semester examination in that course, failing which the student shall be prevented from taking the end-semester examination and shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

R.15b Instructor of each course shall take attendance till five calendar days prior to the last instruction day in the semester and report through the Head of the Department to the Dean of Faculty the names of students who have attendance less than 75% in that course. The Dean shall then announce the names of all students prevented from writing the end-semester examinations in various courses.

R.15c A student should repeat a core course wherein "U" or "I" or "W" grade was awarded. If the student is awarded "U" or "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

ELECTIVE CHOICE; OPTION TO DO PROJECT ALONE IN FINAL SEMESTER

R.16a Apart from the various elective courses listed in the curriculum for each branch of specialisation, the student can choose a maximum of 2 electives from any other specialisation under any Faculty, during the entire period of study, with the approval of the Head of the Parent Department and the Head of the other Department offering the course.

R.16b In the curriculum of 8th Semester, along with the project work, if 2 elective courses alone are listed, then the Dean of Faculty may permit a student, as per approved guidelines, on the recommendation of the Head of the Department, to do a full semester major industrial project
work. In such a case, the above 2 elective courses or any other 2 elective courses in lieu thereof have to be enrolled during any semester including the summer, proceeding or succeeding the project work.

INDUSTRIAL VISIT

R.16c Every student is required to undergo one Industrial visit for every theory course offered, starting from the third semester of the Programme.

PERSONALITY AND CHARACTER DEVELOPMENT

R.17a All students shall enroll, on admission, in any one of the personality and character development programmes the NCC/NSS/NSO and undergo practical training for about 80 hours and attend a camp of about ten days.

National Cadet Corps (NCC) will have about 20 parades

National Service Scheme (NSS) will be social service activities in and around Chennai.

National Sports Organisation (NSO) will have Sports, Games, Drill and Physical exercises.

While the training activities will normally be during week ends, the camp will normally be during vacation period.

R.17b Every student shall put in a minimum of 80% attendance in the practical training and attend the camp compulsorily. Normally this is to be completed during the first year. For valid reasons, the Dean of Students may permit a student to complete this requirements in the second year.

However, before enrolling for 5th Semester (7th Semester in the case of Mining Engineering and of lateral entry), a student should have completed the training and produced a certificate from the appropriate authority of NCC/NSS/NSO for having satisfactorily completed the prescribed training and camp.

R.17c Rule 17a and 17b are not applicable to the sponsored/deputed Candidates satisfying Rule 1c admitted to B.E. in Printing Technology.

DISCIPLINE

R.18a Every student is required to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

R.18b Any act of indiscipline of student reported to the Dean of Faculty will be referred to a Discipline and Welfare Committee nominated by the Syndicate from time to time, for taking appropriate action.

ELIGIBILITY FOR THE AWARD OF DEGREE

R.19a A student shall be declared to be eligible for the award of the B.E./B.Tech. Degree provided the student has:

1) Successfully completed all the required courses in the programme curriculum and earned the number of credits prescribed for the specialisation within a maximum period of 12 semester (10 semesters for Lateral Entry) from the date of admission, including break of study.
ii) Completed the NCC/NSS/NSO requirements.
iii) No dues to the Institution, Library, Hostels, NCC, NSS,
NSO, etc.
iv) No disciplinary action pending against the student.

R.19b The award of the Degree must have been approved by
the Syndicate of the University.

POWER TO MODIFY

R.20 Notwithstanding all that has been stated above, the
University has the right to modify the above regulations
from time to time.

REGULATION 2000 CURRICULUM

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM 131</td>
<td>Chemistry I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>GE 131</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>L1</td>
<td>Language Elective I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA 131</td>
<td>Mathematics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH 131</td>
<td>Physics I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>GE 132</td>
<td>Computer Practice I</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GE 133</td>
<td>Workshop Practice</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

SEMESTER II

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 131</td>
<td>Chemistry II</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>EQ 152</td>
<td>Electronics Engineering</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>EE 151</td>
<td>Electrical Engineering</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>L2</td>
<td>Language Elective II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH 134</td>
<td>Physics II</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>MA 132</td>
<td>Mathematics II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>GE 134</td>
<td>Engineering Graphics</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GE 135</td>
<td>Computer Practice II</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27</td>
</tr>
</tbody>
</table>

SEMESTER-III

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 231</td>
<td>Mathematics III</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH 232</td>
<td>Materials Science</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH 233</td>
<td>Electrical Mechanics &amp; Drives</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH 234</td>
<td>Mechanical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH 235</td>
<td>Mechanics of Solids</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH 236</td>
<td>Organic Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Code No.</td>
<td>Course Title</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>CH237</td>
<td>Chemistry Laboratory III</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CH238</td>
<td>Electrical Engineering Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CH239</td>
<td>Mechanical Engineering Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>MA036</td>
<td>Statistics and Linear Programming</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CH241</td>
<td>Computer Applications in Chemical Engineering</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CH242</td>
<td>Physical Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH243</td>
<td>Material Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH244</td>
<td>Chemical Process Industries I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH245</td>
<td>Instrumental Methods of Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>23</strong></td>
</tr>
<tr>
<td>CH246</td>
<td>Organic Chemistry Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CH247</td>
<td>Technical Analysis Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>23</strong></td>
</tr>
<tr>
<td>MA037</td>
<td>Special Functions, Differential Equations and Z transforms</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CH331</td>
<td>Chemical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH332</td>
<td>Thermodynamics I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH333</td>
<td>Chemical Process Calculation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH334</td>
<td>Fluid Mechanics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH335</td>
<td>Chemical Process Industries II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH336</td>
<td>Mechanical Operations</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>23</strong></td>
</tr>
<tr>
<td>CH336</td>
<td>Technical Analysis Lab-II</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CH337</td>
<td>Chemical Engineering Lab I</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>23</strong></td>
</tr>
<tr>
<td>MA038</td>
<td>Numerical Methods</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CH338</td>
<td>Chemical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH339</td>
<td>Thermodynamics-II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH340</td>
<td>Chemical Reaction Engg. I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH341</td>
<td>Mass Transfer I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH342</td>
<td>Heat Transfer</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH343</td>
<td>Process Instrumentation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH344</td>
<td>Chemical Engg. Lab II</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>24</strong></td>
</tr>
<tr>
<td>CH431</td>
<td>Process Economics and Industrial Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E1</td>
<td>Elective I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH432</td>
<td>Chemical Reaction Engg.</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CH433</td>
<td>Mass Transfer II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CH434</td>
<td>Transport Phenomena</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>E2</td>
<td>Elective – II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Code No.</td>
<td>Course Title</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH435</td>
<td>Chemical Process Equipment Design II</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>CH436</td>
<td>Chemical Engg. Lab III</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>CH437</td>
<td>Seminar and Comprehension</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>0</td>
<td>5</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td><strong>SEMESTER VIII</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>Elective III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E4</td>
<td>Elective-IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

**LIST OF ELECTIVES**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CH034</td>
<td>Fertiliser Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CH035</td>
<td>Petrochemical Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CH036</td>
<td>Drugs and Pharmaceutical Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CH037</td>
<td>Polymer and Plastics Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>CH038</td>
<td>Food Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CH039</td>
<td>Surface Coating Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>CH040</td>
<td>Electrochemical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>CH041</td>
<td>Environmental Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>CH042</td>
<td>Biochemical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>CH043</td>
<td>Biomedical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>CH044</td>
<td>Process Automation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>CH045</td>
<td>Process Modelling and Simulation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**LANGUAGE ELECTIVES**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Subject Name</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS035</td>
<td>Technical German I</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>HS036</td>
<td>Technical German II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS037</td>
<td>Technical Japanese</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS038</td>
<td>Technical Japanese II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS039</td>
<td>Technical French I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS040</td>
<td>Technical French II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS041</td>
<td>English I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS042</td>
<td>English II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL**

187
MA 131 MATHEMATICS I

1. MATRICES

The characteristic equation, Eigen values and Eigen vectors of a real matrix, some properties of Eigen values, Cayley-Hamilton theorem, Reduction of a real matrix to a diagonal form, Orthogonal matrices-properties, reduction of a quadratic form to a canonical form by orthogonal transformation.

2. GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS

Curvature- cartesian and polar coordinates- Circle of curvature, involutes and volutes, Envelopes - Properties of the envelopes - Envelopes of normal to a curve.

3. FUNCTIONS OF SEVERAL VARIABLES

Total differential - Derivative of implicit functions, Partial derivative of a function of two functions, Taylor's expansion for a function of two variables, Maxima and minima, Jacobians, Differentiation under the integral sign.

4. MULTIPLE INTEGRALS

Double integration in cartesian and polar coordinates, change of order of integration, triple integration in cartesian coordinates, Gamma and Beta functions - properties, Area as a double integral.

5. DIFFERENTIAL EQUATIONS

Simultaneous linear equations with constant coefficients, Homogeneous linear equations of Euler type - Equations reducible to homogeneous form, Linear equations of second order with variable coefficients, Method of reduction of order, Transformation of the equation by changing the dependent variable, Method of variation of parameters.

REFERENCES:


PH 131 PHYSICS - I

1. PROPERTIES OF MATTER

Elasticity - Stress - strain diagram - factors affecting elasticity - Twisting couple on a wire - shaft - Torsion pendulum - Depression of a cantilever - Young's modulus by cantilever - Uniform and non-uniform bending - I shape girder - production and measurement of high vacuum - Rotary pump - Diffusion pump - Pirani Gauge - Penning gauge - Viscosity - Oswald Viscometer - Comparison of viscosities.

2. ACOUSTICS

3. HEAT AND THERMODYNAMICS


4. OPTICS


5. LASER AND FIBRE OPTICS

Principle of lasers - Laser characteristics - Ruby - NdYAG, He-Ne, CO2 and semi-conductor lasers - propagation of light through optical fibre - types of optical fibres - applications of optical fibres as optical waveguides and sensors.

6. PRACTICALS

1. Young's modulus by nonuniform bending
2. Rigidity modulus and moment of inertia using Torsion pendulum
3. Viscosity of a liquid by Poiseuille's method
4. Wavelength determination using grating by Spectrometer
5. Particle size determination by Laser
6. Thermal conductivity of Lees' disc
7. Thickness of wire by Air wedge
8. Thermo emf measurement by potentiometer

---

**REFERENCES**


L : 30 T : 15 P : 30 Total = 75
3. ELECTRODICS

Types of electrodes and cells - Nernst equation - emf measurement and its applications - Principles of chemical and electrochemical corrosion control (sacrificial anode and impressed current methods).

4. WATER

Water quality parameters - definition and expression - estimation of hardness (EDTA method) and alkalinity (titrimetry) - water softening (zeolite) - demineralisation (ion-exchangers) and desalination (RO) - domestic water treatment.

5. POLYMERS

Monomer - functionality - degree of polymerisation - classification based on source and applications - addition, condensation and copolymerisation - mechanism of free-radical polymerisation - thermoplastic and thermosetting plastics - injection moulding, blow moulding and extrusion processes.

PRACTICALS

1. WATER ANALYSIS

Determination of hardness alkalinity, DO, Fe (spectrophotometry) and Na & K (flame photometry)

2. ELECTROCHEMISTRY AND CORROSION EXPERIMENTS

3. POLYMER EXPERIMENTS

L: 30 T: 15 P: 30 Total = 75

REFERENCE BOOKS


GE 131 ENGINEERING MECHANICS

1. BASICS

Introductions - Units and Dimensions - Laws of Mechanics - Vectors - Vectorial representation of forces and moments - Vector operations

2. STATICS OF PARTICLES

Coplanar forces - Resolution and composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - equivalent systems of forces - Principle of transmissibility - single equivalent force.

3. EQUILIBRIUM OF RIGID BODIES

Free body diagram types of supports and their reactions - requirements of stable equilibrium - Equilibrium of rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.
4. PROPERTIES OF SURFACES AND SOLIDS

Determination of Areas and Volumes - First moments of area and the centroid - second and product moments of plane area - Parallel axis theorems and perpendicular axis theorems - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia - relation to area moments of inertia.

5. FRICTION

Frictional force - Laws of Coulomb friction - Simple Contact friction - Rolling Resistance - Belt Friction.

6. DYNAMICS OF PARTICLES


7. ELEMENTS OF RIGID BODY DYNAMICS

Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid body - work energy equation.

TEXT BOOKS


REFERENCE


GE 132 COMPUTER PRACTICE

1. FUNDAMENTALS OF COMPUTERS AND OPERATING SYSTEMS:

- Evolution of Computers - Organisation of Modern Digital Computers
  - Single user Operating System - Multitasking OS - GUI
2. OFFICE AUTOMATION

  - Word Processing
  - Data Base Management System 5
  - Spreadsheet Package 2
  - Presentation Software 2

TEXT & REFERENCE BOOKS

3. COMPLEX INTEGRATION

Cauchy’s theorem - Cauchy’s integral formula - Taylor and Laurent’s series - Singularities and classification - residues, Cauchy’s residue theorem - Contour integration around circular and semi-circular contours (excluding poles on the real axis).

4. EMPIRICAL STATISTICS


5. STATISTICAL INFERENCE

Sampling distribution - testing of hypothesis - level of significant - confidence limits tests based on normal distribution, t-distribution and Chi-square distribution.

REFERENCES:

5. INDUSTRIAL INORGANIC COMPOUNDS

Zeolites: Types - Applications - Ion exchange - Adsorbent - Separation process Catalyst.
Refractory: Silicon carbide - Aluminium oxide - Ultramarine.
Refractory: Silicon carbide - Aluminium oxide

6. PRACTICALS

 Phenol water system - Kinetics of Ester Hydrolysis - Distribution Coefficient - Pigment Analysis: Lead and Titanium - Melting point and Molecular weight Determination - Estimation of Percentage Composition of Glycerol (Viscometric method).

REFERENCE

5. DIGITAL ELECTRONICS

Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra - Exclusive or gate - Half and Full adders - flip flops - registers and counters - A/D, D/A conversion - Digital computer principle.

L : 30 P : 30 Total = 60

TEXT BOOK


REFERENCE

1. Mehta, V.K., Principles of Electronics, S.Chand and Company Ltd., 1994

EE 151 ELECTRICAL ENGINEERING

1. ELECTRICAL CIRCUITS

Ohms Law - Kirchhoffs Laws - steady state solution of D C Circuits - Introduction to AC circuits - Waveforms and RMS value - power and power factor, single phase and 3 phase balanced circuits.

2. ELECTRICAL MACHINES

Principles of operation and characteristics of D C machines, Transformers (single phase and three phase) - Synchronous Machines - 3 Phase and single phase induction motors - (op. Principles).
3. ELECTRICAL MEASUREMENTS

Moving coil and moving iron instruments (Ammeter and voltmeter) Dynamometer type watt meters and energy meters (cp. Principles).

L : 30 P : 30 Total = 60

TEXT BOOK

REFERENCE

PH 134 PHYSICS II

1. ELECTROSTATICS AND ELECTROMAGNETISM

Electric field and potential - Gauss theorem - Applications - dielectrics - capacitance - energy stored in a dielectric medium - types of capacitors - Loss of energy due to sharing of charges by the capacitors - electrical conductivity in conductors - Carey Foster's bridge - Maxwell's equations - Free space wave equation - Characteristic impedance.

2. QUANTUM PHYSICS

Development of quantum theory - Dual nature of matter and radiation - Compton effect - Pair production - Uncertainty principle - Equivalence of mass and energy Schrodinger's wave equation - Particle in a box - Electrons in a metal.

3. ATOMIC AND NUCLEAR PHYSICS


4. ELEMENTARY CRYSTALLOGRAPHY

Crystalline and non-crystalline materials - Bravais lattices - Crystal systems - Symmetry elements - Simple crystal structures - Packing factor for sc, bcc, fcc, hcp structures - Miller Indices - Imperfections in crystals - Bragg's law and x-ray diffraction methods to study crystal structures.

5. NONDESTRUCTIVE TESTING

Liquid penetrant, Magnetic particle and eddy current methods - X-ray radiography - Fluoroscopy - Gamma ray radiography - Ultrasonic scanning methods - Ultrasonic flaw detector - Thermography.

6. PRACTICALS

1. Meter Bridge - Temp. Coefficient
2. Field along the axis of coil - Determination of H
3. Carey Foster's Bridge - Resistivity
4. X-ray diffraction - calculation of cell parameters
5. Newton's rings - Wavelength measurement
6. Spectrometer - Dispersive power of a prism
7. Rigidity modulus - static torsion
8. Ammeter & voltmeter calibration using potentiometer

L : 30 T : 15 P : 30 Total = 75
REFERENCES


GE 134 ENGINEERING GRAPHICS  1 0 3 3

1. **PRINCIPLES OF GRAPHICS**  4 + 12
   Two dimensional geometrical construction - Conic sections, involutes and cycloids - Representation of three dimensional objects - Principles of projections - standard codes of principles.

2. **ORTHOGRAPHIC PROJECTIONS**  7 + 21
   Projections of points, straight lines and planes - Auxiliary projections - Projection and sectioning of solids - Intersection of surfaces - Development of surfaces.

3. **PICTORIAL PROJECTIONS**  2 + 6
   Isometric projections - Perspectives - Free hand sketching.

4. **COMPUTER GRAPHICS**  2 + 6
   Hardware - Display technology - Software - Introduction to drafting software.

GE 135 COMPUTER PRACTICE - II  1 0 3 3

1. **MULTIUSER OPERATING SYSTEM**  4
   Unix: Introduction - Basic commands - vi editor - filters - Input/ output redirection - piping - transfer of data between devices - shell scripts.

2. **FUNDAMENTALS OF NETWORKING**  3
   Working on a networked environment - Accessing different machines from one node - Concept of E.mail - Use of Internet.

3. **HIGH LEVEL LANGUAGE PROGRAMMING**  8

L : 15  P : 45  Total = 60

<table>
<thead>
<tr>
<th>SEMESTER III</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 231</td>
<td>3104</td>
</tr>
<tr>
<td>MATHEMATICS</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td></td>
</tr>
<tr>
<td>1. FOURIER SERIES</td>
<td>9</td>
</tr>
<tr>
<td>Dirichlet's conditions, General Fourier series, Half range sine and cosine series, Parseval's Identity, Harmonic Analysis.</td>
<td></td>
</tr>
<tr>
<td>2. FOURIER TRANSFORMS</td>
<td>9</td>
</tr>
<tr>
<td>Fourier integral representation, Fourier transform pairs, Properties, Fourier sine and cosine transforms, Transforms of simple functions, Transforms of derivatives, The convolution integrals of Fourier, Application to one dimensional wave and diffusion equations.</td>
<td></td>
</tr>
<tr>
<td>3. LAPLACE TRANSFORMS</td>
<td>9</td>
</tr>
<tr>
<td>Transforms of simple functions, Basic operational properties, Transforms of derivatives and integrals, Periodic functions, Convolution theorem, Inverse transforms, Initial and final value theorems, Applications of Laplace transforms to linear ordinary differential equations.</td>
<td></td>
</tr>
</tbody>
</table>

4. PARTIAL DIFFERENTIAL EQUATIONS 9
Formation. Solution of standard types of first order equation and Lagrange's Linear Equation, Linear partial differential equations of second and higher order with constant coefficients.

5. BOUNDARY VALUE PROBLEMS 9
Classification of second order partial differential equations, Transverse vibrations of a string. One-dimensional heat equation and two-dimensional heat flow, Fourier series solutions in Cartesian coordinates.

L:45 T:15 Total:60

TEXT BOOK

REFERENCES
PH 232 MATERIALS SCIENCE 3 0 0 3
(Common to Chemical, Leather and Textile Branches)

1. PHASE DIAGRAMS AND PHASE TRANSFORMATIONS

2. MECHANICAL PROPERTIES

3. ELECTRICAL AND MAGNETIC PROPERTIES

4. SEMICONDUCTING AND DIELECTRIC PROPERTIES
Elemental and compound semiconductors and their properties—Hall effect—Experimental arrangement—Applications—Different types of polarisation processes — Frequency and temperature effects on polarisation – Dielectric constant—Dielectric loss – Different types of dielectric breakdown – Ferroelectric materials.

5. THERMAL AND OPTICAL PROPERTIES
Specific heat capacity—Thermal conductivity—Thermal expansion—Fibre optic materials and their applications – Display materials – LED and LCD.

REFERENCES

CH 233 ELECTRICAL MACHINES AND DRIVES 3 0 0 3

1. ELECTRIC CIRCUITS
Definition – ohm’s law – series parallel circuit – parallel circuit – Division of current – Kirchhoff’s law; Superposition and Thevenin’s Theorem; Star-delta transformation; Simplification of networks.

2. A.C.CIRCUITS
Alternating Voltage; Need for A.C. Voltage; Sinusoidal A.C. Voltage; R.L and RLC networks; Impedance angle; Power and Power factor; Actual and apparent power; Resonance in A.C.Circuits; Series, parallel and series-parallel resonance; Vector Diagram (Phasor Diagram); Complex algebra applied to sinusoids; Three phase circuits; Three phase loading; Balanced loads; Simple problems.
### 3. D.C. MACHINES

Lenz's law of electromagnetic induction; Fleming's rule. Principle of operation of D.C. Machines; Kinds of D.C. machines; Emf equation of D.C. generators; Speed control of D.C. motor; Starters; Application of D.C. Machines.

### 4. A.C. MACHINES

Principle of operation of A.C. Machines: Transformer; single and three phase induction motors, Alternators, Synchronous motors; Equivalent circuit, Regulation and efficiency of single phase transformer; Slip—torque characteristics induction motors; starting of induction motors; Emf equation, Regulation and synchronisation of alternators; Synchronous condenser, Hunting in synchronous motor; Single phase induction motors and their applications.

### 5. DRIVES

Industrial requirements and Ward Leonard System of Drives. Servo—Motors; Basic theory and applications.

<table>
<thead>
<tr>
<th>L</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>45</td>
</tr>
</tbody>
</table>

### TEXT


### CH 234 MECHANICAL ENGINEERING

| 3003 |

### 1. LAWS OF THERMODYNAMICS

Basic concepts and hints; Zeroth law; First Law of Thermodynamics—Statement and application; Steady flow energy equation, Second law of Thermodynamics—Statement; Limitations heat engine; Heat Pump, Available energy, Kelvin—Plank statement and Clausius statement; Equivalence entropy; Reversibility—Entropy charts; Third law of Thermodynamics—Statement.

### 2. HEATING AND EXPANSION OF GASES

Expressions for: work done, Internal energy, Hyperbolic and polytropic processes; Free expansion and Throttling.

### 3. AIR STANDARD EFFICIENCY

Carnot cycle; Stirling Cycle; Joule Cycle; Otto Cycle; Diesel Cycle; Dual combustion Cycle.

### 4. I.C. ENGINES

Engine nomenclature and classifications; SI Engine: CI Engine; Four Stroke cycle; Two stroke cycle; Performance of I.C. Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.

### 5. STEAM AND ITS PROPERTIES

Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Superheated steam, Use of steam tables; Volume of wet steam; Volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle; Modified Rankine cycle.

### 6. STEAM ENGINES AND TURBINES

Hypothetical indicator diagram of steam engine; Working of a simple steam engine; Steam turbines—Impulse and Reaction types—Principles of operation.
7. SIMPLE MECHANISM
Kinematic Link, Kinematic Pair Kinematic Chain; Slider Crank mechanism and inversions; Double slider crank mechanism and inversions.

8. FLY WHEEL
Turning moment Diagram; Fluctuation of Energy; Design of fly wheel.

9. DRIVES
Belt and rope drives; Velocity ratio; slip; Ratio of tensions; Length of belt; Maximum HP; simple compound and Epicyclic gear trains.

10. BALANCING
Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

TEXT

CH 235 MECHANICS OF SOLIDS

1. STRESS, STRAIN AND DEFORMATIONS OF SOLIDS
Rigid bodies and deformable solids - forces on solids and supports - equilibrium and stability - strength and stiffness - tension, compression and shear stresses - Hooke's law and simple problems

- compound bars - thermal stresses - elastic constants and poission's ratio - welded joints - design.

2. TRANSVERSE LOADING ON BEAMS
Beams - support conditions - types of beams - transverse loading on beams - shear force and bending moment in beams - analysis of cantilevers, simply - supported beams and over hanging beams - relationships between loading, S.F. and B.M. in beams and their applications - S.F. & B.M. diagrams.

3. DEFLECTIONS OF BEAMS

4. STRESSES IN BEAMS

5. TORSION
Torsion of circular shafts - derivation of torsion equation (T/J = C/R = Gg/L) - stresses and deformation in circular and hollow shafts - stresses and deformation in circular and hollow shafts - stopped shafts - shafts fixed at both ends - stresses in helical springs - deflection of springs - spring constant.

6. COLUMNS
Axially loaded short columns - columns of unsymmetrical sections - Euler's theory of long columns - critical loads for prismatic columns, with different end conditions - effect of eccentricity.

L = 45 Total = 45
CH 236 ORGANIC CHEMISTRY
(Common to Chemical, Textile and Leather Technology Branches)

New Syllabus suggested: Credits 3 (45 Hours duration)

1. CARBOHYDRATES 8

2. ORGANO METALLIC COMPOUNDS 5
   - Grignard reagents and their synthetic utility – Organo Silicon compounds.

3. OILS, FATS AND WAXES 5
   - Analysis of oils and fats – classification of waxes

4. HETEROCYCLIC COMPOUNDS 8
   - Furan, Thiophene, Pyrrole, Pyridine, and Indole – Their important derivatives

5. DYES AND DYING 7
   - Colour and constitution
     - Synthesis of some important azodyes (Methyl orange, Methyl red, and Congo red)
     - Synthesis of Triphenylmethane dyes (Malaechine green, Para Rosaniline Anthraquinone dyes (Alizarin)
     - Phthalein dyes – Eosin preparation
     - Introduction to Natural and Reactive dyes

6. AMINO ACIDS AND PROTEINS 5

7. PHARMACEUTICAL CHEMISTRY 7
   - Synthesis of antimalarial drugs – Isoniazide and chloroquine
   - Antibacterial drugs – Synthesis of sulphanilamide, sulphonylamine

REFERENCE BOOKS
CH 237 CHEMISTRY PRACTICALS – III
1. Ore/ alloy analysis
2. Pigment Analysis
3. Industrial Waste Water Analysis
4. Estimation of Phenol
5. Analysis of fertilizers
6. Sugar Analysis
7. Polymer Analysis
P = 60 Total = 60

CH 238 ELECTRICAL ENGINEERING LAB
LIST OF EXPERIMENTS:
1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator
3. Load characteristics of D.C. compound generator
4. Load test on D.C. shunt motor
5. Study of D.C. motor starters
6. O.C. and S.C. tests on single phase transformer
7. Load test on single phase transformer
8. Load test on 3-phase squirrel cage induction motor
9. Study of 3-phase induction motor starters
10. Load test on 3-phase slip ring induction motor
11. O.C. and S.C. tests on 3-phase alternator
12. Synchronization and V-curves of alternator
P = 60 Total = 60

CH 239 MECHANICAL ENGINEERING LAB
1. Port timing diagram
2. Valve timing diagram
3. Study of 2.4, stroke I.C. Engines
4. Study of steam engine and Gearbox
5. Load test on 4 stroke Villiers Petrol Engine

6. Load test on 4 stroke Lister Diesel Engine
7. Load test on 4 stroke P.S.G. Diesel Engine
8. Compression test
9. Deflection test
10. Hardness test (Rockwell and Brinell)
11. Spring test
12. Study on behaviour of columns
13. Torsion test
14. Impact test
P = 60 Total = 60

SEMESTER IV

MA 036 STATISTICS AND LINEAR PROGRAMMING
1. PROBABILITY AND RANDOM VARIABLES
   Probability concepts, Random variables, Moments, Moment
   Generating function, Binomial Poisson, Geometric, Negative
   binomial, Exponential Gamma, Weibull distributions, Functions of
   random variable, Chebychev inequality.
2. TWO-DIMENSIONAL RANDOM VARIABLES
   Marginal and conditional distributions, Covariance, Correlation and
   regression, Transformation of random variables, Central limit
   theorem.
3. DESIGN OF EXPERIMENTS AND QUALITY
   CONTROL
   Completely randomized design, Randomized block design Latin
   square design, Process control, Control charts of measurements
   and attributes, Tolerance limits.
4. LINEAR PROGRAMMING
   Formulation of linear programming problem graphical solution
   simplex algorithm artificial variable and the M-method, degeneracy,
   alternative optima and unbounded solution.

35
5. FURTHER TOPICS IN LINEAR PROGRAMMING

Duality, primal-dual computations, transportation model and algorithm, Assignment model, and Hungarian technique of solution, imbalance, cost maximization alternative optima in transportation and assignment method.

L = 45  T = 15  Total = 60

REFERENCE


CH 241 COMPUTER APPLICATIONS IN CHEMICAL ENGINEERING

1. INTRODUCTION

Review on Programming languages, Basic, Fortran, Review on operating system commands.

2. SPREAD SHEETS

Application in Density, molecular weight, mole and percentage compositions, Empirical and Molecular formula calculations, Heat of mixture, Gas laws, Vapour pressure, Chemical Kinetics calculations.

3. SPREAD SHEETS (DATA ANALYSIS)

Application in data processing, Statistical analysis of data, Regression Analysis of variance, interpolation, Graphical representations.

4. DATABASE

Design and developments of simple databases on Chemical and Physical properties of substances. Retrieval and Databases in report, query and other formats. Interfacing with other software.

5. MATHEMATICAL PROGRAMMING

Linear Programming, Transportation, Assignment, Dynamic Programming in Chemical Engineering, Formulation and solution through PC based programs.

REFERENCE:


CH 242 PHYSICAL CHEMISTRY

1. ELECTROCHEMISTRY


2. CHEMICAL KINETICS

### PHASE RULE
Definition – Derivation – Application of phase rule to water system – Thermal Analysis – Cooling curves – Two Component system – Eutectic and compound formation.

### ADSORPTION AND CATALYSIS
Physical and chemical adsorption – Types of adsorption isotherm, BET method, Gibbs equation, Homogeneous catalysis – Heterogeneous catalysis, acid – base catalysis, Enzyme catalysis – Applications of catalysts in industries.

### COLLOIDS

### PHOTOCHEMISTRY
Laws of Photochemistry, Quantum efficiency, Photochemical reactions, Actinometry, Kinetics and mechanism of Hydrogen – Bromine reaction.

### REFERENCES

### NATURE OF MATERIALS
Micro and macro structures, properties and definitions; mechanical, thermal, chemical, electrical and magnetic properties, processing of metals and alloys – casting – hot and cold rolling – extrusion – forging – deep drawing – plastic deformation of metal, single crystals and polycrystalline metals – recovery and recrystallization of plastically deformed metals.

### FERROUS METALS
Pure iron; cast iron; mild steel, stainless steels, special steels and alloys; high temperature steels; iron – iron carbide phase diagram: heat treatment of plain – carbon steels. Manufacture, properties and application in chemical industries.

### NON-FERROUS METALS
Lead, tin and magnesium; manufacturing methods, properties and application in process industries.

### NON-METALS

#### POLYMERIC MATERIALS

#### COMPOSITE MATERIALS
III. CERAMIC MATERIALS

Ceramic crystal and silicate structures processing of ceramics – properties – glasses – enamels.

4. INORGANIC MATERIALS

Manufacture of cement and its properties; special cement; cement concrete; reinforced and prestressed concrete; their properties and applications; mixing and curing.

5. CORROSION

Definition and scope; basic theories and mechanism of corrosion; types of corrosion; application of corrosion theories in equipment design and fabrication – anti – corrosion methods.

6. COATINGS

Organic paints and coatings; metal coatings; ceramic coatings; lining.

7. SELECTION OF MATERIALS

General criteria for selection of materials of construction in process industries.

L = 45 Total = 45

REFERENCES

4. Bhattacharya, B.C., Selection of Material and Fabrication for Chemical Process Equipment (Question Based) IEEEEC, I.I.T., Madras.

CH 244 CHEMICAL PROCESS INDUSTRIES

1. INTRODUCTION

Chemical processing, the role of a chemical engineers in process industries importance of block diagrams and flow charts, unit operations, unit processes, process utility and economics, industrial safety and pollution, outline plant and equipment design, process control and instrumentation;

2. WATER IN INDUSTRY

Role of water treatment methods for industrial and domestic use, recovery of waste water, water conditioning.

3. INDUSTRIAL GASES

Synthetic gas, natural gas, carbon dioxide sulphur-di-oxide, acetylene, helium and argon, hydrogen, oxygen, nitrogen.

4. MARINE CHEMICALS

Sodium chloride, by-products of common salt industry, value added product.

5. CHLORO-ALKALI INDUSTRIES

Soda ash and sodium bicarbonate, Chlorine and caustic soda; bleaching powder and related bleaching agents, hydrochloric acid.

6. SULPHUR AND SULPHURIC ACID INDUSTRIES

Mining and manufacturing of Sulphur, recovery of sulphur from polluting gases, sulphur trioxide and sulphuric acid.

7. PHOSPHORUS INDUSTRIES

Phosphate rock, beneficiation, phosphoric acid-phosphate.
8. NITROGEN INDUSTRIES
Synthesis ammonia and nitric acid.

9. FERTILISER INDUSTRIES
Growth elements, function, nitrogenous fertilisers ammonium sulphate, ammonium nitrate and urea phosphatic fertilisers, single and triple super phosphate, ammonium phosphate, nitro phosphate, potassic fertilisers, potassium chloride, potassium nitrate and phosphate, compound fertilisers and bio-fertilisers.

10. AGROCHEMICAL INDUSTRIES
Insecticides, pesticides, herbicides, plant nutrients and regulators.

11. NUCLEAR INDUSTRIES
Production of uranium, thorium and zirconium from ores and minerals, separation of isotopes, waste disposal.

12. ELECTROLYTIC AND ELECTROTHERMAL INDUSTRIES
Explosives, types and characteristics, industrial and military explosives, propellants for rockets.

13. EXPLOSIVES AND PROPELLANTS INDUSTRIES
Paints, pigments, varnishes, lacquers, industrial and marine coatings.

14. SURFACE COATING INDUSTRIES
Paints, pigments, varnishes, lacquers, industrial, and marine coatings.

15. PHOTOGRAPHIC CHEMICALS
Photographic chemicals, manufacture of films, plates and papers, recovery.

L = 45 Total = 45

REFERENCE

CH 245 INSTRUMENTAL METHODS OF ANALYSIS

1. INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS

ELECTROMAGNETIC RADIATION: Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, absorbance & transmittance and their relationship. Permitted energy levels for the electrons of an atom and simple molecules, Classification of instrumental methods based on physical properties.

QUANTITATIVE SPECTROSCOPY: Beer – Lambert's law, Limitations, Deviations (Real, Chemical, instrumental), Nesslerimetry, Diboschq colourimetry, Estimation of inorganic ions such as Fe, Ni and estimation of Nitrile using Beer – Lambert's Law.

2. MOLECULAR SPECTROSCOPY
Various electronic transitions in organic and inorganic compounds effected by UV, Visible and infra red radiations. Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Woodward-Fischer rules for the calculation of absorption maxima (dienes and carbonyl compounds), Effects of auxochromes and effects of conjugation on the absorption maxima, Instrumentation for UV, VISIBLE and
IR spectroscopies (Source, Optical parts and Detectors), Multicomponent analysis, Photometric titration (Experimental set-up and various types of titrations), Applications of UV, VISIBLE AND IR spectroscopies.

3. **ATOMIC SPECTROSCOPY**


4. **POLARIMETRY AND REFRACTOMETRY**

Principle, Instrumentation and Applications

5. **ELECTROMETRIC METHODS OF ANALYSIS**

Introduction to electrometric methods, difference between redox and acid–base reactions, types of cells, schematic representation of cells, single electrode potential, laboratory reference electrodes (Standard hydrogen, saturated calomel, Ag–AgCl and inert electrodes), ion-selective electrodes. Potentiometry: Nernst equation, experimental set-up and measurement of pH; Conductometry-Measurement of conductance, experimental set-up and various titrations (strong and weak acid/base).

6. **XRD ANALYSIS**

Introduction, Mosley’s law. Different emission and diffraction methods, various X-ray detectors.

7. **THERMAL METHODS**

Thermogravimetry: Instrumentation, factors affecting the shapes of thermograms, applications, thermograms of some important compounds (CuSO₄·5H₂O, CaC₂O₄·2H₂O etc).

Differential thermal analysis: Principle, Instrumentation and applications, differences between DSC and DTA. Applications of DSC (Inorganic and Polymer samples).

8. **CHROMATOGRAPHIC METHODS**

Classification of chromatographic methods, Column, Thin layer, Paper, Gas, High Performance Liquid Chromatographical methods (Principle, mode of separation and Technique). Separation of organic compounds by column and Thin layer, mixture of Cu, Co and Ni by Paper, separation of amino acids by paper, estimation of organic compounds by GC and HPLC.

**REFERENCE**

7. Sharma, B.K., Instrumental Methods of Analysis, Goel publishing House, 1995
LIST OF EXPERIMENTS

1. Identification of organic compounds (Aliphatic or aromatic saturated or unsaturated)
2. Characteristic reaction of functional groups (aldehydes, ketones, acids, phenols, nitro compounds, amino compounds, and amides).
3. Characterisation of unknown organic compounds by their functional groups and confirmation of their derivatives.

4. Organic estimation:
   (a) Phenol
   (b) Glucose

5. Organic preparations:
   a) Oxidation of benzaldehyde to benzoic acid
   b) Hydrolysis of ethyl benzoate to benzoic acid
   c) Acetylation of aniline to acetanilide
   d) Nitrlation of nitrobenzene to meta dinitro benzene.

REFERENCE


CH 245 TECHNICAL ANALYSIS LAB I

1. Cement Analysis (Standard method)
   Silica content

CH 246 ORGANIC CHEMISTRY LABORATORY

Mixed Oxide content
Calcium oxide content
2. Estimation of sulphur in coal (Gravimetry)
3. Estimation of glyceral
4. Polarimetry
   Estimation of glucose/sucrose
5. Potentiometry
   Determination of zinc with Ferrocyanide
   Estimation of Iron
6. pHmetry
   Acid-Base titration
7. Demonstration experiments
   UV
   TGA/DSC
   GC

L = 60, Total = 60

SEMESTER V

MA 037 SPECIAL FUNCTIONS, DIFFERENCE EQUATIONS AND Z TRANSFORM 3 1 0 4

Improper integrals - Gamma and Beta functions, Series solutions - Ordinary point, regular singular point of second order linear ordinary differential equation, series solution to a second order linear ordinary differential equation about an ordinary point and a regular singular point.

BESSEL FUNCTIONS 9

Bessel's equation, Bessel functions, recurrence relations, orthogonality property, generating function, equations reducible to Bessel's equation, modified Bessel functions. Applications to boundary value problems.
LEGENDRE POLYNOMIALS

Legendre's equation, Legendre Polynomials, Rodrigue's formula generating function, recurrence relations, orthogonality property. Applications to boundary value problems.

HERMITE AND LAGUERRE POLYNOMIALS

Hermite and Laguerre equations and their solutions - Polynomials, Rodrigue's formula, generating functions, recurrence relations, orthogonality property.

DIFFERENCE EQUATIONS AND Z TRANSFORM

Linear difference equation with constant coefficients, elementary properties of z transform applications of z transform, application of z transform to difference equations.

L = 45  T = 15  Total = 60

REFERENCE

6. **COMPRESSION OF FLUIDS**

Thermodynamic aspects of compression process, classification of compression processes, basic equation for change of state of gases, the work expression for different situations, the effect of clearance volume, multistage compression, convergent divergent flow. Ejectors.

L = 45  Total = 45

**REFERENCE**


**CH 332 CHEMICAL PROCESS CALCULATIONS**  3 0 0 3

1. **UNITS AND DIMENSIONS**  4

Basic and derived units, use of model units in calculations, Methods of expression, compositions of mixture and solutions.

2. **GAS CALCULATIONS**  8

Ideal and real gas laws, Gas constant calculations of pressure, volume and temperature using ideal gas law, use of partial pressure and pure component volume in gas calculations, application of real gas relationship in gas calculation.

L = 45  Total = 45

3. **MATERIAL BALANCE**  8

Stoichiometric principles, Application of material balance to unit operations like distillation, evaporation, crystallisation, drying etc., material balance with chemical reaction, limiting and excess reactants, recycle, by pass and purging.

4. **HUMIDITY AND SATURATION**  4

Calculation of absolute humidity, molar humidity, relative humidity and percentage humidity, use of humidity in condensation and drying, humidity chart, dew point.

5. **FUELS AND COMBUSTION**  4

Determination of Ores of analysis of products of combustion of solid, liquid and gas fuels, calculation of excess air from ores technique, problems on sulphur and sulphur burning compounds.

6. **THERMO PHYSICS**  6

Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy.

7. **THERMOCHEMISTRY**  6

Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heats of reaction, effect of pressure and temperature on heat of reaction, energy balance for systems with and without chemical reaction.

8. **UNSTEADY STATE MATERIAL AND ENERGY BALANCES**  5

Problems on unsteady state material and energy balances.
REFERENCE

CH 333 FLUID MECHANICS

1. INTRODUCTION

The concept of fluid, the fluid as a continuum, laws of dimensional homogeneity, properties of velocity field, thermodynamic properties of a fluid, viscosity and other secondary properties, basic flow analysis techniques, flow patterns.

2. PRESSURE DISTRIBUTION IN A FLUID

Pressure and pressure gradient, equilibrium of fluid element, hydrostatic pressure distributions applications to manometry, hydrostatic forces on planed and curved submerged surfaces, laws of buoyancy and stability considerations for bodies in floatation.

3. INTEGRAL RELATIONS FOR A CONTROL VOLUME

Basic laws of fluid mechanics, concept of system and control volume concept, the Reynold's transport theorem, continuity equation, the linear momentum equation, the angular momentum theorem, steady flow energy equation, friction less flow, Bernoulli equation, relation between the Bernoulli and steady flow energy equation.

4. DIFFERENTIAL RELATIONS FOR A FLUID PARTICLE

The acceleration field of a fluid, the differential of conservation of mass, the differential equation of linear momentum, the Euler's and Navier-Stoke's equations, differential equation of energy, boundary conditions for the basic equations, the stream function, vorticity and irrotationality.

5. DIMENSIONAL ANALYSIS AND SIMILITUDE

The principle of dimensional homogeneity, the Pi-theorem, non-dimensional action of the basic equations, similitude, relationship between dimensional analysis and similitude, use of dimensional analysis for scale up studies.

6. VISCOS FLOW IN DUCTS AND BOUNDARY LAYER FLOW

Reynolds number regimes, internal versus external viscous flow, flow in circular pipe and head loss, minor losses in pipe systems, multiple-pipe systems, boundary layer concepts, functions and pressure drag, flow through fixed and fluidised beds.

7. FLOW MEASUREMENT AND TURBO MACHINERY

Constant and variable headmeters, classification of turbo machines, pumps performance curves and similitude, mixed and axial pumps, matching pumps to system characteristics, compressors and its efficiency.

8. COMPRESSIBLE FLOW

Adiabatic and isentropic flow with the area changes, shock waves, operation of convergence and divergence nozzles, compressible duct flow with friction.

9. COMPUTATIONAL FLUID MECHANICS

Introduction, numerical operations for differentiation and integration, fluid flow problems represented by partial differential equation.

L = 45  Total = 45
REFERENCE

CH 334 CHEMICAL PROCESS INDUSTRIES II

1. WOOD-DERIVED CHEMICALS, PULP AND PAPER INDUSTRIES
   Hardwood distillation and extraction products saccharification of wood, cellulose derivatives, pulp, paper and boards.

2. SUGAR AND STARCH INDUSTRIES
   Raw and refined sugar, by products of sugar industries, Starch and starch derivatives.

3. OILS, FATS, SOAPS AND DETERGENT INDUSTRIES
   Vegetable oils and animal fats, their nature, analysis and extraction methods, hydrogenation of oils, fatty acids and alcohols, waxes, soaps, synthetic detergents.

4. COAL CHEMICAL INDUSTRIES
   Destructive distillation of coal and coal tar products, coal chemicals.

5. PETROLEUM AND PETROCHEMICAL INDUSTRIES
   Petroleum refining, physical and chemical conversion products, lubricating oils, petrochemical precursors, methane, olefins, acetylenes and aromatics and products obtained from them by various unit processes.

6. PLASTICS RUBBER AND LEATHER INDUSTRIES
   Raw materials, classification of polymers, synthetic II polymers, polyethylene, polypropylene, PVC, polystyrene, ABS, teflon, formaldehyde and epoxyresins, polyesters and silicones, rubber, natural rubber, synthetic rubber monomers, SBR, polybutadiene, polyisoprene, polychloroprene, acrylic and silicone rubber, reclaiming of rubber, compounding of rubber, leather tanning and finishing.

7. SYNTHETIC FIBRE AND FILM INDUSTRIES
   Viscose rayon, cuprammonium and cellulose acetate, nylons, polyesters, acrylics, monoacrylics polypropylene.

8. DYES AND INTERMEDIATE INDUSTRIES
   Raw materials, important unit process, various types of dye intermediates and dyes.

9. DRUGS AND PHARMACUTICAL INDUSTRIES
   Raw materials, classification, basic drugs by simple and complex unit processes, formulated products.

10. FOOD AND FOOD BYPRODUCT INDUSTRIES
    Types of foods, food additive products, food processing and preservation methods, food by products.

\[ L = 45 \quad \text{Total} = 45 \]
5. MIXING AND AGITATION

Equipment for blending and kneading, dispersion, power for agitation, correlations.

6. STORAGE AND CONVEYING OF SOLIDS

Conveyors, elevators, pneumatic conveying. Different methods for storage of solids.

REFERENCES


CH 336 TECHNICAL ANALYSIS LABORATORY II  0 0 4 2

LIST OF EXPERIMENTS

1. Oil Analysis:
   Acid value
   Saponification value
   Iodine value

2. Soap Analysis:
   Alkalai content
   Fatty acid content of soap

3. Estimation of purity of glycerol:
   Dichromatic method

4. Analysis of water:
   Determination chlorine demand in water
   Estimation of residual chlorine in water
   Volumetric method

5. Conductometry:
   Titrination of a completely ionised acid

6. Colourometry:
   Estimation of Nickel by Spectrometry
3. NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation with interpolation polynomials. Numerical integration by Trapezoidal rule, Simpson's rule, Romberg's rule, two point Gauss formula and three point Gauss formula, Double integrals using Trapezoidal and Simpson's rule.

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS


5. BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation and wave equation and two dimensional Laplace and Poisson equations.

REFERENCE

1. PROPERTIES OF SOLUTIONS
Partial molar properties, ideal and non-ideal solutions, standard states definition and choice, Gibbs-Duhem equation, excess properties of mixtures.

2. PHASE EQUILIBRIA
Criteria for equilibrium between phases in multi component non-reacting systems in terms of chemical potential and fugacity, application of phase rule, vapour-liquid equilibrium, phase diagrams for homogeneous systems and for systems with a miscibility gap, effect of temperature and pressure on azotrope composition, liquid - liquid equilibrium, ternary liquid - liquid equilibrium.

3. CORRELATION AND PREDICTION OF PHASE EQUILIBRIA
Activity coefficient-composition models, thermodynamic consistency of phase equilibria, application of the correlation and prediction of phase equilibria in systems of engineering interest particularly to distillation and liquid extraction processes.

4. CHEMICAL REACTION EQUILIBRIA
Definition of standard state, standard free energy change and reaction equilibrium constant, evaluation of reaction equilibrium constant, prediction of free energy data, equilibria in chemical reactors, calculation of equilibrium compositions for homogeneous chemical reactors, thermodynamic analysis of simultaneous reactions.

5. REFRIGERATION

REFERENCE
5. REACTOR STABILITY
Criteria for stability of reactors, limit cycles and oscillating reaction, parameter sensitivity.

6. REACTION EQUILIBRIA
Equilibrium in chemically reactive systems, evaluation of reaction equilibrium constant, effect of temperature on equilibrium, application to system involving gaseous components, computation of equilibrium composition.

REFERENCE

CH 340 MASS TRANSFER I
3. DIFFUSION
Molecular and eddy diffusion in gases and liquids, steady state diffusion under stagnant and laminar flow conditions. Diffusivity measurement and prediction, multicomponent diffusion, diffusion in solids and its applications.

2. MASS TRANSFER COEFFICIENTS
Concept of mass transfer coefficients, mass transfer under laminar and turbulent flow past solids, boundary layers, mass transfer at fluids surfaces correlation of mass transfer coefficients, JD, NTU and NTU concepts, theories of mass transfer and their applications, interphase mass transfer and over all mass transfer coefficients in binary and multicomponent systems, application to gas-liquid and liquid-liquid systems.

3. HUMIDIFICATION AND AIR CONDITIONING
Basic concepts, psychrometric chart construction, humidification and dehumidification operations, design calculations, cooling tower principle and operation, types of equipment, design calculation.

4. DRYING
Theory and mechanism of drying, drying characteristics of materials, batch and continuous drying, calculation for continuous drying, drying equipment, design and performance of various drying equipments.

5. CRYSTALLISATION
Nuclei formation and crystal growth, theory of crystallisation, growth coefficients and the factors affecting these in crystallisation, batch and continuous industrial crystallisers, principle of design of equipment.

REFERENCE

CH 341 HEAT TRANSFER I
1. BASIC PRINCIPLES
Importance of heat transfer in Chemical Engineering operations, Modes of heat transfer, Mean temperature difference.
2. **CONDUCTION**

Concept of heat conduction, Fourier’s law of heat conduction, one dimensional steady state heat conduction equation for flat plate, hollow cylinder, hollow sphere heat conduction through a series of resistances, analogy between flow of heat and flow of electricity, thermal conductivity measurement, effect of temperature on thermal conductivity, conduction through liquids.

3. **FILM COEFFICIENTS AND THEIR APPLICATION**

Individual and overall heat transfer coefficients and the relationship between them, conduction with heat source, two dimensional steady conduction, analytical and graphical methods, transient heat conduction.

4. **CONVECTION**

Concept of heat transfer by convection, natural and forced convection, application of dimensional analysis for convection, equations for forced convection under laminar, transition and turbulent conditions, equations for natural convection, heat transfer from condensing vapours, heat transfer to boiling liquids, influence of boundary layer on heat transfer, heat transfer to molten metals, heat transfer in packed and fluidised beds.

5. **HEAT EXCHANGERS**

Parallel and counter flow heat exchangers, log mean temperature difference, single pass and multipass heat exchangers, plate heat exchangers, use of correction factor charts, heat exchangers effectiveness, number of transfer unit chart for different configurations, fouling factors and Wilson’s plot, various types of heat exchangers design, design of furnaces, design of condensers, effect of non-condensibles design of tubular reactors.

6. **RADIATION**

Concept of thermal radiations, Black body concept-Stefan Boltzmann’s law, concept of grey body, radiation between surfaces, radiation from gases, luminous flames, radiation error in temperature measurement, tubular furnaces and applications.
function for controllers and final control element, principles of pneumatic and electronic controllers, transportation lag, transient response of closed-loop control systems and their stability.

UNIT-3
Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram, stability criterion, Nyquist diagram, Tuning of controller settings.

UNIT-4
Controller mechanism, introduction to advanced control systems, cascade control, feed forward control, control of distillation towers and heat exchangers, introduction to microprocessors and computer control of chemical processes.

UNIT-5
Principles of measurements and classification of process control instruments, measurements of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity and consistency, pH, concentration, electrical and thermal conductivity, humidity of gases, composition by physical and chemical properties and spectroscopy.

REFERENCE
SEMESTER VII

CH 431 PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT

PART A

1. PRINCIPLES OF MANAGEMENT AND ORGANISATION
Planning, organisation, staffing, coordination, directing, controlling, communicating, organisation as a process and a structure; types of organisations.

2. PRODUCTION AND MANAGEMENT
Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning, routing, scheduling; despatching; costs and costs control, inventory and inventory control.

3. QUALITY AND QUALITY CONTROL
Elements of quality control, role of control charts in production and quality control.

PART B

1. ENGINEERING ECONOMICS FOR PROCESS ENGINEERS

2. INTEREST, INVESTMENT COSTS AND COST ESTIMATION
Time value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital; invested capital and profitability.

3. PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT
Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

4. ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE
Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

5. ECONOMIC BALANCE
Different unit operations with single and multiple variables.

REFERENCE


1. NON-IDEAL REACTORS

The residence time distribution as a factor performance; residence time functions and relationship between them in reactor; basic models for non-ideal flow; conversion in non-ideal reactors.

2. HETEROGENEOUS PROCESS AND SOLID CATALYSIS

Rate equations for heterogeneous reactions nature of catalysis, adsorption isothermal and rates of adsorption desorption and surface reaction analysis of rate equation and rate controlling steps; surface area and pore-volume distribution; catalyst preparation.

3. GAS-SOLID CATALYTIC REACTORS

Diffusion within catalyst particle effective thermal conductivity mass and heat transfer within catalyst pellets; effective factors; Thiele Modulus, fixed-bed reactors.

4. GAS-SOLID NON-CATALYTIC REACTORS

Models for explaining the kinetics; volume and surface models; controlling resistances and rate controlling steps; time for complete conversion for single and mixed sizes, fluidised and static reactors.

5. GAS-LIQUID REACTIONS

Absorption combined with chemical reactions; mass transfer coefficients and kinetic constants; application of film penetration and surface renewal theories; Hatta number and enhancement factor for first order reaction tower reactor design.

L = 30  T = 15  Total = 45

REFERENCE


1. ABSORPTION

Equilibrium and operating line concept in absorption calculations; types of contactors; design of packed and plate type absorbers; Operating characteristics of stagewise and differential contactors; concepts of NTU, HTU and overall volumetric mass transfer coefficient; multicomponent absorption; mechanism and model of absorption with chemical reaction; thermal effects in absorption process.

2. DISTILLATION

Vapour-liquid equilibria, Raoult’s law and deviations from ideality; methods of distillation; fractionation of binary and multicomponent system; design calculations by McCabe-Thiele and Ponchon-Savarit methods; continuous contact distillation tower (packed tower) design; extractive and azeotropic distillation; low pressure distillation; steam distillation.

3. LIQUID-LIQUID EXTRACTION

Equilibrium in ternary systems; equilibrium stagewise contact calculations for batch and continuous extractors; differential contact extraction equipment; spray, packed and mechanically agitated contactors and their design calculations; pulsed extractors, centrifugal extractors.
4. SOLID-LIQUID EXTRACTION (LEACHING)  
Solid-liquid equilibria; leaching equipment-batch and continuous types; calculation of number of stages.

5. ADSORPTION AND ION EXCHANGE  
Theories of adsorption of gases and liquids; industrial adsorbents, adsorption equipment for batch and continuous operation; design calculation of ion-exchange resins; principle of ion-exchange; industrial equipment.

6. MISCELLANEOUS SEPARATION PROCESSES  
Membrane separation process; solid and liquid membranes; concept of osmosis; reverse osmosis; electrodialysis; their applications; foam separation process; thermal and sweep diffusion process.

REFERENCE

CH 424 TRANSPORT PHENOMENA  
1. PHILOSOPHY AND FUNDAMENTALS OF TRANSPORT PHENOMENA  
Importance of transport phenomena; analogous nature of transfer process; basic concepts, conservation laws; continuous concept, field, reference frames, substantial derivative and boundary conditions; methods of analysis; differential, integral and experimental methods.

2. TRANSPORT BY MOLECULAR MOTION  
Phenomenological laws of transport properties newtonian and non newtonian fluids; rheological models; theories of transport properties of gases and liquids; effect of pressure and temperature.

3. ONE DIMENSIONAL TRANSPORT IN LAMINAR FLOW (SHELL BALANCE)  
General method of shell balance approach to transfer problems; Choosing the shape of the shell; most common boundary conditions; momentum flux and velocity distribution for flow of Newtonian and non-Newtonian fluids in pipes for flow of Newtonian fluids in planes, slits and annulus heat flux and temperature distribution for heat sources such as electrical, nuclear viscous and chemical; forced and free convection; mass flux and concentration profile for diffusion in stagnant gas, systems involving reaction and forced convection.

4. EQUATIONS OF CHANGE AND THEIR APPLICATIONS  
Conservation laws and equations of change; Development of equations of continuity and energy in single multicomponent systems in rectangular co-ordinates and the forms in curvilinear co-ordinates; simplified forms of equations for special cases, solutions of momentum mass and heat transfer problems discussed under shell balance by applications of equation of change, scale factors; applications in scale-up.
5. TRANSPORT IN TURBULENT AND BOUNDARY LAYER FLOW
Turbulent phenomena: phenomenological relations for transfer fluxes; time-smoothed equations of change and their applications for turbulent flow in pipes; boundary layer theory; laminar and turbulent hydrodynamics; thermal and concentration boundary layer and their thicknesses; analysis of flow over flat surface.

6. ANALOGIES BETWEEN TRANSPORT PROCESSES
Importance of analogy; development and applications of analogies between momentum and mass transfer; Reynolds, Prandtl, Von Karman and Colburn analogies.

L = 30  T = 15  Total = 45

REFERENCE

CH 435 CHEMICAL PROCESS EQUIPMENT DESIGN - II

1. STORAGE VESSELS FOR NON-VOLATILE AND VOLATILE FLUIDS
Design of the following equipments as per ASME, ISI, TEMA codes and drawing according to scale.

2. PRESSURE VESSELS AND AUTOCLAVES
Monobloc and multilayer vessels

3. HEAT EXCHANGERS AND CONDENSERS
Double pipe, single pass and multipass exchangers, floating head, U-tube heat exchangers.

4. EVAPORATORS
Standard vertical tube evaporator, single and multiple effect evaporators, forced circulation evaporator.

5. ABSORPTION TOWER
Plate and packed towers.

6. EXTRACTION TOWER
Plate and packed towers

7. DISTILLATION TOWER
Plate and packed towers

8. DRYERS
Rotary and spray dryers

9. FILTERS
Filter presses and filtering type centrifuge.

T = 15  P = 45  Total = 60
REFERENCE

CH 436 CHEMICAL ENGINEERING LABORATORY - III 0 0 4 2

LIST OF EXPERIMENTS
1. Air heater
2. Laminar flow heat exchanger
3. Heat loss in pipes
4. Jacketed pan
5. Jacketed kettle
6. Steam jet ejector
7. Horizontal heat exchanger
8. Liquid-liquid heat exchanger
9. Film type evaporator
10. Study of step response
11. Time constant in measuring instruments. P = 60 Total = 60

CH 437 SEMINAR AND COMPREHENSION 0 0 4 2

The object of the comprehension test is to assess the overall level of proficiency and the scholastic attainment of the student in the various subjects studied during the degree course.

CH 438 PROJECT WORK 0 0 12 6

Each student is required to submit a report on the project assigned to him by the department. The report should be based on the information available in the literature or data obtained in the laboratory / industry.

CH 034 FERTILISER TECHNOLOGY 3 0 0 3

1. AN OVERVIEW 3

Role of organic manures and chemicals fertiliser, types of chemical fertiliser, growth of fertiliser industry in India; their location; energy consumption in various fertiliser processes; materials of various fertiliser processes; materials of consumption in fertiliser industry.

2. NITROGENOUS FERTILISER 15

Feed stock for production of ammonia-natural gas, associated gas, coke oven gas, naphtha, fuel oil, petroleum heavy stock, coal, electricity etc; processes for gasification and methods of production of ammonia and nitric acid; nitrogenous fertiliser-ammonium sulphate, nitrate, urea and calcium ammonium nitrate; ammonium chloride and their methods of production, characteristics and specifications, storage and handling.

3. PHOSPHATIC FERTILISERS 9

Raw materials; phosphate rock, sulphur, pyrites etc., processes for the production of sulphuric and phosphoric acids; phosphates fertilisers - ground rock phosphate; bone meal-superphosphate, triple superphosphate, thermal phosphates and their methods of production, characteristics and specifications.

4. POTASSIC FERTILISER 5

Methods of production of potassium chloride, potassium saponite, their characteristics and specifications.
5. COMPLEX AND NPK FERTILISERS

Methods of production of ammonium phosphate, sulphate, diammonium phosphate, nitrogenates, urea, ammonium phosphate, mono-ammonium phosphate and various grades of NPK fertilisers produced in the country.

6. MISCELLANEOUS FERTILISER

Mixed fertiliser and granulated mixtures; biofertilisers, nutrients, secondary nutrients and micro nutrients; fluid fertilisers, controlled release fertilisers.

7. POLLUTION FROM FERTILISER INDUSTRY

Solid, liquid and gaseous pollution standards laid down for them.

L = 45
Total = 45

REFERENCE


CH035 PETROCHEMICAL TECHNOLOGY

1. IMPORTANCE AND GROWTH

Importance of petrochemical industry; Growth in India, Economics.

2. PETROCHEMICAL PRECURSORS

Principal raw materials and their sources; petrochemical precursors and their production methods - methane synthesis gas - ethane, ethylene, acetylene, propane - propylene, butane, butylene, pentane and pentenes; benzene, toluene - xylene - naphthaenes.

3. CHEMICALS FROM METHANE AND SYNTHESIS GAS

Ammonia, oxo products - methanol, formaldehyde, chlorinated methanes; carbon-di-sulphide; hydrogen cyanide.

4. CHEMICALS FROM ETHANE, ETHYLENE AND ACETYLENE

Synthetic ethanol; acetaldehyde dehyde and acetic acid; vinyl acetate; butyraldehyde; 2-ethyl hexanol and dop; ethylene oxide; ethylene glycols; acrylonitrile; polyethers; ethanolamines; ethylchloride; ethylene dichloride; vinyl chloride; ethylbenzene; styrene.

5. CHEMICALS FROM PROPANE AND PROPYLENE

Isopropane, acetone; glycerol; propyleneoxide; propylene glycols; polyethers, acetylchloride; epichlorhydrin, isopropene, cumene.
6. CHEMICALS FROM BUTENES, BUTENES, PENTANES AND PENTENES

Butadiene; butane epoxides and butaneamines butanol; butyl acetate; methyl ethyl ketone; isoprene; amy alcohol.

7. CHEMICALS FROM AROMATICS

Mono-chloro and dichlorobenzene; BHC; nitrobenzene; phenol; aniline; diphenyl benzene; benzaldehyde; benzonic acid; nitrobenzene; toluene diamines and toluene disocyanate; phthalic anhydride; isophthalic acid; terephthalic acid and dimethyldithythalic malonic anhydride; caprolactum; adipic acid; hexamethylene, diamine.

REFERENCE


CH 036 DRUGS AND PHARMACEUTICAL TECHNOLOGY

1. INTRODUCTION

Development of drugs and pharmaceutical industry; organic therapeutic agents uses and economics.

2. DRUG METABOLISM AND PHARMACO KINETICS

Drug metabolism; physicochemical principles; radio activity; pharma kinetics-action of drugs on human bodies.

3. IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS

Chemical conversion processes; alkylation; carboxylation; condensation and cyclisation; dehydration, esterification, halogenation; oxidation, sulfonation; complex chemical conversions fermentation.

4. MANUFACTURING PRINCIPLES

Compressed tablets; wet granulation; dry granulation or slugging; direct compression; tablet presses formulation; coating pills; capsules sustained action dosage forms; parenteral solutions, oral liquids; injections; ointments; standard of hygiene and manufacturing practice.

5. PHARMACEUTICAL PRODUCTS

Vitamins; cold remedies; laxatives; analgesics; nonsteroidal contraceptives; external antiseptics; antacids and others.

6. MICROBIOLOGICAL AND ANIMAL PRODUCTS

Antibiotics; biologicals; hormones; vitamins; preservation.

7. PHARMACEUTICAL ANALYSIS

Analytical methods and tests for various drugs and pharmaceuticals.

8. PACKING AND QUALITY CONTROL

Packing; packing techniques; quality control.

REFERENCE


CH 037 POLYMER AND PLASTIC TECHNOLOGY 3 0 0 3

1. INTRODUCTION TO POLYMERS

Monomer; functionality and degree of polymerisation; polymers and their classification; polymer coatings: adhesive rubber; plastic and fibres: distinction; polymeric reaction; addition; condensation and copolymerisation.

Methods of polymerisation: bulk, solution emulsion and suspension polymerisations; structure of polymers linear, branched and cross linked; characterization of polymers; molecular weight, crystallinity, glass transition and mechanical properties, testing of polymers; destructive and non-destructive methods.

2. PROCESSING OF PLASTICS

Processing additives; fillers, plasticisers; anti-oxidants; colourants; stabilisers and other related additives. Injection; compression transfer and moulding methods calendaring; extrusion; thermo forming; powder coating.

3. POLYMERIC MATERIALS

Polyethylene; poly propylene; polystyrene, polymethyl methacrylate; polyvinyl chloride; polytetra fluoro ethylene; polyacrylate; nylon 6, nylon 6,6 and polyesters; Phenol formaldehyde urea formaldehyde and melamine formaldehyde; epoxy; urethanes and silicones.

4. SPECIAL POLYMERS

Polycarbonates; poly sulphones; aromatic polyamides; aromatic polyester; photo conductive, piezoelectric and ion exchange polymers.

5. NATURAL POLYMERS

Wool, silk and cellulose derivatives.

Total = 45

REFERENCE


CH 038 FOOD TECHNOLOGY 3 0 0 3

1. AN OVERVIEW

General aspects of food industry; world food needs and Indian situation.

2. FOOD CONSTITUENTS, QUALITY AND DERIVATIVE FACTORS

Constituents of food; quality and nutritive aspects; food additives; standards; deteriorative factors and their control.

3. GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS

Preliminary processing methods; conversion and preservation operators.

4. FOOD PRESERVATION METHODS

Preservation by heat and cold; dehydration; concentration; drying; irradiation; microwave heating; sterilisation and pasteurisation; fermentation and picking; packing methods.
5. **PRODUCTION AND UTILISATION OF FOOD PRODUCTS**

Cereal grains; pulses; vegetables; fruits; spices; fats and oils; bakery; confectionery and chocolate products; soft and alcoholic beverages; dairy products; meat; poultry and fish products.

**REFERENCE**


**CH 039 SURFACE COATING TECHNOLOGY**

1. **PREPARATION OF PIGMENTS; WHITE PIGMENTS**

Red pigments; orange and yellow pigments; green, blue and black pigments.

2. **DRYING OILS AND DRIERS; SOLVENTS AND PLASTICISERS**

Resins, gums; waxes and bitumens; varnishes and lacquers; paints and enamels; cellulose ester products; synthetic resins and finishes; paint chemistry.

Paints plant; varnish plant; manufacture operation; factory cost accounting; research, development and control; fire protection; safety and health.

**REFERENCE**


**CH 040 ELECTROCHEMICAL ENGINEERING**

1. **BASICS OF ELECTROCHEMISTRY**

Faraday’s law; Nernst potential; galvanic cells; polarography.

2. **THE ELECTRICAL DOUBLE LAYER**

It’s role in electrochemical processes; electocapillary curve; Helmholtz layer; Gouy – Steen’s layer; fields at the interface.

3. **METAL FINISHING**

Electrodeposition; electroforming; electroforming; electropolishing; anodising; selective solar coatings.

4. **ELECTROCHEMICALS**

Inorganic; perchlorates; chlorates; permanganates; persulphates. Organic; p-Aminoguanidine bicarbonate; dialdehyde starch; calcium gluconate etc.
5. ELECTRODES USED IN DIFFERENT
ELECTROCHEMICAL INDUSTRIES

Metals; Graphite; lead dioxide; titanium substrate insoluble electrodes; iron oxide; semiconducting type etc.

6. BATTERIES

Primary and secondary batteries; Leclanche dry cell; Alkaline manganese cell; mercury cell; air polarised cell; sea-water cell; reserve electrolyte cells like Mg-Cu(Ni); Zn-PbO_{2}; Secondary cells like lead acid; Ni-Cd; Ni-Fe; AgO-Zn; AgO-Cd. Sodium Sulphur; Li-S; Fuel cells.

7. ELECTROMETALLURGY

Fused salt electrolysis for Al, Na, Mg, etc., CaC_{2}, hydrometallurgy, Zn Cu, Pb etc.

8. CORROSION

Introduction, metallic surface preparation; phosphating; inhibitors in acid media; in engine cooling systems; control measures; industrial boiler water corrosion control; protective coatings; vapour phase inhibitors; cathodic protection; sacrificial anodes; paint removers.

9. CHLORALKALI INDUSTRY

Electrodes used; membranes, electrical efficiency; modern trends.

REFERENCE

1. CONVENTIONAL CHEMICAL PROCESSES AND BIOCHEMICAL PROCESS
An overview of industrial biochemical processes with typical examples, comparing chemical and biochemical processes, development and scope of biochemical engineering as a discipline.

2. ROLE OF MICROORGANISMS
Industrially important microbial strains; their classification; structure; cellular genetics; typical examples of microbial synthesis of biografts.

3. ENZYMES AND ENZYME KINETICS
Enzyme used in industry medicine and food. their classification with typical examples of industrially important enzymes; mechanism of enzymatic reactions; michaelis-menten kinetics; enzymes inhibition; factors affecting the reaction rates; industrial production purification and immobilisation; enzyme reactors with typical examples.

4. MICROBIAL KINETICS
Typical growth characteristics of microbial cells; factors affecting growth; Monod model, modelling of batch and continuous cell growth; immobilised whole cells and their characteristics; free cell and immobilised cell reactors; typical industrial examples; transport in cells.

5. TRANSPORT IN MICROBIAL SYSTEMS
Newtonian and Non-Newtonian behaviour of broths; agitation and mixing; power consumption; gas/liquid transport in cells; transfer resistances; mass transfer coefficients and their role in scaleup of equipments; enhancement of \( \text{O}_2 \) transfer; heat transfer correlation; sterilisation cycles and typical examples of heat addition and during biological production.

6. BIOREACTORS
Batch and continuous types; immobilised whole cell and enzyme reactors; high performance bioreactors; sterile and non-sterile operations; reactors in series with and without recycle; design of reactors and scaleup with typical examples.

7. DOWNSTREAM PROCESSES AND EFFLUENT TREATMENT
Different unit operations in down streaming with special reference to membrane separations; extractive fermentation; anaerobic treatment of effluents; typical industrial examples for downstream processing and effluent disposal.

REFERENCE
3. ANALYSIS OF SOME MONITORING-DIAGNOSTIC THERAPEUTIC PROCEDURES

Introduction to biochemicals; biodynamic models and its application; cardiac assist devices; biomechanics of head injury.

4. MEDICAL INSTRUMENTATION

Amplifier constraints and specification; recording systems; electrical grounding and patient safety; transducers; electrodes for recording biopotentials.

5. ANALYSIS OF BIOELECTRICAL SIGNALS

Introduction; data acquisition; extraction of signals from noise; introduction to pattern recognition.

6. PHYSIOLOGICAL CONTROL SYSTEMS

Regulation of body temperature; recognition and control in the CV system.

7. MEDICAL PHYSICS

Rheology of blood; radiation dosimetry; neutron activation analysis; safety procedures for radiation diagnostics; ultra sound effects.

8. BIOPOLYMERS

Introduction; nature and composition of polymers used as prosthetic devices with special reference to heart valves; artificial bones; denatures; sutures etc.

9. TRANSPORT PHENOMENA IN HUMAN BIOLOGY

Introduction to renal and respiratory system; lung oxygenator and their design characteristics; artificial kidney and their design features.

10. MEDICAL ENZYMOLGY

Role of enzyme in clinical tests; their role as therapeutic agents; Role of enzyme electrodes in chemical testing; extra corporeal shunts using immobilised enzymes.

11. RECENT TRENDS IN MEDICAL FIELD

Role of computers in medical data logging and diagnosis; CAT and NMR scanning; transplants; introduction to avarion and space medicine specially drugs and their mode of action.

REFERENCE


CH 044 PROCESS AUTOMATION

1. INTRODUCTION

Principles of measurement and classification of process control instruments; temperature, pressure fluid flow, liquid level, velocity, fluid density, viscosity, conductivity etc.; instrument scaling; sensors; transmitters and control valves; instrumentation symbols and labels.

2. PROCESS AUTOMATION

Basic concepts; terminology and techniques for process control; control modes; Tuning process controllers.
3. **ADVANCED CONTROL**

Advanced control techniques; feed forward and ratio control; controller design; adaptive control system; statistical process control; expert system; multivariable control techniques; supervisory control.

4. **DIGITAL CONTROL**

Digital control techniques; Z transforms; sampling and filtering; response of discrete time systems; sampled data control systems; design of digital controllers.

5. **OPTIMAL CONTROL**

Optimisation and simulation; optimisation techniques; single and multivariable constrained optimisation; dynamic simulation of distillation columns and reactors.

L = 45  Total = 45

**REFERENCE**

simulation; introduction; discrete event and continuous simulation; dynamic simulation of reactors, distillation columns, absorbers, evaporators and crystallizers; simulation in process control.

REVIEW


CH 046 OPTIMISATION OF CHEMICAL PROCESSES 3 0 0 3

1. OPTIMISATION

Introduction; formulation of objective functions; fitting models to data; classification of functions; necessary and sufficient conditions for optimum; unimodal, multimodal functions; analytical methods; lagrange multiplier methods.

2. NUMERICAL METHODS

Unimodal functions; newton's; quasi newton; secant methods; region elimination methods; polynomial approximation; quadratic and cubic interpolation technique for optimum. Multimodal functions; direct methods; random, grid, hooke's nelder and mead methods; powell's technique; indirect methods; gradient and conjugate gradient methods; secant methods.

3. LINEAR AND NON-LINEAR PROGRAMMING 10

Review on basic concepts of LP formulations; Simplex methods; Integer, quadratic, geometric and dynamic programming.

4. APPLICATIONS

Heat transfer and energy conservation; separation processes; fluid flow systems; reactor design and operation; large scale systems.

REFERENCE


CH 047 COMPUTER AIDED DESIGN 3 0 0 3

1. GENERAL PROCESSORS

Introduction to central processors; historical approach analog register; output buffer; digital logic, CPU, ALU; Computer system architecture; I/O Remote access.
2. DATA STORAGE
Role of storage devices; main memory; backing storage; need for memory mapping; virtual addressing; paging.

3. ALPHA NUMERIC AND GRAPHIC IO
Batch and interactive processing; data input devices; data output devices; combination of I/O control devices; graphic computer terminals; graphic display; graphic terminals; graphic display; graphic terminals; plotters; printers.

4. BASIC SOFTWARE
Operating system and executive operating system; function models of operation: batch operation; time sharing; real time operation; transaction processing; file management system; logging on and off; editors; databases; graphic software.

5. PROPERTIES EVALUATION
Physical properties of compounds; thermodynamic properties of gases and binary mixtures; viscosity; vapour pressure; latent heat; bubble point and dew point calculation; phase equilibria; vapour-liquid equilibria.

6. EQUIPMENT DESIGN
Computer aided design of reactors; evaporators; absorption column; distillation column and crystallizers; heat transfer equipment; heat exchangers; furnaces etc; pumps; piping; pressure drop calculations; mass and energy balance.

7. FLOW SHEET SIMULATION
Process flow sheet simulation; process and information matrix; recycle calculation sequence; material and energy balance computation using modular approach.

8. DYNAMIC SIMULATION
Dynamic simulation of reactors; distillation column; absorbers; evaporators and crystallizers; introduction to simulation packages like GPSS, CSMP.

REFERENCE

CH 048 ENERGY MANAGEMENT IN CHEMICAL INDUSTRIES

1. ENERGY RESOURCES - A GLOBAL VIEW
Energy sources; coal oil, natural gas; nuclear energy; hydro electricity; other fossil fuels; geothermal; supply and demand; depletion of resources; need for conservation; uncertainties; national and international issues.

2. PLANNING FOR ENERGY NEEDS
Forecasting techniques; energy demand; magnitude and pattern; input and output analysis; energy modelling and optimal mix of energy sources.
3. ENERGY AND ENVIRONMENT

Energy; various forms; energy storage; structural properties of environment; bio-geo-chemical cycles; society and environment; population and technology.

4. ENERGY AND TECHNOLOGICAL SOCIETY

Energy and evolution; growth and change; patterns of consumption in developing and advanced countries; commercial generation of power requirements and benefit.

5. MANAGEMENT OF ENERGY CONSERVATION IN CHEMICAL INDUSTRIES

Chemical industries; classification; conservation in unit operation such as separation; cooling tower; drying; conservation applied to refineries, petrochemical, fertilisers, cement, pulp and paper; food industries, chloro-alkali industries; conservation using optimisation techniques.

6. ENERGY ALTERNATIVES

Sources of continuous power; wind and water; geothermal; tidal and solar power; MHD, fuel cells; hydrogen as fuel.

7. ECONOMIC BALANCE IN ENERGY CONSUMPTION

Cost analysis; capacity; production rate; system rate; system cost analysis; corporate models; production analysis and production using fuel inventories; input-output analysis; economics; tariffs.

REFERENCE


4. SAFETY PERFORMANCE

Appraisal; effective steps to implement safety procedures; periodic inspection and study of plant layout and constant maintenance; periodic advice and checking to follow safety procedures; proper selection and replacement of handling equipments; personal protective equipments.
5. ACCIDENTS

6. POLLUTION
Atmospheric pollution - chemicals and dust - toxicity toxic materials and gases - environmental pollution by effluent and industrial wastes - treatment.

7. HEALTH HAZARDS AND LEGAL ASPECTS

8. PROMOTION OF INDUSTRIAL SAFETY
Role of Government, safety organisations, management and trade unions in promoting industrial safety.

REFERENCES

TOTAL = 45

CH 059 OILS AND FATS TECHNOLOGY

1. AN OVERVIEW
General aspects of edible oils, oil seeds and fats technology; World requirement of oils and fats; Indian scenario.

2. OILS AND FATS : CONSTITUENTS
Constitution and Chemistry of oils and fats; Applications of oils and fats; Fat substitutes.

3. GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS
Recovery and Pretreatment of oils and fats; Analysis.

4. OIL REFINING
Physical treatment; Chemical Bleaching; Decolorizing; Wintering

5. HYDROGENATION
Hydrogenation of oils in general; Equipment; Catalysts; Dry & Wet reduction. The Hardening operation; Hydrogenation products.

REFERENCE
3. ROGER'S Industrial Chemistry Edited by C.C. FURNAS
CH 051 BIOCATALYTIC REACTION ENGG. & DESIGN

1. INTRODUCTIONS

Classification of Biocatalytic Reactors - Choice & Design Definition
- General Methods - Phase of Design - Modelling - Data Collection
- Mechanical Design
- Operating conditions

2. TYPES OF REACTORS & METHODS OF HANDLING BIOCATALYSTS

Biocatalystics and Biokinetics - Bioreactions & Mechanisms
- Biocatalysts and Activity - Biocatalysts preparation - Biocatalytic parameters
- Biocatalytic Loading - Biocatalysis study - Data handling - half-life

3. MASS TRANSFER AND BIOCATALYTIC REACTORS

BIOT.NO & FXTL Mass transfer - THIELE MODULUS & INTL Mass Transfer
- IMMobilisation FACTOR - Estimation of $K_M$ & Interpretation

4. REACTOR CONSIDERATION

Reactor operation & Methods - Special Applications - Choice based on kinetics and other factors - Cost Consideration

5. PROCESS DESIGN OF FIXED BED REACTOR

General Design - GLS Reactors Definition and classification
- Transport in GLS Reaction and Design considerations

6. PROCESS DESIGN OF TRICKLE REACTORS

General Procedure - Design examples - Variations

7. SUSPENDED BED REACTORS

Chemostatic Operation - Process Design of Suspended Bed units
- Fluidized Bed Kinetics

8. DESIGNING LAB REACTORS AND PILOT UNITS

Definition - Lab Reactors - Pilot Units

9. REACTIONS EFFECTS AND SAFETY

Causes of Hazard - Parameters of Biomass formation under high productivity - Bio safety - Clean Technology

10. MECHANICAL DESIGN OF REACTORS

Design for a process - Design for Temperature control - Other considerations - Mante caso costing

REFERENCES

1. INTRODUCTION

Biochemical Engineering - Bio geo Chemical Engineering - Fermentation - Bio Process

2. ENZYME KINETICS


3. IMMOBILISED ENZYME

Immobilisation - Effects on immobilised catalysts - IMTR - INTR - EFF DUFFVESIVITIES

4. INDUSTRIAL APPLICATIONS

For recovery of HIM - For Resource Recovery - Kinetics for Process - Experiments - E. Assay - Sugar Assay - Protein Assay

5. CELL CULTIVATION


6. CELL KINETICS & FERMENTER DESIGN


7. STERILISATION

Death Kinetics - Design criteria - Cont Sterilisation

8. AGITATION & AERATION

Tr. Coeff. - Interfacial Atta. Measurement - Gas HOLD UP - Power consumption - OTRATE & O2. ESTIMATION - K1 a - CORRELATIONS - Shear - Scaleup

9. BIO ACCUMULATION & PRECIPITATION OF METALS


10. PROBLEMS IN RECOVERY OF METALS WITH CHEM. ENGG APPROACH

REFERENCES


IB 020 TECHNICAL WRITING AND COMMUNICATION

1. RESEARCH AND WRITING

The project/term paper, selecting a topic, using a library, compiling a working bibliography, taking notes, plagiarism, outlining, writing drafts, guides to writing.
2. MECHANICS OF WRITING

Spelling, punctuation, numbers, titles and quotations

3. FORMAT OF A TERM/PROJECT REPORT

Typing, paper, margins, spacing, heading and title of paper, page numbers, tables and illustrations, corrections and insertions, binding.

4. PREPARATION OF CITATIONS

General guidelines, placement, arrangement, citing books, citing articles in periodicals documenting sources, what is a document, parenthetical documentation, information required in parenthetical documentation, readability, sample references.

5. ABBREVIATIONS AND REFERENCES WORDS

Introduction, time, common scholarly abbreviations and references words, publishers names, symbols and abbreviations used in proofreading and correction, literary and scientific indexing.

6. PRESENTATION THROUGH MULTIMEDIA

Total 45

TEXT BOOK


REFERENCE


GE 034 CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT

1. INTRODUCTION

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brainstorming - different techniques.

2. PROJECT SELECTION AND EVALUATION

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

3. NEW PRODUCT DEVELOPMENT

Research and new product development - Patents - patent search - Patent laws - International code for patents - Intellectual property rights (IPR)

4. NEW PRODUCT PLANNING

Design of prototype - testing - quality standards - marketing research - introducing new products.

L = 30 P = 30

1. LABORATORY


REFERENCES

5. I.R. Bala, Bulletins, TIFAC, New Delhi, 1997.

HS 034 TECHNICAL TAMIL

1. REVIEW OF BASIC GRAMMER
Sentence structure - Tense, case, gender voice and number common errors in usage and their corrections - Errors in conjunction - Spelling and traditional usage.

2. READINGS FROM TECHNICAL WRITINGS IN TAMIL
Critical study of selected passages from technical writings in Tamil (selected Articles from Kalanjiyam may be prescribed from time to time).

3. TRANSLATION FROM ENGLISH TO TAMIL
Principles of Translation - Coinage of Technical terms and exercises in Translation.

4. TAMIL AND COMPUTERS

5. CREATIVE WRITING IN TECHNICAL TAMIL
Style of Technical language, Exercises in writing technical passages in Tamil articles, description of technical matters

L + P = 60

TEXT BOOKS
1. A.K. PARANTHAMANAR, Nalla Tamil Elutha Vendura, Pari Nilayam, Chennai

REFERENCES
2. Kalanjiam, Quarterly of Anna University, Chennai (Journal articles).
4. DR. RADHA CHELLAPEN, Kalacholintakam.

HS 035 TECHNICAL GERMAN-I

1. INTRODUCTION
Special and comparative features of German with English, Hindi and Tamil - German Alphabets, pronunciation.

2. THEMA
Name, Land, Wohnung - Sudium, Beruf - Familie, Geschwieter, Alter - Tagesablauf, termine - Einladung - Stellensuche, Berufswahl - Einkauf.

3. GRAMMATIK

4. UEBUNGEN
Partner ubungen  - Sachliche Uebungen  - Aussprache Uebungen - Kontrolle ubung - Text generation.
HS 037 TECHNICAL JAPANESE I

1. Introduction to Japanese Alphabet - Hiragana, Katakana and KANJI - Group 1, 2, 3 & 4 Syllabus - Writing Practice - Pronunciation - Word Order - Greetings - Receiving a visitor and exchange of pleasantries - KANJI Practice.


3. Classification of particles - Ga, Ka, Wa, O, E, Ni, etc - aural comprehension - Reading comprehension - nouns - Wa, noun-2 desu - Demonstrative pronouns - kore, sore, are and aren - kono, sono, ano and dono - kochira, sochira, achi, and dochira - particle - No, kara, ni and de - question-itsu - conversational grammar - soo desu ka - Na, i adjectives perfect and imperfect - question words - Doo and ikiga - particle - To, ne and yo - KANJI practice.


5. Verbs ending in-te or de - classification of Te forms and Masu forms - verb modifiers - koo, soO, aa and doO - Set phrase - Onegashimasu - Sumimasen - Adverbs - KAZU: sore kara and saigo ni - formation of the - Te form of I adjective and desu - KANJI practice.
TEXT BOOKS

3. YAN-SAN Serial - Video tapes, Japan.

HS 038 TECHNICAL JAPANESE - II

1. Demonstrative Pronouns : Are - Interjection: Ee - Quoted Sentences-ornoinsu - Non polite form of verbs - Group 1 ending in-iert or iru, group 2 verbs ending in -u - Non polite forms of - I-adjectives - non polite form of desu, deshoo, daroo - Suffix - sugiru - expression of reason-tame (m) - Counters: Hon and - Do - Kanji practice.

L = 45 T = 15

TEXT BOOKS

3. YAN-SAN Serial - Video tapes, Japan.

HS 039 TECHNICAL FRENCH - I

1. Alphabets - Pronunciation - Masculine and Feminine Genders only - Numbers - Indefinite and definite articles - Plurals - Verbs to be and to have
2. Present tense - Affirmative, interrogative and negative sentences - Adjectives - Adverbs - Prepositions - Possessive Pronoun - Personnel Pronoun - Indirect Object

L = 45 T = 15
REFERENCE

HS 040 TECHNICAL FRENCH II

2. Comparative, superlative sentences - recent past - immediate future - grammatical analysis, 9
3. Translation from English to French - Translation from French to English - Texts from Physics and Chemistry, 9
4. Translation from English to French - Translation from French to English - Texts from Basic Engineering, 9

L = 45  T = 15

TEXT BOOKS

REFERENCES
1. CENTRE D'ETUDES FRANCAISES, Functional French for Scientists and Technologists, Jawaharlal Nehru University, New Delhi, 1986.

HS 041 ENGLISH I

1. LISTENING
Listening comprehension - listening for specific information - note taking - use of charts and diagrams, 7

2. SPEAKING
Defining - describing objects - describing uses/functions - comparing - offering suggestions - analysing problems and providing solutions - expressing opinions (agreement/disagreement) predicting - expressing possibility/certainty - framing questions - providing answers - pronunciation practice (word stress), 7

3. READING
Skimming - scanning - detailed reading - predicting content - interpreting charts and tables - identifying stylistic features in texts - evaluating texts - understanding discourse coherence - guessing meaning from the context - note-making/transfering information, 12

4. WRITING
Sentence definition - static description - comparison and contrast - classification of information - recommendations - highlightung problems and providing solutions - formal and informal letter writing - using flow-charts/diagrams - paragraph writing - editing, 12

5. FOCUS ON LANGUAGE
Word formation with prefixes and suffixes - discourse markers and their functions - degrees of comparison - expressions relating to recommendations and comparisons - active and passive voice - antonyms - tense forms - gerunds - condition sentences - modal verbs of probability and improbability - acronyms and abbreviations - compound nouns and adjectives - spelling - punctuation, 7

L : 45  T : 15  Total = 60
TEXT BOOK

1. "English for Engineers and Technologists", Volume I, Authors: Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH


HS 042 ENGLISH II

1. LISTENING

Listening comprehension - listening for specific information - note-taking - using non-verbal devices.

2. SPEAKING

Describing processes - stating purpose - offering opinions, suggestions and recommendations - summarising - reporting - free discussion of chosen topics - pronunciation practice (word stress, consonant clusters - homonyms).

3. READING

Skimming - scanning - note-making - understanding the organisation of texts - discourse cohesion - predicting and evaluating content - evaluating style - inferring meaning - study-reading - interpreting tables, flow-charts.

4. WRITING

Extended definition - process description - cause and effect analysis - stating choice and justifying it - safety instructions - check list - letter of application - data sheet/resume.

5. FOCUS ON LANGUAGE AND FUNCTIONS

Word formation - synonyms - prepositions - adverbs - passive voice - sequence words/discourse markers - connective adverbs - numerical expressions - expansion of abbreviations - rules for writing SI units - language of instructions, check-lists, cause and effect, purpose and means - indefinite adjectives of number and quantity - spelling and punctuation.

L : 45 T : 15 Total = 60

TEXT BOOK

1. "English for Engineers and Technologists", Orient Longman, 1990 Volume II, Authors: Humanities and Social Sciences Department, Anna University, Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH II

REGULATIONS AND SYLLABUS

(REGULATIONS 2000)

B. Tech. Degree Programme (8 Semesters)

INDUSTRIAL BIO-TECHNOLOGY

ANNA UNIVERSITY
CHENNAI - 600 025.
APRIL 2000
REGULATIONS AND SYLLABUS
(REGULATIONS 2000)

B.Tech. DEGREE PROGRAMME
(8 SEMESTERS)

INDUSTRIAL BIO-TECHNOLOGY

ANNA UNIVERSITY
CHENNAI - 600 025.
APRIL 2000
REGULATIONS 2000
Degree of Bachelor of Engineering / Technology (Eight Semesters)

(APPROVED IN THE 42ND MEETING OF THE ACADEMIC COUNCIL HELD ON 25.06.1996)

PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) “Programme” means Degree Programme, that is B.E. / B.Tech. Degree Programme

ii) “Branch” means specialisation or discipline of B.E. / B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.

iii) “Course” means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.

iv) “Faculty” means a Faculty of the University, like Faculty of Civil Engineering, Faculty of Technology, etc. Each Faculty is headed by a Dean.

ADMISSION

R1a Candidates for admission to the first semester of the eight semester B.E./B.Tech. Degree Programme shall be required to have passed

i) the Higher Secondary Examination of the (10 +2) curriculum (Academic stream) prescribed by the appropriate authority of Government of Tamil Nadu with
Mathematics, Physics and Chemistry as three of the four subjects of study prescribed under Part III. In the case of B.Tech. Industrial Bio-Technology, the subjects are Physics, Chemistry, Mathematics and/or Biology.

OR

i) any other examination of any University or authority accepted by the Syndicate of the University as equivalent thereto.

R.1b Candidates for admission through lateral entry into the third semester of the eight semester B.Tech. Degree Programme at M.I.T. Campus shall be required to have passed

ii) the examination of a B.Sc. Degree of 10 + 2 + 3 or 11 + 1 + 3 pattern of a recognised University in any one of the following B.Sc. Degree Programmes having Mathematics and Physics as subjects of study: Mathematics / Physics / Chemistry / Applied Sciences / Electronics / Instrumentation / Computer Science.

OR

any other examinations of any University or authority accepted by the Syndicate of the University as equivalent thereto.

R.1c Sponsored/deputed candidates (Diploma holders) for admission to the 1st Semester of B Semester B.E. Degree programme in Printing Technology shall be required to have passed the 3-year Diploma in Printing Technology (Letterpress/Lithography/Integrated) awarded by the State Board of Technical Education of

Government of Tamil Nadu or any other examination of any authority accepted by the Syndicate of the University as equivalent thereto. The institutions eligible to sponsor/depute the candidates and the minimum experience to be possessed by such candidates shall be as prescribed by the Syndicate of the University from time to time.

R.2a Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for plus two academic stream of the Tamil Nadu Board of Higher Secondary Education.

R.2b Notwithstanding the qualifying examination the lateral entry candidate might have passed, the candidate shall also write an entrance examination for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics, Chemistry, Applied Sciences, Electronics, Instrumentation and Computer Science at B.Sc. Degree level.

R.2c Sponsored/deputed candidates satisfying Rule 1c shall also write the entrance examination as per Rule 2a.

R.3. The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Syndicate of the University from time to time.

R.4a The candidate shall not have completed 21 years of age as on first of July of the year of application. In the case of lateral entry, the candidate shall not have completed
22 years of age as on 1st July of the year of application. 
For candidates belonging to SC/ST, the age limit is 
relaxable by 3 years.

R.4b There is no age limit for sponsored/deputed candidates 
satisfying Rule 1c, seeking admission to B.E. Printing 
Technology.

BRANCHES OF STUDY AND STRUCTURE OF THE 
PROGRAMME

R.5a Regulations 2000 is applicable to B.E./B.Tech. Degree 
Programme in various branches of Engineering and 
Technology, each distributed over 8 semesters with 2 
semesters per Academic Year.

Faculty of Civil Engineering
1. B.E. Civil Engineering 
2. B.E. Geo-Informatics.

Faculty of Electrical Engineering
1. B.E. Computer Science and Engineering 
2. B.E. Electrical and Electronics Engineering 
3. B.E. Electronics and Communications Engineering.

Faculty of Engineering (MIT)
1. B.Tech. Aeronautical Engineering 
2. B.Tech. Automobile Engineering 
3. B.Tech. Electronics Engineering 
4. B.Tech. Instrumentation Engineering 
5. B.Tech. Production Engineering 
6. B.Tech. Rubber and Plastics Technology

Faculty of Mechanical Engineering
1. B.E. Industrial Engineering 
2. B.E. Manufacturing Engineering 
3. B.E. Mechanical Engineering 
4. B.E. Mining Engineering 
5. B.E. Printing Technology.

Faculty of Technology
1. B.Tech. Ceramic Technology 
2. B.Tech. Chemical Engineering 
3. B.Tech. Industrial Bio-Technology 
4. B.Tech. Leather Technology 

R.5b Every Programme will have a curriculum with syllabi 
consisting of theory and practicals such as
i) General core courses comprising mathematics, basic sciences, engineering sciences, humanities and 
engineering arts. 
ii) core courses of Engineering / Technology. 
iii) elective courses for specialisation in related fields. 
iv) Workshop practice, computer practice, engineering 
graphics, laboratory work, industrial training, seminar 
presentation, project work, education tours, camps etc. 
v) NCC/NSS/NSO activities for character development.

R.5c Each course is normally assigned certain number of 
credits with 1 credit per lecture period per week, 1 credit 
per tutorial period per week, 1 credit for 2 periods of 
laboratory or practical or seminar or project work per 
week (2 credits for 3 or 4 periods of practical) and 1 or 
2 credits for 4 weeks of industrial training during semester 
vacations.
R.5d Each semester curriculum shall normally have a blend of lecture courses not exceeding 8 and practical courses not exceeding 4.

R.5e For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. This minimum will lie between 181 and 190 credits depending on the branch.

R.5f The medium of instruction, Examinations and project report will be English, except for courses on languages other than English.

DURATION OF THE PROGRAMME

R.6 A student is ordinarily expected to complete the B.E./B.Tech. Programme in 8 semesters (6 semesters in the case of lateral entry student), but in any case not more than 12 semesters (10 semesters in the case of lateral entry student).

FACULTY ADVISER

R.7 To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department of the student will attach a certain number of students to a teacher of the Department who shall function as Faculty Adviser for those students throughout their period of study. Such Faculty Adviser shall advise the students and approve the courses to be taken by the students during each semester.

CLASS COMMITTEE

R.8a For all branches of study during first semester, a common Class Committee will be constituted by the Dean of Academic Courses. During other semesters, separate Class Committees will be constituted by the respective Heads of the Departments of the students.

R.8b Each common theory course offered to more than one discipline or group, shall have a “Course Committee” comprising all the teachers teaching the common course with one of them as nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department/Dean of Faculty/Dean of Academic Courses depending upon whether all the teachers teaching the common course belong to a Department/ Faculty/ different Faculties.

R.8c The first semester Class Committee composition will be as follows:

i) Course Co-ordinators of all common courses.
ii) Teachers of all other individual courses.
iii) One Professor, preferably not teaching first semester class, appointed as Chairman, by Dean of Academic Courses.
iv) One male and one female first semester student from each Faculty to be nominated by the Dean of Academic Courses.
v) All first semester Faculty Advisers and all the Deans may opt to be special invitees.

R.8d The composition of the Class Committee for each branch from 2nd to 8th semester will be as follows:
Teachers of individual courses.

One Professor or Assistant Professor preferably not teaching to the concerned class, appointed as Chairman by the Head of the Department.

2 students, preferably 1 male and 1 female student of the class per group of 30 students or part thereof, to be nominated by the Head of the Department in consultation with the Faculty Advisers.

All Faculty Advisers of the Class, Teacher-in-charge of UG Programme and Head of the Department may opt to be special invitees.

R.8e The Class Committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of class commencement, in which the type of assessments, like test, assignment, assignment based test etc., will be decided for the first second and third assessments. The second meeting will be held with in a week after the date of first assessment report, to review the students performance and for follow up action.

The Third meeting will be held within a week after the second assessment report, to review the students performance and for follow up action.

During these three meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

R.8f The Class committee, excluding the student members and the invited members, shall meet within two weeks from the last day of the End-Semester Examination to analyse the performance of the students in all the components of assessments and decide the grade ranges for each course. The grading ranges for a common course shall be decided by the concerned course committee and shall be presented to the class committe(e)s by the concerned teacher.

REGISTRATION AND ENROLMENT

R.9a Every student shall submit a completed Registration form indicating the list of courses intended to be credited during the next semester. This Registration will be done a week before the last working day of the current semester. Late registration with the approval of Dean of Faculty along with a late fee will be done up to the last working day.

R.9b At the beginning of the semester, before the date of class commencement, every student shall confirm the Registration by paying the prescribed fees for the semester and enroll for the courses. Late enrolment, with the approval of Dean of Faculty along with a late fee, will be done up to 2 weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

R.9c The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

WITHDRAWAL FROM A COURSE

R.9d A student can withdraw from a course at any time before the second assessment with the approval of Dean of Faculty on the recommendation of the Head of the Department of the student.
TEMPORARY BREAK OF STUDY FROM A PROGRAMME

R.0e A Student can take a one time temporary break of study covering the current semester and/or next semester period with the approval of the Dean of Academic Courses, at any time before the start of third assessment of current semester, within the maximum period of 12 or 10 Semesters as the case may be.

CREDIT LIMIT FOR ENROLMENT AND MOVEMENT TO HIGHER SEMESTER

R.10a A student can enroll only for a maximum of 30 credits during a Semester period including arrears courses.

R.10b The following minimum credits should be earned by a student to Register for the higher semester courses:

<table>
<thead>
<tr>
<th>TO REGISTER FOR COURSES</th>
<th>MINIMUM CREDITS TO BE EARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Semester</td>
<td>No minimum</td>
</tr>
<tr>
<td>3rd Semester</td>
<td>10 In 1st Semester Courses alone</td>
</tr>
<tr>
<td>4th Semester</td>
<td>12 In 2nd Semester Courses alone</td>
</tr>
<tr>
<td>5th Semester</td>
<td>12 In 3rd Semester Courses alone</td>
</tr>
<tr>
<td>6th Semester</td>
<td>12 In 4th Semester Courses alone</td>
</tr>
<tr>
<td>7th Semester</td>
<td>12 In 5th Semester Courses alone</td>
</tr>
<tr>
<td>8th Semester</td>
<td>12 In 6th Semester Courses alone</td>
</tr>
</tbody>
</table>

Those who do not satisfy the above minimum credit requirements, may register and enroll for arrears courses only.

R.10c A Student who has not completed the NCC/NSS/NSO requirements, will not be eligible to register for 5th semester (7th Semester for Mining Engineering and for lateral entry student) courses, although satisfying other requirements.

R.10d Rule 10c is not applicable to the sponsored/deputed candidates satisfying Rule 10c admitted to B.E. in Printing Technology.

SUMMER TERM COURSES

R.11a A student can register for a maximum of two courses only during Summer Term, if such courses are offered by the concerned department.

R.11b The Head of the Department, in consultation with the Department Consultative Committee and with the approval of Dean (Academic Courses) may arrange for the conduct of a few courses during summer term, depending on availability of teachers during summer and subject to a minimum of five students registering for such courses.

R.11c However, in the case of a student completing 8th semester and having arrears in the earlier semesters, a minimum of two courses, summer courses may be offered, even if less than five students are registering for the course.

R.11d The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a summer term course or for substitute examination.
### ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

**R.12a** Every theory course shall have a total of four assessments during a semester as given below.

<table>
<thead>
<tr>
<th>Assessment No.</th>
<th>Course coverage in weeks</th>
<th>Duration in hours</th>
<th>Weightage of max. marks %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>1 to 4</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>Test 2</td>
<td>5 to 8</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>Test 3</td>
<td>9 to 12</td>
<td>50 min.</td>
<td>16 2/3</td>
</tr>
<tr>
<td>End-Sem. Exam</td>
<td>1 to 16</td>
<td>3 hours</td>
<td>50</td>
</tr>
</tbody>
</table>

*R.12b* The pattern of question for at least one of the Tests shall be the same as stipulated for the End-Semester Examination by the Board of Studies/Academic Council. Teachers handling course in the third to eighth semesters are given the option to substitute a maximum of two tests with other suitable alternate types of evaluation approved in the class committee. The details of such a scheme shall be announced to the students and informed to the Dean of Academic courses at the beginning of the Semester. However, for the first and second semester, all assessments will be in the form of tests.

**R.12c** Every practical course will have 75% weightage for continuous assessment and 25% for End-Semester examination.

**R.12d** In the case of Industrial Training, the student shall submit a report which will be evaluated along with an oral examination by a Committee of Teachers constituted by the Head of the Department. A progress report from the industry will also be taken into account for evaluation.

**R.12e** In the case of project work and mini project work, a committee of Teachers constituted by the Head of the Department will carry out continuous assessment. Based on the project report submitted by the student, an oral examination (Viva-Voce) will be conducted as the End-Semester examination, for which one External Examiner will also be included in the Committee of Teachers.

**R.12f** Assessment of seminars and comprehension will be carried out by a committee of teachers constituted by the Head of the Department.

### SUBSTITUTE EXAMINATIONS

**R.13a** A student who has missed, for valid reasons, an assessment test/examination may be permitted to write a substitute test/examination. However, permission to take up a substitute test/examination will be given under exceptional circumstances, such as accident or admission to a hospital due to illness.

**R.13b** A student who misses any assessment test/examination in a course should apply for the substitute test/examination within a week from the date of missed assessment, using the prescribed application form for the purpose. Late applications will not be entertained. The decision on the application will be taken by the Head.
of the Department offering the course in the case of first three assessments and by the Dean of Faculty in the case of End-Semester examination (fourth assessment). However, if a student applies for the substitute test/examination for the second time in a semester, the decision will be taken by the Dean of Faculty. The Head of the Department/Dean of Faculty can use his discretion in granting permission, recording reasons for his decision. If permitted, the substitute test/examination for any assessment will be held in about two weeks from the date of missed assessment. The substitute test (from missed assessments 1 to 3) will be conducted by the concerned teacher. However, the substitute examination (for missed end-semester examination) will be conducted centrally.

PASSING AND DECLARATION OF EXAMINATION RESULTS AND GRADE SHEET

R.14a All assessments of a course will be done on absolute marks basis. However, the Class Committee which shall meet within 2 weeks after the End-Semester examinations, shall analyse the relative performance of students in all assessments of a course and decide the letter grade ranges for that course. The letter grades and the corresponding grade points are as follows:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>S</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>U</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Points</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>--</td>
</tr>
</tbody>
</table>

"W" denotes withdrawal from the course.

"T" denotes inadequate attendance and hence prevention from End-Semester examination.

"U" denotes failure in the course.

R.14b A student who earns a minimum of 5 grade points in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student.

R.14c The results, after awarding of grades, shall be signed by the Class Committee Chairman, Head of the Department and Dean of Faculty and declared by the Dean of Faculty.

R.14d Within 2 weeks from the commencement of classes for the next semester, a student can apply for revaluation of his/her end semester examination answer papers in a course, on payment of a prescribed fee, through proper application to the Dean of Faculty. The Dean shall constitute a revaluation committee consisting of Chairman of Class Committee as convener, the teacher of the course and a senior member of faculty knowledgeable in that course. The Committee shall meet within a week, revalue the answer paper and submit its report to the Dean of Faculty for consideration and decision.

R.14e After results are declared, Grade Sheets will be issued to each student which will contain the following details. The list of courses enrolled during the semester including summer term courses; if any, and the grade scored. The Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of
courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses if any.

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

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. "U", "I" and "W" grades will be excluded for calculating GPA and CGPA.

R.14f After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA:

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class with Distinction</td>
<td>8.50 and above</td>
</tr>
<tr>
<td>First Class</td>
<td>6.50 and above but below 8.50</td>
</tr>
<tr>
<td>Second Class</td>
<td>below 6.50</td>
</tr>
</tbody>
</table>

ATTENDANCE REQUIREMENT AND COURSE REPETITION

R.15a A student shall attend a minimum of 75% of the contact periods offered in any registered course, to become eligible to appear for the end-of-semester examination in that course, failing which the student shall be prevented from taking the end-of-semester examination and shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

R.15b Instructor of each course shall take attendance till five calendar days prior to the last instruction day in the semester and report through the Head of the Department to the Dean of Faculty the names of students who have attendance less than 75% in that course. The Dean shall then announce the names of all students prevented from writing the end-of-semester examinations in various courses.

R.15c A student should repeat a core course wherein 'U' or 'I' or 'W' grade was awarded. If the student is awarded 'U' or 'I' or 'W' grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

ELECTIVE CHOICE; OPTION TO DO PROJECT ALONE IN FINAL SEMESTER

R.16a Apart from the various elective courses listed in the curriculum for each branch of specialisation, the student can choose a maximum of 2 electives from any other specialisation under any Faculty, during the entire period of study, with the approval of the Head of the Parent Department and the Head of the other Department offering the course.

R.16b In the curriculum of 8th Semester, along with the project work, if 2 elective courses alone are listed, then the Dean of Faculty may permit a student, as per approved guidelines, on the recommendation of the Head of the Department, to do a full semester major industrial project...
work. In such a case, the above 2 elective courses or any other 2 elective courses in lieu thereof have to be enrolled during any semester including the summer, preceding or succeeding the project work.

INDUSTRIAL VISIT

R.16c Every student is required to undergo one Industrial visit for every theory course offered, starting from the third semester of the Programme.

PERSONALITY AND CHARACTER DEVELOPMENT

R.17a All students shall enroll, on admission, in any one of the personality and character development programmes like NCC/NSS/NSO and undergo practical training for about 80 hours and attend a camp of about ten days.

National Cadet Corps (NCC) will have about 20 parades

National Service Scheme (NSS) will be social service activities in and around Chennai.

National Sports Organisation (NSO) will have Sports, Games, Drills and Physical exercises.

While the training activities will normally be during week ends, the camp will normally be during vacation period.

R.17b Every student shall put in a minimum of 80% attendance in the practical training and attend the camp compulsorily. Normally this is to be completed during the first year. For valid reasons, the Dean of Students may permit a student to complete this requirements in the second year. However, before enrolling for 3rd Semester (7th Semester in the case of Mining Engineering and of lateral entry), a student should have completed the training and produced a certificate from the appropriate authority of NCC/NSS/NSO for having satisfactorily completed the prescribed training and camp.

R.17c Rule 17a and 17b are not applicable to the sponsored/deputed Candidates satisfying Rule 1c admitted to B.E. in Printing Technology.

DISCIPLINE

R.18a Every student is required to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

R.18b Any act of indiscipline of student reported to the Dean of Faculty will be referred to a Discipline and Welfare Committee nominated by the Syndicate from time to time, for taking appropriate action.

ELIGIBILITY FOR THE AWARD OF DEGREE

R.19a A student shall be declared to be eligible for the award of the B.E./B.Tech. Degree provided the student has:

1) Successfully completed all the required courses in the programme curriculum and earned the number of credits prescribed for the specialisation within a maximum period of 12 semester (10 semesters for Lateral Entry) from the date of admission, including break of study.
ii) Completed the NCC/NSS/NSO requirements.
iii) No dues to the Institution, Library, Hostels, NCC, NSS, NSO, etc.
iv) No disciplinary action pending against the student.

**R.19b** The award of the Degree must have been approved by the Syndicate of the University.

**POWER TO MODIFY**

**R.20** Notwithstanding all that has been stated above, the University has the right to modify the above regulations from time to time.

---

**DEGREE OF BACHELOR OF TECHNOLOGY**

**BRANCH – INDUSTRIAL BIO-TECHNOLOGY**

**CURRICULUM AND SYLLABUS**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMESTER I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM-131</td>
<td>CHEMISTRY I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>GE-131</td>
<td>ENGINEERING MECHANICS</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>L1</td>
<td>LANGUAGE ELECTIVE I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA-131</td>
<td>MATHEMATICS I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH-131</td>
<td>PHYSICS I</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>GE-132</td>
<td>COMPUTER PRACTICE I</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GE-133</td>
<td>WORKSHOP PRACTICE</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| SEMESTER II                                     |    |    |    |    |
| IB-131  | CELL BIOLOGY            | 2  | 1  | 2  | 4  |
| EE-151  | ELECTRICAL ENGINEERING  | 2  | 0  | 2  | 4  |
| EC-152  | ELECTRONICS ENGINEERING | 2  | 0  | 2  | 3  |
| L2      | LANGUAGE ELECTIVE II    | 3  | 1  | 0  | 4  |
| MA-132  | MATHEMATICS II          | 3  | 1  | 0  | 4  |
| PH-134  | PHYSICS II              | 2  | 1  | 2  | 4  |
| GE-135  | COMPUTER PRACTICE II    | 1  | 0  | 3  | 3  |
| GE-134  | ENGINEERING GRAPHICS    | 1  | 0  | 3  | 3  |
| <strong>TOTAL</strong>                                     |    |    |    |    |
|         |                         | 27 |    |    |    |</p>
<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB237</td>
<td>BASIC INDUSTRIAL BIOTECHNOLOGY</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB232</td>
<td>BIO-ORGANIC CHEMISTRY</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB231</td>
<td>BIOCHEMISTRY</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB235</td>
<td>CHEMICAL THERMODYNAMICS AND BIOTHERMODYNAMICS</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB233</td>
<td>GENETICS</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB234</td>
<td>MICROBIOLOGY</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB236</td>
<td>PRINCIPLES OF CHEMICAL ENGINEERING</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Practical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IB239</td>
<td>BIO-ORGANIC CHEMISTRY LAB</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>IB238</td>
<td>BIOCHEMISTRY LAB</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><strong>SEMESTER IV</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IB244</td>
<td>BIOPROCESS PRINCIPLES</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB243</td>
<td>ENZYME ENGINEERING AND TECHNOLOGY</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB242</td>
<td>INSTRUMENTAL METHODS OF ANALYSIS</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB241</td>
<td>MOLECULAR BIOLOGY</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>MA059</td>
<td>PROBABILITY AND STATISTICS</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>IB240</td>
<td>UNIT OPERATIONS</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB247</td>
<td>CHEMICAL ENGINEERING LAB</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>IB246</td>
<td>INSTRUMENTAL METHODS OF ANALYSIS</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>IB245</td>
<td>MICROBIOLOGY LAB</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>IB332</td>
<td>CHEMICAL REACTION ENGINEERING</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E1**</td>
<td>ELECTIVE I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E2***</td>
<td>ELECTIVE II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E3***</td>
<td>ELECTIVE III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB331</td>
<td>GENETIC ENGINEERING</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB333</td>
<td>MASS TRANSFER AND SEPARATION</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB234</td>
<td>BIOPROCESS LAB I</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>IB236</td>
<td>DISSERTATION AND SEMINAR</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>IB235</td>
<td>MOLECULAR BIOLOGY LAB</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>IB344</td>
<td>BIOETHICS</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB341</td>
<td>BIOMEDICAL COMPUTATION</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB342</td>
<td>BIOPROCESS ENGINEERING</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E4***</td>
<td>ELECTIVE IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E5***</td>
<td>ELECTIVE V</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E6***</td>
<td>ELECTIVE VI</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB543</td>
<td>IMMUNOLOGY</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Code No.</td>
<td>Course Title</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>IB346</td>
<td>BIOPROCESS LAB II</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>IB345</td>
<td>GENETIC ENGINEERING LAB</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>27</td>
</tr>
</tbody>
</table>

**SEMESTER VII**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB432</td>
<td>ANALYTICAL TECHNIQUES IN BIO-TECHNOLOGY</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB431</td>
<td>DOWNSTREAM PROCESSING</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E7***</td>
<td>ELECTIVE VII</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E8***</td>
<td>ELECTIVE VIII</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E9***</td>
<td>ELECTIVE IX</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB433</td>
<td>PROTEIN ENGINEERING</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**Practical**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB436</td>
<td>DISSERTATION AND SEMINAR</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>IB435</td>
<td>DOWNSTREAM PROCESSING LAB</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>IB434</td>
<td>IMMUNOLOGY LAB</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>IB337</td>
<td>INDUSTRIAL TRAINING</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

**SEMESTER VIII**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB444</td>
<td>PROJECT WORK</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>126</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF DEGREE: 186**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE 034</td>
<td>CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>HS 034</td>
<td>TECHNICAL TAMIL</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>HS 035</td>
<td>TECHNICAL GERMAN - I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 036</td>
<td>TECHNICAL GERMAN - II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 037</td>
<td>TECHNICAL JAPANESE - I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 038</td>
<td>TECHNICAL JAPANESE - II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 039</td>
<td>TECHNICAL FRENCH - I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 040</td>
<td>TECHNICAL FRENCH - II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 041</td>
<td>ENGLISH - I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>HS 042</td>
<td>ENGLISH - II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>IB 034</td>
<td>TECHNICAL WRITING AND COMMUNICATION</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 035</td>
<td>PLANT BIOTECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 036</td>
<td>ANIMAL BIOTECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 037</td>
<td>BIOLOGICAL SPECTROSCOPY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 038</td>
<td>METABOLIC ENGINEERING</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 039</td>
<td>CHROMATOGRAPHIC SEPARATIONS</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 040</td>
<td>ENVIRONMENTAL BIOTECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 041</td>
<td>FOOD SCIENCE AND TECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 042</td>
<td>BIOPHARMACEUTICAL TECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 043</td>
<td>DEVELOPMENTAL BIOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 044</td>
<td>BIOPHYSICS</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 045</td>
<td>IMMUNOTECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 046</td>
<td>CANCER BIOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 047</td>
<td>GENOMICS AND PROTEOMICS</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 048</td>
<td>MOLECULAR PATHOGENESIS</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 049</td>
<td>BIOPROCESS ECONOMICS AND PLANT DESIGN</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 050</td>
<td>MOLECULAR MODELING AND DRUG DESIGN</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 051</td>
<td>NEUROBIOLOGY AND COGNITIVE SCIENCES</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>IB 052</td>
<td>BIODIVERSITY, IPR AND MANAGEMENT OF BIOTECHNOLOGY</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
MA 131 MATHEMATICS I

1. MATRICES

The characteristic equation, Eigen values and Eigen vectors of a real matrix, some properties of eigen values, Cayley-Hamilton theorem, Reduction of a real matrix to a diagonal form, Orthogonal matrices - properties, reduction of a quadratic form to a canonical form by orthogonal transformation.

2. GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS

Curvature - cariesian and polar coordinates - Circle of curvature, involutes and volutes, Envelopes - Properties of the envelopes - Envelopes of normal to a curve.

3. FUNCTIONS OF SEVERAL VARIABLES

Total differential - Derivative of implicit functions, Partial derivative of a function of two functions, Taylor’s expansion for a function of two variables, Maxima and minima, Jacobians, Differentiation under the integral sign.

4. MULTIPLE INTEGRALS

Double integration in cartesian and polar coordinates, change of order of integration, triple integration in cartesian coordinates, Gamma and Beta functions - properties, Area as a double integral.

5. DIFFERENTIAL EQUATIONS

Simultaneous linear equations with constant coefficients, Homogeneous linear equations of Euler type - Equations reducible to homogeneous form, Linear equations of second order with variable coefficients, Method of reduction of order, Transformation of the equation by changing the dependent variable, Method of variation of parameters.

L: 45 T: 15 Total: 60

REFERENCES:


PH 131 PHYSICS - I

1. PROPERTIES OF MATTER

Elasticity - Stress - strain diagram - factors affecting elasticity - Twisting couple on a wire - shaft - Torsion pendulum - Depression of a cantilever - Young’s modulus by cantilever - Uniform and non-uniform bending - I shape girder - production and measurement of high vacuum - Rotary pump - Diffusion pump - Pirani gauge - Penning gauge - Viscosity - Oswald Viscometer - Comparison of viscosities.

2. ACOUSTICS


3. HEAT AND THERMODYNAMICS

Thermal conductivity - Fourier’s and Lees’ Disc methods - Radial flow of heat - Thermal conductivity of rubber and glass - Thermal insulation in buildings - Laws of thermodynamics - Carnot’s cycle
of heat engine and refrigerator - Carnot’s theorem - Ideal Otto and Diesel engines - Concept of entropy - Entropy Temperature diagram of Carnot’s cycle.

4. OPTICS


5. LASER AND FIBRE OPTICS

Principle of lasers - Laser characteristics - Ruby - NdYAG, He-Ne, CO₂ and semiconductor lasers - Propagation of light through optical fibre - Types of optical fibres - Applications of optical fibres as optical waveguides and sensors.

6. PRACTICALS

1. Young’s modulus by nonuniform bending
2. Rigidity modulus and moment of inertia using Torsion pendulum
3. Viscosity of a liquid by Poiseuille’s method
4. Wavelength determination using gratings Spectrometer
5. Particle size determination by Laser
6. Thermal conductivity of Lees’ disc
7. Thickness of wire by Air wedge
8. Thermo emf measurement by potentiometer

Text Book


REFERENCE


L : 30 T : 15 P : 30 Total = 75

CM-131 CHEMISTRY

1. CHEMICAL THERMODYNAMICS

Definition of free energy and spontaneity - Maxwell relations - Gibbs - Helmholtz equation - Van’t Hoff equations - stoichiometry and energy balances in chemical reactions.

2. DYNAMICS OF CHEMICAL PROCESSES

Basic concepts - Composite reactions (opposing, parallel and consecutive reactions) - Collision theory - Thermodynamic formulation of reaction rates - Unimolecular reactions - Chain reactions (stationary and non-stationary) - Enzyme kinetics - Michaelis - Menten equation.

3. ELECTRODICS

Types of electrodes and cells - Nernst equation - emf measurement and applications - Principles of chemical and electrochemical corrosion control (sacrificial anode and impressed current methods).
4. WATER

Water quality parameters - definition and expression - estimation of hardness (EDTA method) and alkalinity (titrimetry) - water softening (zeolite) - demineralisation (ion-exchangers) and desalination (RO) - domestic water treatment.

5. POLYMERS

Monomer - functionality - degree of polymerisation - classification based on source and applications - addition, condensation and copolymerisation - mechanism of free-radical polymerisation - thermoplastics and thermosetting plastics - injection moulding, blow moulding and extrusion processes.

PRACTICALS:

1. WATER ANALYSIS

Determination of hardness alkalinity, DO, Fe (spectrophotometry) and Na & K (Flame photometry).

2. ELECTROCHEMISTRY AND CORROSION EXPERIMENTS

3. POLYMER EXPERIMENTS

L : 30 T : 15 P : 30 Total = 75

REFERENCE BOOKS


5. FRICITION
Frictional force - Laws of Coulomb friction - Simple Contact friction - Rolling resistance - Belt friction.

6. DYNAMICS OF PARTICLES

7. ELEMENTS OF RIGID BODY DYNAMICS
Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid body - work energy equation.

TEXT BOOKS


REFERENCE:


GE 132 COMPUTER PRACTICE - I

1. FUNDAMENTALS OF COMPUTERS AND OPERATING SYSTEMS:

2. OFFICE AUTOMATION

a) Word Processing
b) Data Base Management System

c) Spread Sheet Package

d) Presentation Software

TEXT & REFERENCE BOOKS:


3. COMPLEX INTEGRATION

Cauchy’s theorem - Cauchy’s integral formula - Taylor and Laurent’s series - Singularities and classification - residues - Cauchy’s residue theorem - Contour integration around circular and semi-circular contours (excluding poles on the real axis).

4. EMPIRICAL STATISTICS


5. STATISTICAL INFERENCE

Sampling distribution - Testing of hypothesis - Level of significance - Confidence limits - Tests based on normal distribution, t-distribution and Chi-square distribution.

REFERENCES:

1. **SEMI CONDUCTORS AND RECTIFIERS**

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - P-N junction - VI characteristic of PN junction diode - Zener diode - Zener diode characteristic - Half wave and full wave rectifiers - Voltage regulation.

2. **TRANSISTORS AND AMPLIFIERS**

Bipolar junction transistor - CB, CE, CC - Configurations and characteristics - Biasing circuits - Elementary treatment of voltage amplifier - Class A, B and C power amplifiers - principles of Tuned amplifiers.

3. **POWER AND CONTROL ELECTRONIC DEVICES**

Field Effect Transistor - Configurations and characteristics - FET amplifier - SCR, Diac, Triac, IUI - characteristics and simple applications - switching transistors - concept of feed back - negative feed back - application in temperature and motor speed control.

4. **SIGNAL GENERATORS AND LINEAR IC'S**

Sinusoidal oscillators - positive feed back - RC phase shift, Hastley, Colpit's, Wien bridge Oscillators - multivibrators - operational amplifier - adder, multiplier, integrator and differentiators -integrated circuits.

5. **DIGITAL ELECTRONICS**

Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra - Exclusive or gate - Half and Full adders - flip flos - registers and counters - A/D, D/A conversion - Digital computer principle.

L : 30  P : 30  Total = 60

---

**REFERENCE:**


---

**EE 151 ELECTRICAL ENGINEERING**

1. **ELECTRICAL CIRCUITS**

Ohms Law - Kirchoffs Laws - steady state solution of D C Circuits - Introduction to AC circuits - Waveforms and RMS value - power and power factor, single phase and 3 phase balanced circuits.

2. **ELECTRICAL MACHINES**

Principles of operation and characteristics of D C machines, Transformers (single phase and three phase) - Synchronous Machines - 3 Phase and single phase induction motors - (op. Principles).

3. **ELECTRICAL MEASUREMENTS**

Moving coil and moving iron instruments (Ammeter and voltmeter) Dynamometer type watt meters and energy meters (op. Principles).

L : 30  P : 30  Total = 60

**TEXT BOOK:**

REFERENCE


PH 134 PHYSICS II

1. ELECTROSTATICS AND ELECTROMAGNETISM

Electric field and potential - Gauss theorem - Applications - dielectrics - capacitance - energy stored in a dielectric medium - types of capacitors - Loss of energy due to sharing of charges by the capacitors - electrical conductivity in conductors - Carey Foster's bridge - Maxwell's equations - Free space wave equation - Characteristic impedance.

2. QUANTUM PHYSICS

Development of quantum theory - Dual nature of matter and radiation - Compton effect - Pair production - Uncertainty principle - Equivalence of mass and energy - Schrödinger's wave equation - Particle in a box - Electrons in a metal.

3. ATOMIC AND NUCLEAR PHYSICS


4. ELEMENTARY CRYSTALLOGRAPHY

Crystalline and non-crystalline materials - Bravais lattices - Crystal systems - Symmetry elements - Simple crystal structures - Packing factor for sc, bcc, fcc, hcp structures - Miller Indices - Imperfections in crystals - Bragg's law and x-ray diffraction methods to study crystal structures.

5. NON DESTRUCTIVE TESTING

Liquid penetrant, Magnetic particle and eddy current methods - X-ray radiography - Fluoroscopy - Gamma ray radiography - Ultrasonic scanning methods - Ultrasonic flaw detector - Thermography.

6. PRACTICALS

1. Meter Bridge - Temp. Coefficient
2. Field along the axis of coil - Determination of H
3. Carey Foster's Bridge - Resistivity
4. X-ray diffraction - calculation of cell parameters
5. Newton's rings - Wavelength measurement
6. Spectrometer - Dispersive power of a prism
7. Rigidity modulus - static torsion
8. Ammeter & voltmeter calibration using potentiometer

TEXT BOOK


REFERENCES


**IB 131 CELL BIOLOGY**

1. **CELL STRUCTURE AND FUNCTION OF THE ORGANELLES**

Eukaryotic and prokaryotic cells, Principles of membrane organization, membrane proteins, cytoskeletal proteins, types of cell function, cell division, mitosis & meiosis. Extra cellular matrix, cell cycle and molecules that control cell cycle.

2. **TRANSPORT ACROSS CELL MEMBRANES**


3. **RECEPTORS AND MODELS OF EXTRA CELLULAR SIGNALING**

Cytosolic, nuclear and membrane bound receptors. Examples of receptors, Autocrine, Paracrine and Endocrine models of action. Quantitation and Characterisation of receptors.

4. **SIGNAL TRANSDUCTION**

Signal amplification, Different models of signal amplifications, Cyclic AMP, Role of inositol phosphates as messangers, biosynthesis of inositol trisphosphates, cyclic GMP and G proteins role in signal transduction. Calcium ion flux and its role in cell signalling, current models of signal amplification, Phosphorylation of proteins Kinases.

5. **CELL CULTURE**

Techniques for the propagation of prokaryotic and Eukaryotic cells. Cell line, generation of cell lines, maintenance of stock cells, Characterisation of cells, Immuno cytochemistry, morphological analysis techniques, in cell culture, explant cultures primary cultures, contamination, Differentiation, Three Dimensional cultures, role of matrix in cell growth.

**TEXT BOOK:**


**CELL BIOLOGY LAB**


L : 30 T : 15 P : 30 Total = 75

**GE 134 ENGINEERING GRAPHICS**

1. **PRINCIPLES OF GRAPHICS**

Two dimensional geometrical construction - Conic sections, Involute and cycloids - Representation of three dimensional objects - Principles of projections - standard codes of principles.
2. ORTHOGRAPHIC PROJECTIONS 7 + 21
Projections of points, straight lines and planes - Auxiliary projections - Projection and sectioning of solids - Intersection of surfaces - Development of surfaces.

3. PICTORIAL PROJECTIONS 2 + 6
Isometric projections - Perspectives - Free hand sketching.

4. COMPUTER GRAPHICS 2 + 6
Hardware - Display technology - Software - Introduction to drafting software.

TEXT BOOK

REFERENCE
SEMESTER III

IB 232 BIO-ORGANIC CHEMISTRY

1. INTRODUCTION TO BIO-ORGANIC CHEMISTRY
   Basic considerations-Proximity effects in organic chemistry-Molecular Adaptation-Molecular recognition and the supramolecular level.

2. BIO-ORGANIC CHEMISTRY OF AMINO ACIDS & PEPTIDES
   Chemistry of living cells, Analogy between organic reactions and Biochemical Transformations, Chemistry of the peptide bond Asymmetric Synthesis of amino acids, Transition state Analogues Chemical mutations, Molecular Recognition and Drug Design.

3. ENZYME CHEMISTRY

4. METAL IONS IN BIOLOGICAL SYSTEMS
   Metal ions in proteins and biological molecules-Carboxypeptidase and role of zinc, Hydrolysis of Amides and peptides, Iron and oxygen transport-Copper Ion-Biomodels for photosynthesis and Energy transfer Cobalt and vitamin B12 actions-oxidation/reduction reactions.

5. ENZYME MODELS
   Host guest complexation Chemistry, Developments in Crown ether chemistry, Membrane chemistry and micelles- Cyclodextrin-Enzyme design using steroid templates- Remote functionalisation reaction-Biomimetic polyene cyclisations.

   L : 30 T : 15 Total = 45

TEXT BOOK


IB 233 GENETICS

1. Classical Genetics Mendelian Laws, monohybrid, and dihybrid inheritance
2. Chromosome structure and organisation in prokaryotes and eukaryotes
3. Multiple alleles and blood group antigens
4. Sex chromosomes and sex linked inherited disorders
5. Linkage, crossing over and genetic mapping of chromosomes
6. Identification of the genetic material - classical experiments, Hershey Chase, Avery McLeod etc

   L = 30 T = 15 Total = 45

TEXT


**IB 234 MICROBIOLOGY**  

1. **WORLD OF MICRO ORGANISMS**  
   Characteristic of microorganism, Historical review of the foundation of microbiology, Taxonomy methods of studying microorganisms, Microscopy, light and laser optic systems.

2. **MICROBIAL FORA AND FUNCTION**  
   General structural organisation of bacterial, viral, bacilli, Actinomycetes Differentiation and development.

3. **REPLICATION OF MICRO ORGANISMS**  
   Multiplication of bacteriophages, bacteria and differentiation organisms such as yeast, fungi and actinomycetes.

4. **MICROBIAL NUTRITION AND ENVIRONMENT**  
   Growth of microorganisms in different media- growth curve of microbes and different methods of enumeration of multiplying microorganisms.

5. **MICROBIAL METABOLISM**  
   Metabolic pathways and bioenergetics. Aerobic and anaerobic growth. Production of secondary metabolites and their application in industry, Beneficial microorganisms and products. Clinically important microorganisms and their effects on infections and immunity. Formation of toxic materials by microorganisms. Their role in clinical microbiology and food preservation.

6. **PHYSICAL AND CHEMICAL CONTROL OF MICRO ORGANISMS**  
   Drugs, Chemotherapy, antimicrobial agents and disinfectants, Diseases caused by microorganism and control.

7. **ENVIRONMENTAL APPLICATIONS AND MICROBIOLOGY**  

L = 30 T = 15 Total = 45

**TEXT BOOK**


**IB 235 CHEMICAL & BIOCHEMICAL THERMODYNAMICS**  

**BASIC CONCEPTS IN ENGINEERING THERMODYNAMICS**  

First and Second law of thermodynamics; Calculation of Work, energy and property changes in reversible processes, Thermodynamics of fluid processes; Power cycles and refrigeration cycles.
THERMODYNAMIC PROPERTIES OF FLUIDS
9
Volumetric properties of gases exhibiting non-ideal behaviour; residual properties; estimation of thermodynamic properties using equations of state; Maxwell relationships and their applications; calculation of flow processes based on actual property changes.

SOLUTION THERMODYNAMICS
9
Partial molar properties; concepts of chemical potential and fugacity; ideal non-ideal solutions; Gibbs-Duhem equation; excess properties of mixtures; activity coefficient - composition models.

PHASE EQUILIBRIA
6
Criteria for phase equilibria; Vapour-liquid equilibrium calculations for binary mixtures; Liquid-Liquid equilibria and Solid-liquid equilibria.

CHEMICAL REACTION EQUILIBRIA
6
Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant and effect of pressure and temperature on equilibrium constant; calculation of equilibrium conversions and yields for single and multiple chemical reactions.

BIOCHEMICAL THERMODYNAMICS
9
Energetics of Metabolic Pathways; Energy Coupling (ATP & NADH); Stoichiometry and energetic analysis of cell growth and product formation - elemental balances; degree of reduction concepts; available-electron balances; yield coefficients; oxygen consumption and heat evolution in aerobic cultures; thermodynamic efficiency of growth.

\[ L = 30 \quad T = 30 \quad \text{Total} = 45 \]

TEXT BOOKS AND REFERENCES:

IB 236 - PRINCIPLES OF CHEMICAL ENGINEERING
2 1 0 3

MATERIAL & ENERGY BALANCES

MOMENTUM TRANSPORT
5. Dimensional analysis - Mixing and agitation - Power consumption - scale up - Pumps and gas moving machinery - Pump characteristics - Work of Consumption.

\[ L = 30 \quad T = 15 \quad \text{Total} = 45 \]
TEXT BOOKS:

REFERENCES:
2. Foust C.R. Durgaprasad & DVS Murthy, Process calculation for Chemical Engineers
3. F.A. Holland, Pumping of Liquids
5. J. Raghu Raman, Chemical Process Calculations
6. Reynolds and Colburn Momentum, Heat and Mass Transfer

IB 237 BASIC INDUSTRIAL BIOTECHNOLOGY 2 1 0 3

INTRODUCTION TO INDUSTRIAL BIOPROCESS 3

A historical overview of industrial fermentation processes and products: Role of a bioprocess engineer in the Biotechnology Industry; Outline of the various unit operations involved in an integrated bioprocess; Process Flow-Sheeting: a brief survey of organisms, processes, products and market economies relating to modern industrial biotechnology.

RAW MATERIALS FOR FERMENTATION PROCESS 3

Isolation, Preservation and Improvement of Industrial Micro-Organisms for overproduction of Primary and Secondary metabolites; Medium requirements for fermentation process—carbon, nitrogen, minerals, vitamins and other nutrients—examples of simple and complex media;

PRODUCTION OF PRIMARY METABOLITES 7

A brief outline of processes for the production of some commercially important Organic acids (e.g. citric acid, itaconic acid, lactic acid, acetic acid, gluconic acid, etc.); Amino acids (glutamic acid, lysine, aspartic acid, phenylalanine etc.); and Alcohols (ethanol, 2,3-butanediol etc.)

PRODUCTION OF SECONDARY METABOLITES 8

Study of production processes for various classes of low molecular weight secondary metabolites: Antibiotics—beta-lactams (Penicillins, Cephalosporins etc.), aminoglycosides (streptomycin, kanamycin etc.), macrolides (erythromycin), quinones, aromatics etc.: Vitamins and Steroids

PRODUCTION OF COMMERCIALLY IMPORTANT ENZYMES AND RECOMBINANT PROTEINS 9

Proteases, Amylases, Lipases, Cellulases, Pectinases, Isomerases and other commercially important enzymes for the food and pharmaceutical industries; Production of recombinant proteins having therapeutic and diagnostic applications; production of vaccines

SPECIALITY BIOPRODUCTS FOR AGRICULTURAL, FOOD AND PHARMACEUTICAL INDUSTRIES 6

Biopesticides, Biofertilizers and Plant Growth Factors; Natural Biopreservatives (Nisin), Biopolymers (Xanthan Gum and PHB); Single Cell Protein

ENZYMATIC BIOCONVERSION PROCESSES 6

Production of synthetic Penicillins and Cephalosporins; Racemically-pure Drug Intermediates; Steroid Bioconversions; High-Fructose Corn syrup, Bioconversion of Vegetable Oils;
4. STRUCTURE FUNCTION RELATIONSHIP

Complex carbohydrates, proteins and nucleic acids.

TEXT BOOK


IB 236 BIOCHEMISTRY LABORATORY

1. Units, volume/weight measurements, concentrations units, pH measurements, Preparation of buffers; Sensitivity, Specificity, precision and Accuracy.
2. Qualitative tests for Carbohydrates. Estimation of Reducing sugars by the Benedict's method.
3. Qualitative tests for Amino Acids.
5. Protein estimation : Biuret, Folin's, Spectrophotometry and Bradford assay.
6. Acid hydrolysis of Proteins and Estimation of Amino acids by Ninhydrin, OPA, FTH.
7. Extraction of lipids.
8. Saponification of Fats.
IB 239 BIO-ORGANIC CHEMISTRY
LABORATORY

List of experiments

1. Carbohydrate interconversions
   (1) preparation of alpha-d-glucopyranose penta acetate
   (2) preparation of 1,2:5,6 di-o-cyclohexylidene-alpha-d-
   gluco furanose
2. Preparation of pyruvic acid and phenyl pyruvic acid
3. Preparation of L-proline
4. Preparation of L-cysteine
5. Preparation of 5,10,15,20 tetakis phenyl porphyrin
6. Preparation of barbituric acid.
7. Deacylation reaction using papain.

REFERENCE


P = 60 Total = 60

SEMESTER IV

MA 039 PROBABILITY & STATISTICS

1. PROBABILITY & RANDOM VARIABLES
   Probability concepts, Random variables, Moments, Moment Generating function, Binomial, Poisson, Geometric, Negative Binomial, Exponential, Gamma, Weibull distributions, Functions of Random variable, Chebyshev inequality

2. TWO-DIMENSIONAL RANDOM VARIABLES
   Marginal and Conditional distributions, Covariance, Correlation and regression, Transformation of random variables, Central Limit theorem

3. RANDOM PROCESS

4. RELIABILITY ENGINEERING
   Concepts of reliability, Hazard function, Series and parallel systems, Reliability and Availability of Markovian systems, Maintainability, Preventive Maintenance

5. DESIGN OF EXPERIMENTS & QUALITY CONTROL
   Completely randomised design, Randomised block design, Latin square design, Process control, Control charts of measurements and attributes, Tolerance limits

REFERENCES:


IB 244 BIOPROCESS PRINCIPLES

1. INTRODUCTION TO BIOPROCESSES
   Historical development of bioprocess technology, An overview of traditional and modern applications of biotechnological processes, role of bioprocess engineer in the biotechnology industry, outline of an integrated bioprocess and the various (upstream and
downstream) unit operations involved in bioprocesses, generalised process flow sheets.

2. FERMENTATION PROCESSES

General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries, Main parameters to be monitored and controlled in fermentation processes, An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry, solid-substrate fermentation and its applications.

3. ENZYMATIC BIOCONVERSION PROCESSES

Kinetics and thermodynamics of enzyme-catalyzed reactions, techniques of enzyme immobilisation, basic design and configuration of immobilised enzyme reactors, applications of immobilised enzyme technology.

4. MEDIA DESIGN AND STERILISATION FOR FERMENTATION PROCESSES

Medium requirements for fermentation processes, Carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation for optimal growth and product formation, examples of simple and complex media, design and usage of various commercial media for industrial fermentations, thermal death kinetics of microorganisms, batch and continuous heat, sterilisation of liquid media, filter sterilisation of liquid media, Air, Design of sterilisation equipment.

5. METABOLIC STOICHIOMETRY AND ENERGETICS

Stoichiometry of Cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients Energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

6. KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

EUKARYOTES

1. Organization of genome, interaction with histones
2. Transcription: Exon, intron concepts, transcription initiation factors and characteristics motifs in these factors, promoters and enhancers
3. RNA splicing
4. Retroviruses, retropros and oncogenes

TEXT


IB 242 INSTRUMENTAL METHODS OF ANALYSIS 2103

1. ABSORPTION OF RADIATION 9

Absorptivity, Lambert Beers law, Deviations, Instrumentation, Double beam and single beam spectrometers, sources of radiation detectors, photometric accuracy, spectrophotometer operation, instrumentation optical materials sources, detectors spectrophotometers, Fourier transform, spectrophotometers, calibration and standardisation, atomisation, flame atomisation, sources of radiation, background correction, detection limits, inferences and applications
2. SCATTERING OF RADIATION

Rayleigh scattering, instruments, analytical, applications molecular weights and particle sizes, scattering in gases, turbidimetric and nephelometric titrations.

3. X-RAY METHODS

The absorption of x-rays, monochromatic X-ray sources, X-ray detectors, x-ray diffraction, x-ray fluorescence.

4. ELECTRONS AND ION SPECTROSCOPY

X-ray photoelectron spectroscopy (XPS), ultraviolet photo electron spectroscopy (UPS), electron impact spectroscopy, and Auger electron spectroscopy, instrumentation radiation sources, energy analysis, detectors and auxiliary systems

5. THERMOMETRIC METHODS

Thermogravimetric analysis, thermobalance, derivative thermogravimetric analysis, differential thermal analysis, DTA apparatus scanning calorimetric DTA.

L = 30 T = 15 Total = 45

TEXT


REFERENCE


IB 243 ENZYME ENGINEERING & TECHNOLOGY

1. APPLICATIONS OF ENZYMES

Classification of Enzymes; Commercial applications of enzymes in food, pharmaceutical and other industries; Enzymes for analytical and diagnostic applications.

2. PURIFICATION AND CHARACTERISATION OF ENZYMES FROM NATURAL SOURCES

Production and Purification of Crude Enzyme extracts from plant, animal and microbial sources-some case studies; methods of characterisation of enzymes; development of enzymatic assays

3. MECHANISMS AND KINETICS OF ENZYME ACTION

Mechanisms of Enzyme Action; Concept of active site and energetics of enzyme substrate complex formation; Specificity of enzyme action; Kinetics of single substrate reactions; turnover number; estimation of Michaelis-Menten parameters, multi-substrate reactions—mechanisms and kinetics; Types of Inhibition-kinetic models; Substrate and Product Inhibition; Allosteric regulation of enzymes; Deactivation kinetics
4. ENZYME IMMOBILISATION

Physical and Chemical techniques for enzyme immobilisation: adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc...examples; advantages and disadvantages of different immobilisation techniques, overview of applications of immobilised enzyme systems

5. MASS TRANSFER EFFECTS IN IMMOBILISED ENZYME SYSTEMS

Analysis of Film and Pore Diffusion Effects on Kinetics of Immobilised Enzyme Reactions; Formulation of dimensionless groups and calculation of Effectiveness Factors

6. DESIGN OF ENZYME REACTORS FOR BIOCONVERSION PROCESSES

Design of Immobilised Enzyme Reactors-Packed-bed, Fluidised-bed and Membrane reactors; Bioconversion calculations in free-enzyme CSTRs and immobilised enzyme reactors

7. ENZYME BIOSENSORS

Applications of enzymes in analysis; Design of enzyme electrodes and their application as biosensors in industry, health care and environment

L = 30, T = 15 Total = 45

IB 245 MICROBIOLOGY LABORATORY

0 0 4 2
1. Sterilisation techniques (lecture/demonstrations)
2. Preparation of culture media (a) broth type of media (b) Agar

3. Culturing of microorganisms: (a) broth (b) Pure culture techniques: Streak plate, pour plate, isolation and preservation of bacterial culture.
4. Identification of microorganisms. (a) Staining techniques (b) Biochemical testing
5. Quantitation of micro-organisms (a) counting microscopy (b) Nephelometry/Turbidimetry (c) Total N or dry weight
6. Environmental sample analysis
7. Food microbiology (a) milk (b) Fermented food (c) Salmonella in poultry
8. Clinical microbiology: Normal mouth flora

L = 30 Total = 30

IB 246 INSTRUMENTAL METHODS OF ANALYSIS LABORATORY

0 0 4 2
1. Precision and validity of an experiment
2. Lambert-Beer's law using UV-Vis Spectrometer
3. Emission spectra of anthracene using spectrofluorimeter
4. IR of hydrocarbons using IR spectrometer
5. Principles of TCA and DSC
6. Operation of NMR and EPR spectrometer

P = 60 Total = 60

IB 247 CHEMICAL ENGINEERING LABORATORY

0 0 4 2
1. Calibration of orifice meter and rotameter
2. Flow through straight pipe, annular pipe, packed bed
3. Fluidisation
4. Jaw crusher, crushing tools
5. Size analysis
6. Leaf filters, filter press, rotary drum filters
7. Heat loss in pipes
8. Heat exchangers
9. Film type evaporator

SEMESTER V

IB 331 GENETIC ENGINEERING  2 1 0 3

1. BASICS OF RECOMBINANT DNA

Role of genes within cells, elucidation of the genetic code, genetic elements that control gene expression, method of creating recombinant DNA molecules, safety guidelines of creating recombinant DNA research, restriction enzymes and mapping of DNA, plasmid and phage vectors.

2. CONSTRUCTION OF cDNA LIBRARIES

Construction of genomic and cDNA libraries, methods of nucleic acid sequencing, expression of cloned genes

3. APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY

Cloning in plants, Ti plasmid of agrobacteria, transgenic animals, applications or recombinant DNA technology

TEXT


REFERENCE:


IB 332 - CHEMICAL REACTION ENGINEERING  2 1 0 3

1. Kinetics of Homogeneous reactions - searching for mechanism - Arrhenius equation - Batch reactor analysis for kinetics 10
2. Ideal reactors - Single reactor and multiple reactor design 10
3. Multiple reactions - parallel, series and series-parallel - Design Principles - Non isothermal reactors and pressure effects 9
4. Non ideal flow - Non ideal flow models and reactor performance 8

L = 30 T = 15 Total = 45

TEXTBOOK:


REFERENCES:


**IB 333 MASS TRANSFER AND SEPARATION**

1. Diffusion in gases, liquids and solids - Convective mass transfer and mass transfer coefficients.
2. Vapour - liquid equilibrium - Simple, steam and flash Distillation - Distillation with reflux - McCabe Thiete method and enthalpy - concentration method.
3. Sis-Siq equilibrium - staged and Continuous extraction - solid - liquid extraction - equilibrium relation and staged leaching.
4. Adsorption - equilibrium - Batch and fixed bed Adsorption - ion exchange process.

**TEXT BOOKS:**


**REFERENCES:**


**IB 334 BIOPROCESS LAB 1**

1. **ENZYME ISOLATION AND ASSAY OF ENZYMATIC ACTIVITY**

Extraction of commercially important enzymes from natural sources; Development of enzyme assays; quantification of enzyme activity and specific activity

2. **ENZYME KINETICS**

Estimation of Michaelis Menten parameters. Effect of pH and temperature on enzyme activity, kinetics of inhibition

3. **IMMOBILISED ENZYME REACTIONS**

Techniques of enzyme immobilisation-matrix entrapment, ionic and cross linking; column packing; Analysis of mass transfer effects on kinetics of immobilised enzyme reactions; Bioconversion studies with immobilised enzyme packed-bed reactors

4. **MICROBIAL CULTURE STUDIES**

Culturing of different types of microorganisms (bacteria, yeast, fungi) used in the production of commercially important products; Formulation of simple and complex culture media; Estimation of biomass (dry weight); substrate and product analysis; Study of Growth, substrate utilisation and product formation kinetics in shake-flask cultures

L = 30  T = 15  Total = 45

P = 90  Total = 90
IB 335 MOLECULAR BIOLOGY LAB

1. Isolation and visualisation of plasmids on agarose gels.
2. Restriction mapping and ligation
3. Transformation, screening for recombinants, chemical and transposon mutagenesis
4. Selection of hyper producers of secondary metabolites
5. Characterisation of medium components
6. Characterisation of secondary metabolites by polyacrylamide gel electrophoresis silver staining of protein on gels and HPLC.

P = 60  Total = 60

REFERENCE:
1. Frieberger D., Molecular Biology, Jones and Bartlett Publishers Inc. 1987.

VI SEMESTER

IB 341 BIOINFORMATICS

1. WHAT IS BIOINFORMATICS

Scope of Bioinformatics - Elementary commands and Protocols, ftp, telnet, http, Primer on information theory.

2. SEQUENCING ALIGNMENT AND DYNAMIC PROGRAMMING

Introduction - Strings - Edit distance two strings - string similarity local alignment gaps - parametric sequence alignments - suboptimal alignments - multiple alignment - common multiple alignment methods.

3. SEQUENCE DATABASES AND THEIR USE

Introduction to databases - database search - Algorithms issues in databases search - sequence database search - FASTA - BLAST - Arvino acid substitution matrices PAM and BLOSSUM.

4. EVOLUTIONARY TREES AND PHYLOGENY

Ultrasonic trees - parsimony - Ultrametric problem - perfect phylogeny - Phylogenetic alignment - connection between multiple alignment and tree construction.

5. SPECIAL TOPICS IN BIOINFORMATICS

DNA Mapping and sequencing - Map alignment - Large scale sequencing and alignment - Shotgun - DNA sequencing - Sequence assembly - Gene predictions - Molecular predictions with DNA strings.

L = 30 P = 15 Total = 45

REFERENCE:

IB 342 BIOPROCESS ENGINEERING

1. DESIGN AND ANALYSIS OF BIOREACTION

Modelling of Non-Ideal Behaviour in Bioreactors - Tanks-in-series and Dispersion models-applications to design of continuous sterilisers; Design and operation of novel bioreactors-Air-lift loop reactors; Fluidized -bed bioreactors; Stability analysis of bioreactors

2. BIOREACTOR SCALE-UP

Regime analysis of bioreactor processes, Correlations for oxygen transfer; Scale-up criteria for bioreactors based on oxygen transfer and power consumption
3. MONITORING OF BIOPROCESSES

On-line data analysis for measurement of important physicochemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetry; Flow injection analysis for measurement of substrates, products and other metabolites; State and parameter estimation techniques for biochemical processes; Computer-based data acquisition, monitoring and control-LABVIEW Software

4. MODERN BIOTECHNOLOGICAL PROCESSES

Recombinant cell culture processes, guidelines for choosing host-vector systems, plasmid stability in recombinant cell culture, limits to over expression, Modelling of recombinant bacterial cultures; Bioreactor strategies for maximising product formation; Bioprocess design considerations for plant and animal cell cultures

5. MODELLING AND SIMULATION OF BIOPROCESSES

Study of Structured Models for analysis of various bioprocess; Model simulation using MATLAB-SIMULINK and ISIM software packages

L : 30 T : 15 Total = 45

IB 343 IMMUNOLOGY

1. THE IMMUNE SYSTEM

Introduction, Lymphocytes, their origin and differentiation, antigens, their structure and classification, complement and their biological functions, types of immune responses, anatomy of immune response

2. HUMORAL IMMUNITY

B-lymphocytes and their activation, structure and function of immunoglobulin, immunoglobulin classes and subclasses, genetic control of antibody production, mono clonal antibodies and diagnosis, idiotypes and idiotypic antibodies, major histocompatibility complex

3. CELLULAR IMMUNOLOGY

Thymus derived lymphocytes (T cells) their classification antigen presenting cells (APC), macrophages, larger hns cells, their origin and functions, mechanisms of phagocytosis, identification of cell types of immune system, immunosuppression, immune tolerance

4. IMMUNITY TO INFECTION

Hypersensitivity reactions, mechanisms of T cell activation, cytokines and their role in immune response macrophage activation and granuloma formation

5. TRANSPLANTATION

Graft rejection, evidence and mechanisms of graft rejection, prevention of graft rejection, immunosuppressive drugs, HLA and disease, mechanisms of immunity to tumour antigens

6. AUTOIMMUNITY

Auto antibodies in humans, pathogenic mechanisms, experimental models of autoimmune disease treatment of auto immune disorders

TEXT

IB 344 BIOETHICS

The legal and socioeconomic impacts of biotechnology, public education of the processes of biotechnology involved in generating new forms of life for informed decision making; Biosafety regulation and national and international guidelines; r-DNA guidelines, Experimental protocol approvals, levels of containment; Environmental aspects of biotech applications; Use of genetically modified organisms and their release in environment; Special procedures for r-DNA based product production; Intellectual property rights, TRIPS, International conventions patents and methods of application of patents; Legal implications; Biodiversity and farmers rights; Beneficial applications and development of research focus to the need of the poor; Identification of directions for yield effect in agriculture, aquaculture etc.; Bioremediation

L = 30 T = 15 Total = 45

REFERENCE

IB 345 GENETIC ENGINEERING LABORATORY

Preparation of DNA-genomic and plasmid, Agarose gel electrophoresis, Transfer to membrane (Southern) Hybridisation (Southern). Expression of beta-galactosidase and assay. Restriction enzyme digestion, cloning of DNA into plasmid vector

P = 90 Total = 90

REFERENCE

SEMESTER VII

IB 346 BIOPROCESS LAB II

1. Isolation of useful micro-organisms from natural samples
2. Growth of micro-organisms estimation of Monod parameters
3. Temperature effect on growth-estimation of energy of activation and Arrhenius constant for micro-organisms
4. Batch, fed batch and continuous cultures a) Estimation of Monod parameters b) Pure and mixed cultures c) Production of secondary metabolites in synthetic and complex industrial media
5. Identification of growth factors transient pulse experiment
6. Screening of process variables single dimensional search, blackett surman design, design expert etc
7. Study of rheology of fermentation broth and power determination

P = 90 Total = 90

IB 431 DOWNSTREAM PROCESSING

1. ROLE OF DOWNSTREAM PROCESSING IN BIOTECHNOLOGY

Role and importance of downstream processing in biotechnological processes. Problems and requirements of bioprocess purification. Economics of downstream processing in Biotechnology, cost-cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, low value products and low volume, high value products); physico-chemical basis of bioseparation processes.

2. PRIMARY SEPARATION AND RECOVERY PROCESSES

Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.
3. ENRICHMENT OPERATIONS
Membrane-based separations (micro and ultrafiltration theory, design and configuration of membrane separation equipment, applications, precipitation methods (with salts, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction) in situ product removal, integrated bioprocessing

4. PRODUCT RESOLUTION/FRACTIONATION
Adsorptive chromatographic separations processes, electrophoretic separations (all electrophoresis techniques including capillary electrophoresis) hybrid separation technologies (membrane chromatography, electrophotography etc)

5. PRODUCT POLISHING
gel Permeation Chromatography, dialysis, Crystallisation

REFERENCE
1. Wankat PC, Rate controlled separations, Elsevier, 1990

IB 432 ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY

1. MICROSCOPY
Microscopic identification of various microorganisms; phase contrast and confocal microscopy; SEM-TEM microscopy.

2. METHODS OF BIOCHEMICAL ANALYSIS
Glucose, sugars, carbohydrates, lipids, proteins and nucleotides; enzymatic assays of various metabolites.

3. ELECTROPHORETIC TECHNIQUES
Electrophoresis of proteins and nucleic acids; ID & 2D Gels; pulsed-field electrophoresis; capillary electrophoresis; western blotting; gel documentation.

4. NUCLEOTIDE AND DNA ANALYSIS
DNA purification, PCR-based analysis; DNA fingerprinting; DNA sequencing.

5. IMMUNO-TECHNIQUES
Antiserum production, immunofluorescence, immuno-histocompatibility ELISA, localisation of cells in tissues immunoblotting; monoclonal antibodies.

6. ANALYSIS OF BIOPROCESSES
Analysis of biomass; measurement of dry weight and biomass composition; analysis of substrate uptake and product formation rates; measurement of BOD and COD in waste-waters; Gas analysis for O2 and CO2; flow injection analysis; computerised data acquisition of bioprocesses.

REFERENCES
1. **STRUCTURE OF PROTEINS**

Primary structure and its determination, secondary structure prediction and determination of supersecondary structures, protein folding pathways, tertiary structure and domain in proteins, quaternary structure, methods to determine tertiary and quaternary structures, post translational modification

2. **STRUCTURE FUNCTION RELATIONSHIP OF PROTEINS**

DNA binding proteins, prokaryotic and eukaryotic transcription factors, DNA polymerases, Membrane proteins and receptors, bacteriophages, photosynthetic centres, epidermal growth factor, insulin and PDGF receptors and their interaction with effectors, protein phosphorylation, immunoglobulins, Nucleotide binding proteins, enzyme serine proteases, ribonuclease, lysozyme.

3. **PROTEIN ENGINEERING AND PROTEIN DESIGN**

Protein data base analysis, methods to alter primary structure of proteins, examples of engineered proteins, protein design, principles and examples.

**REFERENCE:**


**IB 434 IMMUNOLOGY LABORATORY** 0 0 4 2

Handling of animals, raising of antibodies, purification of antibodies, immunodiffusion, agglutination and precipitation, enzyme linked immunosorbant assay (ELISA), purification of lymphocytes from peripheral blood, identification of cell populations by rosettes, immunofluorescence, preparation of gels, types of electrophoresis

**REFERENCE:**


**IB 435 DOWNSTREAM PROCESSING LABORATORY** 0 0 4 2

Cell disruption techniques, solid-liquid separation methods, filtration, sedimentation, centrifugation, product enrichment operations, precipitation, ultrafiltration, two phase aqueous extraction, high resolution purification, preparative liquid chromatographic techniques, product crystallisation and drying

**LIST OF ELECTIVES**

**IB 034 TECHNICAL WRITING AND COMMUNICATION** 3 0 0 3

1. **RESEARCH & WRITING**

The project/term paper, selecting a topic, using a library, compiling a working bibliography, taking notes, plagiarism, outlining, writing drafts, guides to writing.

2. **MECHANICS OF WRITING**

Spelling, punctuation, numbers, titles and quotations.
3. FORMAT OF A TERM/PROJECT REPORT

Typing, paper, margins, spacing, heading and title of paper, page numbers, tables and illustrations, corrections and insertions, binding.

4. PREPARATION OF CITATIONS

General guidelines, placement, arrangement, citing books, citing articles in periodicals, documenting sources, what is a document, parenthetical documentation, information required in parenthetical documentation, readability, sample references.

5. ABBREVIATIONS AND REFERENCES

Introduction, time, common scholarly abbreviations and references words, publishers names, symbols and abbreviations used in proof-reading and correction, literacy and scientific indexing.

6. MULTIMEDIA

L = 45 Total = 45

TEXT BOOK


REFERENCE


IB035 PLANT BIOTECHNOLOGY

1. AN OUTLINE OF MOLECULAR BIOLOGY

DNA Replication, translation, transcription, fundamentals of recombinant DNA technology, Gene regulation.

2. AGROBACTERIUM AND PLANT GENETIC ENGINEERING

Agrobacterium mediated gene transfer and cloning. Types of plant vectors and their use in gene manipulation.

3. PLANT VIRUSES

Classification diagnosis - remedy - viruses as a tool to deliver foreign DNA.

4. DEVELOPMENTAL ASPECTS OF RHIZOBIUM

Legume Symbiosis, Symbiotic Nitrogen fixation, Regulation of nif and nod gene.

5. MOLECULAR ASPECTS OF DISEASE SUSCEPTIBILITY AND RESISTANCE

Transposable elements, factors influencing disease resistance and susceptibility PFLP

6. TRANSGENICS

Herbicide tolerance - insect resistance - viral resistance - stress tolerance - development of disease resistance plants by introducing Bacillus thuringianensis genes.

REFERENCES:


IB 036 ANIMAL BIOTECHNOLOGY 3 0 0 3

1. INTRODUCTION 5
What is Animal Biotechnology and its scope, animals in Biotechnology- State of the Art

2. ANIMAL CELL CULTURE 20
Principles of sterile techniques and cell propagation, Chemically defined and serum Free media for membrane cell culture, scaling up of animal cell cultures, preservation and characterisation of animal cells , organ culture, cytotoxity and viability assays, Cell cultures as sources of valuable products.

3. GENETIC RECOMBINATION TECHNIQUES 20
Mammalian genome, genetic recombination in mammalian cells and embryos, Protein production by genetically engineered mammalian cell lines, optimisation of animal cells growth in bio reactors Emission.

L = 45 Total = 45

IB 037 BIOLOGICAL SPECTROSCOPY 3 0 0 3

1. SPECTROSCOPY 9
Interaction of radiation with matter, Definitions frequency, Wavelength, Wave number, types of electromagnetic radiation, interparticle forces and energies, energy levels. Population of energy levels, Scattering, Absorption and Emission.

2. INFRARED SPECTROSCOPY 9
Measurement of Infrared spectrum - Physical basis of infrared spectra, Infrared of Polyatomic molecules, biological examples, infrared of oriented samples.

L = 45 Total = 45

3. ULTRAVIOLET & VISIBLE SPECTROSCOPY 9
Electronic energy levels - Electronic transitions, Selection regale, Absorption range of biological chromophors, transition metal d-d transition - charge transfer spectra, application of UV spectra to proteins, properties associated with the transition dipole moment and interaction between them, measurement of molecular dynamics by florescence spectroscopy.

4. NUCLEAR MAGNETIC RESONANCE 9
The phenomenon - magnetisation - measurement, spectral parameters in NMR, Intensity, Chemical Shift - spin, spin coupling, T1 and T2 relaxation times, line widths, nuclear overhauser effect, chemical exchange paramagnetic centres, application of NMR in biology, assignment in NMR, studies of Macromolecules, ligand binding, ionisation studies and pH kinetics, molecular motion.

5. ELECTRON PARAMAGNETIC RESONANCE 9
Introduction - Resonance condition - measurement - spectral parameters, intensity g values - spectral anisotropy, time scale of EPR - spin labels transition metal ions, spin trapping.

L = 45 Total = 45

REFERENCE

IB 038 METABOLIC ENGINEERING 3 0 0 3

1. INTRODUCTION 15
Induction - Jacob Monod model, catabolite regulation, glucose effect, cAMP deficiency, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes,
concerted feed back regulation, cumulative feed back regulation, amino acid regulation of RNA synthesis, energy charge regulation, amino acid regulation of RNA synthesis, energy charge regulation, permeability control passive diffusion, facilitated diffusion, active transport group transportation.

2. SYNTHESIS OF PRIMARY METABOLITES 6
Alteration of feed back regulation, limiting accumulation of end products, feed back, resistant mutants, alteration of permeability.

3. BIOSYNTHESIS OF SECONDARY METABOLITES 6
Precursor effects, prophase, idiophase relationship, enzyme induction, feed back regulation, co-enzyme, regulation by passing control of secondary metabolism, producers of secondary metabolites.

4. BIOCONVERSIONS 3
Advantages of Bioconversions, specificity, yields, factors important to bioconversions, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or sequential bioconversions, conversion of insoluble substances.

5. REGULATION OF ENZYME PRODUCTION 9
Strain selection, improving fermentation, recognising growth cycle peak, induction, feedback repression, co-enzyme repression, mutants resistant to repression, gene dosage.

REFERENCE


IB 039 CHROMATOGRAPHIC SEPARATIONS 3 0 0 3

1. INTRODUCTION 12
Classification of techniques, distribution coefficients, retention chromatography, sorption mechanisms, retention parameters, factors affecting retention, qualitative and quantitative aspects of chromatography, peak shape, sorption isotherms, column efficiency, band broadening processes, selectivity and resolution.

2. CLASSICAL CHROMATOGRAPHY 7
Stationary phases, applications of ion exchange size exclusion, TLC - HPTLC.

3. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY 10
Introduction - design of a typical HPLC machine - types of columns - applications.

4. GAS CHROMATOGRAPHY 10
Introduction - instrumentation - columns - qualitative and quantitative aspects of gas chromatography - quantitative analysis of GC.

5. CHIRAL CHROMATOGRAPHY 6
Principles - types of chromatography - scopes and limitations - applications - capillary electrophoresis.
REFERENCES:

IB 040 ENVIRONMENTAL BIOTECHNOLOGY 3 0 0 3

1. FUNDAMENTALS OF MICRO-ORGANISMS 9
Microbial flora of soil, growth, ecological adaptations, interactions among soil microorganisms, biogeochemical role of soil microorganisms.

2. DEGRADATION OF XENOBIOTIC COMPOUNDS 9
Simple aromatics, chlorinated polycyclic petroleum products, pesticides and surfactants.

3. INDUSTRIAL WASTE WATER MANAGEMENT 9
Waste water characteristics, biological waste water treatment, unit operations, design and modelling of activated sludge process, mathematical modelling of anaerobic digested dynamics.

4. TREATMENT OF INDUSTRIAL WASTES 9
Dairy, pulp, dye, leather and pharmaceuticals, solid waste management

5. MOLECULAR BIOLOGY 9
Latest elements, developments pertaining to environmental biotechnology.

L = 45 Total = 45

REFERENCE:

IB 041 FOOD SCIENCE & TECHNOLOGY 3 0 0 3

1. INTRODUCTION TO FOOD PROCESSING 9
Biotechnology in relation to the food industry, nutritive value of food, types of microorganisms associated with food, its sources, types and behaviour in foods.

2. FOOD PRESERVATION 9
Bioprocessing of meat, fisheries, vegetables, dairy products, enzymes and chemicals used in food processing, biochemical engineering for flavour and food production.

3. FERMENTED FOOD PRODUCTS 9
Dairy products, meat. Fishery, non beverage plant products, beverages and related products of baking.

4. FOOD SPOILAGE 9
Food borne illness, quality control, case studies on Biotechnology in the evolution of food quality, HFCS (High Fructose Corn Syrup) and mycoproteins.

5. FOOD MICROBIOLOGY 9
Utilisation of microorganisms in food industry, genetic manipulations, food borne illness.

L = 45 Total = 45
REFERENCE:


IB 042 BIOPHARMACEUTICAL TECHNOLOGY

1. **INTRODUCTION**

Development of Drug and Pharmaceutical Industry- Therapeutic agents, their uses and economics; Regulatory aspects

2. **DRUG METABOLISM AND PHARMACOKINETICS**

Drug metabolism-physico chemical principles, radioactivity-pharma kinetics-action of drugs on human bodies.

3. **IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS**

Bulk drug Manufacturers, Types of Reactions in Bulk drug Manufacture and Processes. Special Requirements for Bulk Drug Manufacture.

4. **MANUFACTURING PRINCIPLES**

Compressed tablets, wet granulation- dry granulation or slugging-direct compression- tablet presses, coating of tablets, capsules sustained action dosage forms-parenteral solutions - oral liquids-injections-ointments-Topical Applications, Preservation, analytical methods and test for various drugs and pharmaceuticals, Packing - Packing Techniques, Quality Management, GMP

5. **PHARMACEUTICAL PRODUCTS AND THEIR CONTROL**

Therapeutic categories such as vitamins, laxatives, analgesics, non-steroidal contraceptives, Antibiotics, biologicals, hormones.

REFERENCE

2. Remington’s *Pharmaceutical Sciences*, Mark publishing and Co.

IB 043 DEVELOPMENTAL BIOLOGY

1. Basic concepts of developmental Biology, mosaic and regulative development, pattern formation, positional information.
3. Setting up the body axes - Dorsalventral and anteroposterior axes. Modes of axes determination.
4. Origins of Germ layers, gastrite formation, role of Organiser region, Hox genes and Homoeotic genes.
5. Drosophila development - positional information gradient, gap genes, segment polarity genes, pair-rule of maintenance genes, Maternal and zygotic genes.

REFERENCES:

IB 044 BIOPHYSICS

1. INTRODUCTION
Levels of structures in Biological macromolecules. Central questions in biophysics, basic strategies in biophysics.

2. CONFORMATIONAL ANALYSIS
Forces that determine protein and nucleic acid structure, basic problems, polypeptide chains geometrics, potential energy calculations, observed values for rotation angles, hydrogen bonding, hydrophobic interactions and water structures ionic interactions, disulfide bonds.

3. STRUCTURAL ANALYSIS OF MACROMOLECULES
Prediction of proteins structure nucleic acids, general characteristics of nucleic acid structure, geometrics, glycosidic bond rotational isomers and those puckering backbone rotational isomers and ribose puckering backbone rotational isomers and ribose puckering forces stabilising ordered forms, base pairing, base stacking tertiary structure of nucleic acids.

4. KINETICS OF LIGAND INTERACTIONS
Biochemical Kinetics studies, unimolecular reactions, simple biomolecular multiple intermediates, steady state kinetics, catalytic efficiency, relaxation spectrometry, ribonuclease as an example.

5. TECHNIQUES FOR THE STUDY OF BIOLOGICAL STRUCTURE & FUNCTION
Size and shape of macromolecules- methods of direct visualisation, macromolecules as hydrodynamic particles- macromolecular diffusion, ultracentrifugation, viscometry x-ray crystallography, determination of molecular structures, X-ray fibre diffraction, electron microscopy neutron scattering- light scattering.

L = 45 Total = 45

REFERENCE:


IB 045 IMMUNOTECHNOLOGY

1. ANTIGENS
Types of antigens, their structure, preparation of antigens for raising antibodies, handling of animals, adjuvants and their mode of action

2. ANTIBODIES & IMMUNODIAGNOSIS
Monoclonal and polyclonal antibodies- their production and characterisation, western blot analysis, immuno electrophoresis, SDS-PAGE, purification and synthesis of antigens, ELISA- principle and applications, radio immuno assay(RIA)-principles and applications, non isotopic methods of detection of antigens-enhanced chemiluminescence assay

3. ASSESSMENT OF CELL MEDIATED IMMUNITY
Identification of lymphocytes and their subsets in blood, T cell activation parameters, estimation of cytokines, macrophages activation, macrophage microbicidal assays, in-vitro experimentation, application of the above technology to understand the pathogenesis of infectious diseases.

4. IMMUNOPATHOLOGY
Preparation of storage of tissues, identification of various cell types and antigens in tissues, isolation and characterisation of cell types from inflammatory sites and infected tissues, functional studies on isolated cells, immunocytology- immunofluorescence, immunoenzymatic and immunofluorescent techniques, immuno electron microscopy.
5. MOLECULAR IMMUNOLOGY

Preparation of vaccines, application of recombinant DNA technology for the study of the immune system, production of idiotypic antibodies, catalytic antibodies, application of PCR technology to produce antibodies and other immunological reagents, immunotherapy with genetically engineered antibodies.

6. Current Topics in Immunology

Trends in Immunology of infectious diseases and tumours, topics as identified from time to time.

L = 45 Total = 45

TEXT BOOK


REFERENCE


IB 046 CANCER BIOLOGY

1. FUNDAMENTALS OF CANCER BIOLOGY

Regulation of Cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle-in cancer, Different forms of cancers, Diet and cancer.

70
IB 047 GENOMICS AND PROTEOMICS

2. Genomics in Biopharmaceutical Industry Functional Genomes - Pharmacogenetics - Genomics in relation to molecular Diagnosis- Molecular Therapeutic technologies.
5. Role of animal models in identification of genes for disorders knockout mice.

REFERENCES:

IB 048 MOLECULAR PATHOGENESIS

1. Introduction to pathogenesis, attributes of microbial pathogenesis, components of microbial pathogenicity.
2. Population genetics of Microbial pathogenesis, methods to detect genetic diversity and structure in nature population, epidemiology, cryptic diseases.
3. Host defences against pathogens, clinical importance of understanding host defences, components of the host surface defences systems like skin, mucosa and the defences systems of the eye, mouth, respiratory tract etc., components of the systemic defence like the tissues and blood.

4. Virulence and virulence factors, colonising virulence factors, virulence factors damaging the host tissues, virulence genes and regulation of the virulence genes.
5. Experimental methods to study host-pathogen interaction, selecting the pathogen model, measurement of virulence, identification of potential virulence factors, modulation of immune response by vaccines, properties of vaccines, other immune modulators.

6. PARADIGMS OF PATHOGENESIS:
(a) Diphtheria disease by colonisation
(b) Disease without colonisation, C. Botulinum and Staph aureus
(c) cholera
(d) Intestinal infections, Shigella and E. coli infections
(e) Salmonella infections
(f) Fungal infections

7. FUTURE CHALLENGES
(a) Gastric and duodenal ulcers are they due to infections
(b) Lyme disease and Syphilis -unsolved mystery
(c) Legionnaires disease - aftermath of comforts
(d) Tuberculosis and other mycobacterial infections - re-emerging with vengeance.
(e) Rheumatic fever and glomerulo nephritis still a question to be solved.

REFERENCES:
4. Janeway C.A. Jr. and Travers P.T. Immunobiology; Blackwell
5. Austyn J.M. and Wood K.J. Principles of Cellular and
Molecular Immunology; Oxford University Press, 1993.

IB 049 BIOPROCESS ECONOMICS AND PLANT
DESIGN

1. PROCESS DESIGN DEVELOPMENT

Technical feasibility survey, process development, flow diagrams,
equipment design and specifications.

2. GENERAL DESIGN CONSIDERATION

Marketable products, availability of technology, raw
materials, equipment, human resources, land and utilities, site
characteristics, waste disposal, govt. regulations and other legal
restrictions, community factors and other factors affecting
investment and production costs.

a. Cost Estimation

Capital investments- fixed capital investments including land,
building, equipments and utilities, installation cost (including
equipments, instrumentation, piping, electrical installation and other
utilities), working capital investments. Manufacturing costs- Direct
Production costs (including raw materials, human resources,
maintenance and repair, operating supplies, power and other
utilities, royalties, etc.), fixed charges (including depreciation, taxes,
insurance, rental costs etc.), Plant overheads - Administration,
safety and other auxiliary services, payroll overheads, warehouse
and storage facilities etc. Profitability Analysis - return on original
investment, interest rate of return, accounting for uncertainty and
variations and future developments. Optimization techniques-
Linear and Dynamic programming. Optimization strategies.

L = 45 Total = 45

REFERENCES:

1. Peters and Timmerhaus. Plant design and Economics for
1967.

IB 050 MOLECULAR MODELLING AND
DRUG DESIGN

1. EMPIRICAL FORCE FIELDS MOLECULAR
MECHANISMS

Bond Stretching - Angle Bending - Torsional terms - Out of plane
bonding motions - Electrostatic interactions - Van Der Waals
interactions - Effective pair Potentials - Hydrogen Bonding -
Simulation of liquid water

2. COMPUTER SIMULATION METHODS

Calculation of thermodynamic properties - Phase space - Practical
aspects of computer simulation - Boundaries monitoring
Equilibrium - Long range process - Analysing results of simulation
and estimating errors.

3. MOLECULAR DYNAMICS SIMULATION
METHODS

Molecular Dynamics using simple modules - Molecular Dynamics
with continuous potentials - Running Molecular Dynamics
simulation - Constant dynamics - Time dependent properties -
Molecular Dynamics at constant temperature and pressure.
5. MOLECULAR MODELLING TO DISCOVER AND DESIGN NEW MOLECULES  
Molecular modelling in drug discovery - Deriving and using 3D Pharma cores - Molecular docking - Structure Based methods to identify lead components - De novo ligand design

L = 45 Total = 45

2. J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997

REFERENCE

IB 051 NEUROBIOLOGY AND COGNITIVE SCIENCES 3003

1. INTRODUCTION TO NERVOUS SYSTEMS
Central and Peripheral nervous systems

2. NEURO ANATOMY
Structure and functions of neurons, synapse, their function, signals produced by neurons, sensors function, Glial cells, molecular and cellular organisation of neuronal differentiation, characterisation of neuronal cells.
5. Measures for conservation of Biodiversity and sustainable use of its components.

**TEXT BOOK:**


**HS 034 - TECHNICAL TAMIL**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>REVIEW OF BASIC GRAMMER</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>READINGS FROM TECHNICAL WRITINGS IN TAMIL</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>PRINCIPLES OF TRANSLATION</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>TAMIL AND COMPUTERS</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>CREATIVE WRITING IN TECHNICAL TAMIL</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

L = 45  Total = 45

**TEXT BOOKS**

1. A.K. PARANTHAMANAR, Nalla Tamil Elutha Venduma, Pañ Nilayam, Chennai

**REFERENCES**

2. Kalanjiyam, Quarterly of Anna University, Chennai (Journal articles).
4. DR. RADHA CHELLAPEN, Kalaichollakam.

**HS 035 TECHNICAL GERMAN - I**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>INTRODUCTION</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>THEMA</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>GRAMMATIK</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>UEBUNGEN</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>DIALOGUE</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Name, Land Wohnort Sudium, Beruf Familie, Geschwister, Alter Tagesablauf, termine Einladung Stellensuche, Berufswahl Einkauf

10


10

Partner ubungen Schriftliche Ubungen Aussprache Ubungen Kontrollubungen Text generation

5

Oral Written
TEXT BOOK:

1. Lernziel Deutsch (Deutsch als Fremdsprache) - Grundstufe I From Max Hueber Verlag

HS 036 TECHNICAL GERMAN - II 3 1 0 4

1. INTRODUCTION 5

German Idioms and Phrases

2. THEMA 10

Geschenke, Auf der Post, Auskunft-Fest, Heirat, Kinder Studium, Ausbildung, Erziehung, Jugend Deutschsprachige Landesordnung, Europa Arbeitswelt, Urlaub

3. GRAMMATIK 10

Dativ Ort und Richtung, Reflexive Verben, Verben mit Präposition, Objekt, Perfekt, Prätenum, Adjective, Komparation, Genitiv, Wortbildung, Nebensätze

4. UEBUNGEN 10

Partnerübungen, Schnittliche Übungen, Aussprache Übungen, Kontrollübungen, Text Generation

5. DIALOGUE 5

Oral Written

6. GLOSSARY 5

Technical Words

L : 45 T : 15 Total = 60

TEXT BOOK

Lernziel Deutsch (Deutsch als Fremdsprache) - Grundstufe I From Max Hueber Verlag

HS 037 TECHNICAL JAPANESE - I 3 1 0 4

1. Introduction to Japanese Alphabets - Hiragana, Katakana and Kanji - Group 1, 2, 3 & 4 syllables - writing practice - pronunciation - word order - Greetings - receiving a visitor and exchange of pleasantries - Kanji Practice. 9

2. Basic structure of sentences - Classification of verbs - Polite form of verbs - irregular verbs - Particle-E - Time expressions - question sentences - Japanese numerals - Kanji practice. 9

3. Classification of particles - Ga, Ka, Wa, O E, Ni etc - aural comprehension - Reading comprehension - noun 1, Wa, noun 2 desu - Demon-strative pronouns - kure, sore, are and door - kono, sono, ano and dono - kocho - hochira - achira and dochira - particle - No, kara, ni and de - question-Itsu - conversational grammar - soo desu ka - Na, i adjectives perfect and imperfect - question words - Doo and Ikaga - particle - To, ne and yo - Kanji practice. 9

4. Desu as a substitute for a verb - demonstrative pronouns - sono and sore - Group 1 particles - De, O, Me and Ka - conjunction - soshite - Ques-tion words - dare, nani, doke, itsu, door, dochira, doyatte, ikutsu, ikura - Words for degrees - gurai or kurai - Phrase - Sea - Ano-numerals - counters and numbers - humble form of desu and arimasu - Kanji practice. 9

5. Verbs ending in -te or de - classification of Te forms and Masu forms - verb modifiers - koo, soo aa and doo - Set phrase - Onegaishimasu - Sumimasen - Adverbs-Mazu, sore kara and saigo ni - formation of the - Te form of i adjective and desu - Kanji practice. 9

L : 45 T : 15 Total = 60
TEXT BOOKS:

HS 038 TECHNICAL JAPANESE - II 3 1 0 4


3 1 0 4

1. Alphabets: Pronunciation - Masculine and Feminine Genders only - Numbers: Indefinite and definite articles - Plurals - Verbs to be and to have.
TEXT BOOKS:

REFERENCE

HS 040 TECHNICAL FRENCH - II
1. Group III Verbs - Conjugations - Adjectives - Adverbs - Sentences - Present - Past compound - Simple past - future 64 9
2. Comparative, superlative sentences - recent past - immediate future - grammatical analysis. 9
3. Translation from English to French - Translation from French to English Texts from Physics and Chemistry 9
4. Translation from English to French - Translation from French to English Texts from Basic Engineering 9

L : 45  T : 15 Total = 60

TEXT BOOKS

REFERENCES
1. Centre D'études Françaises, Functional French for Scientists and Technologists, Jawaharlal Nehru University, New Delhi, 1986.

HS 041 ENGLISH I
1. LISTENING 7
- Listening comprehension - listening for specific information - note taking - use of charts and diagrams.
2. SPEAKING 7
- Defining - describing objects - describing uses/functions - comparing - offering suggestions - analysing problems and providing solutions - expressing opinions (agreement/disagreement) predicting - expressing possibility/certainty - framing questions - providing answers - pronunciation practice (word stress).
3. READING 12
- Skimming - scanning - detailed reading - predicting content - interpreting charts and tables - identifying stylistic features in texts - evaluating texts - understanding discourse coherence - guessing meaning from the context - note-making/transfering information.
4. WRITING 12
- Sentence definition - static description - comparison and contrast - classification of information - recommendations - highlighting problems and providing solutions - formal and informal letter writing - using flow-charts/diagrams - paragraph writing - editing.
5. FOCUS ON LANGUAGE 7

Word formation with prefixes and suffixes - discourse markers and their functions - degrees of comparison - expressions relating to recommendations and comparisons - active and passive voice - antonyms - tense forms - gerunds - condition sentences - modal verbs of probability and improbability - acronym and abbreviations - compound nouns and adjectives - spelling - punctuation.

L : 45  T : 15 Total = 60

TEXT BOOK

1. "English for Engineers and Technologists", Volume I. Authors: Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd., 1990.

REFERENCE BOOKS FOR ENGLISH


HS 042 ENGLISH II 3 1 0 4

1. LISTENING 7

Listening comprehension - listening for specific information - note-taking - using non-verbal devices.

2. SPEAKING 7

Describing processes - stating purpose - offering opinions, suggestions and recommendations - summarising - reporting - free discussion of chosen topics - pronunciation practice (word stress, consonant clusters - homonyms).

L : 45  T : 15 Total = 60

4. WRITING 12

Extended definition - process description - cause and effect analysis - stating choice and justifying it - safety instructions - check list - letter of application - data sheet/resume.

5. FOCUS ON LANGUAGE AND FUNCTIONS 7

Word formation - synonyms - prepositions - adverbs - passive voice - sequence words/discourse markers - connective adverbs - numerical expressions - expansion of abbreviations - rules for writing SI units - language of instructions, checklists, cause and effect, purpose and means - indefinite adjectives of number and quantity - spelling and punctuation.

REFERENCES BOOKS FOR ENGLISH II


GE 034 CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT

1. INTRODUCTION

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

2. PROJECT SELECTION AND EVALUATION

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

3. NEW PRODUCT DEVELOPMENT

Research and new product development - Patents - patent search - Patent laws - International code for patents - Intellectual property rights (IPR)

4. NEW PRODUCT PLANNING

Design of prototype - testing - quality standards - marketing research - introducing new products.

1. LABORATORY


REFERENCES