ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

CHEMICAL ENGINEERING

For
B.TECH. FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2017-2018)

JNTUH COLLEGE OF ENGINEERING HYDERABAD
(Autonomous)
Kukatpally, Hyderabad - 500085
TELANGANA, INDIA
1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

JNTUH offers 4 Year (8 Semesters) Bachelor of Technology (B.Tech.) Degree Programme, under Choice Based Credit System (CBCS) at its Constituent Autonomous College - JNTUH College of Engineering, Hyderabad, with effect from the Academic Year 2017-18 onwards, in the following Branches of Engineering …

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>II.</td>
<td>Computer Science and Engineering</td>
</tr>
<tr>
<td>III.</td>
<td>Electrical and Electronics Engineering</td>
</tr>
<tr>
<td>IV.</td>
<td>Electronics and Communication Engineering</td>
</tr>
<tr>
<td>V.</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>VI.</td>
<td>Metallurgical Engineering</td>
</tr>
<tr>
<td>VII.</td>
<td>Chemical Engineering</td>
</tr>
</tbody>
</table>

2.0 Eligibility for Admission

2.1 Admission to the UGP shall be made either on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (EAMCET), OR the University, OR on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

2.2 The medium of instructions for the entire UGP in E&T will be ENGLISH only.

3.0 B.Tech. Programme (UGP) Structure

3.1 The B.Tech. Programmes of JNTUH-CEH are of Semester Pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/ AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are as listed below.

3.2.1 Semester Scheme:
Each UGP is of 4 Academic Years (8 Semesters), with the year being divided into two Semesters of 22 weeks (≥ 90 working days) each, each Semester having - ‘Continuous Internal Evaluation (CIE)’ and ‘Semester End Examination (SEE)’. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC, and Curriculum/ Course Structure as suggested by AICTE are followed.

3.2.2 Credit Courses:
All Subjects/Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject/Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practicals Periods : Credits) Structure, based on the following general pattern ..

- One Credit - for One hour/ Week/ Semester for Theory/ Lecture (L) Courses; and,
- One Credit - for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses or Tutorials (T).

Other student activities like NCC, NSS, NSO, Study Tour, Guest Lecture etc., and identified Mandatory Courses will not carry Credits.
3.2.3 Subject/Course Classification:

All Subjects/Courses offered for the UGP are broadly classified as: (a) Foundation Courses (FnC), (b) Core Courses (CoC), and (c) Elective Courses (ElC).

- Foundation Courses (FnC) are further categorized as: (i) HS (Humanities and Social Sciences), (ii) BS (Basic Sciences), and (iii) ES (Engineering Sciences);
- Core Courses (CoC) and Elective Courses (ElC) are categorized as PS (Professional Subjects), which are further subdivided as – (i) PC (Professional/Departmental Core) Subjects, (ii) PE (Professional/Departmental Electives), (iii) OE (Open Electives); and (iv) Project Works (PW);
- Minor Courses (1 or 2 Credit Courses, belonging to HS/BS/ES/PC as per relevance); and
- Mandatory Courses (MC - non-credit oriented).

3.2.4 Course Nomenclature:

The Curriculum Nomenclature or Course-Structure Grouping for each of the UGP E&T (B.Tech. Degree Programmes), is as listed below (along with AICTE specified % Range of Total Credits)...

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Broad Course Classification</th>
<th>Course Group/Category</th>
<th>Course Description</th>
<th>Range of Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Foundation Courses (FnC)</td>
<td>BS – Basic Sciences</td>
<td>Includes - Mathematics, Physics and Chemistry Subjects</td>
<td>15% - 20%</td>
</tr>
<tr>
<td>2)</td>
<td></td>
<td>ES - Engineering Sciences</td>
<td>Includes fundamental engineering subjects</td>
<td>15% - 20%</td>
</tr>
<tr>
<td>3)</td>
<td></td>
<td>HS – Humanities and Social Sciences</td>
<td>Includes subjects related to Humanities, Social Sciences and Management</td>
<td>5% - 10%</td>
</tr>
<tr>
<td>4)</td>
<td>Core Courses (CoC)</td>
<td>PC – Professional Core</td>
<td>Includes core subjects related to the Parent Discipline/Department/Branch of Engg.</td>
<td>30% - 40%</td>
</tr>
<tr>
<td>5)</td>
<td>Elective Courses (ElC)</td>
<td>PE – Professional Electives</td>
<td>Includes Elective subjects related to the Parent Discipline/Department/Branch of Engg.</td>
<td>10% - 15%</td>
</tr>
<tr>
<td>6)</td>
<td></td>
<td>OE – Open Electives</td>
<td>Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline/Department/Branch of Engg.</td>
<td>5% - 10%</td>
</tr>
<tr>
<td>7)</td>
<td>Core Courses</td>
<td>Project Work</td>
<td>B.Tech. Project or UG Project or UG Major Project</td>
<td>10% - 15%</td>
</tr>
<tr>
<td>8)</td>
<td></td>
<td>Industrial Training/Mini-Project</td>
<td>Industrial Training/Internship/UG Mini-Project/Mini-Project</td>
<td></td>
</tr>
<tr>
<td>9)</td>
<td></td>
<td>Seminar</td>
<td>Seminar/Colloquium based on core contents related to the Parent Discipline/Department/Branch of Engg.</td>
<td></td>
</tr>
<tr>
<td>10)</td>
<td>Minor Courses</td>
<td>1 or 2 Credit Courses (subset of HS)</td>
<td>included</td>
<td></td>
</tr>
<tr>
<td>11)</td>
<td>Mandatory Courses (MC)</td>
<td>Mandatory Courses (non-credit)</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits for UGP (B. Tech.) Programme 192 (100%)

4.0 Course Work

4.1 A student, after securing admission, shall pursue the B.Tech. UGP in a minimum period of 4 Academic Years, and a maximum period of 8 Academic Years (starting from the Date of Commencement of I Year).

4.2 Each student shall Register for and Secure the specified number of Credits required for the completion of the UGP and Award of the B.Tech. Degree in respective Branch of Engineering.

4.3 Each Semester is structured to provide typically 24 Credits (24 C), totaling to 192 Credits (192 C) for the entire B.Tech. Programme.
5.0 Course Registration

5.1 A ‘Faculty Advisor or Counselor’ shall be assigned to each student, who will advise him about the UGP, its Course Structure and Curriculum, Choice/Option for Subjects/Courses, based on his competence, progress, pre-requisites and interest.

5.2 Academic Section of the College invites ‘Registration Forms’ from students apriori (before the beginning of the Semester), through ‘ON-LINE SUBMISSIONS’, ensuring ‘DATE and TIME Stamping’. The ON-LINE Registration Requests for any ‘CURRENT SEMESTER’ shall be completed BEFORE the commencement of SEE’s (Semester End Examinations) of the ‘PRECEDING SEMESTER’.

5.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the ‘WRITTEN APPROVAL’ from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of the same being retained with Head of Department, Faculty Advisor and the Student).

5.4 A Student may be permitted to Register for his Subjects/Course of CHOICE with a typical total of 24 Credits per Semester (Minimum being 20 C and Maximum being 28 C, permitted deviation being ± 17%), based on his PROGRESS and SGPA/CGPA, and completion of the ‘PRE-REQUISITES’ as indicated for various Subjects/Courses, in the Department Course Structure and Syllabus contents. However, a MINIMUM of 20 Credits per Semester must be registered to ensure the ‘STUDENTSHIP’ in any Semester.

5.5 Choice for ‘additional Subjects/Courses’ to reach the Maximum Permissible Limit of 28 Credits (above the typical 24 Credit norm) must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/ Counselor.

5.6 If the Student submits ambiguous choices or multiple options or erroneous entries - during ON-LINE Registration for the Subject(s)/Course(s) under a given/specified Course Group/Category as listed in the Course Structure, only the first mentioned Subject/Course in that Category will be taken into consideration.

5.7 Subject/Course Options exercised through ON-LINE Registration are final and CAN NOT be changed, and CAN NOT be inter-changed; further, alternate choices will also not be considered. However, if the Subject/Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5.8 Dropping of Subjects/Courses may be permitted, ONLY AFTER obtaining prior approval from the Faculty Advisor (subject to retaining a minimum of 20 C), ‘within 15 Days of Time’ from the beginning of the current Semester.

5.9 For Mandatory Courses like NCC/ NSS/ NSO etc., a ‘Satisfactory Participation Certificate’ from the concerned authorities for the relevant Semester is essential. No Marks or Grades or Credits shall be awarded for these activities.

6.0 Subjects/Courses to be offered

6.1 A typical Section (or Class) Strength for each Semester shall be 60.

6.2 A Subject/Course may be offered to the Students, ONLY IF a Minimum of 20 Students (1/3 of the Section Strength) opt for the same. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

6.3 More than ONE TEACHER may offer the SAME SUBJECT (Lab./Practicals may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection choice for students will be based on - ‘FIRST COME FIRST SERVE Basis and CGPA Criterion’ (ie., the first focus shall be on early ON-LINE ENTRY from the student for Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).
6.4 If more entries for Registration of a Subject come into picture, then the concerned Head of Department shall take necessary action, whether to offer such a Subject/ Course for TWO (or multiple) SECTIONS or NOT.

6.5 In case of options coming from Students of other Departments/ Branches/ Disciplines (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the ‘Parent Department’ first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the End Semester Examinations, if he acquires a minimum of 75% of attendance in aggregate of all the Subjects/ Courses (excluding Mandatory or Non-Credit Courses) for that Semester.

7.2 Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each Semester may be granted by the College Academic Committee on genuine and valid grounds, based on the student’s representation with supporting evidence.

7.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

7.4 Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

7.5 Students, whose shortage of attendance is not condoned in any Semester, are not eligible to take their End Examinations of that Semester, they get detained and their registration for that Semester shall stand cancelled. They will not be promoted to the next Semester. They may seek re-registration for all those Subjects registered in that Semester in which he got detained, by seeking re-admission for that Semester as and when offered; in case if there are any Professional Electives and/or Open Electives, the same may also be re-registered if offered, however, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the SAME set of Elective Subjects offered under that category.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Item No.7.

8.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 35% marks (25 out of 70 marks) in the End Semester Examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing P Grade or above in that Subject/ Course.

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to - Industry oriented Mini-Project/ Seminar, if he secures not less than 40% of the total marks (40 marks) to be awarded for each. The student would be treated as failed, if he - (i) does not submit a report on his Industry oriented Mini-Project, or does not make a presentation of the same before the Evaluation Committee as per schedule, or (ii) does not present the Seminar as required in the IV year II Semester, or (iii) secures less than 40% of marks (40 marks) in Industry oriented Mini-Project/ Seminar evaluations. He may reappear once for each of the above evaluations, when they are scheduled again; if he fails in such ‘one reappearance’ evaluation also, he has to reappear for the same in the next subsequent Semester, as and when it is scheduled.

8.3 A Student will not be promoted from I Year to II Year, unless he fulfils the Attendance and Academic Requirements and secures a total of minimum 24 Credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.

8.4 A Student will not be promoted from II Year to III Year, unless he fulfils the Attendance and Academic Requirements and secures a total of minimum 58 Credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
8.5 A Student will not be promoted from III Year to IV Year, unless he fulfils the Attendance and Academic Requirements and secures a total of minimum 86 Credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.

8.6 A Student shall - register for all Subjects covering 192 Credits as specified and listed (with the relevant Course/Subject Classifications as mentioned) in the Course Structure, put up all the Attendance and Academic requirements for 192 Credits securing a minimum of P Grade (Pass Grade) or above in each Subject, and ‘earn ALL 192 Credits securing SGPA $\geq 5.0$ (in each Semester), and CGPA (at the end of each successive Semester) $\geq 5.0’$, to successfully complete the UGP.

8.7 After securing the necessary 192 Credits as specified for the successful completion of the entire UGP, an exemption of maximum 8 secured Credits (in terms of two of their corresponding Subjects/Courses) may be permitted for optional drop out from these 192 Credits earned; i.e., the performance of the Student after the deduction of maximum 8 credits shall alone be taken into account for the calculation of ‘the final CGPA however, the Student’s Performances in the earlier individual Semesters, with the corresponding SGPA and CGPA for which already Grade Cards are given, will not be altered. Further, optional drop out for such 8 secured Credits shall not be allowed for Subjects/Courses listed as … i) Laboratories/Practicals, Industrial Training/Mini-Project, iii) Seminar, iv) Major Project.

8.8 If a Student registers for some more ‘extra Subjects’ (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totaling to 192 Credits as specified in the Course Structure of his Department, the performances in those ‘extra Subjects’ (although evaluated and graded using the same procedure as that of the required 192 Credits) will not be taken into account while calculating the SGPA and CGPA. For such ‘extra Subjects’ registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 7 and 8.1 – 8.7 above.

8.9 Students who fail to earn 192 Credits as per the Course Structure, and as indicated above, within 8 Academic Years from the Date of Commencement of their I Year shall forfeit their seats in B.Tech. Programme and their admissions shall stand cancelled.

8.10 When a Student is detained due to shortage of attendance in any Semester, he may be re-admitted into that Semester, as and when offered, with the Academic Regulations of the Batch into which he gets readmitted. However, no Grade Allotments or SGPA/CGPA calculations will be done for that entire Semester in which he got detained.

8.11 When a Student is detained due to lack of Credits in any year, he may be readmitted in the next year, after fulfilment of the Academic Requirements, with the Academic Regulations of the Batch into which he gets readmitted.

8.12 A student eligible to appear in the End Semester Examination in any Subject/Course, but absent at it or failed (thereby failing to secure P Grade or above), may reappear for that Subject/Course at the supplementary examination (SEE) as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/Course will be carried over, and added to the Marks to be obtained in the SEE supplementary examination, for evaluating his performance in that Subject.

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory or Practicals or Seminar or Drawing/Design or Industry oriented Mini-Project or Minor Course, etc; however, the B.Tech. Project Work (Major Project) will be evaluated for 200 Marks. These evaluations shall be based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination), and a Letter Grade corresponding to the % marks obtained shall be given.
9.2 For all Subjects/Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE. The semester end examinations will be conducted for 70 marks consisting of two parts viz. i) Part-A for 20 marks (10 x 2 marks), ii) Part-B for 50 marks. Part-B consists of five questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" or "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

9.3 a) For Theory Subjects (inclusive of Minor Courses), during the Semester, there shall be 2 mid-term examinations for 25 marks each. Each mid-term examination consists of one objective paper for 10 marks, plus one subjective paper for 15 marks, with a duration of 120 minutes (20 minutes for objective and 100 minutes for subjective papers). Further, there will be an allocation of 5 marks for Assignment. Objective paper may be set with multiple choice questions, True/False, fill-in the blanks, matching type questions, etc. Subjective paper shall contain 5 questions, out of which the Student has to answer 3 questions, each for 5 marks.

b) The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

c) First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second mid-term examinations. The Assignments shall be as specified by the concerned subject teacher.

d) The first mid-term examination Marks and first Assignment Marks shall make one set of CIE Marks, and the second mid-term examination Marks and second Assignment Marks shall make second set of CIE Marks; and the better of these two sets of marks shall be taken as the final marks secured by the Student towards Continuous Internal Evaluation in that Theory Subject.

9.4 For Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks, and 70 marks are assigned for Lab./Practical End Semester Examination (SEE). Out of the 30 marks for internals, day-to-day work in the laboratory shall be evaluated for 20 marks; and for the remaining 10 marks - two internal practical tests (each of 10 marks) shall be conducted by the concerned laboratory teacher and the better of these two tests is taken into account. The SEE for Practicals shall be conducted at the end of the Semester by Two Examiners appointed by Head of the Department.

9.5 For the Subjects having Design and/or Drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation), the distribution shall be 30 marks for CIE (20 marks for day-to-day work, and 10 marks for internal tests) and 70 marks for SEE. There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marks for internal tests.

9.6 Open Electives: Students are to choose One Open Elective (OE-I) during III Year I Semester, one (OE-II) during III Year II Semester, and one (OE-III) in IV Year II Semester, from the list of Open Electives given. However, Students can not opt for an Open Elective Subject offered by their own (parent) Department, if it is already listed under any category of the Subjects offered by parent Department in any Semester.

9.7 a) There shall be an Industry oriented Mini-Project, in collaboration with an Industry of the relevant specialization, to be registered immediately after III Year II Semester examinations, and taken up during the summer vacation for about eight weeks duration.

b) The Industry oriented Mini-Project shall be submitted in a Report form, and a presentation of the same shall be made before a Committee, which evaluates it for 100 marks. The Committee shall consist of Head of the Department, the supervisor of Mini-Project, and a Senior Faculty Member of the Department. There shall be no internal marks for Industry oriented Mini-Project. The Mini-Project shall be evaluated in the IV Year I Semester.

9.8 There shall be a Seminar Presentation in IV Year II Semester. For the Seminar, the student shall collect the information on a specialized topic, prepare a Technical Report and submit to the Department at the time of Seminar
Presentation. The Seminar Presentation (along with the Technical Report) shall be evaluated by Two Faculty Members assigned by Head of the Department, for 100 marks. There shall be no SEE or external examination for Seminar.

9.9 Each Student shall start the Project Work during the IV Year I Semester, as per the instructions of the Project Guide/Project Supervisor assigned by the Head of Department. Out of a total 200 marks allotted for the Project Work, 60 marks shall be for CIE (Continuous Internal Evaluation and 140 marks for the SEE (End Semester Viva-voce Examination). The Project Viva-voce shall be conducted by a Committee comprising of an External Examiner, Head of the Department and Project Supervisor. Out of 60 marks allocated for CIE, 30 marks shall be awarded by the Project Supervisor (based on the continuous evaluation of student’s performance throughout the Project Work period), and the other 30 marks shall be awarded by a Departmental Committee consisting of Head of the Department and Project Supervisor, based on the work carried out and the presentation made by the Student at the time of Viva-voce Examination.

9.10 For NCC/ NSS/ NSO types of Courses, and/or any other Mandatory Non-Credit Course offered in a Semester, a ‘Satisfactory Participation Certificate’ shall be issued to the Student from the concerned authorities, only after securing ≥ 65% attendance in such a Course. No marks or Letter Grade shall be allotted for these activities.

10.0 Grading Procedure

10.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 9 above, and a corresponding Letter Grade shall be given.

10.2 As a measure of the student’s performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed ...

<table>
<thead>
<tr>
<th>% of Marks Secured in a Subject / Course</th>
<th>Letter Grade As per UGC Guidelines</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than or equal to 90%</td>
<td>O (Outstanding)</td>
<td>10</td>
</tr>
<tr>
<td>80 and less than 90%</td>
<td>A (Excellent)</td>
<td>9</td>
</tr>
<tr>
<td>70 and less than 80%</td>
<td>A (Very Good)</td>
<td>8</td>
</tr>
<tr>
<td>60 and less than 70%</td>
<td>B+ (Good)</td>
<td>7</td>
</tr>
<tr>
<td>50 less than 60%</td>
<td>B (Average)</td>
<td>6</td>
</tr>
<tr>
<td>40 less than 50%</td>
<td>C (Pass)</td>
<td>5</td>
</tr>
<tr>
<td>Below 40%</td>
<td>F (Fail)</td>
<td>0</td>
</tr>
<tr>
<td>Absent</td>
<td>Ab</td>
<td>0</td>
</tr>
</tbody>
</table>

10.3 A student obtaining F Grade in any Subject shall be considered ‘failed’ and will be required to reappear as ‘Supplementary Candidate’ in the End Semester Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

10.4 A Letter Grade does not imply any specific % of Marks.

10.5 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of ‘Grade Improvement’ or ‘SGPA/ CGPA Improvement’. However, he has to repeat all the Subjects/ Courses pertaining to that Semester, when he is detained (as listed in Items 8.10- 8.11).

10.6 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding ‘Credit Points’ (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits .... For a Course
10.7 The Student passes the Subject/ Course only when he gets GP ≥ 5 (P Grade or above).

10.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (∑CP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

\[ \text{SGPA} = \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{i=1}^{N} C_i} \]  

For each Semester,

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects ‘REGISTERED’ for the Semester (as specifically required and listed under the Course Structure of the parent Department), \( C_i \) is the no. of Credits allotted to the ith Subject, and \( G_i \) represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

**Illustration of calculation of SGPA**

<table>
<thead>
<tr>
<th>Course / Subject</th>
<th>Credits</th>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Credit Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course 1</td>
<td>4</td>
<td>A</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>Course 2</td>
<td>3</td>
<td>O</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Course 3</td>
<td>4</td>
<td>C</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Course 4</td>
<td>4</td>
<td>B</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Course 5</td>
<td>3</td>
<td>A+</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>Course 6</td>
<td>2</td>
<td>C</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Course 7</td>
<td>2</td>
<td>B</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Course 8</td>
<td>2</td>
<td>C</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24</td>
<td></td>
<td><strong>165</strong></td>
<td></td>
</tr>
</tbody>
</table>

SGPA = 165/24 = 6.87

10.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

\[ \text{CGPA} = \left( \frac{\sum_{j=1}^{M} C_j G_j}{\sum_{j=1}^{M} C_j} \right) \]  

for all S Semesters registered (i.e., upto and inclusive of S Semesters, S ≥ 2),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has ‘REGISTERED’ from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), \( C_j \) is the no. of Credits allotted to the jth Subject, and \( G_j \) represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

10.10 For Merit Ranking or Comparison Purposes or any other listing, ONLY the ‘ROUNDED OFF’ values of the CGPAs will be used.

10.11 For Calculations listed in Item 10.6 – 10.10, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/ Courses will also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.

10.12 Passing Standards:

10.12.1 A student shall be declared successful or ‘passed’ in a Semester, only when he gets a SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared successful or ‘passed’ in the entire UGP, only when gets a CGPA ≥ 5.00; subject to the condition that he secures a GP ≥ 5 (P Grade or above) in every registered Subject/ Course in each Semester (during the entire UGP) for the Degree Award, as required.
10.12.2 In spite of securing P Grade or above in some (or all) Subjects/Courses in any Semester, if a Student receives a SGPA < 5.00 and/or CGPA < 5.00 at the end of such a Semester, then he ‘may be allowed’ (on the ‘specific recommendations’ of the Head of the Department and subsequent approval - by the College Academic Committee.

(i) to go into the next subsequent Semester (subject to fulfilling all other attendance and academic requirements as listed under Items 7-8);

(ii) to ‘improve his SGPA of such a Semester (and hence CGPA) to 5.00 or above’, by reappearing for ONE or MORE (as per Student’s choice) of the same Subject(s) / Course(s) in which he has secured P Grade(s) in that Semester, at the Supplementary Examinations to be held in the next subsequent Semester(s). In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

In these considerations, the newly secured Letter Grades will be recorded and taken into account for calculation of SGPA and CGPA, only if there is an improvement.

10.12.3 A Student shall be declared successful or ‘passed’ in any Non-Credit Subject/ Course, if he secure a ‘Satisfactory Participation Certificate’ for that Mandatory Course.

10.13 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the Registered Students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA, and CGPA.

11.0 Declaration of Results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 10.6 – 10.10.

11.2 For Final % of Marks equivalent to the computed final CGPA, the following formula may be used …

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

12.0 Award of Degree

12.1 A Student who registers for all the specified Subjects/Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire UG E&T Programme (UGP), and secures the required number of 192 Credits (with CGPA ≥ 5.0), within 8 Academic Years from the Date of Commencement of the First Academic Year, shall be declared to have ‘QUALIFIED’ for the Award of the B.Tech. Degree in the chosen Branch of Engineering as selected at the time of Admission.

12.2 A Student who qualifies for the Award of the Degree as listed in Item 12.1, shall be placed in the following Classes …

12.3 Students with final CGPA (at the end of the UGP) ≥ 8.00 :

(i) Shall be placed in ‘First Class with distinction’ if fulfilling the following conditions.

(a) should not fail in any Subjects/Courses and should complete the required credits for the Award of Degree within the first 4 Academic Years (or 8 Sequential Semesters) from the Date of Commencement of his First Academic Year,

(b) should not have been detained or prevented from writing the End Semester Examinations in any Semester due to shortage of attendance or any other reason.

(ii) Shall be placed in ‘First Class’ if not fulfilling the above a & b conditions

12.4 Students with final CGPA (at the end of the UGP) ≥ 6.50 but < 8.00, shall be placed in ‘First Class’. 

12.5 Students with final CGPA (at the end of the UGP) ≥ 5.50 but < 6.50, shall be placed in ‘Second Class’. 

12.6 All other Students who qualify for the Award of the Degree (as per Item 12.1), with final CGPA (at the end of the UGP) ≥ 5.00 but < 5.50, shall be placed in ‘Pass Class’. 

12.7 A student with final CGPA (at the end of the UGP) < 5.00 will not be eligible for the Award of the Degree.
12.8 Students fulfilling the conditions listed under Item 12.3 alone will be eligible candidates for - ‘University Rank’ and ‘Gold Medal’ considerations.

13.0 Withholding of Results

13.1 If the student has not paid fees to University/College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

14.0 Transitory Regulations

14.1 Student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the Degree Programme, may be considered eligible for readmission to the same Subjects/Courses (or equivalent Subjects/Courses, as the case may be), and same Professional Electives/Open Electives (or from set/category of Electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the Date of Commencement of his I Year I Semester).

15.0 Student Transfers

15.1 There shall be no Branch transfers after the completion of Admission Process.

15.2 There shall be no transfer among the Constituent Colleges and Units of Jawaharlal Nehru Technological University Hyderabad.

16.0 Scope

i) Where the words “he”, “him”, “his”, occur in the write-up of regulations, they include “she”, “her”, “hers”.

ii) Where the words “Subject” or “Subjects”, occur in these regulations, they also imply “Course” or “Courses”.

iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor/Principal is final.

v) The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all Students with effect from the dates notified by the College Authorities.

* * * * *

MALPRACTICES RULES

<table>
<thead>
<tr>
<th>Nature of Malpractices</th>
<th>Punishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the candidate:</td>
<td></td>
</tr>
<tr>
<td>1 (a)</td>
<td></td>
</tr>
<tr>
<td>Possesses or keeps</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject only.</td>
</tr>
</tbody>
</table>
| accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the
<table>
<thead>
<tr>
<th>1 (b)</th>
<th>Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Impersonates any other candidate in connection with the examination.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5</th>
<th>Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancellation of the performance in that subject.</strong></td>
<td></td>
</tr>
</tbody>
</table>

| 6 | Refuses to obey the orders of the Chief Superintendent / Assistant --Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in-charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall of any injury to his person or to any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BS</td>
<td>Mathematics - I</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>BS</td>
<td>Engineering Physics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>BS</td>
<td>Applied Chemistry</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>ES</td>
<td>Computer Programming &amp;</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>
### Data Structures

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>ES</td>
<td>Applied Mechanics</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>BS</td>
<td>Engineering Physics Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>BS</td>
<td>Applied Chemistry Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>ES</td>
<td>Computer Programming &amp; Data Structures Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**NSS/NCC/NSO Total Credits:** 24

---

### II Year

#### I Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BS</td>
<td>Mathematics – III</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>ES</td>
<td>Fundamentals of Electrical &amp; Electronics Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>HS</td>
<td>English</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>ES</td>
<td>Engineering Graphics</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>ES</td>
<td>Environmental Science</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>BS</td>
<td>Computational Mathematics</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>ES</td>
<td>Engineering Workshop</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>HS</td>
<td>English Language Communication Skills Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>BS</td>
<td>Computational Mathematics Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**NSS/NCC/NSO Total Credits:** 24

---

### II Year

#### II Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PC</td>
<td>Chemical Technology</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>BS</td>
<td>Organic Chemistry</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PC</td>
<td>Chemical Engineering Thermodynamics-II</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>PC</td>
<td>Mechanical Operations</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>PC</td>
<td>Process Heat Transfer</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>PC</td>
<td>Process Heat Transfer Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>HS</td>
<td>Gender Sensitization Lab</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>PC</td>
<td>Mechanical Operations Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>PC</td>
<td>Chemical Technology &amp; Organic Synthesis Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total Credits:** 15 9 24

---

### III Year

#### I Semester

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OE-I</td>
<td>Open elective-I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PC</td>
<td>Process Modeling &amp; Simulation</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>PC</td>
<td>Chemical Reaction</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>
### III YEAR II SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OE</td>
<td>Open Elective</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PE-I</td>
<td>Professional Elective-I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PE-II</td>
<td>Professional Elective-II</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>PC</td>
<td>Mass Transfer Operations – II</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>PC</td>
<td>Chemical Reaction Engineering-II</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>PC</td>
<td>Chemical Reaction Engineering Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>PC</td>
<td>Separation Processes Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>PC</td>
<td>Process Simulation Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>18</td>
<td>2</td>
<td>9</td>
<td>24</td>
</tr>
</tbody>
</table>

Industry Oriented Mini Project: Between III & IV Year Summer

---

### IV YEAR II SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OE</td>
<td>Open Elective – III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Management Science</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Seminar</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Energy &amp; Environmental Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major Project</td>
<td></td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td></td>
<td>7</td>
<td>3</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>
OPEN ELECTIVE- I

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>Offering Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Disaster Management</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>2</td>
<td>Non-Conventional Power Generation</td>
<td>Electrical &amp; Electronics Engineering</td>
</tr>
<tr>
<td>3</td>
<td>Electrical Engineering Materials</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>4</td>
<td>Operations Research</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Basics of Thermodynamics</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Fabrication Processes</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Electronic Measuring Instruments</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>OOPS through JAVA</td>
<td>Computer Science &amp; Engineering</td>
</tr>
<tr>
<td>9</td>
<td>Computer Graphics</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Engineering Materials</td>
<td>Metallurgical Engineering</td>
</tr>
<tr>
<td>11</td>
<td>Metallurgy for Non Metallurgists</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Industrial Pollution Control Engineering</td>
<td>Chemical Engineering</td>
</tr>
</tbody>
</table>

OPEN ELECTIVE- II

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>Offering Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Estimation, Quantity Survey &amp; Valuation</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>2</td>
<td>Design Estimation and Costing of Electrical Systems</td>
<td>Electrical &amp; Electronics Engineering</td>
</tr>
<tr>
<td>3</td>
<td>Energy Storage Systems</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mechatronics</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Jet propulsion and Rocket Engineering</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ergonomics</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Mechatronics</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Principles of Electronic Communications</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Cyber Security</td>
<td></td>
</tr>
</tbody>
</table>

MATHEMATICS – I

Objectives:
- To train the students thoroughly in mathematical concepts of ordinary differential equations and their applications.
To prepare students for lifelong learning and successful careers using mathematical concepts of differential and integral calculus, ordinary differential equations and vector calculus.

To develop the skill pertinent to the practice of the mathematical concepts including the students abilities to formulate and modeling the problems, to think creatively and to synthesize information.

Outcomes:
At the end of the course, the student will be able to:

- become familiar with the application of differential and integral calculus, ordinary differential equations and vector calculus to engineering problems.
- attain the abilities to use mathematical knowledge to analyze, formulate and solve problems in engineering applications.

UNIT–I: Differential calculus (12 lectures)
Rolle's Mean value Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – (all theorems without proof but with geometrical interpretations), verification of the Theorems and testing the applicability of these theorem to the given function.
Curve tracing – Equations given in Cartesian, polar and parametric forms.
Functions of several variables – Functional dependence- Jacobian-Maxima and Minima of functions of two variables with constraints and without constraints-Methon of Lagrange multipliers.

UNIT–II: Improper Integrals, Multiple Integration (12 lectures)
Gamma and Beta Functions –Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions.
Multiple integrals – double and triple integrals – change of order of integration- change of variables (polar, cylindrical and spherical) . Finding the area of a region using Double integration and volume of a region in space using triple integration.

UNIT–III: Vector Calculus (12 lectures)

UNIT–IV: First Order Ordinary Differential Equations (10 lectures)
Linear and exact differential equations

Applications of first order differential equations – Newton’s Law of cooling, Law of natural growth and decay, orthogonal trajectories and electrical circuits

UNIT-V: Higher Order Ordinary Differential Equations (10 lectures)
Linear, homogeneous and non-homogeneous differential equations of second and higher order with constant coefficients. Non-homogeneous term of the type $e^{at}, \sin ax, \cos ax$, and $x^n V(x), x^n V(x)$. Method of variation of parameters. Applications: Bending of beams, Electrical circuits and simple harmonic motion.

Text books:
1) HIGHER ENGINEERING MATHEMATICS BY B S GREWAL, KHANNA PUBLICATIONS.
2) ENGINEERING MATHEMATICS BY ERWIN KREYSZIG, WIELY PUBLICATIONS.
3) VECTOR ANALYSIS BY GHOSSG & MAITY, NEW CENTRAL BOOK AGENCY.

References:
1) ENGINEERING MATHEMATICS BY SRIMANTAPAL & SUBODH C. BHUNIA, OXFORD UNIVERSITY PRESS.
2) ADVANCE ENGINEERING MATHEMATICS BY PETER V O’NEIL, CENGAGE LEARNING.
rather than of past interest, and to condition the student to the atmosphere of change he will encounter during his carrier. The main purpose of this course is to equip engineering undergraduates with an understanding of the scientific method, so that they may use the training beneficially in their higher pursuits. An earnest attempt is made in framing the course in this direction by blending careful presentation of fundamental concepts and methods of physics. The course begins with a detailed coverage of optics, which includes topics such as interference, diffraction, polarization of Light phenomenon. It then delves into discussion on Characterization of materials in terms of bonding, defects, Structures, X-ray diffraction, dielectric nature, Magnetic behavior, Superconducting nature, Nano size activity etc. The basic principles behind the Acoustics of good structures (Halls) are elucidated for easy understanding of complex concepts.

Outcomes:
The knowledge of Physics relevant to engineering is critical for converting ideas into technology. An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements. In the present course, the students can gain knowledge not only about one of the naturally main source of life on the earth planet i.e. sun rays and their phenomenon, but also of other artificial light source behavior and their phenomenon. Similarly, by studying other chapters, the student can gain the knowledge of the relation between the micro level physical properties of the materials and their macro level behavior thereby acquires the idea of making them use effectively in real time situation or in applications of interest.

UNIT-I
1. **Interference**: Superposition of Waves, Young’s double slit experiment, Coherence, Interference in Thin films by Reflection, Newton’s Rings.
3. **Polarization**: Introduction to polarization, Double Refraction, Nicol Prism, Quarter and Half wave plates

UNIT-II

5. **Crystallography and Crystal Structures**: Space Lattice, Unit Cell, Lattice parameters, Crystal Systems, Bravais Lattices, Miller Indices, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Diamond Structure(Cubic), Structures of NaCl, ZnS, CsCl, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems

UNIT-III

UNIT-IV
8. **Dielectric Properties**: Basic definitions: Electric dipole, Dipole moment, Permittivity, Dielectric constant, Polarizability, Electric susceptibility, Displacement vector; Electronic Polarization, Ionic Polarization (Quantitative treatment) and Orientation Polarization (Qualitative treatment), Internal Fields in Solids, Clausius - Mosotti Equation, Piezo-electricity, Pyro-electricity and Ferro-electricity, Properties of ferro-electric materials.
10. **Superconductivity**: Introduction of Superconductivity, Properties of Superconductors, Meissner Effect, BCS theory (Qualitative), Type-I and Type II Superconductors, Magnetic Levitation and Applications of Superconductors.

UNIT-V
12. **Nanomaterials**: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-Gel, Precipitation, combustion Methods; Top-Down Fabrication:
Chemical Vapor Deposition, Physical Vapor Deposition, Characterization Techniques (XRD, SEM &TEM) and Applications.

**Text books:**
2. Introduction to Solid State Physics by Charles Kittel, Wiley India Pvt Ltd, 7th Edition
4. Solid State Physics by A J Dekker, MACMILLAN INDIA LTD.

**References:**
1. Modern Engineering Physics by Dr.K.Vijaya Kumar, Dr.S.Chandralingam, S.CHAND & COMPANY LTD
4. Introduction to Nanotechnology by Charles P.Poole, Jr.Frank J ownes, John Wiley & sons

**JNTUH COLLEGE OF ENGINEERING HYDERABAD**

I Year B.Tech. Chem. Engg. I-Sem  

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**APPLIED CHEMISTRY**

**Prerequisites:** Nil

**Course objectives:**

The student is made to understand the basic concepts of chemistry. To explore the economically viable techniques developed for utilizing water resources and to provide the skills for analysis of water and materials. To inculcate the knowledge of corrosion to face thin burning issue of the Globe. The principle of the preparing and utilizing various polymers for varied applications.

**Outcomes:**

At the end of the course, the student will be able to:

- learn the concepts of electrochemistry, batteries. The principles and procedures for making varied polymers for different applications are well understood. The skills pertaining to water treatment and analysis will be inculcated.

**Unit-I: Water and its treatment**


**Unit-II: Electrochemistry and corrosion**


**Unit-III: High Polymers:**

Definition – Classification of polymers with examples – Types of polymerisation – Chain growth (free radical addition mechanism), step growth polymerization, Plastics, fibres and elastomers - definition and

Unit-IV: Chemistry of Energy sources

Unit-V: Engineering Materials:

Text Books:

Reference Books:
4. It provides an understanding of data structures such as stacks and queues.

Outcomes:
At the end of the course, the student will be able to:
1. Develop C programs for computing and real life applications using basic elements like control statements, arrays, functions, pointers and strings; and data structures like stacks, queues and linked lists.
2. Implement searching and sorting algorithms

UNIT - I

Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output, Operators. Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Bit wise operators, Statements, Simple C Programming examples.

UNIT – II
Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Simple C Programming examples.

Designing Structured Programs- Functions, basics, user defined functions, inter function communication, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, Preprocessor commands, example C programs

UNIT – III
Arrays and Strings – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, C program examples. Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions, command –line arguments.

UNIT - IV
Derived types – Structures – Declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit fields, enumerated types, C programming examples.

Input and Output – Concept of a file, streams, standard input / output functions, formatted input / output functions, text files and binary files, file input / output operations, file status functions (error handling), C program examples.

UNIT – V
Sorting and Searching selection sort, bubble sort, insertion sort, linear and binary search methods.

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

TEXT BOOKS:
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCES:
6. C Programming & Data Structures,E.Balagurusamy,TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
Objectives:

- The study of Engineering Mechanics is very vital to the curriculum of Engineering Studies
- The objective of this course is to build up and enhance the knowledge of mechanics studied in the physics in the application orientation for engineering problems. This course enables the students to take up the further courses in Engineering orientation for respective branches

Outcomes:

In applied mechanic Program, the student will be given maximum flexibility in pursuing an area of special interest like

- Dynamics and Vibrations -its interfaces to materials and structures for understanding on applications. Towards characteristics of structures and study on material and structure
- Applied Mathematics and Numerical Methods
- Experimental Mechanics and Materials
- Strength of materials & structural analysis

After completing the course student will have the basic knowledge on material and structures at analysis level. This will also integrate the science, engineering and mathematical concept for student understanding.

UNIT – I

INTRODUCTION OF ENGINEERING MECHANICS – Basic concepts


UNIT – II


UNIT – III


MOMENT OF INERTIA: Moment of Inertia of Areas and Masses - Transfer Formula for Moments of Inertia - Moment of inertia of composite areas and masses.

UNIT – IV


UNIt – V
VIRTUAL WORK: Theory of virtual work – Applications.

TEXT BOOKS:

REFERENCES:
1. Engineering Mechanics (Statics and Dynamics) by Hibbler; Pearson Education.

JNTUH COLLEGE OF ENGINEERING HYDERABAD
I Year B.Tech. Chem. Engg. I-Sem

ENGINEERING PHYSICS LAB
LIST OF EXPERIMENTS
1. Dispersive power of the material of a prism –Spectrometer
2. Determination of wavelengths of a source-Diffraction Grating.
4. Time constant of an R-C Circuit.

JNTUH COLLEGE OF ENGINEERING HYDERABAD
I Year B.Tech. Chem. Engg. I-Sem

APPLIED CHEMISTRY LAB
LIST OF EXPERIMENTS
1) Estimation of ferrous iron by Permanganometry.
2) Estimation of ferric iron by Dichrometry,
3) Estimation of copper by Iodometry
4) Estimation of Fe^{2+} & Fe^{3+} by dichrometry.
5) Estimation of hardness of water by Complexometry using EDTA,
6) Estimation of copper by Complexometry using EDTA.
7) Estimation of alkalinity of water.
8) Estimation of Permanent hardness by EDTA
9) Preparation of Thikol rubber
10) Estimation of iron in cement by Colorimetry; KMnO₄
11) Estimation of Mn in KMnO₄ by Colorimetry;
12) Estimation of HCl in a given solution by pH - metry.
13) Estimation of HCl in acid mixture by conductometry.
14) Estimation of Fe²⁺ by Potentiometry.

Recommeded Books:

JNTUH COLLEGE OF ENGINEERING HYDERABAD
0 0 3 2

COMPUTER PROGRAMMING & DATA STRUCTURES LAB

Week 1:
1. Write a C program to find the sum of individual digits of a positive integer.
2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1.
   Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

Week 2:
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, *, /, % and use Switch Statement)

Week 3:
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following:
    i) Addition of Two Matrices
    ii) Multiplication of Two Matrices

Week 4:
11. Write a C program that uses functions to perform the following operations:
    i) To insert a sub-string in to a given main string from a given position.
    ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn’t contain T.
14. Write a C program to count the lines, words and characters in a given text.

Week 5:
15. Write a C program to generate Pascal’s triangle.
16. Write a C program to construct a pyramid of numbers.
17. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: 1+x+x²+x³+............+xⁿ
   For example: if n is 3 and x is 5, then the program computes 1+5+25+125.
   Print x, n, the sum
   Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the
Week 6:
18. 2’s complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2’s complement of 11100 is 00100. Write a C program to find the 2’s complement of a binary number.
19. Write a C program to convert a Roman numeral to its decimal equivalent.

Week 7:
20. Write a C program that uses functions to perform the following operations:
   i) Reading a complex number
   ii) Writing a complex number
   iii) Addition of two complex numbers
   iv) Multiplication of two complex numbers
   (Note: represent complex number using a structure.)

Week 8:
21. i) Write a C program which copies one file to another.
    ii) Write a C program to reverse the first n characters in a file.
        (Note: The file name and n are specified on the command line.)
22. i) Write a C program to display the contents of a file.
    ii) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

Week 9:
23. Write a C program that uses functions to perform the following operations on singly linked list:
    i) Creation
    ii) Insertion
    iii) Deletion
    iv) Traversal

Week 10:
24. Write C programs that implement stack (its operations) using
    i) Arrays
    ii) Pointers
25. Write C programs that implement Queue (its operations) using
    i) Arrays
    ii) Pointers

Week 11:
26. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order
    i) Bubble sort
    ii) Selection sort

Week 12:
27. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
   i) Linear search
   ii) Binary search

JNTUH COLLEGE OF ENGINEERING HYDERABAD
I Year B.Tech. Chem. Engg. II-Sem       L   T    P    C
3    1    0   3
MATHEMATICS – II
(Common to all Branches)
Pre Requisites: NIL
Objectives:
• Our emphasis will be more on conceptual understanding and application of Fourier series, Fourier, Z and Laplace transforms and solution of partial differential equations.
Outcomes:
At the end of the course, the student will be able to:

- gains the knowledge to tackle the engineering problems using the concepts of Fourier series, various transforms and partial differential equations.

UNIT–I: Linear ODE with variable coefficients and series solutions  
(8 lectures)

Equations reducible to constant coefficients-Cauchy’s and Legendre’s differential equations. Motivation for series solutions, Ordinary point and Regular singular point of a differential equation, Transformation of non-zero singular point to zero singular point. Series solutions to differential equations around zero, Frobenius Method about zero.

UNIT-II: Special Functions  
(8 lectures)

Bessel’s Differential equation, Bessel functions properties: – Recurrence relations, Orthogonality, Generating function, Trigonometric expansions involving Bessel functions.

UNIT–III: Laplace Transform  
(8 lectures)

Definition of Integral transform. Domain of the function and Kernel for the Laplace transforms, Laplace transform of standard functions, first shifting Theorem, Laplace transform of functions when they are multiplied or divided by “t”. Laplace transforms of derivatives and integrals of functions. – Unit step function – second shifting theorem – Dirac’s delta function, Periodic function – Inverse Laplace transform by Partial fractions( Heaviside method) Inverse Laplace transforms of functions when they are multiplied or divided by “s”. Inverse Laplace Transforms of derivatives and integrals of functions, Convolution theorem-solving differential equations by Laplace transforms.

UNIT – IV: Fourier series and Fourier Transforms  
(8 lectures)


UNIT-V: Partial Differential Equations  
(10 lectures)

Introduction and Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and non-linear equations (Charpit’s method).

Method of separation of variables for second order equations. Applications of Partial differential equations- one dimensional wave equation., Heat equation.

Text books:
1) HIGHER ENGINEERING MATHEMATICS BY B S GREWAL, KHANNA PUBLICATIONS.
2) ENGINEERING MATHEMATICS BY ERWIN KREYSZIG, WIELY PUBLICATIONS

References:
1) ENGINEERING MATHEMATICS BY SRIMANTAPAL & SUBODH C. BHUNIA, OXFORD UNIVERSITY PRESS.
2) ADVANCED ENGINEERING MATHEMATICS BY PETER V O’NEIL, CENGAGE LEARNING
Outcomes:
At the end of the course, the student will be able to:

- To analyze and solve electrical circuits using network laws and theorems.
- To design & analyse various circuits using electronic components viz. diodes, transistors & other special purpose devices.

UNIT- I ELECTRICAL and SINGLE PHASE AC CIRCUITS

Single Phase AC Circuits - R.M.S. and Average values, Form Factor, steady state analysis of series, Parallel and Series parallel Combinations of R, L and C with Sinusoidal excitation, concept of reactance, Impedance, Susceptance and Admittance – phase and phase difference, Concept of Power Factor, j-notation.

UNIT- II RESONANCE and NETWORK THEOREMS
Resonance – Series resonance and Parallel resonance circuits, concept of bandwidth and Q factor, Locus Diagrams for RL, RC and RLC Combinations for Various Parameters.

Network Theorems - Thevenin’s, Norton’s, Maximum Power Transfer, Superposition, Reciprocity theorems for DC and AC excitations.

UNIT- III P-N JUNCTION DIODE & DIODE CIRCUITS
P-N Junction Diode - Diode equation, Energy Band diagram, Volt-Ampere characteristic, Temperature dependence, Static and dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances.

Rectifiers and Filters - The P-N junction as a rectifier - A Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L-section Filters, π-section Filters.

UNIT- IV BIPOLAR JUNCTION TRANSISTOR

Transistor Configurations - BJT modeling, Hybrid model, Determination of h-parameters from transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters, Comparison of CE, CB and CC configurations.

UNIT- V JUNCTION FIELD EFFECT TRANSISTOR & SPECIAL PURPOSE DEVICES:
Junction Field Effect Transistor - Construction, Principle of Operation, Symbol, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and JFET.

Special Purpose Devices - Breakdown Mechanisms in Semi Conductor Diodes, Zener diode characteristics, Use of Zener diode as simple regulator, Principle of operation and Characteristics of Tunnel Diode (With the help of Energy band diagram) and Varactor Diode, Principle of Operation of SCR.

TEXT BOOKS:

REFERENCES:
1. Introduction to Electronic Devices and Circuits-Rober T. Paynter, Pearson Education.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read the topics selected for discussion on their own in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material, etc. However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.

2. OBJECTIVES:

a. To improve the language proficiency of the students in English with emphasis on LSRW skills.

b. To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.

c. To develop the study skills and communication skills in formal and informal situations.

LEARNING OUTCOMES:

1. Use of English Language - written and spoken.
2. Enrichment of comprehension and fluency

SYLLABUS:

Listening Skills:

Objectives
1. To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions.

   Students should be given practice in listening to the sounds of the language, to be able to recognize them, to distinguish between them, to mark stress and recognize and use the right intonation in sentences.

   - Listening for general content
   - Listening to fill up information
   - Intensive listening
   - Listening for specific information

Speaking Skills:

Objectives
1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students express themselves fluently and appropriately in social and professional contexts.
   - Oral practice
   - Describing objects/situations/people
   - Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: *Skills Annexe–Functional English for Success*)
   - Just A Minute (JAM) Sessions.

Reading Skills:

Objectives
1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences, etc.
   - Skimming the text
   - Understanding the gist of an argument
   - Identifying the topic sentence
   - Scanning
   - Inferring lexical and contextual meaning
   - Understanding discourse features

Writing Skills:

Objectives
1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.
   - Writing sentences
   - Use of appropriate vocabulary
   - Paragraph writing
   - Coherence and cohesiveness
   - Narration / description
   - Note Making
   - Formal and informal letter writing
   - Describing graphs using expressions of comparison

NOTE: The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.

TEXTBOOKS PRESCRIBED:

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into Five Units, are prescribed:

For Detailed study: First Textbook: “Skills Annexe -Functional English for Success”, Published by Orient Black Swan, Hyderabad

For Non-detailed study
Second Textbook “Epitome of Wisdom”, Published by Maruthi Publications, Hyderabad.
   - The course content and study material is divided into Five Units.

Unit –I
1. Chapter entitled ‘Wit and Humour’ from ‘Skills Annexe’ - Functional English for Success, Published by Orient Black Swan, Hyderabad
2. Chapter entitled ‘Mokshagundam Visvesvaraya’ from “Epitome of Wisdom”, Published by Maruthi Publications, Hyderabad.
L - Listening for Sounds, Stress and Intonation  
S - Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations)  
R - Reading for Subject/ Theme- The Palm Islands from Epitome of Wisdom is for Reading Comprehension  
W - Writing Paragraphs  
G - Types of Nouns and Pronouns  
V - Homonyms, Homophones & Homographs

Unit –II  
1. Chapter entitled “Cyber Age” from “Skills Annexe - Functional English for Success” Published by Orient Black Swan, Hyderabad.  
2. Report Writing (First & Second Textbooks)  
   L - Listening for themes and facts  
   S - Apologizing, interrupting, requesting and making polite conversation  
   R - Reading for theme and gist- The 1 Thing Every Business Executive Must Understand about Social Media by Dave Kerpen from Skills Annexe is for Reading Comprehension  
   W - Describing people, places, objects, events  
   G - Verb forms  
   V - Noun, Verb, Adjective and Adverb

Unit –III  
1. Chapter entitled ‘Risk Management’ from “Skills Annexe - Functional English for Success” Published by Orient Black Swan, Hyderabad  
2. Chapter entitled ‘Leela’s Friend’ by R.K. Narayan from “Epitome of Wisdom”, Published by Maruthi Publications, Hyderabad  
   L - Listening for main points and sub-points for note taking  
   S - Giving instructions and directions; Speaking of hypothetical situations  
   R - Reading for details- Sivakasi: Who to Blame for the Frequent Fire Accidents in India’s Largest Fireworks Industry Hub? by Amrutha Gayathri from Skills Annexe & Forensic Science from Epitome of Wisdom are for Reading Comprehension  
   W - Note-taking, Information transfer, Punctuation  
   G - Present tense

V - Synonyms and Antonyms

Unit –IV  
1. Letter Writing – Writing formal letters, letter of application along with curriculum vitae (First & Second Textbooks)  
2. Chapter entitled ‘The Last Leaf’ from “Epitome of Wisdom”, Published by Maruthi Publications, Hyderabad  
   L - Listening for specific details and information  
   S - Narrating, expressing opinions and telephone interactions  
   R - Reading for specific details and information- What I Cherish Most by V. S. Srinivasa Sastri from Skills Annexe & Choose How to Start Your Day from Epitome of Wisdom are for Reading Comprehension  
   W - Writing e-mails  
   G - Past and Future tenses  
   V - Vocabulary - Idioms and Phrasal verbs

Unit –V  
1. Chapter entitled ‘Sports and Health’ from “Skills Annexe - Functional English for Success” Published by Orient Black Swan, Hyderabad  
2. Chapter entitled ‘The Convocation Speech’ by N.R. Narayanmurthy from “Epitome of Wisdom”, Published by Maruthi Publications, Hyderabad  
   L - Critical Listening and Listening for speaker’s tone/ attitude  
   S - Group discussion and Making presentations  
   R - Critical reading, reading for reference - Benefits of Physical Activity from Skills Annexe & What is meant by Entrepreneurship? from Epitome of Wisdom are for Reading Comprehension  
   W - Project proposals; Project Reports and Research Papers  
   G - Adjectives, Prepositions and Concord  
   V - Collocations and Technical vocabulary, Using words appropriately  
   Exercises from the texts not prescribed shall be used for classroom tasks.

REFERENCES:  
2. Murphy’s English Grammar with CD, Murphy, Cambridge University Press.  
3. Contemporary English Grammar Structures and Composition by
JNTUH COLLEGE OF ENGINEERING HYDERABAD

I Year B.Tech. Chem. Engg. II-Sem

**OUTCOMES:**

At the end of the course, the student will be able to:

- Preparing working drawings to communicate the ideas and information.
- Read, understand and interpret engineering drawings.

**UNIT – I**

**INTRODUCTION TO ENGINEERING DRAWING :**

**UNIT – II**

**ORTHOGRAPHIC PROJECTIONS:**
Principles of Orthographic Projections – Conventions – Projections of Points and Lines
Projections of Plane regular geometric figures.—Auxiliary Planes.

**UNIT – III**

Projections of Regular Solids – Auxiliary Views.

**UNIT – IV**

Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere.
Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

**UNIT – V**

**ISOMETRIC PROJECTIONS :**
Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions
Auto CAD: Basic principles only

**TEXT BOOKS:**
1. Engineering Drawing N.D. Bhatt / Charotar

**REFERENCE BOOKS:**
ENVIRONMENTAL SCIENCE
Prerequisites : NIL

Objectives:
• Creating the awareness about environmental problems among students.
• Imparting basic knowledge about the environment and its allied problems.
• Developing an attitude of concern for the environment.

Outcomes:
At the end of the course, it is expected that students will be able to:
• Identify and analyze environmental problems as well as the risks associated with these problems
• Understand what it is to be a steward in the environment
• Studying how to live their lives in a more sustainable manner

UNIT- I
MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:
Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - II
ECOSYSTEMS : Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT - III

UNIT - IV
ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of:
   a. Air pollution
   b. Water pollution
   c. Soil pollution
   d. Marine pollution
   e. Noise pollution
   f. Thermal pollution
   g. Nuclear hazards

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

UNIT - V


FIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. - Study of simple ecosystems pond, river, hill slopes, etc.

TEXT BOOK:
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE:
1. Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publication.

JNTUH COLLEGE OF ENGINEERING HYDERABAD
I Year B.Tech. Chem. Engg. II-Sem L T P C
2 0 0 2

COMPUTATIONAL MATHEMATICS
(Common to all Branches)

Pre Requisites: NIL

Objectives:
This course aims at providing the student with the concepts of matrices, numerical techniques and curve fitting.

Outcomes:
At the end of the course, the student will be able to:

• analyze engineering problems using the concepts of Matrices and Numerical Methods.

UNIT-I: Matrices and Linear Transformations (8 lectures)

UNIT-II: Interpolation and Curve fitting (5 lectures)

UNIT-III: Numerical techniques (5 lectures)

UNIT- IV: Numerical Differentiation, Integration: (5 lectures)

UNIT – V: Numerical solutions of First order differential equations (5 lectures)

Text Books:
1) INTRODUCTORY METHODS OF NUMERICAL ANALYSIS BY SS SASTRY
2) NUMERICAL AND STATISTICAL METHODS WITH PROGRAMMING IN C BY SUJATHA SINHA AND SUBHABRADA DINDA, SCITEC PUBLISHERS.
3) NUMERICAL METHODS, PRINCIPLES, ANALYSIS AND ALGORITHMS BY SRIMANTAPAL & SUBODH C. BHUNIA, OXFORD UNIVERSITY PRESS.

References:
1) ADVANCED ENGINEERING MATHEMATICS BY ALAN JEFFERY
2) APPLIED NUMERICAL METHODS USING MATLAB BY RAO.V.DUKKIPATI, NEW AGE PUBLISHERS
3) NUMERICAL METHODS IN SCIENCE AND ENGINEERING –APRACTICAL APPROACH BY S.RAJASEKRARAN, S.CHAND PUBLICATIONS
• To Study different hand operated power tools, uses and their
demonstration.
• To gain a good basic working knowledge required for the production
of various engineering products.
• To provide hands on experience about use of different engineering
materials, tools, equipments and processes those are common in the
engineering field.
• To develop a right attitude, team working, precision and safety at
work place.
• It explains the construction, function, use and application of different
working tools, equipment and machines.
• To study commonly used carpentry joints.
• To have practical exposure to various welding and joining processes.
• Identify and use of marking out tools, hand tools, measuring
equipment and to work to prescribed tolerances.
• To understand the computer hardware and practice the Assembly of
computer parts.
• To practice the process of Installation of operating system windows.

Outcomes:

At the end of the course, the student will be able to:
• Better understanding the process of assembly of computer parts and
installation of different software’s.
• Study and practice on machine tools and their operations
• Practice on manufacturing of components using workshop trades
including plumbing, fitting, carpentry, foundry, house wiring and
welding.
• Identify and apply suitable tools for different trades of Engineering
processes including drilling, material removing, measuring, chiseling.
• Apply basic electrical engineering knowledge for house wiring
practice.

I. TRADES FOR EXERCISES :
(Any six trades from the following with minimum of two exercises in
each trade)
1. Carpentry
2. Fitting
3. Tin-Smithy
4. Black Smithy
5. House-wiring
6. Foundry
7. Plumbing

II. Trades for Demonstration & Exposure
1. Demonstration of power tools & wiring
2. Welding
3. Machine Shop

III. IT Workshop I: Computer hardware, identification of parts,
Disassembly, Assembly of computer to working condition, simple
diagnostic exercises.

IT Workshop II: Installation of operating system windows and
linux simple diagnostic exercises.

JNTUH COLLEGE OF ENGINEERING HYDERABAD
I Year B.Tech. Chem. Engg. II-Sem
ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

The Language Lab focuses on the production and practice of sounds of
language and familiarises the students with the use of English in
everyday situations and contexts.

Objectives
To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
To improve the fluency in spoken English and neutralize mother tongue influence
To train students to use language appropriately for interviews, group discussion and public speaking

Learning Outcomes
- Better understanding of nuances of language through audio-visual experience and group activities
- Neutralization of accent for intelligibility
- Speaking with clarity and confidence thereby enhancing employability skills of the students

SYLLABUS
English Language Communication Skills Lab shall have two parts:
  a. Computer Assisted Language Learning (CALL) Lab
  b. Interactive Communication Skills (ICS) Lab

The following course content is prescribed for the English Language Communication Skills Lab

Exercise – I
CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants
ICS Lab: Ice-Breaking activity and JAM session
Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms

Exercise – II
CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker
  – Weak Forms and Strong Forms - Consonant Clusters.
Concord (Subject in agreement with verb) and Words often misspelt-confused/misused

Exercise - III
CALL Lab: Minimal Pairs- Word accent and Stress Shifts- Listening Comprehension.
ICS Lab: Descriptions- Narrations- Giving Directions and guidelines.
Sequence of Tenses, Question Tags and One word substitutes.

Exercise – IV
CALL Lab: Intonation and Common errors in Pronunciation.
ICS Lab: Extompore- Public Speaking
Active and Passive Voice, –Common Errors in English, Idioms and Phrases

Exercise – V
CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice
ICS Lab: Information Transfer- Oral Presentation Skills
Reading Comprehension and Job Application with Resume preparation.

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:
The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self-study by learners.
System Requirement (Hardware component):
Computer network with Lan with minimum 60 multimedia systems with the following specifications:
   i) P – IV Processor
       a) Speed – 2.8 GHZ
       b) RAM – 512 MB Minimum
       c) Hard Disk – 80 GB
   ii) Headphones of High quality
2. Interactive Communication Skills (ICS) Lab:
The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Suggested Software:
- Cambridge Advanced Learners’ English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley
- Punctuation Made Easy by Darling Kindersley
- Clarity Pronunciation Power – Part I
- Clarity Pronunciation Power – part II
- Oxford Advanced Learner’s Compass, 8th Edition
SUGGESTED READING:

4. Sasi Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata McGraw Hill
10. A textbook of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Examination:
1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 30 sessional marks and 70 semester-end Examination marks. Of the 30 marks, 20 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The year-end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

I Year B.Tech. Chem. Engg. I-Sem

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>T</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COMPUTATIONAL MATHEMATICS LAB
(Common to all Branches)

UNIT-I: Interpolation
Programming Tasks:
A) Write a program to determine $y$ for a given $x$, if two arrays of $x$ and $y$ of same size are given (using Newton’s interpolation both forward and backward).

B) Write a program to determine $y$ for a given $x$, if two arrays of $x$ and $y$ of same size are given (using Lagrange’s interpolation).

C) Write a program to determine $y$ for a given $x$, if two arrays of $x$ and $y$ of same size are given (using Gauss interpolation). (Selection criteria of the interpolation formula are important.)

UNIT- I: Curve fitting

Programming Tasks:
A) Write a program to find a line of best fit from the given two arrays of $x$ and $y$ of same size.

B) Write a program to find a curve of the form $y = Ae^{Bx}$ from the given two arrays of $x$ and $y$ of same size.

C) Write a program to find a curve of the form $y = Ax^2$ from the given two arrays of $x$ and $y$ of same size.

D) Write a program to find a curve of the form $y = Ax^3 + Bx + C$ from the given two arrays of $x$ and $y$ of same size.

UNIT- II: Solution of Algebraic and Transcendental Equations

Programming Tasks:
A) Write a program to find the root of a given equation using bisection method.
   (Write this program such that the initial values given to the system are not usable, then the system should ask us to give new set of initial values).

B) Write a program to find the root of a given equation using method of false position (regula false position).

C) Write a program to find the root of a given equation using iteration method.

D) Write a program to find the root of a given equation using Newton Raphson method.

UNIT- IV: Linear system of equations

Programming Tasks:
A) Write a program to find the solution of given system of linear equations using $L$- $U$ decomposition method.

B) Write a program to find the solution of given system of linear equations using Jacob’s method.

C) Write a program to find the solution of given system of equations using Gauss Sidel iteration method.

D) Write a program to find the solution of given system of equations using Gauss Jordan elimination method.

UNIT-V: Numerical Differentiation, Integration and Numerical solutions of First order differential equations

Programming Tasks:
A) Write a program to evaluate definite integral using trapezoidal rule, Simpson’s $1/3$rd rule and $3/8$th rule.

B) Write a program to solve a given differential equation using Taylor’s series.

C) Write a program to solve a given differential equation Euler’s and modified Euler’s method.

D) Write a program to solve a given differential equation using Ruge-Kutta method.
Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.
Binomial, Poisson & normal distributions and their properties. Moment generating functions of the above three distributions, and hence finding the mean and variance.

UNIT-II: Multiple Random variables, Correlation & Regression
Joint probability distributions- Joint probability mass / density function, Marginal probability mass / density functions, Covariance of two random variables, Correlation -Coefficient of correlation, The rank correlation, Regression- Regression Coefficient, The lines of regression and multiple correlation & regression.

UNIT-III: Sampling Distributions and Testing of Hypothesis
Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variance.
Parameter estimations – likelihood estimate, interval estimations.
Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, Level of significance. One sided test, Two sided test,

Large sample tests:
(i) Test of Equality of means of two samples equality of sample mean and population mean (cases of known variance & unknown variance, equal and unequal variances)
(ii) Tests of significance of difference between sample S.D and population S.D.
(iii) Tests of significance difference between sample proportion and population proportion & difference between two sample proportions.

Small sample tests:
Student t-distribution, its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples Snedecor’s F- distribution and its properties. Test of equality of two population variances Chi-square distribution, it’s properties, Chi-square test of goodness of fit.

UNIT-IV: Functions of Complex Variables
Radius of convergence – Expansion in Taylor’s series, Maclaurin’s series and Laurent series. Singular point –Isolated singular point – pole of order m – essential singularity

UNIT – V: Contour Integration
Evaluation of integrals of the type
(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)\,dx$
(b) $\int_{0}^{2\pi} f(\cos \theta, \sin \theta)\,d\theta$

Conformal mapping.
Transformation of z-plane to w-plane by a function, Conformal transformation. Standard transformations- Translation; Magnification and rotation; inversion and reflection, Transformations like $e^z$, $\log z$, $z^2$, and Bilinear transformation. Properties of Bilinear transformation, determination of bilinear transformation when mappings of 3 points are given.

Text Books:
1) FUNDAMENTALS OF MATHEMATICAL STATISTICS BY S C GUPTA AND V.K.KAPOOR
2) PROBABILITY AND STATISTICS FOR ENGINEERS AND SCIENTISTS BY SHELDON M.ROSS,ACADEMIC PRESS
3) PROBABILITY AND STATISTICS FOR ENGINEERING AND THE SCIENCCE BY JAY L.DEVORE.
4) HIGHER ENGINEERING MATHEMATICS BY B S GREWAL.
5) ADVANCED ENGINEERING MATHEMATICS BY PETER V O’NEIL, CENGAGE LEARNING
6) ENGINEERING MATHEMATICS BY ERWIN KREYSZIG,10TH EDITION WIELY PUBLICATIONS

References:
1) MATHEMATICS FOR ENGINEERS SERIES –PROBABILITY STATISTICS AND STOCHASTIC PROCESS BY K.B.DATTA AND M.A S.SRINIVAS,CENGAGE PUBLICATIONS
2) PROBABILITY, STATISTICS AND STOCHASTIC PROCESS BY PROF.A R K PRASAD., WIELY INDIA
3) ADVANCED ENGINEERING MATHEMATICS BY SAHANAZ BATHUL, PHI PUBLICATION
Prerequisites:
The student who is intended to study this paper, should have a concept of electromagnetic radiation, to understand the principles of spectrophotometry. He should also have the knowledge of stationary and mobile phases to learn the chromatography. The basic ideas about adsorption and speed of reactions are required to understand surface chemistry and kinetics.

Objectives:
1) To understand the basic Principles of analytical methods and detailed methods of u.v. visible.
2) I.R.Spectroscopy are required for B.Tech chemical Engineering students to analyse the Chemical compounds.
3) The chromatographic techniques and the knowledge of colloids and adsorption are required for further understanding and analysis.

UNIT I
Principles of Analytical Methods: Quantitative analysis - Gravimetry:
Precipitation- types of precipitates, impurities, co-precipitation, post-precipitation-conditions for participation-precipitation from homogeneous solution-Gravimetric determination of Fe, Ni and Cu.

UNIT II
Molecular Spectrophotometry: UV-Visible Spectroscopy:
Absorption spectra-Lamberts Law, Beer’s Law - Combined law equation; Deviation from Beer’s Law. Block diagram of a double beam UV-visible spectrophotometer – quantitative analysis; Direct method for the determination of metal ions; Chromium, Manganese, Iron etc in alloys;
Infrared Spectroscopy: Interaction of infra-red radiation with molecules-Sources of IR Radiation-Spectral regions- Block diagram of IR Spectrometer- Function of each component; Sampling Techniques-Applications of IR Spectroscopy to functional group analysis ( -OH, -NH₂, -CHO, -CO-R, -CONH).

UNIT III
Chromatography: Column chromatography-Principle-terminology-retention time, retention volume, RF value. Thinlayer chromatography-identification of spots by spraying and other methods; Gas Chromatography: Principle of Gas Chromatography-block diagram of gas chromatograph- Functions of each component, Detectors- (FID, ECD)-stationary phase for column, mobile phase, chromatogram, qualitative analysis, quantitative analysis, retention time, retention volume, capacity factor, area normalization method; HPLC: Principles of high performance liquid chromatography, Block
diagram of HPLC- functions of each component, stationary phases, eluting solvents, pumps, detectors- quantitative applications of HPLC.

UNIT IV
Colloids & Surface chemistry:
Colloids: Classification of colloids-preparation & purification of colloids, properties of colloids — electrical properties, zeta potential and its measurement-Stability of colloids- protective action of colloids — gold number and factors affecting their stability. Applications of colloids.

UNIT V
Chemical Kinetics: Order, molecularity— definitions with examples. Introduction to first order, second order, third order kinetics-Theories of Reaction rates — Collision theory and transition state theory. Theory of unimolecular reactions — Lindemann’s theory-Kinetics of Photochemical reactions: Chain reactions and their characteristics-Steady state treatment — dissociation of HI, reaction between H₂ & Br₂ and H₂ & O₂

Outcomes:
The student will gain a thorough knowledge of GC & HPLC techniques and spectroscopic Principles. The Principles of Kinetics, adsorptions colloidal Chemistry are clearly understood.

TEXT BOOK
5. Instrumental Methods of Chemical Analysis, BSP Galen W. Ewing.
Objective:
To develop the basic concepts of stoichiometry in chemical reactions and to solve material & energy balances in a simple flow sheet related unit operations and unit processes

UNIT I
Stoichiometric & Composition relations: Stoichiometric relation, basis of calculations, methods of expressing compositions of mixtures and solutions, density and specific gravity, Baume and API gravity scales.
Behavior of Ideal gases: Kinetic theory of gases, application of ideal gas law, gaseous mixtures, gases in chemical reactions.

UNIT II
Vapor pressure: Liquefaction and liquid state, vaporization, boiling point, effect of temperature on vapor pressure, Antoine equation, vapor pressure plots, estimation of critical properties, vapor pressure of immiscible liquids and ideal solutions, Raoult’s law, Non volatile solutes.
Humidity and Saturation: Partial saturation, Humidity- Absolute Humidity, Vaporization process, Molal humidity, Relative and percentage saturation, dew point, humid heat, wet bulb and dry bulb temperatures, use of humidity charts, adiabatic vaporization.

UNIT III
Material balances: Tie substance, Yield, conversion, limiting reactant, excess reactant, processes involving reactions, Material balances with the help of Stoichiometric equations, Material balances involving drying, dissolution, & crystallization. Material balance calculations for processes involving recycle, bypass and purge.

UNIT IV
Thermo physics: Energy, energy balances, heat capacity of gases, liquid and mixture solutions. Kopp’s rule, latent heats, heat of fusion and heat of vaporization, Trouton’s rule, Kistyakowsky equation for non polar liquids enthalpy and its evaluation.
Thermo chemistry: Calculation and applications of heat of reaction, combustion, formation and neutralization, Kirchoff’s equation, enthalpy concentration change, calculation of theoretical and actual flame temperatures.

UNIT V
Combustion Calculations: Introduction, fuels, calorific value of fuels, coal, liquid fuels, gaseous fuels, air requirement and flue gases, combustion calculations, incomplete combustion, material and energy balances, thermal efficiency calculations.

TEXTBOOKS

REFERENCES:
1. Basic principles and calculations in chemical engineering by D.H. Himmelblau, 7th Ed. PHI, 2013

OUTCOME: This course will enable the students to evaluate the efficiency of a process in terms of yield, energy and provide guidance to improve upon them.
Objective:
The behavior of fluids is important to process Engineering and constitutes foundations for the study of unit operations. An understanding of fluids is essential to students not only for accurately treating problems on the moment of fluids through pipes, pumps, but for dealing with all kinds of process equipment.

UNIT I
Unit operations and unit processes, unit systems, basic concepts, nature of fluids, hydrostatic equilibrium, applications of fluid statics.
Fluid flow phenomena-Laminar flow, Shear rate, Shear stress, Rheological properties of fluids, Turbulence, Boundary layers, Basic equation of fluid flow –Mass balance in a flowing fluid; continuity equation, differential momentum balance; equations of motion, Macroscopic momentum balances, Bernoulli equation, pump work in Bernoulli equation.

UNIT II
Incompressible Flow in pipes and channels- shear stress and skin friction in pipes, laminar flow in pipes and channels, turbulent flow in pipes and channels, friction from changes in velocity or direction, Dimensional analysis including Buckingham π Theorem and Rayleigh’s method.

UNIT III
Flow of compressible fluids- Definitions and basic equations, Processes of compressible flow, Isentropic flow through nozzles, adiabatic frictional flow, and isothermal frictional flow.

UNIT IV
Flow past immersed bodies, Drag and Drag coefficient, friction in flow through beds of solids, Kozeny-Camman, Blake-Plummer and Ergun equations, and motion of particles through fluids.
Fluidization, Conditions for fluidization, Minimum fluidization velocity, Types of fluidization, Expansion of fluidized beds, Applications of fluidization. Continuous fluidization; slurry and pneumatic transport.

UNIT V
Transportation and Metering of fluids- Pipes, fittings and valves, Fluid-moving machinery, Fans, blowers, and compressors.
Measurement of flowing fluids- variable head meters- Orifice meter, Venturi meter, Pitot tube; Area meters- Rota meter.

TEXTBOOKS
REFERENCES:
1. Transport processes and unit operations by Christie J. Geankoplis, PHI
2. Unit operations, Vol-1 –Chattopadhya, Khanna publishers

OUTCOME: To apply the concept of hydrostatic equilibrium and to have knowledge on fluid flow phenomena and to determine engineering design quantities for laminar and turbulent flow.
CHEMICAL ENGINEERING THERMODYNAMICS-I

Objective:
1. Students will be able to understand the role and relevance of thermodynamics properties, processes, reversibility, equilibrium, phases, components; the relationship between heat and work by understanding thermodynamic laws.
2. Students will be able to understand and analyze steam power cycles; refrigeration cycles

UNIT I
Introduction: The scope of thermodynamics, temperature, defined quantities; volume, pressure, work, energy, heat, Joules Experiments.
The first law and other basic concepts: The first law of thermodynamics, thermodynamic state and state functions, enthalpy, the steady-state steady-flow process, equilibrium, the phase rule, the reversible process, constant-V and constant- P processes, heat capacity, isobaric, isochoric, isothermal, adiabatic and polytrophic processes.

UNIT II
Volumetric properties of pure fluids: The PVT behavior of pure substances, virial equations, the ideal gas, the applications of the virial equations, second virial coefficients from potential functions. Cubic equations of state, generalized correlations for gases, generalized correlations for liquids, molecular theory of fluids.
Heat effects: Sensible heat effects, Internal energy of ideal gases:
Microscopic view, Latent heats of pure substances, heat effects of industrial reactions, heat effects of mixing processes.
Standard heat of reaction, Standard heat of formation, Standard heat of combustion, temperature dependence of heat of reaction

UNIT III
The second law of thermodynamics: Statements of the second law, heat engines, thermodynamic temperatures scales, thermodynamic temperature and the ideal gas scale
Entropy, Entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point, calculation of ideal work and lost work.

UNIT IV
Power cycles: Carnot cycle, Rankine cycle, Otto cycle, Diesel cycle.
Refrigeration and liquefaction: The Carnot refrigerator, the vapor compression cycle, the comparison of refrigeration cycles, the choice of refrigerant, absorption refrigeration, the heat pump, liquefaction processes.

UNIT V
Thermodynamic properties of fluids: Property relations for homogeneous phases, residual properties, two phase systems, thermodynamic diagrams, tables of thermodynamic properties, generalized property correlation for gases.

TEXT BOOKS
2. K. V. Narayanan, Chemical Engineering Thermodynamics, PHI, 2001

OUTCOME: This course will enable the student to understand the spontaneity and energy efficiency of a process.
BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

LIST OF EXPERIMENTS:

PART A: ELECTRONIC WORKSHOP PRACTICE (in 3 lab sessions):

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's
2. Identification, Specifications and Testing of Active Devices, Diodes, BJT's, Low power JFET’s, MOSFET’s, Power Transistors, LED’s, LCD’s, SCR, UJT.
3. Study and operation of
   - Multimeters (Analog and Digital)
   - Function Generator
   - Regulated Power Supplies
   - CRO.

PART B: (For Laboratory examination – Minimum of 12 experiments)

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator
3. Input & Output characteristics of Transistor in CB / CE configuration
4. Full Wave Rectifier with & without filters
5. Input and Output characteristics of FET in CS configuration
6. Measurement of h-parameters of transistor in CB, CE, CC configurations
7. SCR Characteristics.
8. Verification of KVL and KCL.
10. Verification of Superposition and Reciprocity theorems.
11. Verification of maximum power transfer theorem. Verification on DC, verification on AC with Resistive and Reactive loads.
12. Experimental determination of Thevenin’s and Norton’s equivalent circuits and verification by direct test.

FLUID MECHANICS LAB

Objectives:
- Know the different types of flow using Reynolds apparatus.
- Verify the Bernoulli’s equation by using Bernoulli’s apparatus.
- Calibrate the Rotameter.
- Find out the variation of orifice coefficients with Reynolds Number.
- Determine the venturi coefficient by using venturimeter.
- Find out the frictional losses in flow through pipes.
- Study the coefficient of contraction in an open orifice.
- Study the coefficient of discharge in V-Notches.
- Study the characteristic of a centrifugal pump.
- Find out the pressure drop in packed bed for different velocities.

List of Experiments:
1. Identification of laminar and turbulent flows
   Major equipment - Reynolds apparatus
2. Measurement of point velocities
   Major equipment - Pitot tube setup
3. Verification of Bernoulli’s equation
   Major equipment – Bernoulli’s Apparatus
4. Calibration of Rotameter
   Major equipment – Rotameter Assembly
5. Variation of Orifice coefficient with Reynolds Number
   Major equipment - Orifice meter Assembly
6. Determination of Venturi coefficient
   Major equipment – Venturi meter Assembly
7. Friction losses in Fluid flow in pipes
   Major equipment - Pipe Assembly with provision for Pressure measurement
8. Pressure drop in a packed bed for different fluid velocities
   Major equipment - Packed bed with Pressure drop measurement
9. Pressure drop and void fraction in a fluidized bed
   Major equipment - Fluidized bed with Pressure drop measurement
10. Studying the coefficient of contraction for a given open orifice
    Major equipment - Open Orifice Assembly

JNTUH COLLEGE OF ENGINEERING HYDERABAD

II Year B.Tech. Chem. Engg. I-Sem

L T P C
0 0 3 2
11. Studying the coefficient of discharge in a V-notch
   Major equipment - V-notch Assembly

12. Studying the Characteristics of a centrifugal pump
   Major equipment - Centrifugal Pump

Outcomes:
- Student will be able to understand the concept of fluid flow phenomena and types of flow by calculating Reynolds number
- Calibrate the flow meters with actual discharge
- Characterize of a centrifugal pump and its efficiency.
- Calculate the pressure drop in packed bed for different velocities.

ANALYTICAL & PHYSICAL CHEMISTRY LAB

1. To determine the partition coefficient value by studying the adsorption of acetic acid on animal charcoal.

2. Chemical kinetics:
   Study of first order kinetics of Acid catalysed hydrolysis of Methyl acetate.

3. Complex preparations:
   a) [Ni(DMG)₂]
   b) [Co(NH₃)₄Cl]Cl₂
   c) [Cu(NH₃)₄]SO₄


5. Thin Layer Chromatography:
   a) Determination of the purity (No. of compounds present) of a given sample by thin layer chromatography (TLC).
   b) Monitoring the progress of chemical reactions by thin layer chromatography (TLC)

7. Determination of stability constant by Job’s method.
8. Determination of sulphates through turbidometry.
10. Redox titrations by potentiometry. Estimation of Ferrous

TEXT BOOKS
Human Values & Professional Ethics


Unit IV Professional Rights: professional rights and employee rights communicating risk and public policy – Whistle blowing - collective bargaining. Professionals/engineers as managers, advisors, experts, witnesses and consultants – moral leadership- Regulatory compliances, Monitoring and control- Mini-Cases.


Mini-projects

Project 1: The student of this course should invariably attend (or watch on internet/any TV channel/you tube/social media) two speeches of 30 minutes duration each dealing with spiritual discourse and submit a report on the contents of the lecture proceedings.

Project 2: Visit any organization (including shops/ hotels or shopping malls in your region) of your choice and observe how the professionals perform the given job with a focus on professional ethics and human values.

References

1. Aryasri, Human Values and Professional Ethics, Maruthi Publications.
2. S B George, Human Values and Professional Ethics, Vikas Publishing.
CHEMICAL TECHNOLOGY

Objective:

- Unit operations, unit processes involved in manufacture of important and widely employed organic and inorganic chemicals.
- Impart clear description of one latest process along with its Chemistry, Process parameters, Engineering Problems and Optimum Conditions.
- Demonstrate the importance of updating the latest technological developments in producing products economically and environment friendly.

UNIT – I

Water and Air: Importance of water, sources, plant location factors related to water, water shortage problems, methods of treating fresh water, methods of obtaining fresh water from saline waters, waste water treatment and disposal, air as a chemical raw material.

Soda ash, caustic soda and chlorine, Glass: manufacture of special glasses

UNIT – II


Sulphur and sulphuric acid, manufacture of sulphuric acid, hydrochloric acid and some other chemicals – Aluminum sulphate and alum.

UNIT – III

Cement manufacture, special cements, miscellaneous calcium compounds, magnesium compounds. Manufacture of phenols, formaldehyde, vinyl chloride and vinyl acetate, manufacture of phenol-formaldehyde resin and polyvinyl chloride polymer, SBR

UNIT – IV

Oils: Definition, constitution, extraction and expression of vegetable oils, refining and hydrogenation of oils. Synthetic fibers: Classification, manufacture of Nylon 66, polyester fiber and viscose rayon fiber. Soaps and detergents: Definitions, continuous process for the production of fatty acids, glycerin and soap, production of detergents.

UNIT – V


Text books:

References:
1. Industrial Chemistry by B.K. Sharma,

Outcomes:

Upon successful completion of the course the students will be able to:

1. Make a neat and easy to understand the plant process flow sheet.
2. Keeps up the productivity while maintaining all safety norms stipulated, during their job.
3. Solve Engineering problems that are likely to come across during the operation of plants.
4. Suggest alternative manufacturing process in terms of Economic viability of the product.

Pre-requisite:---Nil---
ORGANIC CHEMISTRY

Prerequisites: The fundamental knowledge of formation of various types of bonds, their energies and electron movements in organic molecules is required. The information about heterocyclic compounds that build the drugs is necessary to understand drugs and heterocyclics.

Objectives:

The fundamental basic mechanisms of various types of Chemical reactions and isomerism are necessary to understand the procedures of synthetic techniques.

The classification of drugs and mechanism of drug action, and heterocyclics as basic components of various drugs are very important for a chemical engineer.

UNIT I
Bond fission: Homolytic and heterolytic fission of covalent bond.
Types of Reagents: Electrophiles, nucleophiles and free radicals – structure, reactivity, characteristics. Polar effects – Inductive effect- electromeric effect- resonance- hyper conjugation- The influence of these effects on the acidity and basicity of organic compounds- steric inhibition of resonance.

UNIT II
Electrophilic reactions: Introduction – Mechanisms, and synthetic applications - a) Friedel-Crafts reactions b) Riemer- Teimenn Reaction c) Beckmann rearrangement
Nucleophillic reaction: Introduction ,mechanisms and applications - a) Aldol condensation b) Suzuki Reaction c) Heck reaction.
Free radical reactions: a) Halogenation of Alkane b) Addition of HBr to Alkene in the presence of peroxide. c) Allylic halogenation Using N-Bromo succinimide (NBS)
Stereo isomerism: Optical isomerism- Symmetry and chirality- Optical isomerism in lactic acid and tartaric acid - Sequence rules- Enantiomers, diastereomers- Geometrical Isomerism; E-Z system of nomenclature- conformational analysis of ethane and cyclohexane.

UNIT-III
Classification of drugs: Introduction -Classification by pharmacological effects by chemical structure by target system and by site of action.

UNIT IV
Heterocyclic compounds: Nomenclature-preparation, properties and uses of (1) Pyrrole (2) Furan (3) Pyridine (4) Quinoline (5) Isoquinoline.

Outcomes:
A student will get a complete information about the mechanism of various reactions which are helpful for the designing of drugs. The student also learn about the green methods for the synthesis. A good knowledge of dyes and properties of Heterocyclic Chemistry is gained.

TEXTBOOKS
4. Heterocyclic Chemistry by T.Gilchrist

JNTUH COLLEGE OF ENGINEERING HYDERABAD

II Year B.Tech. Chem. Engg. II-Sem

Page 48 of 131
CHEMICAL ENGINEERING THERMODYNAMICS – II

Pre-requisite:
Students should have completed Chemical Engineering thermodynamics-I

Objective:
To introduce the concepts of chemical potential, partial properties, property relations for ideal gases, fugacity excess properties and to develop the theoretical foundation for applications of thermodynamics to gas mixtures and liquid solutions and to perform the phase equilibrium calculations using simple models for VLE, Gamma/Phi approach and equation of state approach.

UNIT I
Solution Thermodynamics: Theory, Fundamental property relation, chemical potential as a criterion for phase equilibrium, partial properties, ideal gas mixtures, fugacity and fugacity coefficient for pure species, fugacity and fugacity coefficient for species in solutions, generalized correlations for Fugacity coefficient, The ideal solutions, excess properties.

UNIT II
Solution Thermodynamics: Applications: The liquid phase properties from VLE data, models for the excess Gibbs energy, property changes of mixing
VLE at low to moderate pressures: The nature of equilibrium, the phase rule, Duhem's theorem, VLE: Qualitative behavior, the gamma /Phi formulation of VLE, Dew point and bubble point calculations, flash calculations, solute (1)/solvent (2) systems

UNIT III
Thermodynamic Properties and VLE from Equations of State: properties of fluids from the virial equations of state, properties of fluids from cubic equations of state, fluid properties from correlations of the Pitzer type, VLE from cubic equations of state

UNIT IV
Chemical Reaction Equilibria: The reaction coordinate, application of equilibrium criterion to chemical reactions, The standard Gibb’s energy change and the equilibrium constant, effect of temperature on equilibrium constants, relation of equilibrium constants to composition, equilibrium conversion for single reactions, Phase rule and Duhem’s theorem for reacting systems.

UNIT V

TEXT BOOK:

REFERENCE:
1. Chemical Engineering Thermodynamics, Pradeep Ahuja, PHI Learning Pvt. Ltd., New Delhi, 2009

Outcome: Students will be able to understand the procedures for estimating the thermodynamic properties and perform thermodynamic calculations oriented to the analysis and design of chemical processes.
Objective:
This course deals with the different mechanical unit operations in chemical engineering. Specific attention is given on particle and separation techniques.

UNIT I
Properties, handling and mixing of particulate solids: Characterization of solid particles, properties of particulate mass, storage and mixing of solids, types of mixers, mixers for cohesive solids, mixers for free flowing solids.
Transportation of solid particulate mass, belt, screw, apron conveyers, bucket elevators, pneumatic conveying.

UNIT II
Size reduction: Principles of comminution, computer simulation of milling operations, size reduction equipment-crushers, grinders, ultra fine grinders, cutting machines, Equipment operation. Laws of crushing: Kick's law, Bond's law, Rittinger's law
Screening, Industrial screening equipments, Effectiveness of the screen, differential & cumulative analysis.

UNIT III
Filtration, cake filters, centrifugal filters, cyclone separators, electrostatic precipitators.
Principles of cake filtration. Clarifying filters, liquid clarification, gas cleaning, principles of clarification.
Cross flow filtration, types of membranes, permeate flux for ultrafiltration, Concentration polarization, particle rejection of solutes, micro filtration.

UNIT IV
Separations based on motion of particles through fluids, gravity settling processes and centrifugal settling processes, float and sink method, differential settling, coagulation, Flotation-separation of ores, flotation agents

UNIT V
Crystallization: crystal geometry, principles of crystallization equilibria and yields, nucleation, crystal growth, ∆L law, crystallization equipment including MSMPR crystallizers.

TEXT BOOK:

REFERENCES:

OUTCOME: Student will gain knowledge on various mechanical separation operations used in chemical industry.
Objective: To impart the students about knowledge on modes of heat transfer and design of heat transfer equipment evaporators etc.

UNIT I
Heat transfer by conduction in Solids: Fourier’s law, thermal conductivity, steady state conduction in plane wall & composite walls, compound resistances in series, heat flow through a cylinder, conduction in spheres.
Unsteady state heat conduction: Equation for one-dimensional conduction, Semi-infinite solid.

UNIT II
Principles of heat flow in fluids: Typical heat exchange equipment, countercurrent and parallel current flows, energy balances, rate of heat transfer, overall heat transfer coefficient, electrical analogy, critical radius of insulation, logarithmic mean temperature difference, variable overall coefficient, multi-pass exchangers, individual heat transfer coefficients, resistance form of overall coefficient, fouling factors, classification of individual heat transfer coefficients, magnitudes of heat transfer coefficients, effective coefficients for unsteady-state heat transfer.

UNIT III
Heat Transfer to Fluids without Phase change: Regimes of heat transfer in fluids, thermal boundary layer, heat transfer by forced convection in laminar flow, heat transfer by forced convection in turbulent flow, the transfer of heat by turbulent eddies and analogy between transfer of momentum and heat, heat transfer to liquid metals, heating and cooling of fluids in forced convection outside tubes.

UNIT IV
Natural convection: Natural convection to air from vertical shapes and horizontal planes, effect of natural convection in laminar-flow heat transfer.
Heat transfer to fluids with phase change: Heat transfer from condensing vapors, heat transfer to boiling liquids.
Radiation: Introduction, properties and definitions, black body radiation, real surfaces and the gray body, absorption of radiation by opaque solids, radiation between surfaces, radiation shielding, radiation to semi transparent materials, combined heat transfer by conduction, convection and radiation.

UNIT V
Heat exchange equipment: General design of heat exchange equipment, heat exchangers, condensers, boilers and calendrias, extended surface equipment, heat transfer in agitated vessels, scraped surface heat exchangers, heat transfer in packed beds, heat exchanger effectiveness (NTU method)
Evaporators: Evaporators, performance of tubular evaporators, capacity and economy, multiple effect evaporators, methods of feeding, vapor recompression.

TEXT BOOK:
REFERENCES:

OUTCOME: Student will be able to use the heat transfer principles in selection and design of heat exchanger, evaporator, etc. for a chemical industry.
PROCESS HEAT TRANSFER LAB

Objective:
This lab will provide practical knowledge on various heat transfer process and equipment like heat exchangers and evaporators.
- Learn basic Heat transfer principles.
- Impart the knowledge in heat transfer measurements and different heat transfer equipment
- Learn about natural and forced convection and gain knowledge of different types of heat exchangers.

List of Experiments:
1. Determination of total thermal resistance and thermal conductivity of composite wall.
   Major equipment - Composite wall Assembly
2. Determination of thermal conductivity of a metal rod.
   Major equipment - Thermal Conductivity apparatus
3. Determination of natural convective heat transfer coefficient for a vertical tube.
   Major equipment - Natural convection heat transfer apparatus
4. Determination of critical heat flux point for pool boiling of water.
   Major equipment - Pool boiling apparatus
5. Determination of forced convective heat transfer coefficient for air flowing through a pipe
   Major equipment – Forced convection heat transfer apparatus
6. Determination of overall heat transfer coefficient in double pipe heat exchanger.
   Major equipment - Double pipe heat exchanger apparatus
7. Determination of heat transfer coefficient for a helical coil in an agitated vessel.
   Major equipment – Helical coil in a agitated vessel.
8. Study of the temperature distribution along the length of a pin-fin under natural and forced convection conditions
   Major equipment - Pin fin apparatus
9. Estimation of un-steady state film heat transfer coefficient between the medium in which the body is cooled.
   Major equipment - Heat transfer coefficient determination apparatus
10. Determination of Stefan – Boltzmann constant.
    Major equipment - Stefan Boltzmann apparatus
11. Determination of emissivity of a given plate at various temperatures.
    Major equipment - Emissivity determination apparatus

OUTCOME:
The student will be able to understand the thermal conductivity measurement, heat transfer coefficient, calculation in natural and forced convection and some of the radiation aspects.
- Demonstrate basic Heat transfer principles
- Design heat exchangers.
- Understand the concept of boiling & condensation processes.
(Common to All Branches)

(Code no.) GENDER SENSITIZATION LAB
(An Activity-based Course)

Objectives of the Course:

- To develop students’ sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Learning Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Unit-I: UNDERSTANDING GENDER
Gender: Why Should We Study It? (Towards a World of Equals: Unit -1)

Socialization: Making Women, Making Men (Towards a World of Equals: Unit -2)

Unit – II: GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences (Towards a World of Equals: Unit -4)
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit -10)
Two or Many? Struggles with Discrimination.

Unit – III: GENDER AND LABOUR

Housework: the Invisible Labour (Towards a World of Equals: Unit -3)
“My Mother doesn’t Work.” “Share the Load.”
Women’s Work: Its Politics and Economics (Towards a World of Equals: Unit -7)

Unit – IV: ISSUES OF VIOLENCE

Sexual Harassment: Say No! (Towards a World of Equals: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “Chupulu”.
Domestic Violence: Speaking Out (Towards a World of Equals: Unit -8)
Thinking about Sexual Violence (Towards a World of Equals: Unit -11)
Blaming the Victim-“I Fought for my Life…” - Additional Reading: The Caste Face of Violence.

Unit – V: GENDER : CO-EXISTENCE

Just Relationships: Being Together as Equals (Towards a World of Equals: Unit -12)

Essential Reading: All the Units in the Textbook, “Towards a World of Equals: A Bilingual Textbook on Gender” written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama
Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

Reference Books:


JNTUH COLLEGE OF ENGINEERING HYDERABAD

II Year B.Tech. Chem. Engg. II-Sem
MECHANICAL OPERATIONS LAB

Objective:
This lab will give practical knowledge on size reduction, different types of crushing equipment and different mechanical separation techniques.

List of Experiments:

1. To determine the time of grinding in a ball mill for producing a product with 80% passing a given screen.
   Major equipment - Ball mill Apparatus, Sieve shaker, Different sizes of sieves, weighing balance.

2. To verify the laws of crushing using any size reduction equipment like crushing rolls or vibrating mills and to find out the working index of the material.

3. To find the effectiveness of hand screening and vibrating screen of a given sample.
   Major equipment - Vibrating Sieve shaker, Different sizes of sieves, Weighing Balance.

4. To achieve beneficiation of a ore using froth flotation technique.
   Major equipment - Froth flotation cell

5. To obtain batch sedimentation data and to calculate the minimum thickner area under given conditions.
   Major equipment- Sedimentation apparatus

6. To determine the specific cake resistance and filter medium resistance of a slurry in plate and frame filter press.
   Major equipment - Plate and frame filter press.

7. To separate a mixture of particles by Jigging.
   Major equipment - Jigging apparatus

8. To calculate separation efficiency of particles in a mixture using cyclone separator.
   Major equipment - Cyclone separator

9. To determine reduction ratio of a given sample in a pulverizer.
   Major equipment - Pulverizer

10. To Verify Stoke’s law.
    Major equipment – Stoke’s law apparatus

11. To determine reduction ratio of a given sample in a grinder
    Major equipment - Grinder

Outcome:
Students will gain practical knowledge on various mechanical separation techniques like filtration, sedimentation, screening and centrifugation.
CHEMICAL TECHNOLOGY & ORGANIC SYNTHESIS LAB

List of Experiments
A. Analysis of oils:
1. Acid value
2. Iodine value
3. Saponification value

B. Miscellaneous analysis:
4. Analysis of lime: Estimation of acid insolubles, available lime and calcium carbonate
6. Analysis of starch/glucose: Estimation of total reducing sugars
7. Analysis of saw dust: Estimation of total cellulose and – cellulose

C. Miscellaneous preparations:
8. Preparation of soap
9. Preparation of phenol formaldehyde resin

D. Synthesis of organic compounds.
10. Preparation of benzanilide from benzophenone via the oxime by Beckmann rearrangement.
11. Cycloaddition of anthracene with maleic anhydride by Diels – Alder Reaction.
12. Preparation of acetyl salicylic acid (aspirin) from salicylic acid.

TEXT BOOKS
1) "Quantitative and Qualitative analysis in Organic Chemistry", Vogel
2) "Practical Organic Chemistry", Mann and Saunders
3) "Laboratory Organic Manul", R.K.Bansal.

PROCESS MODELING AND SIMULATION

Objective:
To impart knowledge on modeling of various equipment and their simulation using different numerical techniques.

UNIT I
Classification of mathematical models- steady state Vs dynamic models, lumped Vs distributed parameter models, deterministic Vs stochastic models.

UNIT II
Examples of mathematical models of chemical engineering systems: Series of isothermal constant hold-up CSTRs, CSTRs with variable hold-ups, two heated tanks, gas phase pressurized CSTR, Non-isothermal CSTR

UNIT III
Examples of mathematical models of chemical engineering systems: Single component vaporizer, batch reactor, reactor with mass transfer, ideal binary distillation column, batch distillation with hold-up.

UNIT IV
Empirical model building- method of least squares, linear, polynomial and multiple regression, non-Linear regression
Process Simulation examples: VLE dew point and bubble point calculations, binary distillation column, gravity flow tank, batch reactor, Non- isothermal CSTR, counter current heat exchanger

UNIT V
Process simulation using modular and equation based solving approaches: Modular approaches to process simulation: Analysis Vs Design mode, sequential modular approach, Simultaneous modular approach, Equation solving approach, Introduction to various simulation software packages in chemical engineering

TEXTBOOKS:
2. Introduction to Numerical Methods in Chemical Engineering, P. Ahuja, PHI learning Pvt. Ltd., New Delhi, 2010

OUTCOME:
- Understand the stages involved in the development of a process model.
- Formulate a chemical engineering problem as a mathematical model from basic engineering principles.
- Identify the appropriate numerical method to solve the models.
- Apply various simulation tools for solving the chemical engineering models developed.

UNIT I
Overview of chemical reaction engineering- classification of reactions, variables affecting the rate of reaction definition of reaction rate. Kinetics of homogenous reactions- concentration dependent term of rate equation, Temperature dependent term of rate equation, searching for a mechanism, predictability of reaction rate from theory.

Interpretation of batch reactor data - constant volume batch reactor:
Analysis of total pressure data obtained in a constant-volume system, the conversion, Integral method of analysis of data- general procedure, irreversible unimolecular type first order reactions, irreversible bimolecular type second order reactions, irreversible trimolecular type third order reactions, empirical reactions of nth order, zero-order reactions, overall order of irreversible reactions from the half-life, fractional life method, irreversible reactions in parallel, homogenous catalyzed reactions, autocatalytic reactions, irreversible reactions in series.

UNIT II
Constant volume batch reactor- first order reversible reactions, second order reversible reactions, reversible reactions in general, reactions of shifting order, Differential method of analysis of data. Varying volume batch reactor- differential method of analysis, integral method of analysis, zero order, first order, second order, nth order reactions, temperature and reaction rate, the search for a rate equation.

UNIT III
Introduction to reactor design- general discussion, symbols and relationship between CA andXA. Ideal reactors for a single reaction- Ideal batch reactor, Steady-state mixed flow reactor, Steady-state plug reactors.

Design for single reactions- Size comparison of single reactors, Multiple-reactor systems, Recycle reactor, Autocatalytic reactions.
Design for parallel reactions - introduction to multiple reactions, qualitative discussion about product distribution, quantitative treatment of product distribution and of reactor size. 

Multiple reactions - irreversible first order reactions in series, quantitative discussion about product distribution, quantitative treatment, plug flow or batch reactor, quantitative treatment, mixed flow reactor, first-order followed by zero-order reaction, zero order followed by first order reaction.

UNIT V
Temperature and Pressure effects - single reactions - heat of reaction from thermodynamics, heat of reaction and temperature, equilibrium constants from thermodynamics, equilibrium conversion, general graphical design procedure, optimum temperature progression, heat effects, adiabatic operations, non adiabatic operations, comments and extensions. Exothermic reactions in mixed flow reactors - A special problem, multiple reactions.

TEXT BOOK:

REFERENCES:

OUTCOME: This course provides necessary knowledge for selection of the chemical reactors for a particular process, design and simulation of existing reactor.

JNTUH COLLEGE OF ENGINEERING HYDERABAD
Ill Year B.Tech. Chem. Engg. I-Sem L T P C

UNIT IV

MASS TRANSFER OPERATIONS-I

Objective:
To impart the basic concepts of molecular diffusion, mass transfer coefficients and analysis of different mass transfer processes.

UNIT I
Diffusion and mass Transfer - Mass Transfer Operations and their applications.


Types of diffusion in solids: - Eddy diffusion - Basic concepts of mass transfer theories - Film mass transfer coefficients for the cases of equimolar counter diffusion and diffusion of one component (A) in stagnant component (B) – Correlations for mass transfer coefficients and Reynolds & Colburn analogies.

UNIT II
Interphase mass transfer - overall mass transfer coefficients - Two resistance theory - Gas phase & liquid-phase controlled situations.

Equipment for gas- liquid contact - Description of continuous and stage wise contact equipment - packing for packed columns - Liquid distribution - Mass transfer coefficients in packed columns - Flooding in packed and plate columns - Ideal- plate - Murphree, point, plate and column efficiency - Comparison of packed and plate columns.

UNIT III
Absorption and Stripping - counter current and co- current isothermal absorption and stripping of single component - Operating lines - Minimum flow rates - Determination of number of transfer Units and height of the Continuous contact absorbers. Multistage absorption and determination of number of plates - absorption factor - Kremser-Brown equation.
Vapor, gas mixtures - Humidity and relative saturation. Dew point adiabatic saturation and wet bulb temperatures- psychrometric Charts- Enthalpy of gas-vapor mixtures.

Humidification and Dehumidification - Operating lines and Design of Packed Humidifiers, Dehumidifiers and Cooling towers, Spray Chambers.

UNIT V
Drying - moisture contents of solids- equilibrium content, bound and unbound moisture. Drying conditions- Rate of batch drying and under constant drying conditions- Mechanism of batch drying- Drying time of batch drying- through circulation drying- Description of batch and continuous dryers. Crystallization, crystallization equipment, principles of crystallization.

TEXT BOOK:

REFERENCES:

OUTCOME:
Students will gain knowledge on mass transfer mechanisms and operations like absorption, stripping, drying and humidification. They also learn about selection and design of the column internals like packing, tray efficiency, calculation of transfer units, etc.
OUTCOME: Ability to model the dynamic processes, to analyze the dynamic processes, to design feedback control system for chemical, mechanical & electrical engineering systems and to design advanced control system for complex and normal processes.

ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

1. Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students’ fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

2. Introduction

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use ‘good’ English and perform the following:

- Gathering ideas and information to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

Learning Outcomes
3. Syllabus:
The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

2. **Activities on Reading Comprehension** – General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.


4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ e-mails/assignments etc.

5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. Minimum Requirement:
The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:
- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality


6. **Suggested Software:**
The software consisting of the prescribed topics elaborated above should be procured and used.
- Oxford Advanced Learner’s Compass, 8th Edition
- DELTA’s key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- The following software from ‘train2success.com’
  - Preparing for being Interviewed
  - Positive Thinking
  - Interviewing Skills
  - Telephone Skills
  - Time Management

7. Books Recommended:
2. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.

**DISTRIBUTION AND WEIGHTAGE OF MARKS:**

**Advanced Communication Skills Lab Practicals:**

1. The practical examinations for the ACS Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned, by inviting the External Examiner from outside. In case of the non-availability of the External Examiner, other teacher of the same department can act as the External Examiner.

**Mini Project:** As a part of Internal Evaluation

1. Seminar/ Professional Presentation
2. A Report on the same has to be prepared and presented.

* Teachers may use their discretion to choose topics relevant and suitable to the needs of students.
* Not more than two students to work on each mini project.
* Students may be assessed by their performance both in oral presentation and written report.

---

**III Year B.Tech. Chem. Engg. I-Sem**

**L T P C**

0 0 3 2

**PROCESS DYNAMICS AND CONTROL LAB**

**Objectives:**
- To study the dynamic response of first and higher order systems.
- Study the dynamic response of interacting & non-interacting systems

**List of Experiments:**
1. Calibration and determination of time lag of various first and second Order instruments
   - Major equipment - First order instrument like Mercury-in-Glass thermometer and overall second order instrument like Mercury-in-Glass thermometer in a thermal well
2. Experiments with single and two capacity systems with and without interaction.
   - Major equipment- Single tank system, Two-tank systems (Interacting and Non- Interacting)
3. Level control trainer
   - Major equipment - Level control trainer set up with computer
4. Temperature control trainer
   - Major equipment - Temperature control trainer with computer
5. Cascade control
   - Major equipment - Cascade control apparatus with computer
6. Experiments on proportional, reset, rate mode of control etc.
   - Major equipment – PID control apparatus
7. Control valve characteristics
   - Major equipment – Control valve set up
8. Estimation of damping coefficient for U-tube manometer
   - Major equipment - U-tube manometer

**Outcome:**
They will be able to understand the dynamics & control of different first and higher order systems.

---

**JNTUH COLLEGE OF ENGINEERING HYDERABAD**
MASS TRANSFER OPERATIONS LAB

List of Experiments:

1. Determination of diffusivity coefficient for a given Liquid-Liquid system.
2. Determination of diffusivity coefficient for a given Vapor-Gas system.
3. Determination of mass transfer coefficient for Surface Evaporation of a liquid.
4. Study of hydrodynamics of single drop extraction.
5. Study of Hydrodynamics of perforated plate tower.
6. Determination of mass transfer coefficient in a wetted wall tower.
7. Determination of mass transfer coefficient in packed bed absorption.
9. Mass transfer coefficient in Humidification and De-Humidification

INTERFACIAL & COLLOIDAL SCIENCE

(Departmental Elective-I)

Qualitative treatment only

UNIT I

Introduction to Interface and Colloidal Science:
Examples of surface and colloidal phenomena in industry and nature, Historical perspective, areas where future research is needed, nature of interfaces, Surface free energy, Work of cohesion and adhesion, Surface activity and surfactant structures, Physical and chemical interactions between atoms and molecules interactions between surfaces and particles, Surface tension.

UNIT II


Solid-Vapor adsorption isotherms:

UNIT III

Capillarity: Capillary flow, Driving forces, Interfacial tension, Contact angle, Laplace expression for pressure difference across a curved interface, Capillary flow and spreading processes, Contact angle effects, Some practical capillary systems such as wetting in woven fibers and papers, repellency control, detergency, enhanced oil recovery.

UNIT IV

Electrostatic Forces and Electrical Double Layer:
Sources of interfacial charge, Electrostatic theory, Coulomb's law, Boltzmann’s distribution and the Electrical double layer, Double layer thickness, Specific ion adsorption and the stern layer, Overview of electrokinetic phenomena (Electro-osmosis and Electrophoresis).

Colloids and Colloidal Stability: Working definition of colloids, Practical applications of colloids and colloids phenomena. Mechanisms of colloid formation, Sources of colloidal stability, Steric or entropic stabilization, Coagulation kinetics, DLVO theory and its applications.

UNIT V
Emulsions: Emulsion formation, Classification of emulsifiers and stabilizers, Flocculation and coalescence. Adsorption at liquid-liquid interfaces, General considerations of emulsion formation and stability. Mechanistic details of stabilization, Solubility parameters, Hydrophilic-Lipophile balance. Phase inversion temperature, Association colloids such as micelles, ionic and nonionic surfactants, Kraft temperature, Critical micelle concentration, Microemulsions.

REFERENCE BOOKS:

PETROLEUM AND PETROCHEMICAL TECHNOLOGY
(Professional Elective-I)

Objective:
To study the origin of petroleum and production of different petrochemicals and their derivatives.

UNIT I
Origin, formation and composition of petroleum: Origin and formation of petroleum, Reserves and deposits of world, Indian Petroleum Industry.
Petrochemical processing data: Evaluation of petroleum, thermal properties of petroleum fractions, important products, properties and test methods.

UNIT II
Fractionation of petroleum: Dehydration and desalting of crudes, heating of crude-pipe still heaters, distillation of petroleum, blending of gasoline.
Treatment techniques: fraction-impurities, treatment of gasoline, treatment of kerosene, treatment of lubes.

UNIT III
Thermal and catalytic processes: Cracking, catalytic cracking, catalytic reforming, Naphtha cracking, coking, hydrogenation processes, Alkylations processes, Isomerization process.

UNIT IV
Petrochemical Industry – Feed stocks
Chemicals from methane: Introduction, production of Methanol, Formaldehyde, Ethylene glycol, PTFE, Methylamines.

UNIT V
Chemicals from Ethane-Ethylene-Acetylene: Oxidation of ethane, production of Ethylene, Manufacture of Vinyl Chloride monomer, vinyl Acetate manufacture, Ethanol from Ethylene, Acetylene manufacture, Acetaldehyde from Acetylene.
REFERENCES:

OUTCOME: The student will gain familiarity with various processes deployed in petroleum industries.

III Year B.Tech. Chem. Engg. II-Sem

COMPUTATION METHODS FOR CHEMICAL ENGINEERING
(Professional Elective-I)

Objective: This course will focus on different numerical methods related to algebraic and ordinary differential equations

UNIT I
Eigen values and Eigen vectors: Introduction, Calculation of Largest and smallest Eigen Values and Corresponding Eigen vectors using power method.


UNIT II
Nonlinear Algebraic Equations: Introduction, single variable successive substitutions (Fixed point method), single variable Newton-Raphson Technique, Multivariable Newton-Raphson Technique.

UNIT III
Regression Analysis: Introduction, least squares curve-fit (linear regression), Newton’s forward formulae, Newton’s backward formulae.
Interpolation Polynomial, Lagrangian Interpolation (Unequal Intervals), Pade’ approximations, (up to second order both in numerator and denominator)

UNIT IV


UNIT V
Advanced methods for Differential Equations: Introduction, the finite difference technique (method of lines), Orthogonal Collocation, Finite Volume Method.

JNTUH COLLEGE OF ENGINEERING HYDERABAD
TEXT BOOKS:

REFERENCE BOOKS:

Outcome: The student will be able to learn different numerical techniques to solve the chemical engineering problems.

III Year B.Tech. Chem. Engg. II-Sem

CORROSION ENGINEERING
(Professional Elective-II)

L T P C
4 0 0 4

Objectives:
The course will enable the students to:
1. The principles of electrochemistry as well as the essential elements of electrochemical corrosion.
2. Lay a foundation for understanding the forms of corrosion, the mechanisms of corrosion, electrochemical methods.
3. Develop the thermodynamic and kinetic aspects of electrochemistry, including potential-pH
4. Design methods for combating corrosion, the principles and methods leading to mitigation of corrosion problems that might occur in engineering practice.

UNIT- I:
Introduction

UNIT-II:
Forms of Corrosion
Uniform attack, galvanic, crevice, pitting, Inter granular, selective leaching, erosion and stress corrosion – Mechanisms, testing procedures and their protection.

UNIT- III:
Electrode kinetics and polarization phenomena
Methods of corrosion prevention and control

UNIT-V:
Industry Approach
Selection for a given Chemical Engineering Service Environment-Materials for Chemical Engineering Industry to resist the given chemical Environment-Ferritic, Austenitic steels and stainless steels-Copper and its alloys-Brasses, bronzes, Nickel and its alloys-Monel alloys-materials for a petroleum refinery industry.

TEXT BOOKS:

REFERENCE:

Outcomes:
At the end of the course, the students will be able to:
1. Understand the electrochemical and metallurgical behavior of corroding systems.
2. Apply the electrochemical and metallurgical aspects of combating eight forms of corrosion.
3. Select or choose the testing procedures for corroding systems.

REFERENCE:

OUTCOME: The student will get an overview on the design, development and manufacturing of different pharmaceuticals and fine chemicals.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

III Year B.Tech. Chem. Engg. II-Sem

L T P C
4 0 0 4

FOOD PROCESSING TECHNOLOGY
(Professional Elective-II)

Pre-requisite: Mechanical operations, Process heat transfer.

Objective:
To teach the student about different unit operations involved in the food processing industry.

UNIT I
Food process engineering - Fundamentals: Fundamentals of food process engineering, application of quantitative methods of material and energy balances in food engineering practices.

UNIT II
Unit Operations in food industries: Fluid flow, thermal process calculations, refrigeration, evaporation and dehydration operations in food processing.

UNIT III
Microwave heating: Theory of microwave heating, microwave properties of foods, comparison of microwave and conventional heating, benefits of microwave heating, applications in food processing, microwave heating equipment, hazards of microwave heating.

UNIT IV
Mechanical Operations in food processing: Conversion operations, Size reduction and screening of solids, mixing and emulsification, filtration and membrane separation, centrifugation, crystallization, extraction.

UNIT V
Preservation operations: Preservation methods & Strategies, Thermal Methods, Nabla Factor Sterilization Types Pasteurization Dehydro freezing Irradiation Dosimetry Transport of food & Preservation strategies Cheap and applicable everywhere.

TEXT BOOKS

REFERENCES

OUTCOME: The student will enable to learn microwave heating and preservation methods and strategies in food technology.

III Year B.Tech. Chem. Engg. II-Sem

L T P C
4 1 0 4

MASS TRANSFER OPERATIONS-II

Pre-requisite:--- Mass Transfer Operations-I

Objective: To understand the principles and applications of distillation, liquid-liquid extraction, adsorption and leaching processes.

UNIT I
Distillation: VLE phase diagrams, Tie lines and mixture rule- Flash vaporization and differential distillation for binary mixtures- Steam distillation. Batch distillation with reflux for binary mixtures.

UNIT II

UNIT III
Liquid-Liquid Extraction: Solubilities of ternary liquid systems. Triangular and solvent free coordinate systems. Choice of solvent. Extraction with insoluble and partially soluble systems- single stage, multistage cross current and multistage counter current extraction without reflux and with reflux. Continuous contact extraction (packed beds). Equipments for liquid-liquid extraction operation.

UNIT IV

UNIT V
**TEXT BOOK:**

**REFERENCES:**

**Outcome:** student will have complete insight of stage wise contact processes absorption; distillation, extraction and leaching that are used in processes in industries.

---

**JNTUH COLLEGE OF ENGINEERING HYDERABAD**

**III Year B.Tech. Chem. Engg. II-Sem**

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**CHEMICAL REACTION ENGINEERING – II**

**Pre-requisite:** Chemical Reaction Engineering-I

**Objective:** To understand the characteristic features of non-ideal flow and mixing of fluids in reaction vessels. To give the introductory aspects of the design for heterogeneous reacting systems.

**UNIT I**

**Basics of non-ideal flow:** E, the exit age distribution function of fluid, the RTD, conversion in non-ideal flow reactors, diagnosing reactors (qualitative discussion only).

**The dispersion model:** axial dispersion, correlations for axial dispersion, chemical reaction and dispersion.

**UNIT II**

**The tanks in series model:** pulse response experiments and the RTD, chemical conversion. The convection model for laminar flow- the convective model and its RTD, chemical conversion in laminar flow reactors

**Earliness of mixing, segregation and RTD:** self-mixing of a single fluid, mixing of two miscible fluids.

**UNIT III**

**Catalysis and Catalytic reactors:** catalysts, steps in catalytic reactions, synthesizing a rate law, mechanism and rate limiting step. (From chapter 10, Fogler)

**Heterogeneous reactions:** introduction to Solid catalyzed reactions: The rate equation for Surface Kinetics- Pore diffusion resistance combined with surface kinetics, Porous catalyst particles, heat effects during reaction, Performance equations for reactors containing porous catalyst particles.

**UNIT IV**

Solid catalyzed reactions- Experimental methods for finding rates. Deactivating catalysts- mechanisms of catalyst deactivation, the rate and performance equations.

**UNIT V**

**Fluid-fluid reactions:** kinetics- the rate equation.

TEXT BOOKS:

REFERENCES:

Outcome: This course will give knowledge on selection of catalyst and design of multiple reactors and their evaluation of performance, concepts of heterogeneous reaction system applications.

III Year B.Tech. Chem. Engg. II-Sem

L T P C
0 0 3 2

CHEMICAL REACTION ENGINEERING LAB
Pre-requisite: Chemical Reaction Engineering.
Objective:
- Student will learn about different types of reactors like CSTR, Batch, PFR.
- Analyze the concentration versus time data and determine the specific rate constant and the order of the reaction.
- Estimate RTD and model parameters in a CSTR, PFR, packed bed and CSTR in-series

List of Experiments:
1. Determination of the order of a reaction using a batch reactor and analyzing the data by (a) differential method (b) integral method.
   Major equipment - Batch reactor
2. Determination of the activation energy of a reaction using a batch reactor
   Major equipment - Batch reactor
3. To determine the effect of residence time on conversion and to determine the rate constant using a CSTR.
   Major equipment – CSTR apparatus
4. To determine the specific reaction rate constant of a reaction of a known order using a batch reactor.
   Major equipment - Batch reactor
5. To determine the order of the reaction and the rate constant using a tubular reactor.
   Major equipment – PFR apparatus
6. CSTRs in series- comparison of experimental and theoretical values for space times and volumes of reactors.
   Major equipment - CSTRs in series setup
7. Mass transfer with chemical reaction (solid-liquid system) – determination of mass transfer coefficient.
   Major equipment – beaker, stirrer
8. Axial mixing in a packed bed. Determination of RTD and dispersion number for a packed-bed using a tracer
9. Determination of RTD and dispersion number in a tubular reactor using a tracer.

Outcomes:
- The student will be able to understand about batch and continuous flow reactors.
- Understand the concept of non-ideal flow.

**Pre-requisite**: Mass transfer operations

**Objective**: This lab gives an idea about distillation & extraction.

**List of Experiments**:
1. Steam distillation.
2. Differential distillation.
3. Determination of H.E.T.P of a packed bed distillation column.
4. Determination of Vapor-Liquid equilibria for a given system.
5. Determination of Ternary Liquid equilibria for a given system.
6. Determination of Liquid-Liquid equilibria for a given system.
7. Determination of oil content in the given sample of oil bearing material.
8. Determination of stage efficiency in single and multi stage liquid – liquid extraction
9. Ion Exchange

**Outcome**: The student will be able to learn about the calculation of different parameters in distillation and extraction
PROCESS SIMULATION LAB

Pre-requisite:
Fluid mechanics for chemical Engineers, Process heat transfer, Mass transfer operation, Chemical Reaction Engineering,

Objective: To make the student familiar with different simulation software’s related to chemical Engineering.

The following experiments have to be conducted using C/C++/Simulink using MATLAB

2. Three CSTR’s in series – open loop
3. Three CSTR’s in series – closed loop
4. Non isothermal CSTR
5. Binary Distillation column
6. Batch Reactor isothermal; Batch reactor non isothermal – closed loop
7. Isothermal batch reactor – open loop
8. Heat Exchanger
9. Interacting System- two tank liquid level
10. Non interacting system-two tank liquid level
11. Plug flow reactor
12. Bubble point calculations
13. Dew point calculations
14. Using ASPEN Software simulating a flow sheet of a simple process

TEXT BOOK:

1. C++ and MATLAB for Chemical Engineers

Outcome: The student will be able to simulate different chemical processes
osmotic pressure model, boundary layer resistance model, concentration polarization in diffusive membrane separations and electro dialysis, membrane fouling, methods to reduce fouling, compaction. Module and process design: Introduction, plate and frame module, spiral wound module, tubular module, capillary module, hollow fiber module, comparison of module configurations.

TEXT BOOKS:

REFERENCES:

Outcome: The student will understand the underlined principles and importance of ultrafiltration reverse Osmosis, electro dialysis, nanofiltration, etc., in industrial waste water treatment.

UNIT I
Introduction to microbiology: Biophysics and the cell doctrine, the structure of cells, important cell types, from nucleotides to RNA and DNA, amino acids into proteins. Kinetics of enzyme catalyzed reaction: the enzyme substrate complex and enzyme action, simple enzyme kinetics with one and two substrates, other patterns of substrate concentration dependence, modulation and regulation of enzyme activity, other influences on enzyme activity.

UNIT II

UNIT III
Introduction to metabolic pathways, biosynthesis, transport across cell membranes, end products of metabolism, stoichiometry of cell growth and product formation. Design and analysis of biological reactors: batch reactors, fed-batch reactors, enzyme catalyzed reactions in CSTR, CSTR reactors with recycle and cell growth, ideal plug flow reactors, sterilization reactors, sterilization of gases, packed bed reactors using immobilized catalysts. Fermentation technology: medium formulation, design and operation of a typical aseptic, aerobic fermentation process.

UNIT IV
Transport phenomena in bioprocess systems: Gas-liquid mass transfer in cellular systems, determination of oxygen transfer rates, overall $k_a\alpha$ estimates and power requirements for sparged and agitated vessels, scaling of mass transfer equipment, heat transfer.
UNIT V
Downstream processing: Strategies to recover and purify products; separation of insoluble products-filtration and centrifugation; cell disruption-mechanical and non-mechanical methods; separation of soluble products: liquid-liquid extractions, membrane separation (dialysis, ultra filtration and reverse osmosis), chromatographic separation-gel permeation chromatography, electrophoresis, final steps in purification – crystallization and drying.

TEXT BOOKS:

REFERENCES:

OUTCOME: This course will help the students to understand and apply the principles of biochemical engineering in analysis and design of industrial biochemical processes.

TEXT BOOK:
Outcome:
The student will be able to learn about
- Design of an experiment and calculate the factor levels that optimize a given objective.
- Use response surface methodology to optimize the process, by considering curvature effects.
- Understand strategy in planning and conducting experiments
- Choose an appropriate experiment to evaluate a new product design or process improvement

Computational Fluid Dynamics
(Professional Elective – IV)
Prerequisite: Fluid mechanics for chemical engineers, process heat transfer, mass transfer operations, chemical reaction engineering, process modeling & simulation

Objective: This subject deals with different mathematical methods like finite difference techniques to solve Navier-Stokes equations & other fluid flow problems

Unit I

Unit II

Unit III
Convection and diffusion, different methods i.e., upwind scheme, Exponential scheme, Hybrid scheme, power law scheme, calculation of flow field, staggered grid method, pressure and velocity corrections, SIMPLE Algorithms & SIMPLER (revised algorithm). Solution methods of elliptical, parabolic and hyperbolic partial differential equations in fluid mechanics - Burgers equation.

Unit IV
Formulations for incompressible viscous flows - vortex methods - pressure correction methods.

Unit V
Treatment of compressible flows - potential equation, Navier - Stokes equation - flow field dependent variation methods, boundary conditions. Linear fluid flow problems, 2-I) and 3-1) fluid flow problems.

Text Books:
1. Numerical heat transfer and fluid flow - S.V. Patankar
ENERGY ENGINEERING
(Professional Elective – IV)

Objectives: To acquaint the student with the conventional energy sources and their utilization. To understand the importance of heat recovery and energy conservation methods and energy audit.

UNIT I
Sources of energy, types of fuels- energy and relative forms. Calorific value- gross and net value, calculation of calorific value from fuel analysis, experimental determination energy resources present and future energy demands with reference to India.

Coal: origin, occurrence, reserves, petrography, classification, ranking, analysis, testing, storage, coal carbonization and byproduct recovery, liquefaction of coal, gasification of coal, burning of coal and firing mechanism, burning of pulverized coal.

UNIT II
Liquid fuels: petroleum: origin, occurrence, reserves, composition, classification, characteristics, fractionation, reforming, cracking, petroleum products, specification of petroleum products, burning of liquid fuels.

Natural gas, coke oven gas, producer gas, water gas, LPG, burning of gaseous fuels, hydrogen (from water) as future fuel, fuel cells, flue gas, analysis: orsat apparatus

UNIT III
Steam Plant: Run time cycle, boiler plant, steam cost, steam distribution and utilization, combined heat and power systems, energy from biomass and biogas plants, gas purification, solar energy, wind energy, energy storage

UNIT IV
Waste heat recovery, sources of waste heat and potential application, various types of heat recovery systems, regenerators, recuperators, waste heat boilers

Energy conservation: conservation methods in process industries, theoretical analysis, practical limitations.

UNIT-V
Energy auditing: short term, medium term, long term schemes, energy conversion, energy index, energy cost, representation of energy consumption, Sankey diagram, energy auditing.

TEXT BOOKS:
1. Fuels, Furnaces and Refractories, O.P.Gupta
REFERENCES:
3. Fuel Science- Harker and Allen, Oliver and Boyd, 1972

Outcomes: Student will gain knowledge about conventional energy sources and their audit. Ability to apply the fundamentals of energy conversion and applications.

Prerequisite: Nil

FLUIDIZATION ENGINEERING
(Professional Elective – IV)

Prerequisite: Fluid mechanics for chemical engineers, process heat transfer, mass transfer operations and chemical reaction engineering.

Objective:
To teach the student about the basic principles of fluidization and its application in chemical industry & learn the design aspects of fluidized beds

UNIT I
Introduction: The phenomenon of fluidization; Liquid like behavior of a fluidized bed; Comparison with other contacting methods; Advantages and disadvantages of fluidized beds.

Industrial applications of fluidized beds: Coal gasification; gasoline from other petroleum fractions; Gasoline from natural and synthesis gases; Heat exchange; Coating of metal objects with plastics; Drying of solids; Synthesis of phthlac anhydride; Acrylonitrile; Polymerization of olefins; FCCU; Fluidized combustion of coal; Incineration of solid waste; Activation of carbon; Gasification of waste; Bio-fluidization.

UNIT II
Fluidization and mapping of regimes: Minimum fluidization velocity; Pressure drop vs. velocity diagram; effect of temperature and pressure on fluidization; Geldart classification of particles; Terminal velocity of particles, Transport disengaging height; Turbulent fluidization; Pneumatic transport of solids; Fast fluidization; Solid circulation systems; Voidage diagram; Mapping of regimes of fluidization.

UNIT III
Bubbles in dense bed: Single rising bubbles; Davidson model for gas flow at bubbles; Evaluation of models for gas flow at bubbles.

Bubbling Fluidized beds: Experimental findings; Estimation of bed Voidages; Physical models: simple two phase model; K-L model.

UNIT IV
High velocity Fluidization: Turbulent fluidized bed; Fast fluidization pressure drop in turbulent and fast fluidization.

Solids Movement, Mixing, Segregation and staging: Vertical movement of solids; Horizontal movement of solids; Staging of fluidized beds.

UNIT V
Gas Dispersion and Gas interchange in Bubbling Beds:
Dispersion of gas in beds; Gas interchange between bubble and emulsion; Estimation of gas interchange coefficients.

Particle to Gas Mass Transfer:
Experimental interpolation of mass transfer coefficients; Heat transfer; Experimental heat transfer from the bubbling bed model.

TEXT BOOKS
2. Fluidization Engineering by J.R. Howard, Adam Heilgar.

Outcome:
The student will have knowledge on fluidization phenomenon, behavior of fluidized beds their importance and applications of fluidization in chemical and allied industries.

IV Year B.Tech. Chem. Engg. I-Sem
L T P C
4 0 0 4

POLYMER ENGINEERING & TECHNOLOGY
(Professional Elective-V)

Objective: To understand the concepts of plastics, polymers and their manufacturing processes

Unit I
Introduction; definitions: polymer & macro molecule, monomer, functionality, average functionality, co-polymer, polymer blend, plastic and resin. Classification of polymers: based on source, structure, applications, thermal behavior, mode of polymerization. Concept of average molecular weight of polymers, molecular weight distribution, poly disparity index. Determination of average molecular weights: End group analysis, osmometry, light scattering techniques, viscometer, Gel permeation chromatography.

Unit II
Natural polymers: brief study of i) Natural rubber ii) shellac iii) rosin iv) cellulose v) proteins.
Mechanism and kinetics of: Addition or chain polymerization
a) Free radical addition polymerization b) Ionic addition polymerizations c) Coordination polymerization d) Coordination or step growth or condensation polymerization.

Unit III
Methods of polymerization: mass or bulk polymerization process, solution polymerization process, suspension polymerization process and emulsion polymerization method comparison of merits and demerits of these methods. Properties of polymers: crystalline and amorphous status, melting and glass transition temperatures and their determination, effect of polymer structure on mechanical, physical, chemical and thermal properties.

Unit IV
Degradation of polymers, Role of the following additives in the polymers: i) Fillers and reinforcing fillers ii) Plasticizers iii) Lubricants iv) Antioxidants and UV stabilizers v) Blowing agents vi) Coupling agents vii) Flame retardants viii) Inhibitors

Unit V
Brief description of manufacture, properties and uses of: i) Polyesters
polyesters) ii) Nylon (Nylon 66) iii) Phenol- Formaldehyde resins iv) Epoxy resins v) Polyurethane vi) Silicones

Compounding of polymer resins, brief description of: i) Compression and transfer moulding ii) Injection moulding iii) Extrusion iv) Blow moulding v) Calendering vi) Laminating and pultrusion

TEXT BOOKS:

REFERENCES:

Outcome: The student will be able get the knowledge on different types of polymers and polymerization processes.

Prerequisite: Nil

JNTUH COLLEGE OF ENGINEERING HYDERABAD
**Linear programming and applications:** Basic concepts in linear programming, graphical solution, artificial variable technique, exceptional cases in LPP, non-existing feasible solution, degeneracy, duality in linear programming, dual simplex method, revised simplex method.

**TEXT BOOKS:**

**Outcome:**
- Knowledge of optimization to formulate the problems and analyze the optimization criterion for solving problems
- Apply different methods of optimization and to suggest a technique for specific problem

**IV Year B.Tech. Chem. Engg. I-Sem**

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**PROCESS INTENSIFICATION**

(Professional Elective-V)

**Objectives:** Understand the concept of Process Intensification. Know the limitations of intensification of the chemical processes. Apply the techniques of intensification to a range of chemical processes.

**UNIT –I**

*Introduction to Process Intensification (PI):* sustainability-related issues in process industry, definitions of Process Intensification, fundamental principles and techniques of PI, the original ICI PI strategy, benefits of PI and obstacles to PI

**Issues in designing of a sustainable, inherently safer processing plant**

**UNIT-II**

*PI Approaches:* STRUCTURE - PI approach in spatial domain, ENERGY - PI approach in thermodynamic domain, SYNERGY - PI approach in functional domain and TIME - PI approach in temporal domain

**Mechanisms involved in PI:** Mechanisms of intensified heat transfer, mass transfer, electrically enhanced processes, microfluidics

**UNIT –III**

*Application of PI techniques to heat transfer:* Compact & micro heat exchangers

*Application of PI techniques to reactors:* Spinning disc reactors, oscillatory baffled reactors (OBR), Rotating reactors, Micro reactors, membrane reactors, micro reactors, Reactive separation/super critical operation and other intensified reactor types.

*JNTUH COLLEGE OF ENGINEERING HYDERABAD*
UNIT-IV

**Intensification of Separation Processes**: Distillation, Centrifuges, membranes, drying, precipitation and crystallization

**Intensified Mixing**: Inline mixers, mixing on spinning disk, induction heated mixer

UNIT –V

Application areas of PI: Petrochemicals and Fine Chemicals: Refineries, Bulk Chemicals, Fine Chemicals, Fine Chemicals and Pharmaceuticals, bio processing

Offshore Processing, Nuclear Industries, Food and drink water sector, Textiles, Aerospace, biotechnology

Text Books


**Outcomes**: At the end of this course, students are able to: Assess the values and limitations of process intensification, cleaner technologies and waste minimization options. Measure and monitor the usage of raw materials and wastes generating from production and frame the strategies for reduction, reuse and recycle.

**JNTUH COLLEGE OF ENGINEERING HYDERABAD**

**TRANSPORT PHENOMENA**

**Pre-requisites**: Fluid mechanics for chemical engineers, process heat transfer, mass transfer operations and chemical reaction engineering.

**Objectives**: Different types of fluids, their flow characteristics and different mathematical models applied to actual situations.

**Mechanism of fluids in motion under different conditions.**

UNIT-I


UNIT -II

Shell momentum balances and velocity distributions in laminar flow: shell momentum balances and boundary conditions, flow of a falling film, flow through a circular tube, flow through annulus, flow of two adjacent immiscible fluids, creeping flow around a sphere.

UNIT -III

Shell energy balances and temperature distributions in solids and laminar flow: shell energy balances; boundary conditions, heat conduction with an electrical heat source, heat conduction with a nuclear heat source, heat conduction with a viscous heat source, heat conduction with a chemical heat source, heat conduction through composite walls, heat conduction in a cooling fin, forced convection, free convection.
UNIT -IV
Concentration distributions in solids and laminar flow: shell mass balances; boundary conditions, diffusion through a stagnant gas film, diffusion with a heterogeneous chemical reaction, diffusion with a homogeneous chemical reaction, diffusion into a falling liquid film (gas absorption), diffusion into a falling liquid film (solid dissolution), diffusion and chemical reaction inside a porous catalyst.

UNIT -V
The equations of change: Derivation of the equation of continuity in Rectangular and Polar coordinates, the equation of motion, the equation of energy, the equation of continuity of a component in multi component mixture (in rectangular coordinates only) the equations of change in terms of the substantial derivative. Use of equations of change to solve one dimensional steady state problems of momentum, heat and component transfer, Introduction to Turbulent flow and Time smoothing

Text Book:

References:

Outcome: Ability to analyze the processes involving simultaneous flow, heat and mass transfer, to design packed bed flows and fluidization processes, to calculate heat and mass transfer.

Codes / Tables:
1. Leonard – Jones potential parameters and critical properties.
2. Equations of change (from Bird)
TEXT BOOK:

REFERENCE:
1. Process Engineering Economics, Schweyer

Outcome: The student will be able to learn about various costs involved in a process industry and evaluate the tax burden of an establishment. Compute break even period for an investment and rate of return.

Prerequisite: Nil

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Chem. Engg. I-Sem

L T P C 0 0 3 2

CHEMICAL PROCESS EQUIPMENT DESIGN LAB

Pre-requisite: Chemical Process equipment design theory

Objective: To make the student familiar with design and drawing aspects of chemical processes equipments.

LIST OF EXPERIMENTS:

1. Drawing of flow sheet symbols.
2. Drawing of instrumentation symbols.
3. Drawing of instrumentation diagrams.
4. Mechanical aspects chemical equipment design and drawing of following equipment.
   a) Double pipe heat exchanger
   b) Shell and tube heat exchanger
   c) Evaporator
   d) Distillation column
   e) Batch reactor.

TEXT BOOK:
1. Process Equipment Design by M. V. Joshi

REFERENCES:
1. Process Equipment Design by Brownell and Young
2. Chemical Process Equipment Design by Bhattacharyya
3. Process Equipment Design by Wallas
**Outcome:** Students would gain knowledge to develop key concepts and techniques to design the process equipment in a process plant. These key concepts would be utilized to make design and operating decisions.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

IV Year B.Tech. Chem. Engg. II-Sem

L   T   P   C
0   0   3   1

MANAGEMENT SCIENCE


Unit IV Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).


TEXT BOOKS:

REFERENCES:
ENERGY & ENVIRONMENTAL ENGINEERING LAB

Prerequisites: Industrial pollution control engineering and Energy engineering

Objective: The aim of this lab is to give knowledge about estimation of various parameters related to water, air and also estimation of calorific value of solid fuels

List of Experiments:


2. Estimation of physical parameters of waste water: pH, TDS, Hardness, Turbidity, Alkalinity etc.

3. Estimation of chemical parameters of waste water: COD, BOD, TSS

   Same above system with UF membrane for turbidity removal and water disinfection

5. Analysis of Air: Estimation of SPM, RSPM, Sox, Nox, CO and ozone in atmospheric air to study air pollution.

6. Fuel cell Test Kit [Energy] A small ½ watt to 1 watt fuel cell with water electrolysis kit (H₂ and O₂ Generation) plus small volt meter and ammeter for measuring fuel cell performance.

7. One small transparent anaerobic/aerobic biological reactor with slurry pump and aerator for treatment of industrial effluents to reduce COD levels.

8. Measurement of Flash point, fire point and calorific value of petroleum products.

9. Energy auditing of your Department.

List of Equipment

PH meter, Colorimeter, TDS meter, Aerobic /Anaerobic reactor 25L capacity, BOD incubator, High accuracy analytical balance (5 digit), Desiccators, RO system with domestic 2”x12” Membrane module, H₂S
vial kit, Water analysis kit, UV-Vis spectrophotometer, High volume air sampler, Bomb calorimeter, Fuel cell test kit, Microscope.

**Outcome:** The student will be able to understand various aspects of energy and environment which are very much essential in the industry.

---

**JNTUH COLLEGE OF ENGINEERING HYDERABAD**

**IV Year B.Tech. Chem. Engg. II-Sem**

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
</tr>
</tbody>
</table>

**PROJECT WORK**

The project work may consist of any one of the following works.

a) The project work should consist of a comprehensive design project of a chemical plant in the form of a report with the following chapters.

1. Introduction
2. Physical and Chemical Properties and uses
3. Literature survey for different processes
4. Selection of the process
5. Material and Energy balances
6. Specific equipment design, (Process as well as mechanical design with drawing), including computer programs where possible, of Heat Transfer equipments or separation equipments or reactors
7. General equipment Specifications
8. Plant location and layout
9. Materials of construction
10. Health and Safety factors
11. Preliminary cost estimation
12. Bibliography

b) Modeling & Simulation of any Chemical Engineering Process

c) Any experimental work with physical interpretations
OPEN ELECTIVE - I

OPEN ELECTIVE - I DISASTER MANAGEMENT

Pre Requisites: NIL

Course Objectives:
The subject provide different disasters, tools and methods for disaster management

Course Outcomes:
Estimate, perform quantity survey & valuate various engineering works

UNIT 1: Understanding Disaster
Concept of Disaster
Different approaches
Concept of Risk
Levels of Disasters
Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerability
Natural and man-made hazards; response time, frequency and forewarning levels of different hazards
Characteristics and damage potential or natural hazards; hazard assessment
Dimensions of vulnerability factors; vulnerability assessment
Vulnerability and disaster risk
Vulnerabilities to flood and earthquake hazards

UNIT 2: Disaster Management Mechanism
Concepts of risk management and crisis managements
Disaster Management Cycle
Response and Recovery
Development, Prevention, Mitigation and Preparedness
Planning for Relief

UNIT 3: Capacity Building
Capacity Building: Concept
Structural and Nonstructural Measures
Capacity Assessment; Strengthening Capacity for Reducing Risk
Counter-Disaster Resources and their utility in Disaster Management
Legislative Support at the state and national levels
UNIT 4: Coping with Disaster
Coping Strategies; alternative adjustment processes
Changing Concepts of disaster management
Industrial Safety Plan; Safety norms and survival kits
Mass media and disaster management

UNIT 5: Planning for disaster management
Strategies for disaster management planning
Steps for formulating a disaster risk reduction plan
Disaster management Act and Policy in India
Organizational structure for disaster management in India
Preparation of state and district disaster management plans

Text Books

References
UNIT - V

OUTCOMES:
- The student will be able analyse solar thermal and photovoltaic systems and related technologies for energy conversion.
- Wind energy conversion and devices available for it.
- Biomass conversion technologies.
- Geo thermal resources and energy conversion principles and technologies.
- Power from oceans (thermal, wave, tidal) and conversion and devices.
- Fundamentals of fuel cells and commercial batteries.

TEXT BOOKS

REFERENCE BOOKS
2. F.C. Treble, Generating Electricity from Sun.
4. S.P. Sukhatme, Solar Energy Principles and Application - TMH
UNIT – V
SPECIAL PURPOSE MATERIALS: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI

OUTCOMES: Will be able to
- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Materials used in electrical engineering and applications.

TEXT BOOKS
3. TTTI Madras: Electrical Engineering Materials

JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. EEE

OPEN ELECTIVE-I
NANO-TECHNOLOGY

Pre-requisites: Nil
OBJECTIVES: To enable the student to understand fundamentals of nano materials and technologies for these materials and their manufacturing, applications in various fields.

UNIT - I
Background of Nanotechnology: Scientific Revolutions, Nanotechnology and Nanomachines - The Periodic Table, Atomic Structure, Molecules and Phases, Energy, Molecular and Atomic size, Surfaces and Dimensional Space, Top down and Bottom up approach.

UNIT - II

UNIT - III
Nanopowders and Nanomaterials: Preparation, Plasma arcing, chemical vapor deposition, Sol-gels, Electrodeposition, Ball milling, using natural nanoparticles, Applications of nanomaterials.

UNIT - IV
Nanoelectronics: Approaches to nanoelectronics, Fabrication of integrated circuits, MEMS, NEMS, Nano circuits, Quantum wire, Quantum well, DNA-directed assembly and application in electronics.

UNIT - V
OUTCOMES:

- To evaluate electronic structural studies of nano materials and different synthesis methods to obtain nano structures.
- Understand characterization techniques through various measurements to study electrical, mechanical, thermal properties of nano materials.
- Applications of nano materials for specific purposes like MEMS, NEMS, nano electronics, energy storage.

TEXT BOOKS

1. Introduction to Nanoscience and Nanotechnology Gabor L. Hornyak, NanoThread, Inc., Golden, Colorado, USA; H.F. Tibbals, University of Texas Southwestern Medical Center, Dallas, USA; Joydeep Dutta, Asian Institute of Technology, Pathumthani, Thailand; John J. Moore, Colorado School of Mines, Golden, USA

2. Introduction to Nanotechnology by Charles P. Poole Jr and Frank J.Owens Wiley India Pvt Ltd.

3. Introduction to Nanoscience and Nanotechnology, Chatopadhyaya.K.K, and Banerjee A.N.

4. Introduction to nano tech by phani kumar

5. Introduction to Nano Technology by Charles P. Poole Jr and Frank J. Owens, Wiley India Pvt Ltd.

6. Introduction to Nanoscience and Nanotechnology, Chatopadhyaya.K.K, and Banerjee A.N.

NANOTECHNOLOGY Basic Science and Emerging Technologies by Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse- CHAPMAN & HALL/CRC PRESS 2002.

JNTUH COLLEGE OF ENGINEERING HYDERABAD


OPERATIONS RESEARCH
OPEN ELECTIVE-I

Prerequisites: None

Objectives:
Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.

Outcomes:
Understanding the problem, identifying variables & constants, formulas of optimization model and applying appropriate optimization Techniques

UNIT – I


UNIT – II

UNIT – III
SEQUENCING – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through ‘m’ machines-graphical model

REPLACEMENT: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

UNIT – IV

INVENTORY: Introduction – Single Item, Deterministic models – Types - Purchase inventory models with one price break and multiple price
breaks – Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

UNIT – V


DYNAMIC PROGRAMMING:

TEXT BOOK :
2. Operations Research/A.C.S.Kumar/Yesdee

REFERENCE BOOKS :
1. Operations Research: Methods and Problems / Maurice Saseini, Arhur Yaspan and Lawrence Friedman
4. Introduction to O.R/Hillier & Libermann (TMH).
5. Introduction to O.R/Taha PHI

JNTUH COLLEGE OF ENGINEERING HYDERABAD

3  0  0  3

BASICS OF THERMODYNAMICS
OPEN ELECTIVE-I

Pre-requisite: Engineering Chemistry and Physics

Course Objective: To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications

Course Outcomes:
At the end of the course, the student should be able to

- Understand and differentiate between different thermodynamic systems and processes
- Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes
- Understand and analyze the Thermodynamic cycles

UNIT – I

Introduction: Basic Concepts:

UNIT II

UNIT – III
UNIT IV
Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Relative Humidity, Saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Psychrometric chart.

UNIT - V
Power Cycles : Otto, Diesel cycles - Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis

TEXT BOOKS :
1. Engineering Thermodynamics / PK Nag /TMH, III Edition
2. Thermodynamics / C.P.Arora.

REFERENCE BOOKS:
1. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Thermodynamics – J.P.Holman / McGraw Hill
4. Engineering Thermodynamics – Jones & Dugan

JNTUH COLLEGE OF ENGINEERING HYDERABAD

3 0 0 3

FABRICATION PROCESSES
OPEN ELECTIVE-I

Prerequisites: Nil

Objectives:
Understand the philosophies of various manufacturing processes.

Outcomes:
For given product, one should be able identify the manufacturing process.

UNIT – I
Casting : Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands.
Methods of Melting - Crucible melting and cupola operation – Defects in castings;

UNIT – II
Welding: Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.
Inert Gas Welding _ TIG Welding, MIG welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non-destructive testing of welds.

UNIT – III
Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth.
Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – IV
Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion – Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion

UNIT – V

TEXT BOOKS:
1. Manufacturing Technology / P.N. Rao/TMH

REFERENCE BOOKS:
1. Production Technology / R.K. Jain
2. Metal Casting / T.V Ramana Rao / New Age
4. Welding Process / Parmar /
5. Production Technology /Sarma P C /
Responding Voltmeters, Specifications of Instruments. CRT, Block
Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO
Probes.

Unit-IV:
Recorders: X-Y Plotter, Curve tracer, Galvanometric Recorders, Servo
transducers, pen driving mechanisms, Magnetic Recording, Magnetic
recording techniques.

Unit-V:
Transducers: Classification, Strain Gauges, Bounded, unbounded;
Force and Displacement Transducers, Resistance Thermometers,
Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special
Resistance Thermometers, Digital Temperature sensing system,
Piezoelectric Transducers, Variable Capacitance Transducers,
Magneto Stritive Transducers.

TEXT BOOKS:
1. Electronic Measurements and Instrumentation: B.M. Oliver, J.M.
   Cage TMH Reprint 2009.

REFERENCES:
1. Electronic Instrumentation and Measurements – David A. Bell,
2. Modern Electronic Instrumentation and Measurement Techniques:
3. Electronic Measurements and Instrumentation – K. Lal Kishore,
   Pearson Education 2010.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. CSE

OPEN ELECTIVE-I

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Prerequisites
1. A course on "Computer Programming & Data Structures"

Objectives
1. Introduces object oriented programming concepts using the Java
   language.
2. Introduces the principles of inheritance and polymorphism; and
   demonstrates how they relate to the design of abstract classes
3. Introduces the implementation of packages and interfaces
4. Introduces exception handling, event handling and multithreading
5. Introduces the design of Graphical User Interface using applets
   and swings

Outcomes
1. Develop applications for a range of problems using object-
   oriented programming techniques
2. Design simple Graphical User Interface applications

UNIT I:
Object oriented thinking and Java Basics - Need for OOP
paradigm, summary of OOP concepts, coping with complexity,
abstraction mechanisms. A way of viewing world – Agents,
responsibility, messages, methods, History of Java, Java buzzwords,
data types, variables, scope and life time of variables, arrays,
operators, expressions, control statements, type conversion and
casting, simple java program, concepts of classes, objects,
constructors, methods, access control, this keyword, garbage
collection, overloading methods and constructors, method binding,
inheritance, overriding and exceptions, parameter passing, recursion,
nested and inner classes, exploring string class.

UNIT II:
Inheritance, Packages and Interfaces – Hierarchical abstractions,
Base class object, subclass, subtype, substitutability, forms of
inheritance- specialization, specification, construction, extension,
limitation, combination, benefits of inheritance, costs of inheritance.
Member access rules, super uses, using final with inheritance,
polymorphism- method overriding, abstract classes, the Object class.
Defining, Creating and Accessing a Package, Understanding
CLASSPATH, importing packages, differences between classes and
interfaces, defining an interface, implementing interface, applying
interfaces, variables in interface and extending interfaces, Exploring java.io.

UNIT III:
Exception handling and Multithreading—Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.

String handling, Exploring java.util.Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter-thread communication, thread groups, daemon threads, Enumerations, auto boxing, annotations, generics.

UNIT IV:
Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

UNIT V:
Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.


TEXT BOOKS:
1. Java the complete reference, 7th edition, Herbert Schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.

REFERENCES:
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
3. An introduction to Java programming and object oriented application development, R.A. Johnson- Thomson.
Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland – Hodgenman polygon clipping algorithm, Polygon Filling

UNIT-III:
**3-D object representation:** Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.

UNIT-IV:
**3-D Geometric transformations:** Translation, rotation, scaling, reflection and shear transformations, composite transformations.

**3-D viewing:** Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT-V:
**Computer animation:** Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

**Visible surface detection methods:** Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area subdivision and octree methods.

Text Books:
3. Computer Graphics, Steven Harrington, TMH

References:

JNTUH COLLEGE OF ENGINEERING HYDERABAD


ENGINEERING MATERIALS
OPEN ELECTIVE-I

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Pre requisites: Nil

Course Objectives:
1. To gain an knowledge about the uses and application of various ferrous metals and alloys.
2. To gain an knowledge about the uses and application of various non ferrous alloys.
3. To gain an knowledge about the uses and application of various ceramics, polymers and composites for different engineering applications.

Course Outcomes:
At the end of the course, student would be able to recommend
1. Ferrous metals and alloys for a given engineering applications and service condition.
2. Non ferrous alloys for a given engineering applications and service condition.
3. Ceramics, Polymers and composites for a given engineering applications and service condition.

UNIT-I
**FERROUS ALLOYS:** Introduction, Designations and classifications for steels, Simple Heat Treatments, Effect of Alloying Elements.

UNIT-II
**NONFERROUS ALLOYS:** Introduction, properties and applications, Aluminum Alloys, Magnesium Alloys, Copper Alloys and Titanium Alloys.

UNIT-III
**CERAMIC MATERIALS:** Introduction, Properties and Applications of Ceramics, Glasses and Refractories.

UNIT-IV
**POLYMERS:** Introduction, Classification of Polymers, Polymerization, Degree of Polymerization, Typical Thermoplastics and Thermosets.
UNIT-V
COMPOSITES: Introduction, Classification, Properties and Applications of Polymer matrix, Metal Matrix Ceramic Matrix and Laminar composites.

TEXT / REFERENCE BOOKS:

JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. Met. Engg. L T P C 3 0 0 3

METALLURGY FOR NON METALLURGIST OPEN ELECTIVE-I

Pre requisites: Nil

Course Objectives:
1. To describe the basic principles of metallurgy and the importance of metallurgy in various discipline of engineering.
2. Gain a thorough knowledge about heat treatment of steels.
3. Gain a knowledge about properties and uses of cast irons and non ferrous metals.
4. Gain a working knowledge of basic testing methods for metals.

Course Outcomes:
At the end of the course Student would be able
1. To use and apply metallurgy in his own branch of engineering.
2. The student will be able to justify the various testing methods adopted for metals.

UNIT-I
Introduction: Crystal structure and defects, Crystal structure of metals, Classification of steels, Carbon steels

UNIT-II
Heat Treatment of Steels: The Iron carbon systems, Common phases in steels, Annealing, Normalizing, Hardening and tempering

UNIT-III
Cast irons: Properties and applications of Ductile irons, Malleable irons, Compacted graphite iron

UNIT-IV
Non Ferrous Metals: Properties and applications of Light Metals (Al, Be, Mg, Ti), Super alloys

UNIT-V
TEXT BOOKS
2. Introduction to Physical Metallurgy – SH Avner, TATA Mc GRAW HILL ,1997
3. Metallurgy for Engineers- Clark and Varney
4. Mechanical Metallurgy – G. E. Dieter

REFERENCE BOOKS
1. Engineering Physical Metallurgy and Heat treatment – Y Lakhtin
   Foundations of Materials Science and Engineering – WF Smith

JNTUH COLLEGE OF ENGINEERING HYDERABAD

L T P C 3 1 0 3

OPEN ELECTIVE-I
INDUSTRIAL POLLUTION CONTROL ENGINEERING
Objective:
To expose the students to various types of industrial pollutions and controlling techniques.

UNIT-I
Introduction to industrial pollution and types of pollution from chemical industries, Effects of pollution as environment and ecosystems-global warming-green house effect; Environmental legislatures-standards and guidelines.

UNIT –II
Air pollution- Meteorological aspects of pollution dispersion-adiabatic lapse rate-Environmental lapse rate-Turbulence and stability of atmosphere, Richardson number-Plume raise-plume behavior and characteristics, effective stack height. Major air pollutants and their sources, measurement of air pollutants

UNIT -III

UNIT -IV
Introduction to water pollution – water pollutants classification – characteristics of liquid effluents from fertilizer, pulp & paper and petroleum industries, estimation of oxygen demands – DO, BOD, COD, TOC – BOD curves, oxygen sag curve – modeling of BOD curves

UNIT -V

Text books:
1. Pollution control in process industries by S.P. Mahajan TMH., 1985

References:

OUTCOME: The student will be able learn the sources of air, water pollution and also their treatment methods.
OPEN ELECTIVE -II
ESTIMATION, QUANTITY SURVEY & VALUATION

Pre Requisites:
Concrete Technology, RC Design, Design of Steel Structure

Course Objectives:
The subject provide process of estimations required for various work in construction. To have knowledge of using SOR & SSR for analysis of rates on various works.

Course Outcomes:
Able to provide control steps for disaster mitigation steps

UNIT – I

UNIT – II
Detailed Estimates of Buildings - Reinforcement bar bending and bar requirement schedules

UNIT – III
Earthwork for roads and canals.

UNIT – IV
Rate Analysis – Working out data for various items of work over head and contingent charges.

UNIT-V

NOTE : NUMBER OF EXERCISES PROPOSED :
1. Three in flat Roof & one in Sloped Roof
2. Exercises on Data – three Nos.

Text Books:
2. Estimating and Costing by G.S. Birdie

Reference books:
2. I. S. 1200 (Parts I to XXV – 1974/ method of measurement of building and Civil Engineering works – B.I.S.)
3. Estimation, Costing and Specifications by M. Chakraborthi; Laxmi publications.
OPEN ELECTIVE-II  
DESIGN ESTIMATION AND COSTING OF ELECTRICAL SYSTEMS

Pre-requisite: Power systems-I and Power Systems-II

Objectives:
- To emphasize the estimating and costing aspects of all electrical equipment, installation and designs to analyze the cost viability.
- To design and estimation of wiring,
- To design overhead and underground distribution lines, substations and illumination design.

UNIT - I  
DESIGN CONSIDERATIONS OF ELECTRICAL INSTALLATIONS:
Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, Earthing, General requirements of electrical installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections, Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT - II  
ELECTRICAL INSTALLATION FOR DIFFERENT TYPES OF BUILDINGS AND SMALL INDUSTRIES:  
Electrical installations for residential buildings – estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.

UNIT - III  
OVERHEAD AND UNDERGROUND TRANSMISSION AND DISTRIBUTION LINES:  
Introduction, Supports for transmission lines, Distribution lines – Materials used, Underground cables, Mechanical Design of overhead lines, Design of underground cables.

UNIT - IV  
SUBSTATIONS:  Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

UNIT – V  
DESIGN OF ILLUMINATION SCHEMES:  Introduction, Terminology in illumination, laws of illumination, various types of light sources, Practical lighting schemes LED, CFL and OCFL differences.

OUTCOMES:  Students are in a position to Understand the design considerations of electrical installations.
- To design electrical installation for buildings and small industries.
- To identify and design the various types of light sources for different applications.

TEXT BOOKS
2. Design of Electrical Installations, Er. V. K. Jain, Er. Amitabh Bajaj, University Science Press.

REFERENCE BOOKS
JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. EEE

OPEN ELECTIVE-II
ENERGY STORAGE SYSTEMS

Pre-requisite: None

Objectives: Objectives of this course are
- To enable the student to understand the need for energy storage, devices and technologies available and their applications.

UNIT - I
Electrical Energy Storage Technologies: Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

UNIT - II

UNIT - III
Features of Energy Storage Systems: Classification of EES systems, Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES), Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2), Synthetic natural gas (SNG).

UNIT - IV
Types of Electrical Energy Storage systems: Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES), Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

UNIT - V
Applications: Present status of applications, Utility use (conventional power generation, grid operation & service), Consumer use (uninterruptable power supply for large consumers), New trends in applications, Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems, External connection of EES systems, Aggregating EES systems and distributed generation (Virtual Power Plant), Battery SCADA—aggregation of many dispersed batteries.

OUTCOMES: After this course, the student
- Can analyze the characteristics of energy from various sources and need for storage
- Can classify various types of energy storage and various devices used for the purpose
- Can apply the same concepts to real time problems.

TEXT BOOKS

REFERENCE BOOKS:
JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. EEE

OPEN ELECTIVE-II

MECHATRONICS

UNIT – I

INTRODUCTION: Definition – Trends - Control Methods: Standalone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.


UNIT – II

PRECISION MECHANICAL SYSTEMS: Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

ELECTRONIC INTERFACE SUBSYSTEMS: TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids, motors Isolation schemes- opto coupling, buffer IC’s - Protection schemes – circuit breakers, over current sensing, resetable fuses, thermal dissipation - Power Supply - Bipolar transistors / MOSFETs

UNIT – III

ELECTROMECHANICAL DRIVES: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives, PWM’s - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.


UNIT – IV


UNIT – V


TEXT BOOKS

2. Mechatronics by M.D.Singh, J.G.Joshi PHI.
3. Mechatronics HMT

REFERENCE BOOKS

JNTUH COLLEGE OF ENGINEERING HYDERABAD

3    0    0   3

JET PROPULSION & ROCKET ENGINEERING
OPEN ELECTIVE-II

Prerequisites: None

Course outcomes:
After doing this course, student should be in position to
1. Understand Turbo Jet Propulsion System
2. Analyze the flight performance
4. Learn the Aero thermo chemistry of the combustion products
5. Understand the physics of Solid propellant rocket engine, Liquid Rocket Propulsion System & Ramjet and Integral Rocket Ramjet Propulsion System:

Unit - I:
Turbo Jet Propulsion System:
Gas turbine cycle analysis – layout of turbo jet engine. Turbo machinery-compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis.

Flight Performance:
Forces acting on vehicle – Basic relations of motion – multi stage vehicles.

Unit - II:
Principles of Jet Propulsion and Rocketry:
Fundamentals of jet propulsion, Rockets and air breathing jet engines – Classification – turbo jet, turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines.

Nozzle Theory and Characteristics Parameters:
Theory of one dimensional convergent – divergent nozzles – aerodynamic choking of nozzles and mass flow through a nozzle – nozzle exhaust velocity – thrust, thrust coefficient, $A_c / A_t$ of a nozzle, Supersonic nozzle shape, non-adapted nozzles, summer field criteria, departure from simple analysis – characteristic parameters – 1) characteristic velocity, 2) specific impulse 3) total impulse 4) relationship between the characteristic parameters 5) nozzle efficiency, combustion efficiency and overall efficiency.

Unit - III: Aero Thermo Chemistry of The Combustion Products:

Solid Propulsion System:

Unit - IV:
Solid propellant rocket engine – internal ballistics, equilibrium motor operation and equilibrium pressure to various parameters. Transient and pseudo equilibrium operation, end burning and burning grains, grain design. Rocket motor hard ware design. Heat transfer considerations in solid rocket motor design. Ignition system, simple pyro devices.

Liquid Rocket Propulsion System:
Liquid propellants – classification, Mono and Bi propellants, Cryogenic and storage propellants, ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine – system layout, pump and pressure feed systems, feed system components. Design of combustion chamber, characteristic length, constructional features, and chamber wall stresses. Heat transfer and cooling aspects. Uncooled engines, injectors – various types, injection patterns, injector characteristics, and atomization and drop size distribution, propellant tank design.

Unit - V: Ramjet and Integral Rocket Ramjet Propulsion System:
Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification – critical, super critical and sub-critical operation of air intakes, engine intake matching, classification and comparison of IIRR propulsion systems.

TEXT BOOKS:

REFERENCE BOOKS:
1. Rocket propulsion –Sutton
2. Gas Turbines /Cohen, Rogers & Sarvana Muttoo/Addision Wesley & Longman.
3. Gas Turbines-V.Ganesan /TMH.
ERGONOMICS
OPEN ELECTIVE-II

Prerequisites: None

Objectives:
Provide a broad based introduction to ergonomic principles and their application in the design of work, equipment and the workplace. Consideration is given to musculo-skeletal disorders, manual handling, ergonomic aspects of the environment as well as to the social and legal aspects.

Course Outcomes:
On completing this course successfully the student will be able to:
- understand and apply ergonomic principles to the creation of safer, healthier and more efficient and effective activities in the workplace;
- understand ergonomic risk assessments and appropriate control measures;
- understand the causes of upper limb disorders and how to reduce them;
- appreciate workplace layout and equipment design;
- appreciate environmental aspects of good ergonomic design.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

Text books
1. Introduction to Ergonomics(Third Edition)/ R.S.Bridger/CRC Press , Taylor & Francis Group
2. Human factors in Engineering and Design/E.J.McCormick/ TMH Edison
---|---|---|---|---
3 | 0 | 0 | 3

MECHATRONICS OPEN ELECTIVE-II

Pre-requisites: None.

Course objectives:
- They should be able to link up mechanical and electronics.

Outcomes:
- Develop a relationship between mechanical elements and electronic elements for proper functioning of mechanical systems.

UNIT – I
INTRODUCTION: Definition – Trends - Control Methods: Standalone , PC Based ( Real Time Operating Systems, Graphical User Interface , Simulation ) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.


UNIT – II
PRECISION MECHANICAL SYSTEMS :
Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

Note: (text book: Mechatronics HMT – chapter 5)

ELECTRONIC INTERFACE SUBSYSTEMS : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC’s - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

UNIT – III
ELECTROMECHANICAL DRIVES : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.


UNIT – IV

UNIT – V

TEXT BOOKS :
2. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

REFERENCE:
1 “Designing Intelligent Machines”. open University, London.
2 Michel B. Histand and David G. Alciatore, “
3 Introduction to Mechatronics and Measurement systems, “Tata MC Graw hill
PRINCIPLES OF ELECTRONIC COMMUNICATIONS
OPEN ELECTIVE-II

Prerequsite : Nil

Course Objectives:
The objective of this subject is to:
- Introduce the students to modulation and various analog and
digital modulation schemes.
- They can have a broad understanding of satellite, optical,
cellular, mobile, wireless and telecom concepts.

Course Outcomes:
By completing this subject, the student can
- Work on various types of modulations.
- Should be able to use these communication modules in
implementation.
- Will have a basic understanding of various wireless and cellular,
mobile and telephone communication systems.

Unit 1:
Introduction: Need for Modulation, Frequency translation,
Electromagnetic spectrum, Gain, Attenuation and decibels.

Unit 2:
Simple description on Modulation: Analog Modulation-AM, FM, Pulse
Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK,
FSK, PSK, QPSK modulation and demodulation schemes.

Unit 3:
Telecommunication Systems: Telephones Telephone system, Paging
systems, Internet Telephony.
Networking and Local Area Networks: Network fundamentals, LAN
hardware, Ethernet LANs, Token Ring LAN.

Unit 4:
Satellite Communication: Satellite Orbits, satellite communication
systems, satellite subsystems, Ground Stations Satellite
Applications, Global Positioning systems.

Text Books:
1. Principles of Electronic Communication Systems, Louis E. Frenzel,
2. Kennady, Davis, Electronic Communications systems, 4e, TMH,
   1999.

Reference Books:
1. Tarmo Anttalainen, Introduction to Telecommunications Network
   Engineering, Artech House Telecommunications Library.
2. Theodore Rappaport, Wireless Communications-Principles and
   practice, Printice Hall, 2002.
3. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley
   publications.
4. Wayne Tomasi, Introduction to data communications and networking,
Prerequisites
1. A course on "Advanced Data Structures"

Objectives
1. To understand the basic concepts and the applications of database systems.
2. To master the basics of SQL and construct queries using SQL.
3. Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

Outcomes
1. Gain knowledge of fundamentals of DBMS, database design and normal forms
2. Master the basics of SQL for retrieval and management of data.
3. Be acquainted with the basics of transaction processing and concurrency control.
4. Familiarity with database storage structures and access techniques

UNIT I:
Database System Applications: database system Vs. file system, view of data, data abstraction, instances and schemas, data models, the ER model, relational model, other models, database languages, DDL, DML, database access for application programs, database users and administrator, transaction management, database system structure, storage manager, the query processor, history of data base systems, data base design and ER diagrams, beyond ER design entities, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER Model, conceptual design for large enterprises.

UNIT II:
Introduction to the Relational Model: integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views, form of basic SQL query, examples of basic SQL queries, introduction to nested queries, correlated nested queries, set comparison operators, aggregation operators, NULL values, comparison using null values, logical connectivity's, AND, OR and NOT, impact on SQL constructs, outer joins, disallowing NULL values, complex integrity constraints in SQL, triggers and active data bases, Oracle, SQL Server, DB2.

UNIT III:
Relational Algebra: Selection and projection, set operations, renaming, Joins, Division, Examples of Algebra overviews, Relational calculus, Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.

Schema refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, dependency preserving decomposition, schema refinement in database design, multi valued dependencies, FOURTH normal form, FIFTH normal form.

UNIT IV:

UNIT V:

Text Books:
References:
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Introduction to Database Systems, C.J. Date Pearson Education
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. C.S.E.

OPEN ELECTIVE -II
CYBER SECURITY

Prerequisites
1. A Course on "Network Security and Cryptography"

Objectives
1. The purpose of the course is to educate on cyber security and the legal perspectives of cyber crimes and cyber offenses.
2. Introduce tools and methods for enhancing cyber security.
3. Topics include- cyber crimes, cyber offenses, cyber crimes on mobile and wireless devices, tools and methods to prevent cyber crimes, legal perspectives of cyber crimes and cyber security, computer forensics, Intellectual Property Rights and cyber terrorism

Outcomes
1. Demonstrate the knowledge of cyber security and understand the Indian and Global Act concerning cyber crimes
2. Employ security and privacy methods in the development of modern applications such that personal data is protected; and provide safe Internet usage.

UNIT-I
Introduction to Cybercrime:
Introduction, Cybercrime and Information security, who are cyber criminals, Classification of Cyber crimes, Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cyber crimes.

Cyber offenses: How criminals Plan Them

UNIT-II
Cybercrime: Mobile and Wireless Devices
Tools and Methods Used in Cyber Crime:
Introduction, Proxy services and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

UNIT III
Cyber crimes and Cyber Security: the Legal Perspectives
Introduction
Cyber Crime and Legal Landscape around the world, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario In India, Digital signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment Cyber law, Technology and Students: Indian Scenario.

Understanding Computer Forensics
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody concept, Network Forensics, Approaching a computer, Forensics Investigation, Challenges in Computer Forensics, Special Tools and Techniques Forensics Auditing

UNIT IV
Cyber Security: Organizational Implications
Introduction, cost of cyber crimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cyber crimes the psychology, mindset and skills of hackers and other cyber criminals

UNIT V
Cybercrime: Illustrations, Examples and Mini-Cases
Examples:
Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases:
The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios.

Text book:

Reference book:
Corrosion Engineering
OPEN ELECTIVE-II

Pre-requisites: NIL

Course Objectives:
1. To demonstrate electrometallurgy principles in deposition winning and the efficiency of the bath.
2. To determine corrosion rate/ resistance of metals and alloys.
3. To explain corrosion protection methods and tests.

Course Outcomes:
At the end of the course the student will be able:
1. To gain knowledge in various types of electrolytic cells and the processes taking place in them.
2. To obtain knowledge about the importance of controlling corrosion and its prevention measures.
3. The course is useful for higher studies, R&D, and also for getting into jobs in industries.

UNIT - I
Introduction, Electro Chemistry principles, electrochemical reactions, Polarization, passivity, environmental effects (oxygen, oxidizers, velocity, temperature, corrosive concentration, Galvanic coupling).

UNIT - II

UNIT - III
Intergranular corrosion: Sensitization, weld decay, Knife-Line attack, Stress corrosion cracking: crack morphology, stress effects, environmental factors, metallurgical factors, Erosion corrosion: cavitation damage, fretting corrosion, Corrosion fatigue.

UNIT - IV

UNIT - V
Modern theory and applications of corrosion: Introduction, free energy, cell potentials, emf series, applications of thermodynamics to corrosion, Corrosion rate expressions and measurements, corrosion testing.

Text / Reference Books:
TESTING OF MATERIALS
OPEN ELECTIVE-II

Pre-requisites: NIL

Course Objectives:
1. To gain and understanding of the response of various metals under the application of stress and/or temperature.
2. To build necessary theoretical background of the role of lattice defects in governing both elastic and plastic properties of metals will be discussed.
3. Obtain a working knowledge of various hardness testing machines BHN, VHN, RHN
4. Obtain a working knowledge of creep and fatigue and analysis of data.

Course Outcomes:
At the end of the course the student will be able to:
1. Classify mechanical testing of ferrous and non-ferrous metals and alloys.
2. Recognize the importance of crystal defects including dislocations in plastic deformation.
3. Identify the testing methods for obtaining strength and hardness.
4. Examine the mechanisms of materials failure through fatigue and creep

UNIT – I
Introduction, Importance of testing
Hardness Test: Methods of hardness testing – Brinell, Vickers, Rockwell hardness tests.
The Impact Test: Notched bar impact test and its significance, Charpy and Izod Tests, fracture toughness testing - COD and CTOD tests, significance of transition temperature curve.

UNIT - II

UNIT - III

UNIT – IV
Creep and Stress Rupture: Introduction, The creep curve, Stress-rupture test, Structural changes during creep, Mechanism of creep deformation, theories of creep. Fracture at elevated temperature.

UNIT – V
NDT: Principle, Operation, Advantages and Limitations of Liquid Penetrant, Magnetic Particle, Radio graphy and Ultrasonic tests.

TEXT / REFERENCE BOOKS:
1. Mechanical Metallurgy – G. E. Dieter
2. Mechanical behavior - Ed. Wulf.
OPEN ELECTIVE-II
SOLID WASTE MANAGEMENT

Objectives:
- To know the Classification of solid waste and characterization of the same
- Understand the sense of onsite handling storage and collection systems including transportation
- Understand the different processing technologies of solid waste

Unit I


Unit II

Unit III

Unit IV

Text Books:

Reference Books:

Outcomes:
The student will be able to
- Apply the knowledge of characterization of waste and develop a suitable management plan
- Assess the cost of transportation and laboratory processing of solid waste
- Identify hazardous nature of waste if any and can suggest suitable dumping methods.
- Suggest processing waste for material for energy recovery.

Unit V
Case studies: Major industries and management methods used in typical industries – Coal fired power stations, textile industry, oil refinery, distillery, sugar industry, and radioactive waste generation units.
OPEN ELECTIVE - III

JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. Civil Engg.

OPEN ELECTIVE -III
ENVIRONMENTAL IMPACT ASSESSMENT

Pre Requisites: Environmental Engineering

Course Objectives:
This subject will cover various aspects of Environment Impact Assessment methodologies, impact of development activities. Impact on surface water, Air and Biological Environment, Environment legislation Environment.

Course Outcomes: Environmental Science

UNIT – I
Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

UNIT-II
Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

UNIT-III
Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

UNIT – IV
Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

UNIT - V
Text Books:

References:
3. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication(P) Ltd, Delhi.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. EEE  
3 0 0 3

OPEN ELECTIVE-III
ENTERPRISE RESOURCE PLANNING

(Students must read text book. Faculty are free to choose any other cases)

Course Aim:
It enables the student to understand the foundations of Enterprise planning and ERP System Options.

Learning Outcome: The student understands the challenges in implementation of ERP system, ERP System Implementation options, and functional modules of ERP.

1. Introduction to ERP- Foundation for Understanding ERP systems-Business benefits of ERP-The challenges of implementing ERP system-ERP modules and Historical Development.
   Case: Response to RFP for ban ERP system (Mary Sumner).
2. ERP system options & Selection methods-Measurement of project impact- Information Technology Selection-ERP proposal evaluation-Project Evaluation Technique (David Lolson).
   Case: Atlantic Manufacturing (Mary Sumner).
3. ERP system Installation Options- IS/IT Management results-Risk Identification analysis-System Projects- Demonstration of the system-Failure method-system Architecture & ERP (David L.Olson)
   Case: DataSolutions & Technology Knowledge (Mary Sumner).
   Case: Atlantic制造ing (Mary Sumner).
5. ERP – Production and Material Management-Control process on production and manufacturing-Production module in ERP- supply chain Management & e-market place-businesss & ERP-e supply chain & ERP- Future directions for ERP.
   Case: HR in Atlantic manufacturing. (Mary Sumner).
Text Book:

References:

JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. EEE

OPEN ELECTIVE-III
MANAGEMENT INFORMATION SYSTEM (MIS)

The objective of the course is to provide the basic concepts of Enterprise Resource Planning and Management of Information System.


Unit – 2: IS Security, Control and Audit– System Vulnerability and Abuse, business value of security and control, Need for Security, Methods of minimizing risks IS Audit, ensuring system quality.


References

- Vaman, ERP in Practice, TMH, 2009.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

B.Tech. EEE

OPEN ELECTIVE-III
ORGANIZATIONAL BEHAVIOUR

The objective of the course is to provide the students with the conceptual framework and the theories underlying Organisational Behaviour.


Unit-3: Dynamics of OB-I: Communication – types - interactive communication in organizations – barriers to communication and strategies to improve the follow of communication - Decision Making: Participative decision making techniques – creativity and group decision making . Dynamics of OB –II Stress and Conflict: Meaning and types of stress –Meaning and types of conflict - Effect of stress and intra-individual conflict - strategies to cope with stress and conflict.


Unit-5: Leading High performance: Job design and Goal setting for High performance- Quality of Work Life- Socio technical Design and High performance work practices - Behavioural performance
management: reinforcement and punishment as principles of Learning – Process of Behavioural modification - Leadership theories - Styles, Activities and skills of Great leaders.

References
- Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2009
- McShane: Organizational Behaviour, 3e, TMH, 2008
- Aswathappa: Organisation Behaviour, 7/e, Himalaya, 2009
Unit 5
Programming of Robots and Vision System- Lead through programming methods- Teach pendent overview of various textual programming languages like VAL etc.

Textbooks:
2. Industrial Robotics/ Grover/ McGraw hill
3. Robotics/ Mittal and Nagarath/ TMH

REFERENCE BOOKS:
1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley
2. Robot Analysis and control Asada and Slotine / Wiley Inter-Science
3. Introduction to Robotics / John J Craig / Pearson Education

JNTUH COLLEGE OF ENGINEERING HYDERABAD


L T P C
3 0 0 3

NON-CONVENTIONAL SOURCES OF ENERGY
OPEN ELECTIVE-III

Pre-requisites: None

Course Outcomes:
At the end of the course, the student will be able to identify renewable energy sources and their utilization. Understand the basic concepts of solar radiation and analyze the working of solar and thermal systems. Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas and hydrogen. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator. Identify methods of energy storage for specific applications

UNIT – I
PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT - II
SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/cooling techniques, solar distillation and drying, photovoltaic energy conversion.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

UNIT - III
UNIT – IV
GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

UNIT – V
DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday’s laws, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:
1. Renewable Energy Resources / Tiwari and Ghosal / Narosa
2. Non-conventional Energy Sources / G.D. Rai

REFERENCE BOOKS:
1. Renewable Energy Sources / Twidell & Weir
2. Solar Energy / Sukhame
5. Non-Conventional Energy / Ashok V Desai / Wiley Eastern
7. Renewable Energy Technologies / Ramesh & Kumar / Narosa
UNIT - IV
Refrigeration and Air conditioning: Introduction to refrigeration, necessity and applications, unit of refrigeration and COP, Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

UNIT-V
Heat pipes: structure - operation - construction - thermal resistance-performance characteristics - effects of working fluid and operating temperature, wick - selection of material - pore size, applications.

Text books:
3. A course in Refrigeration and Air conditioning – SC Arora and & Domkundwar / Dhanpatrai

Reference books:
UNIT-IV
Physical and data link layer Concepts:
The Physical and Electrical Characteristics of wire, Copper media, fiber optic media, wireless Communications. Introduction to data link Layer, the logical link control and medium access control sub-layers.

UNIT-V
Network Hardware Components:
Introduction to Connectors, Transreceivers and media convertors, repeaters, network interference cards and PC cards, bridges, switches, switches Vs Routers.

Text Books:

Reference Books:

B.Tech. C.S.E
3 0 0 3
OPEN ELECTIVE -III
WEB TECHNOLOGIES

Prerequisites
1. A Course on “Computer Programming and Data Structures”

Objectives
1. To learn the basic web concepts and Internet protocols
2. To introduce XML and processing of XML data
3. To introduce client side scripting with JavaScript and DHTML
4. To introduce server side programming with Java Servlets and JSP

Outcomes
1. Ability to create dynamic and interactive web sites
2. Gain knowledge of client side scripting using JavaScript and DHTML.
3. Demonstrate understanding of what is XML and how to parse and use XML data
4. Able to do server side programming with Java Servlets and JSP

UNIT I: Introduction
Web Essentials - Clients, Servers and Communication:

Markup Languages – HTML: Basic Tags, Forms, Style sheets

UNIT II: Client-Side Programming
Introduction to JavaScript, JavaScript in Perspective, Basic Syntax, Variables and Data Types, Statements, Operators, Literals, Functions, Objects, Arrays, Built-in Objects, JavaScript Debuggers.


UNIT III: Server-Side Programming
Java Servlets: Servlet Architecture, Servlets Generating Dynamic Content, Servlet Life Cycle, Parameter Data, Sessions, Cookies, URL Rewriting, Case Study.
UNIT IV: Representing Web Data

UNIT V: Separating Programming and Presentation
JSP Technology: Introduction to JavaServer Pages, Running JSP Applications, Basic JSP, JavaBeans Classes and JSP, Tag Libraries and Files, Support for the Model-View-Controller Paradigm, Case Study.

TEXT BOOKS:
1. Web Technologies: A Computer Science Perspective, Jeffrey C. Jackson, Pearson Education

REFERENCES:

JNTUH COLLEGE OF ENGINEERING HYDERABAD
B.Tech. C.S.E
OPEN ELECTIVE -III
SIMULATION AND MODELING

OUTCOMES
1. Ability to construct a model for a given system/set of data.
2. Ability to generate and test random number variates and apply them to develop simulation models.
3. Ability to interpret the model and apply the results to resolve issues in a real world environment

UNIT-I: System Models and Studies

UNIT-II: Random Numbers
Random Number Generation: Properties, Generation of Pseudo-Random Numbers, Techniques of generating random numbers, tests for random numbers
Unit-III: Simulation of Continuous and Discrete Systems
Simulation of Continuous Systems: A chemical reactor, Numerical integration vs. continuous system simulation, Selection of an integration formula, Runge-Kutta integration formulas, Simulation of a servo system, Simulation of a water reservoir system, Analog vs. digital simulation.
Discrete System Simulation: Fixed time-step vs. event-to-event model, On simulating randomness, Generation of random numbers, Generation of non-uniformly distributed random numbers, Monte-Carlo computation vs. stochastic simulation.

Unit-IV: System Simulation
Simulation of Queuing Systems: Rudiments of queuing theory, Simulation of a single-server queue, Simulation of a two-server queue, Simulation of more general queues.

Unit-V: Simulation Experimentation
Design and Evaluation of Simulation Experiments: Length of simulation runs, Variance reduction techniques, Experimental layout, Validation.
Simulation Languages: Continuous and discrete simulation languages, Continuous simulation languages, Block-structured continuous simulation languages, Expression-based languages, Discrete-system simulation languages, GPSS.

Text Books

Reference Books
1. System Modeling and Simulation: An Introduction, Frank L. Severance, Wiley Publisher, 2005

JNTUH COLLEGE OF ENGINEERING HYDERABAD
3 0 0 3

SURFACE ENGINEERING
OPEN ELECTIVE-III

Pre-requisites: Thermodynamics, Physical Metallurgy.

Course Objectives:
1. To provide a state-of-the art knowledge to the students and various surface engineering techniques.

Unit-I
Introduction to surface modification, need for surface modification, surface properties, surface property modification, history of surface modification.

Unit-II
Plating and coating process: concept of coating, types of coatings, properties of coatings, hard facing, anodizing, PVD, CVD, Electro deposition Electro less deposition, hot deposition, hot dipping.

Unit-III
Thermo-chemical Processes: carburizing, nitriding, carbonitriding, nitro carburizing, Boronising, Plasma nitriding, thermal spraying, Plasma spraying.

Unit-IV

Unit-V
General design principles related to surface engineering, design guidelines for surface preparation, surface engineering solution to specific problems.

Course Outcomes:
1. This course provides an opportunity to the students to engineer the microstructure for an enhanced performance based on the need in actual practice.
Text books/ References:
3. Advanced techniques for surface engineering, W.Gissler, Herman A.Jehn, Kluwar Academy Publishers
4. Laser material processing, W.Steen, Springer

JNTUH COLLEGE OF ENGINEERING HYDERABAD
NANOMATERIALS                        3 0 0 3
OPEN ELECTIVE-III

Pre-requisites: Physics, chemistry

Course Objective:
1. This course is primarily intended to expose the students to a highly interdisciplinary subject.
2. This would emphasize on the classification, synthesis and applications of Nano materials.

Course Outcomes:
The student will be able to design a component/material that would provide us a 'better tomorrow' via nanotechnology.

Unit -I
Introduction

Unit-II
Materials of Nano Technology
Introduction- Si based materials —Ge- based materials- Ferro electric materials —Polymer Materials GaAs and InP (III-V) Group materials.

UNIT-III
Nano Particles: Introduction Synthesis procedures -- wet chemical approach & physical vapor synthesis approach, size effect and shape change and their properties —examples of systems involved characterization techniques properties & their applications

UNIT- IV
Nano Wires: Introduction --- Various synthesis procedures (template assisted method and VLS methods) Principles, characterization procedures, properties and applications of Nano wires
Carbon Nano Tubes: Synthesis procedures properties and applications of carbon Nano tubes.
UNIT-V
Thin films deposition and Doping. Applications of Thin films.

TEXT / REFERENCE BOOKS
2. Nano Essentials: T. Pradeep, TMH
3. Springer Handbook of Nanotechnology
4. The Guest for new materials Author S. T. Lakshmi Kumar, Published by Vigyan Prasar.

JNTUH COLLEGE OF ENGINEERING HYDERABAD


INDUSTRIAL SAFETY & HAZARD MANAGEMENT
OPEN ELECTIVE-III

Objective: The student will be exposed to various industrial hazards and prevention and control methods

UNIT I

UNIT II
Toxicology: How toxicants enter biological organisms, How toxicants are eliminated from biological organisms. Industrial Hygiene: Government regulations, Identification, Evaluation, Control.

UNIT III
Fires and Explosions: The fire triangle, Distinction between fire and explosions; Definitions, Flammability characteristics of liquids and vapors, MOC and inerting, ignition energy, Auto ignition, Auto oxidation, Adiabatic compression, Explosions.

UNIT IV
Designs to prevent fires and explosions: Inerting, Explosion proof equipment and instruments, Ventilations, Sprinkler systems. Introduction to Reliefs: Relief concepts, Definitions, Location of reliefs, Relief types, Data for sizing reliefs, Relief systems.

UNIT V
Relief Sizing: Conventional spring operated reliefs in liquids, Conventional spring operated relief's in vapor or gas service, Rupture disc relief's in liquid, vapour or gas service. Hazards Identification: Process hazards checklists, Hazard surveys, Hazop safety reviews.
TEXT BOOK:

REFERENCES:

OUTCOME: The student will be equipped with the knowledge by which thorough safety is ensured in the organization.

Prerequisite: Nil