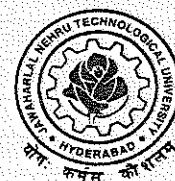


**ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS**

V

**CHEMICAL
ENGINEERING**

For
B.TECH. FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2009-2010)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
KUKATPALLY, HYDERABAD – 500 085.

Academic Regulations 2009 for B. Tech (Regular)

(Effective for the students admitted into I year from the Academic Year 2009-2010 onwards)

1. Award of B.Tech. Degree

A student will be declared eligible for the award of the B. Tech. Degree if he fulfils the following academic regulations:

- i. Pursued a course of study for not less than four academic years and not more than eight academic years.
- ii. Register for 200 credits and secure 200 credits
2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech course.

3. Courses of study

The following courses of study are offered at present for specialization for the B. Tech. Course:

Branch Code	Branch
I	Aeronautical Engineering.
II	Automobile Engineering.
III	Bio-Medical Engineering.
IV	Biotechnology.
V	Chemical Engineering.
VI	Civil Engineering.
VII	Computer Science and Engineering.
VIII	Electrical and Electronics Engineering.
IX	Electronics and Communication Engineering.
X	Electronics and Computer Engineering.
XI	Electronics and Instrumentation Engineering.
XII	Electronics and Telematics Engineering.
XIII	Information Technology.
XIV	Instrumentation and Control Engineering.
XV	Mechanical Engineering (Mechatronics).
XVI	Mechanical Engineering (Production).
XVII	Mechanical Engineering.
XVIII	Metallurgy and Material Technology.

and any other course as approved by the authorities of the University from time to time.

4. Credits

	I Year		Semester	
	Periods / Weeks	Credits	Periods / Weeks	Credits
Theory	03	06	03	03
Practical	02	04	—	—
Drawing	03	04	03 06	02 04
Mini Project	02T/03D	04	—	02
Comprehensive Viva Voce	—	—	—	02
Seminar	—	—	6	02
Project	—	—	15	10

5. Distribution and Weightage of Marks

- The performance of a student in each semester / I year shall be evaluated subject-wise with a maximum of 100 marks for theory and 75 marks for practical subject. In addition, Industry oriented mini-project, seminar and project work shall be evaluated for 50, 50 and 200 marks respectively.
- For theory subjects the distribution shall be 25 marks for Internal Evaluation and 75 marks for the End-Examination.
- For theory subjects, during the semester there shall be 2 mid term examinations. Each mid term examination consists of one objective paper, one subjective paper and one assignment. The objective paper is for 10 marks and subjective paper is for 10 marks, with a duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for subjective paper). Objective paper is set for 20 bits of – multiple choice questions, fill-in the blanks, matching type questions – for the 10 marks. Subjective paper of each semester shall contain 4 full questions (one from each unit) of which, the student has to answer 2 questions, each carrying 5 marks.

First mid term examination shall be conducted for 1-4 units of syllabus and second mid term examination shall be conducted for 5-8 units. 5 marks are allocated for Assignments (as specified by the concerned subject teacher) – first Assignment should be submitted before the conduct of the first mid, and the second Assignment should be submitted before the conduct of the second mid. The total marks secured by the student in each mid term examination are evaluated for 25 marks, and the better of the two mid term examinations shall be taken as the final marks secured by each candidate.

However, for first year, there shall be 3 mid term examinations (each for 25 marks), along with 3 assignments in a similar pattern as above [1st mid shall be from 1-2 units, 2nd mid from 3-5 units and 3rd mid shall be from 6-8 units], and the average marks of the best two examinations secured (each evaluated for a total of 25 marks) in each subject shall be considered as final marks for the internals / sessionals.

- For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and 50 end examination marks. Out of the 25 marks for internal, day-to-day work in the laboratory shall be evaluated for 15 marks and internal examination for practical shall be evaluated for 10 marks conducted by the concerned laboratory teacher. The end examination shall be conducted with external examiner and laboratory teacher. The external examiner shall be appointed from the cluster of colleges as decided by the University examination branch.
- For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 25 marks for internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for end examination. 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. However in the I year class, there shall be three tests and the average of best two will be taken into consideration.
- There shall be an industry-oriented mini-Project, in collaboration with an industry of their specialization, to be taken up during the vacation after III year II Semester examination. However, the mini project and its report shall be evaluated with the project work in IV year II Semester. The industry oriented mini project shall be submitted in report

- form and should be presented before the committee, which shall be evaluated for 50 marks. The committee consists of an external examiner, 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.
- vii. There shall be a seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminarsupervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.
- viii. There shall be a Comprehensive Viva-Voce in IV year II semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of (i) Head of the Department (ii) two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students' understanding in various subjects he / she studied during the B.Tech course of study. The Comprehensive Viva-Voce is evaluated for 100 marks by the Committee. There are no internal marks for the Comprehensive viva-voce.
- ix. Out of a total of 200 marks for the project work, 50 marks shall be for Internal Evaluation and 150 marks for the End Semester Examination. The End Semester Examination (viva-voce) shall be conducted by the same committee appointed for industry oriented mini project. In addition the project supervisor shall also be included in the committee. The topics for industry oriented mini project, seminar and project work shall be different from each other. The evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project.
- x. Laboratory marks and the sessional marks awarded by the College are not final. They are subject to scrutiny and scaling by the University wherever necessary. In such cases, the sessional and laboratory marks awarded by the College will be referred to a Committee. The Committee will arrive at a scaling factor and the marks will be scaled as per the

scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same is asked for.

6. Attendance Requirements:

- i. A student shall be eligible to appear for University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.
- ii. Shortage of Attendance below 65% in aggregate shall in NO case be condoned.
- iii. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or I year may be granted by the College Academic Committee.
- iv. A student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester / I year, as applicable. They may seek re-admission for that semester / I year when offered next.
- v. Students whose shortage of attendance is not condoned in any semester / I year are not eligible to take their end examination of that class and their registration shall stand cancelled.
- vi. A stipulated fee shall be payable towards condonation of shortage of attendance.

7. Minimum Academic Requirements:

- The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.6
- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical design or drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together.
 - ii. A student shall be promoted from II to III year only if he fulfils the academic requirement of 37 credits from one regular and one supplementary examinations of I year, and one regular examination of II year

- I semester irrespective of whether the candidate takes the examination or not.
- iii. A student shall be promoted from third year to fourth year only if he fulfils the academic requirements of total 62 credits from the following examinations, whether the candidate takes the examinations or not.
 - a. Two regular and two supplementary examinations of I year.
 - b. Two regular and one supplementary examinations of II year I semester.
 - c. One regular and one supplementary examinations of II year II semester.
 - d. One regular examination of III year I semester.
 - iv. A student shall register and put up minimum attendance in all 200 credits and earn the 200 credits. Marks obtained in all 200 credits shall be considered for the calculation of percentage of marks.
 - v. Students who fail to earn 200 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech course and their admission shall stand cancelled.

8. Course pattern :

- i. The entire course of study is of four academic years. The first year shall be on yearly pattern and the second, third and fourth years on semester pattern.
 - ii. A student eligible to appear for the end examination in a subject, but absent at it or has failed in the end examination may appear for that subject at the supplementary examination.
- When a student is detained due to lack of credits / shortage of attendance he may be re-admitted when the semester / year is offered after fulfilment of academic regulations, whereas the academic regulations hold good with the regulations he was first admitted.

9. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured	Class Awarded
First Class with Distinction	70% and above	From the aggregate marks secured for the best 200 Credits.
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

10. Minimum Instruction Days :

The minimum instruction days for each semester / I year shall be 90/ 180 clear instruction days.

11. There shall be no branch transfers after the completion of admission process.

12. There shall be no place transfer within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Hyderabad.

13. General:

- i. Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
- ii. The academic regulation should be read as a whole for the purpose of any interpretation.
- iii. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- iv. The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

*_*_*

Academic Regulations for B. Tech. (Lateral Entry Scheme)

(Effective for the students getting admitted into

II year from the Academic Year 2009-2010 and onwards)

1. The Students have to acquire 150 credits from II to IV year of B.Tech. Program (Regular) for the award of the degree.
Register for 150 credits and secure 150 credits.
2. Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.
3. The same attendance regulations are to be adopted as that of B.Tech. (Regular).
4. **Promotion Rule :**
A student shall be promoted from third year to fourth year only if he fulfils the academic requirements of 37 credits from the examinations.
 - a. Two regular and one supplementary examinations of II year I semester.
 - b. One regular and one supplementary examinations of II year II semester.
 - c. One regular examination of III year I semester.

5. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree he shall be placed in one of the following four classes :

Class Awarded	% of marks to be secured	Class Awarded
First Class with Distinction	70% and above	From the aggregate marks secured for 150 Credits. (i.e. II year to IV year)
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

6. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)

MALPRACTICES RULES**DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS**

	Nature of Malpractices/ Improper conduct <i>If the candidate ..,</i>	Punishment
1. (a)	Possesses or keeps 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 candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in the subject only
1. (b)	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.	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.
2.	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	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

	(theory or practical) in which the candidate is appearing.	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 and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	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 University 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.

4.	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.	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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	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.	Cancellation of the performance in that subject.
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	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

	<p>the 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 or 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 opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.</p>	<p>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.</p>
7.	<p>Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.</p>	<p>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 University examinations. The</p>

		<p>continuation of the course by the candidate is subject to the academic regulation; in connection with forfeiture of seat.</p>
8.	<p>Possess any lethal weapon or firearm in the examination hall.</p>	<p>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 for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.</p>
9.	<p>If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.</p>	<p>Student of the colleges 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 for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.</p>

10.	Comes in a drunken condition to the examination hall.	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 for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
 - (i) A show cause notice shall be issued to the college.
 - (ii) Impose a suitable fine on the college.
 - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD**

B.TECH. CHEMICAL ENGINEERING

COURSE STRUCTURE

IYEAR	Code	Subject	L	T/P/D	C
	51001	English	2	-	4
	51002	Mathematics – I	3	1	6
	51003	Engineering Mechanics	3	1	6
	51004	Engineering Physics	2	1	4
	51005	Engineering Chemistry	2	-	4
	51006	Computer Programming & Data Structures	3	-	6
	51007	Engineering Drawing	1	3	4
	51620	Computer Programming Lab.	-	3	4
	51661	Engineering Physics & Engineering Chemistry Lab	-	3	4
	51662	English Language Communication Skills Lab.	-	3	4
	51663	Engineering Workshop / IT Workshop	-	3	4
		Total	17	18	50

II YEAR I SEMESTER

COURSE STRUCTURE

Code	Subject	L	T/P/D	C
53001	Mathematics-II		4	14
53026	Electrical Engineering	3	1	3
53027	Process Instrumentation	3	1	3
53013	Environmental Studies	3	0	3
53028	Analytical Chemistry	4	1	4
53029	Chemical Process Calculations	4	1	4
53610	Electrical Engineering Lab	0	3	2
53611	Analytical Chemistry Lab	0	3	2
	Total	21	11	25

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD**

B.TECH CHEMICAL ENGINEERING

II YEAR II SEMESTER

COURSE STRUCTURE

Code	Subject	L	T/P/D	C
54001	Probability and Statistics	3	1	3
54017	Management Science	3	1	3
54018	Momentum Transfer	4	0	4
54019	Organic Chemistry	3	1	3
54020	Chemical Engineering Thermodynamics-I	4	1	4
54021	Mechanical Unit Operations	4	1	4
54611	Momentum Transfer Lab	0	3	2
54612	Mechanical Unit Operations Lab	0	3	2
Total		21	11	25

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD**

B.TECH CHEMICAL ENGINEERING

III YEAR I SEMESTER

COURSE STRUCTURE

Code	Subject	L	T/P/D	C
55033	Chemical Engineering Thermodynamics	4	0	4
55034	Chemical Reaction Engineering-I	4	0	4
55035	Mass Transfer Operations-I	4	0	4
55036	Process Heat Transfer	3	1	3
55037	Energy Engineering	3	1	3
Open Elective		3	1	3
55038	Bioprocess Engineering			
55039	Nanotechnology			
55040	Intellectual Property Rights			
55610	Advanced English Communication Skills Lab	0	3	2
55611	Process Heat Transfer Lab	0	3	2
Total		21	9	25

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD**

B.TECH. CHEMICAL ENGINEERING

III YEAR II SEMESTER

COURSE STRUCTURE

Code	Subject	L	T/P/D	C
56033	Chemical Technology - I	4	0	4
56034	Mass Transfer Operations – II	4	0	4
56035	Chemical Reaction Engineering-II	4	0	4
56036	Chemical Engineering Mathematics	3	1	3
56037	Material Science for Chemical Engineering	3	1	3
Elective-I		3	1	3
56038	Biochemical Engineering			
56039	Corrosion Engineering			
56040	Plastics Materials			
56611	Mass Transfer Operations Lab	0	3	2
56612	Chemical Reaction Engineering Lab	0	3	2
Total		21	9	25

IV YEAR I SEMESTER

COURSE STRUCTURE

Code	Subject	L	T/P/D	C
57058	Transport Phenomena	4	0	4
57059	Process Dynamics & Control	4	0	4
57060	Chemical Process Equipment Design	4	0	4
57061	Process Modeling and Simulation	3	1	3
57062	Industrial Safety & Hazard Management	3	1	3
Elective - II		3	1	3
57063	Environmental Biotechnology			
57064	Polymer Technology			
57065	Petroleum & Petro-Chemical Technology			
57611	Process Dynamics and Control Lab	0	3	2
57612	Simulation Lab	0	3	2
Total		21	9	25

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD
B.TECH CHEMICAL ENGINEERING
IV YEAR II SEMESTER COURSESTRUCTURE

Code	Subject	L	T/P/D	C
58043	Industrial Pollution Control Engineering	3	1	3
	Elective-III	3	1	3
58044	Membrane Technology			
58045	Fluidization Engineering			
58046	Plant Design & Economics			
	Elective – IV	3	1	3
58047	Design and Analysis of Experiments			
58048	Technology of Pharmaceuticals and Fine Chemicals			
58049	Optimization of Chemical Processes			
58621	Industry Oriented Mini Project	0	0	2
58622	Seminar	0	6	2
58623	Project Work	0	15	10
58624	Comprehensive viva	0	0	2
	Total	9	24	25

Note: All End Examinations (Theory and Practical) are of three hours duration.

T - Tutorial

P - Practical/Drawing

L - Theory

C - Credits

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I Year B.Tech. Ch.E.

L	T/P/D	C
2	-/-	4

(51001) ENGLISH

1. INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

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 by the students. Hence, it is suggested that they read it on their own with topics selected for discussion 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 and practice of language skills.

2. OBJECTIVES:

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To equip the students to study academic subjects with greater facility through the theoretical and practical components of the English syllabus.
- To develop the study skills and communication skills in formal and informal situations.

3. SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its 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 recognise them, to distinguish between them to mark stress and recognise 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 to express themselves fluently and appropriately in social and professional contexts.
 - Oral practice
 - Describing objects/situations/people
 - Role play – Individual/Group activities (Using exercises from all the nine units of the prescribed text: Learning English : A Communicative Approach.)
 - 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
- Inferring lexical and contextual meaning
- Understanding discourse features
- Recognizing coherence/sequencing of sentences

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 the non-detailed text or other authentic texts, such as magazines/newspaper articles.

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
 - Editing a passage

4. 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 Eight Units, are prescribed:

For Detailed study

1. First Text book entitled "Enjoying Everyday English", Published by Sangam Books, Hyderabad

For Non-detailed study

1. Second text book "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

A. STUDY MATERIAL:**Unit –I**

1. Chapter entitled Heaven's Gate from "Enjoying Everyday English", Published by Sangam Books, Hyderabad
2. Chapter entitled Haragovind Khorana from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

Unit –II

1. Chapter entitled Sir CV Raman: A Pathbreaker in the Saga of Indian Science from "Enjoying Everyday English", Published by Sangam Books, Hyderabad
2. Chapter entitled Sam Petroda from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

Unit –III

1. Chapter entitled The Connoisseur from "Enjoying Everyday English", Published by Sangam Books, Hyderabad
2. Chapter entitled Mother Teresa from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

Unit –IV

1. Chapter entitled The Cuddalore Experience from "Enjoying Everyday English", Published by Sangam Books, Hyderabad
2. Chapter entitled Dr Amartya Kumar Sen from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

Unit –V

1. Chapter entitled Bubbling Well Road from "Enjoying Everyday English", Published by Sangam Books, Hyderabad
2. Chapter entitled I Have a Dream by Martin Luther King from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

Unit –VI

1. Chapter entitled Odds Against Us from "Enjoying Everyday English", Published by Sangam Books, Hyderabad

2. Chapter entitled Ask Not What Your Country can do for you by John F Kennedy from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

* Exercises from the lessons not prescribed shall also be used for classroom tasks.

Unit – VII

- | | |
|-----------------------|----------------------------|
| Exercises on | Reading and Writing Skills |
| Reading Comprehension | Situational dialogues |
| Letter writing | Essay writing |

Unit – VIII

Practice Exercises on Remedial Grammar covering Common errors in English, Subject-Verb agreement, Use of Articles and Prepositions,

Tense and aspect

Vocabulary development covering Synonyms & Antonyms, one-word substitutes, prefixes & suffixes, Idioms & phrases, words often confused.

REFERENCES:

1. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books
2. English Grammar Practice, Raj N Bakshi, Orient Longman.
3. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson
4. Handbook of English Grammar & Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
5. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
6. Technical Communication, Meenakshi Raman, Oxford University Press
7. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education
8. Grammar Games, Renuvoluri Mario, Cambridge University Press.

9. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
 10. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,
 11. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.
 12. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education
 13. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw -Hill.
 14. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO
 15. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education
 16. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,
 17. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
Year B.Tech. Ch.E.

L T/P/D C
3 1/-/- 6

(51002) MATHEMATICS – I

UNIT – I Sequences – Series

Basic definitions of Sequences and series – Convergences and divergence – Ratio test – Comparison test – Integral test – Cauchy's root test – Raabe's test – Absolute and conditional convergence

UNIT – II Functions of Single Variable

Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – Generalized Mean Value theorem (all theorems without proof) Functions of several variables – Functional dependence- Jacobian- Maxima and Minima of functions of two variables with constraints and without constraints

UNIT – III Application of Single variables

Radius, Centre and Circle of Curvature – Evolutes and Envelopes Curve tracing – Cartesian , polar and Parametric curves.

UNIT – IV Integration & its applications

Riemann Sums , Integral Representation for lengths, Areas, Volumes and Surface areas in Cartesian and polar coordinates multiple integrals - double and triple integrals – change of order of integration- change of variable

UNIT – V Differential equations of first order and their applications

Overview of differential equations- exact, linear and Bernoulli. Applications to Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories and geometrical applications.

UNIT – VI Higher Order Linear differential equations and their applications

Linear differential equations of second and higher order with constant coefficients. RHS term of the type $f(X) = e^{ax}$, $\sin ax$, $\cos ax$, and x^n , $V(x)$, $xV(x)$, method of variation of parameters. Applications bending of beams, Electrical circuits, simple harmonic motion.

UNIT – VII Laplace transform and its applications to Ordinary differential equations

Laplace transform of standard functions – Inverse transform – first Laplace transform of derivatives and integrals – Unit step shifting Theorem, Transforms of derivatives and integrals – Dirac's delta function – Convolution theorem – Periodic function – Differentiation and integration of transforms-Application of Laplace transforms to ordinary differential equations.

UNIT – VIII Vector Calculus

Vector Calculus: Gradient- Divergence- Curl and their related properties Potential function - Laplacian and second order operators. Line integral – work done — Surface integrals - Flux of a vector valued function.

Vector integrals theorems: Green's -Stoke's and Gauss's Divergence Theorems (Statement & their Verification)

TEXT BOOKS:

1. Engineering Mathematics – I by P.B. Bhaskara Rao, S.K.V.S. Rama Chary, M. Bhujanga Rao.
2. Engineering Mathematics – I by C. Shankaraiah, VGS Booklinks.

REFERENCES:

1. Engineering Mathematics – I by T.K. V. Iyengar, B. Krishna Gandhi & Others, S. Chand.
2. Engineering Mathematics – I by D. S. Chandrasekhar, Prism Books Pvt. Ltd.
3. Engineering Mathematics – I by G. Shanker Rao & Others I.K. International Publications.
4. Higher Engineering Mathematics – B.S. Grewal, Khanna Publications.
5. Advance Engineering Mathematics by Jain and S.R.K. Iyengar, Narosa Publications.
6. A text Book of KREYSZIG'S Engineering Mathematics, Vol-1 Dr. A. Ramakrishna Prasad. WILEY publications

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. Ch.E.

L	T/P/D	C
3	1/-/-	6

(51003) ENGINEERING MECHANICS

UNIT – I

Introduction to Engineering Mechanics – Basic Concepts.

Systems of Forces : Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

UNIT – II

Equilibrium of Systems of Forces : Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lami's Theorem, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

UNIT – III

Centroid : Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity : Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, pappus theorem.

UNIT – IV

Area moment of Inertia : Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia : Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V

Analysis of perfect frames (Analytical Method) – Types of Frames – Assumptions for forces in members of a perfect frame, Method of joints, Method of sections, Force table, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads.

UNIT - VI

Kinematics : Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics : Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

UNIT - VII

Work – Energy Method : Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

UNIT - VIII

Principle of virtual work: Equilibrium of ideal systems, efficiency of simple machines, stable and unstable equilibriums

TEXT BOOKS :

1. Engineering Mechanics / Timoshenko & Young.
2. Engineering Mechanics / S.S. Bhavikatti & J.G. Rajasekharappa

REFERENCES :

1. Engineering Mechanics / Ferdinand . L. Singer / Harper – Collins.
2. Engineering Mechanics / Irving. H. Shames Prentice – Hall.
3. Engineering Mechanics Umesh Regi / Tayal.
4. Engineering Mechanics / R.V. Kulkarni & R.D. Askhevkar
5. Engineering Mechanics/Khurmi/S.Chand.
6. Engineering Mechanics / KL Kumar / Tata McGraw Hill.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. Ch.E.

L	T/P/D	C
2	1/-	4

(51004) ENGINEERING PHYSICS**UNIT-I**

1. **Bonding in Solids:** Ionic Bond, Covalent Bond, Metallic Bond, Hydrogen Bond, Vander-Waal's Bond, Calculation of Cohesive Energy.
2. **Crystallography and Crystal Structures:** Space Lattice, Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices, Miller Indices, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Diamond and hcp Structures, Structures of NaCl, ZnS, CsCl.

UNIT-II

3. **X-ray Diffraction:** Basic Principles, Bragg's Law, Laue Method, Powder Method, Applications of X-ray Diffraction.
4. **Defects in Crystals:** Point Defects: Vacancies, Substitutional, Interstitial, Frenkel and Schottky Defects; Qualitative treatment of line (Edge and Screw Dislocations) Defects, Burger's Vector, Surface Defects and Volume Defects.

UNIT-III

5. **Elements of Statistical Mechanics:** Maxwell-Boltzman, Bose-Einstein and Fermi-Dirac Statistics (Qualitative Treatment), Photon gas, Wein's Law, Rayleigh-Jeans law, Planck's Law of Black Body Radiation, Concept of Electron Gas, Fermi Energy, Density of States.
6. **Principles of Quantum Mechanics:** Waves and Particles, de Broglie Hypothesis, Matter Waves, Davisson and Germer's Experiment, G. P. Thomson Experiment, Heisenberg's Uncertainty Principle, Schrödinger's Time Independent Wave Equation – Physical Significance of the Wave Function - Particle in One Dimensional Potential Box.

UNIT-IV

7. **Band Theory of Solids:** Electron in a periodic Potential, Bloch Theorem, Kronig-Penny Model (Qualitative Treatment), Origin of

Energy Band Formation in Solids, Classification of Materials into Conductors, Semi Conductors & Insulators, Concept of Effective Mass of an Electron and Hole.

UNIT-V

8. **Semiconductor Physics:** Fermi Level in Intrinsic and Extrinsic Semiconductors, Intrinsic Semiconductors and Carrier Concentration, Extrinsic Semiconductors and Carrier Concentration, Equation of Continuity, Direct & Indirect Band Gap Semiconductors, Hall Effect.
9. **Physics of Semiconductor Devices:** Formation of PN Junction, Open Circuit PN Junction, Energy Diagram of PN Diode, I-V Characteristics of PN Junction, PN Diode as a Rectifier (Forward and Reverse Bias), Diode Equation, LED, LCD and Photo Diodes.

UNIT-VI

10. **Dielectric Properties:** Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector, Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities - Internal Fields in Solids, Clausius - Mossotti Equation, Piezo-electricity, Pyro-electricity and Ferro-electricity.
11. **Magnetic Properties:** Permeability, Field Intensity, Magnetic Field Induction, Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Domain Theory of Ferro Magnetism on the basis of Hysteresis Curve, Soft and Hard Magnetic Materials, Properties of Anti-Ferro and Ferri Magnetic Materials, Ferrites and their Applications, Concept of Perfect Diamagnetism, Meissner Effect, Magnetic Levitation, Applications of Superconductors.

UNIT-VII'

12. **Lasers:** Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Carbon Dioxide Laser, Semiconductor Diode Laser, Applications of Lasers.

13. **Fiber Optics:** Principle of Optical Fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Types of Optical Fibers and Refractive Index Profiles, Attenuation in Optical Fibers, Application of Optical Fibers.

UNIT-VIII

14. **Acoustics of Buildings & Acoustic Quieting:** Basic Requirement of Acoustically Good Hall, Reverberation and Time of Reverberation, Sabine's Formula for Reverberation Time(Qualitative Treatment), Measurement of Absorption Coefficient of a Material, Factors Affecting The Architectural Acoustics and their Remedies. **Acoustic Quieting:** Aspects of Acoustic Quietling, Methods of Quietling, Quietling for Specific Observers, Mufflers, Sound-proofing.
15. **Nanotechnology:** Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Precipitation, Combustion Methods; Top-down Fabrication: Chemical Vapour Deposition, Physical Vapour Deposition, Pulsed Laser Vapour Deposition Methods, Characterization(XRD&TEM) and Applications.

TEXT BOOKS:

1. Applied Physics – P.K.Palanisamy (SciTech Publications (India) Pvt. Ltd., Fifth Print 2008).
2. Applied Physics – S.O. Pillai & Sivakami (New Age International (P) Ltd., Second Edition 2008).
3. Applied Physics – T. Bhima Shankaram & G. Prasad (B.S. Publications, Third Edition 2008).

REFERENCES:

1. Solid State Physics – M. Armugam (Anuradha Publications).
2. Modern Physics – R. Murugesan & K. Siva Prasath – S. Chand & Co. (for Statistical Mechanics).
3. A Text Book of Engg Physics – M. N. Avadhanulu & P. G. Khsirsagar – S. Chand & Co. (for acoustics).
4. Modern Physics by K. Vijaya Kumar, S. Chandralingam: S. Chand & Co.Ltd
5. Nanotechnology – M.Ratner & D. Ratner (Pearson Ed.).
6. Introduction to Solid State Physics – C. Kittel (Wiley Eastern).
7. Solid State Physics – A.J. Dekker (Macmillan).
8. Applied Physics – Mani Naidu Pearson Education

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. Ch.E.

L	T/P/D	C
2	-/-/-	4

(51005) ENGINEERING CHEMISTRY

UNIT I:

Electrochemistry and Batteries: Concept of Electro Chemistry, Conductance-Electrolyte in solution, Conductance-Specific, Equivalent and molar conductance, Ionic mobilities, Kolrausch's Law. Application of conductance. EMF: Galvanic Cells, types of Electrodes, Reference Electrode (SCE, Quinhydrone electrode), Ion Selective Electrodes (Glass Electrode) Nernst equation, Concentration Cells, Galvanic series, Potentiometric titrations, Numerical problems.

Batteries: Primary and secondary cells, (lead-Acid cell, Ni-Cd cell, Lithium cells). Applications of batteries, fuel cells – Hydrogen – Oxygen fuel cells, Advantages of fuel cells.

UNIT II:

Corrosion and its corrosion control: Introduction, causes and different types of corrosion and effects of corrosion, theories of corrosion – Chemical, Electrochemical corrosion, corrosion reactions, factors affecting corrosion – Nature of metal – galvanic series, over voltage, purity of metal, nature of oxide film, nature of corrosion product. Nature of environment-effect of temperature, effect of pH, Humidity, effect of oxidant. Corrosion control methods – Cathodic protection, sacrificial anode, impressed current cathode. Surface coatings – methods of application on metals- hot dipping, galvanizing, tinning, cladding, electroplating - Organic surface coatings – paints constituents and functions.

UNIT III:

Polymers: Types of Polymerization, Mechanism (Chain growth & Step growth). **Plastics:** Thermoplastic resins & Thermo set resins. Compounding & fabrication of plastics, preparation, properties, engineering applications of: polyethylene, PVC, PS, Teflon, Bakelite, Nylon. **Conducting Polymers:** Poly acetylene, polyaniline, conduction, doping, applications. **Liquid Crystal polymers:** Characteristics and uses **Rubber** – Natural rubber, vulcanization. **Elastomers** – Buna-s,

Butyl rubber, Thiokol rubbers, Fibers – polyester, fiber reinforced plastics (FRP), applications

UNIT IV:

Water: Introduction. **Hardness:** Causes, expression of hardness – units – types of hardness, estimation of temporary & permanent hardness of water, numerical problems. Boiler troubles – Scale & sludge formation, caustic embrittlement, corrosion, priming & foaming. Softening of water (Internal & external treatment-Lime soda, Zeolite, Ion exchange process and Numerical problems) Reverse osmosis, electro dialysis.

UNIT V:

Surface Chemistry: Solid surfaces, types of adsorption, Langmuir adsorption isotherm, BET adsorption equip. Calculation of surface area of solid & application adsorption, classification of colloids, Electrical & optical properties micelles, applications of colloids in industry. **Nano materials:** Introduction, preparation and applications of nano materials

UNIT VI:

Energy sources: fuels, classification – conventional fuels (solid, liquid, gaseous) Solid fuels – coal – analysis – proximate and ultimate analysis and their significance. Liquid fuels – primary – petroleum – refining of petroleum-cracking knocking synthetic petrol – Bergius and Fischer Tropsech's process; Gaseous fuels – natural gas, analysis of flue gas by Orsat's method. Combustion – problems, Calorific value of fuel – HCV, LCV, determination of calorific value by Junker's gas calorie meter.

UNIT VII:

Phase rule: Definitions – phase, component, degree of freedom, phase rule equitation. Phase diagrams – one component system: water system. Two component system lead- silver system, heat treatment based on iron-carbon phase diagram, hardening, annealing.

UNIT VIII:

Materials Chemistry: **Cement:** composition of Portland cement, manufacture of port land Cement, setting & hardening of cement (reactions). **Lubricants:** Criteria of a good lubricant, mechanism,

properties of lubricants: Cloud point, pour point, flash & fire point, Viscosity. Refractories: Classification, Characteristics of a good refractory. Insulators & conductors: Classification of insulators characteristics of thermal & electrical insulators and applications of Superconductors ($\text{Nb}-\text{Sn}$ alloy, $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$), applications.

TEXT BOOKS:

1. Text Books of Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
2. Text of Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co, New Delhi(2006)

REFERENCE BOOKS

1. Engineering Chemistry by B. Siva Shankar Mc.Graw Hill Publishing Company Limited , New Delhi(2006)
2. Engineering Chemistry J.C. Kuriacase & J. Rajaram, Tata McGraw Hills co., New Delhi (2004).
3. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).
4. Chemistry of Engineering Materials by CV Agarwal,C.P. Murthy, A.Naidu, BS Publications.
5. Chemistry of Engineering Materials by R.P Mani and K.N Mishra, CENGAGE learning.
6. Applied Chemistry –A text for Engineering & Technology – Springer (2005).
7. Text Book of Engineering Chemistry – Shashi Chawla, Dhantpat Rai publishing Company, NewDelhi (2008).
8. Engineering Chemistry – R. Gopalan, D. Venkatappayya, D.V. Sulochana Nagarajan – Vikas Publishers (2008).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. Ch.E.

L	T/P/D	C
3	-/-	6

(51006) COMPUTER PROGRAMMING AND DATA STRUCTURES

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programmes, Software Development Method, Algorithms, Pseudo code, flow charts, applying the software development method.

UNIT - II

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

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

UNIT - III

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

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, C programme examples.

UNIT - IV

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.

Strings – Concepts, C Strings, String Input / Output functions, arrays of

strings, string manipulation functions, string / data conversion, C programme examples.

UNIT - V

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.

UNIT - VI

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 programme examples.

UNIT - VII

Searching and Sorting – Sorting- selection sort, bubble sort, insertion sort, quick sort, merge sort, Searching-linear and binary search methods.

UNIT - VIII

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 application-infix to postfix conversion, postfix expression evaluation, recursion implementation, Queues-operations, array and linked representations.

TEXT BOOKS :

1. C Programming & Data Structures, B.A. Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson education.

REFERENCES:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, PHI/Pearson Education

3. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press.
4. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
5. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
6. Data Structures using C – A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI
7. C Programming & Data Structures, E. Balagurusamy, TMH.
8. C Programming & Data Structures, P. Dey, M. Ghosh R. Thereja, Oxford University Press
9. C& Data structures – E V Prasad and N B Venkateswarlu, S. Chand&Co.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. Ch.E.

L T/P/D C

2 -/-3 4

(51007) ENGINEERING DRAWING

UNIT-I

INTRODUCTION TO ENGINEERING DRAWING : Principles of Engineering Graphics and their Significance – Drawing Instruments and their Use – Conventions in Drawing – Lettering – BIS Conventions. Curves used in Engineering Practice & their Constructions :

- Conic Sections including the Rectangular Hyperbola – General method only.
- Cycloid, Epicycloid and Hypocycloid
- Involute.
- Scales: Different types of Scales, Plain scales comparative scales, scales of chords.

UNIT-II

DRAWING OF PROJECTIONS OR VIEWS ORTHOGRAPHIC PROJECTION IN FIRST ANGLE

PROJECTION: Principles of Orthographic Projections – Conventions – First and Third Angle, Projections of Points and Lines inclined to both planes, True lengths, traces.

UNIT-III

PROJECTIONS OF PLANES & SOLIDS: Projections of regular Planes, auxiliary planes and Auxiliary projection inclined to both planes. Projections of Regular Solids inclined to both planes – Auxiliary Views.

UNIT-IV

SECTIONS AND SECTIONAL VIEWS: Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of Surfaces of Right, Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts. Interpenetration of Right Regular Solids

UNIT-V

INTERSECTION OF SOLIDS: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT - VI

ISOMETRIC PROJECTIONS : Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- Isometric lines. Isometric Projection of Spherical Parts.

UNIT -VII

TRANSFORMATION OF PROJECTIONS : Conversion of Isometric Views to Orthographic Views – Conventions.

UNIT - VIII

PERSPECTIVE PROJECTIONS : Perspective View : Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods (General Method only).

TEXT BOOK:

- Engineering Drawing, N.D. Bhat / Charotar
- Engineering Drawing and Graphics, Venugopal / New age.
- Engineering Drawing – Basant Agrawal, TMH

REFERENCES:

- Engineering drawing – P.J. Shah/S.Chand.
- Engineering Drawing, Narayana and Kannaiah / Scitech publishers.
- Engineering Drawing- Johie/Tata Macgraw Hill.
- Computer Aided Engineering Drawing- Trymbaka Murthy- I.K. International.
- Engineering Drawing – Grower.
- Engineering Graphics for Degree – K.C. John.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I Year B.Tech. Ch.E.

L	T/P/D	C
0	-/3/-	4

(51620) COMPUTER PROGRAMMING LAB

Objectives:

- To make the student learn a programming language.
- To teach the student to write programs in C to solve the problems.
- To introduce the student to simple linear data structures such as lists, stacks, queues.

Recommended Systems/Software Requirements:

- Intel based desktop PC
- ANSI C Compiler with Supporting Editors

Week 1.

- a) Write a C program to find the sum of individual digits of a positive integer.
- b) A 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.
- c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 2.

- a) Write a C program to calculate the following Sum:

$$\text{Sum} = 1 - x^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10!$$
- b) Write a C program to find the roots of a quadratic equation.

Week 3

- a) Write C programs that use both recursive and non-recursive functions
 - i) To find the factorial of a given integer.
 - ii) To find the GCD (greatest common divisor) of two given integers.
 - iii) To solve Towers of Hanoi problem.

Week 4

- a) The total distance travelled by vehicle in 't' seconds is given by

distance = $ut + \frac{1}{2}at^2$ where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec²). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

- b) 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 5

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

Week 6

- a) 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.
- b) i) To delete n Characters from a given position in a given string.
- b) Write a C program to determine if the given string is a palindrome or not

Week 7

- a) 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.
- b) Write a C program to count the lines, words and characters in a given text.

Week 8

- a) Write a C program to generate Pascal's triangle.
- b) Write a C program to construct a pyramid of numbers.

Week 9

- a) Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:

$$1+x+x^2+x^3+\dots+x^n$$

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 next pair of numbers without computing the sum. Are any values of x also illegal? If so, test for them too.

Week 10

- a) 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.
- b) Write a C program to convert a Roman numeral to its decimal equivalent.

Week 11

- 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 12

- a) Write a C program which copies one file to another.
 - b) 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)

Week 13

- a) Write a C programme to display the contents of a file.
- b) Write a C programme 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 14

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 15

Write C programs that implement stack (its operations) using

- i) Arrays ii) Pointers

Week 16

Write C programs that implement Queue (its operations) using

- i) Arrays ii) Pointers

Week 17

Write a C program that uses Stack operations to perform the following:

- i) Converting infix expression into postfix expression
- ii) Evaluating the postfix expression

Week 18

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 19

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

Week 20

Write C program that implements the following sorting method to sort a given list of integers in ascending order: i) Quick sort

Week 21

Write C program that implement the following sorting method to sort a given list of integers in ascending order: i) Merge sort

Week 22

Write C programs to implement the Lagrange interpolation and Newton- Gregory forward interpolation.

Week 23

Write C programs to implement the linear regression and polynomial regression algorithms.

Week 24

Write C programs to implement Trapezoidal and Simpson methods.

TEXT BOOKS

1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications
2. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.
3. The Spirit of C, an introduction to modern programming, M.Cooper, Jaico Publishing House.
4. Practical C Programming, Steve Oualline, O'Reilly,SPD, TMH publications.
5. Computer Basics and C Programming, V. Rajaraman, PHI Publications.
6. Data structures and Program Design in C,R.Kruse, C.L.Tondo, B.P.Leung, M.Shashi, Pearson Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. Ch.E.

L	T/P/D	C
0	-/3/-	4

(51621) ENGINEERING PHYSICS / ENGINEERING CHEMISTRY LAB
ENGINEERING PHYSICS LAB

(Any twelve experiments compulsory)

1. Dispersive power of the material of a prism – Spectrometer.
2. Determination of wavelength of a source – Diffraction Grating.
3. Newton's Rings - Radius of curvature of plano convex lens.
4. Melde's experiment – Transverse and longitudinal modes.
5. Time constant of an R-C circuit.
6. L-C-R circuit.
7. Magnetic field along the axis of current carrying coil – Stewart and Gees method.
8. Study the characteristics of LED and LASER sources.
9. Study the characteristics of p-i-n and avalanche photodiode detectors.
10. Bending losses of fibres.
11. Evaluation of numerical aperture of given fibre.
12. Energy gap of a material of p-n junction.
13. Thermo electric effect – Seebeck effect and Peltier effect.
14. Torsional pendulum.
15. Single slit diffraction using laser.

ENGINEERING CHEMISTRY LAB

List of Experiments (Any 12 of the following):

Titrimetry:

- a. Estimation of hardness of water by EDTA method. (or)
Estimation of calcium in limestone by Permanganometry.

Mineral Analysis:

2. Determination of percentage of copper in brass
3. Estimation of manganese dioxide in pyrolusite.

Instrumental Methods:**4. Colorimetry:**

- Determination of ferrous iron in cement by colorimetric method.
(Or) Estimation of Copper by Colorimetric method.

5. Conductometry:

Conductometric titration of strong acid Vs strong base.
(or) Conductometric titration of mixture of acids Vs strong base.

6. Potentiometry:

Titration of strong acid Vs strong base by potentiometry.
(or) Titration of weak acid Vs strong base by potentiometry.

Physical Properties:

7. Determination of viscosity of sample oil by redwood/oswald's viscometer
8. Determination Surface Tension of lubricants.

Identification and Preparations:

9. Identification of functional groups present in organic compounds.
10. Preparation of organic compounds
Asprin (or) Benzimidazole

Kinetics:

11. To determine the rate constant of hydrolysis of methyl acetate catalysed by an acid and also the energy of activation. (or) To study the kinetics of reaction between $K_2S_2O_8$ and KI.
12. Demonstration Experiments (Any One of the following) :
 - a. Determination of dissociation constant of weak acid-by PH metry
 - b. Preparation of Thiokol rubber
 - c. Adsorption on Charcoal
 - d. Heat of reaction

TEXT BOOKS:

1. Practical Engineering Chemistry by K. Mukkanti, et al, B.S. Publications, Hyderabad.
2. Inorganic quantitative analysis, Vogel.

REFERENCE BOOKS:

1. Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel.
2. A text book on experiments and calculation Engg. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. Ch.E.

L	T/P/D	C
0	-3/-	4

(51622) 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:

1. To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
2. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.
3. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.

SYLLABUS:

The following course content is prescribed for the English Language Laboratory sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate
9. Telephoning Skills.
10. Giving Directions.

Minimum Requirement:

The English Language Lab shall have two parts:

- i) The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self-study by learners.
- ii) The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a T.V., a digital stereo –audio & video system and camcorder etc.

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

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- The Rosetta Stone English Library.
- Clarity Pronunciation Power – Part I.
- Mastering English in Vocabulary, Grammar, Spellings, Composition
- Dorling Kindersley series of Grammar, Punctuation, Composition etc.
- Language in Use, Foundation Books Pvt Ltd with CD.
- Oxford Advanced Learner's Compass, 7th Edition.
- Learning to Speak English - 4 CDs.
- Vocabulary in Use, Michael McCarthy, Felicity O'Den, Cambridge.
- Murphy's English Grammar, Cambridge with CD.
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. A Handbook for English Language Laboratories – Prof. E. Suresh Kumar, P. Sreehari, Foundation Books.
2. Effective Communication & Public Speaking by S. K. Mandai, Jaico Publishing House.

3. English Conversation Practice by Grant Taylor, Tata McGraw Hill.
4. Speaking English effectively by Krishna Mohan, N. P. Singh, Mac Millan Publishers.
5. Communicate or Collapse: A Handbook of Effective Public Speaking, Group Discussions and Interviews, by Pushpa Lata & Kumar, Prentice-Hall of India.
6. Learn Correct English, Grammar, Usage and Composition by Shiv. K. Kumar & Hemalatha Nagarajan, Pearson Longman.
7. Spoken English by R. K. Bansal & J. B. Harrison, Orient Longman.
8. English Language Communication: A Reader cum Lab Manual Dr A Ramakrishna Rao, Dr. G. Natanam & Prof. S. A. Sankaranarayanan, Anuradha Publications, Chennai.
9. Effective Technical Communication, M. Ashraf Rizvi, Tata McGraw-Hill.
10. A Practical Course in English Pronunciation, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.
11. A text book of English Phonetics for Indian Students by T. Balasubramanian, Mac Millan.
12. Spoken English: A foundation Course, Parts 1 & 2, Kamlesh Sadanand and Susheela Punitha, Orient Longman

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Paper:

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 25 sessional marks and 50 year-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 year-end Examination shall be conducted by an external examiner/ or the teacher concerned with the help of another member of the staff of the same department of the same institution.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. Ch.E.

L T/P/D C

0 -/3/- 4

(51623) ENGINEERING WORKSHOP / IT WORKSHOP

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry
2. Fitting
3. Tin-Smyth and Development of jobs carried out and soldering.
4. Black Smithy
5. House-wiring
6. Foundry
7. Welding
8. Power tools in construction, wood working, electrical engineering and mechanical Engineering.
9. IT Workshop-I : Computer hard ware , identification of parts , Disassembly, Assembly of computer to working condition, Simple diagnostic exercises.
10. IT workshop-II : Installation of Operating system windows and Linux , simple diagnostic exercises.

2. TRADES FOR DEMONSTRATION & EXPOSURE:

1. Plumbing
2. Machine Shop
3. Metal Cutting (Water Plasma)

TEXT BOOK:

1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers.
2. Workshop Manual by Venkat Reddy

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E. I Sem

L T/P/D C

4 1/-/- 4

(53001) MATHEMATICS – II

UNIT – I: Linear Systems

Matrices: Elementary row transformations – Rank – Normal form - Echelon form – Consistency – Solution of system of simultaneous linear homogeneous and non-homogeneous equations.

UNIT – II: Eigen values & Eigen vectors

Eigen Values, Eigen vectors - properties – Cayley-Hamilton Theorem - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonization of matrix. Calculation of powers of matrix – Modal and spectral matrices.

UNIT-III: Linear Transformations

Real matrices -Symmetric, skew - symmetric, orthogonal, Linear Transformation - Orthogonal Transformation. Complex matrices: Hermitian, Skew-Hermitian and Unitary – Eigen values and Eigen vectors of complex matrices and their properties.

UNIT – IV: Quadratic forms

Quadratic Forms - Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - index - signature - Sylvester law, Applications of quadratic forms.

UNIT-V: Fourier Series

Fourier Series: Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

UNIT – VI: Introduction to partial differential equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations.

UNIT – VII: Solution of partial differential equations

Classification of second order linear Partial Differential Equations, separation of variables methods for the solutions of one dimensional

heat equation, wave equation and two-dimensional Laplace's equation under initial and boundary conditions.

UNIT-VIII: Fourier transforms

Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

TEXT BOOKS:

1. Engineering Mathematics – II by P.B. Bhaskara Rao, S.K.V.S.Rama Chary, M.Bhujanga Rao, B.S. Publications.
2. Engineering Mathematics – II by G.Shankar Rao & Others, I.K. International Publications.

REFERENCES:

1. Engineering Mathematics – II by T.K.V. Iyengar, B.Krishna Gandhi & Others, S.Chand.
2. Higher Engineering Mathematics by B.S.Grewal, Khanna Publications.
3. Engineering Mathematics – II by Engineering Mathematics – II by C. Shankaraiah, Vijaya Publications.
4. Advanced Engineering Mathematics by Jain and S.R.K. Iyengar, Narasa Publications.
5. Engineering Mathematics – II by Dr. A. Anjaneyulu & others, Deepthi Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E. I Sem

L	T/P/D	C
3	1/-	3

(53026) ELECTRICAL ENGINEERING

UNIT – I

SI Unit's ohm's law, series, and parallel circuits, Kirchhoff's laws, Star-delta transformation (Simple Problems)– Force on a current carrying conductor in magnetic field– electromagnetic induction, Faraday's law, Lenz's law – Self and mutual inductances.

UNIT – II

Generation of an alternating emf – average and rms values of alternating quantity – representation of alternating quantities by phasors – single phase series and parallel circuits (simple problems)– series and parallel resonance – three phase balanced systems – single and three phase power calculations.

UNIT – III

Principle of operation of DC machines – emf equation – types of generators – Magnetization and Load characteristics of DC generators

UNIT-IV

DC Motor: Principle of operation of DC Motor, Types of Motors, Back EMF Equation, Characteristics of DC motor, Torque Equation, DC Motor Starter (Three Point starter), Efficiency Calculation, Swinburne's Test and speed control.

UNIT – V

Construction and principle of operation of single phase transformer – emf equation O.C. & S.C. tests – efficiency and regulation

UNIT-VI

Principle and operation of three phase induction motors – types of motors, Squirrel cage and slip ring motor – slip torque characteristics.

UNIT-VII

Principle and operation of alternators – O.C. & S.C. tests – regulation by synchronous impedance method.

UNIT – VIII

Electrical Instruments: Basic principles of indicating instruments –

moving coil and moving iron instruments (Ammeters and voltmeters).

TEXT BOOKS :

1. Introduction to Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH
2. Basic Electrical Engineering by T.K. Nagasarkar and M.S.Sukhija, Oxford University Press, 2005

REFERENCES:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath Pearson Education/PHI
2. Essentials of Electrical and Computer Engineering by David V.Kerns,Jr, J.David Irwin, Pearson Education.
3. Basic electrical Engineering, V.N. Mittle, 2nd edition, TMH
4. Principles of electrical engineering, V.K. Mehta, S.Chand publications

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E. I Sem

L	T/P/D	C
3	1/-	3

(53027) PROCESS INSTRUMENTATION

Unit-I:

Elements of instruments, static and dynamic characteristics, basic concepts of response of first order type instruments, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer, static accuracy and response of thermometers.

Unit-II:

Thermo electricity: Industrial thermocouples, thermocouple wires, thermo couple wells and response of thermocouples.

Unit-III:

Thermal coefficient of resistance, industrial resistance thermometer bulbs and circuits, radiation receiving elements, radiation, photoelectric and optical pyrometers.

Unit-IV:

Composition analysis, spectroscopic analysis by absorption, emission, mass and color measurement spectrometers, gas analysis by thermal conductivity, analysis of moisture, gas chromatography, refractometer.

Unit-V:

Pressure vacuum and head: liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, measurement of absolute pressure, measuring pressure in corrosive liquids, static accuracy and response of pressure gauges.

Unit -VI

Head, density and specific gravity, direct measurement of liquid level, pressure measurement in open vessels, level measurements in pressure vessels, measurement of interface level, density measurement, and level of dry materials.

Unit -VII

Head flow meters, area flow meters, open channel meters, viscosity meters, quantity meters, flow of dry materials, viscosity measurements.

Unit -VIII

Recording instruments, indicating and signaling instruments, transmission of instrument readings, control center, instrumentation diagram, process analysis.

Text Book:

1. Industrial instrumentation by Donald P.Eckman, Wiley eastern, 1950.

REFERENCE:

1. Principles of industrial instrumentation by Patra Nabis, TMH.
2. Instruments for measurements and control by Holbrook W.C. Van Nostrand East West.
3. Hand book Instrumentation, Considine, McGraw Hill,
4. Instrumentation for Process measurement and Control, Norman A. Anderson, 1st Edition, CRC press

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E. I Sem

L	T/P/D	C
3	-/-/-	3

(53013) ENVIRONMENTAL STUDIES

UNIT-I : ECOSYSTEMS: Definition, Scope and Importance of ecosystem, Concept of ecosystem, Classification of ecosystems, Structure and Structural Components of an ecosystem, Functions of ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Homeostasis / Cybernetics, Food chain concentration, Biomagnification, ecosystems value, services and carrying capacity.

UNIT-II: NATURAL RESOURCES: Classification of Resources: Living and Non-Living resources, Renewable and non-renewable resources. Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources – 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 and land use / land cover mapping.

UNIT-III: BIODIVERSITY AND BIOTIC RESOURCES: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and intrinsic values. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, conservation of biodiversity: In-Situ and Ex-situ conservation. Food and fodder resources, Timber and non-timber forest products.

UNIT-IV: ENVIRONMENTAL POLLUTION AND CONTROL: Classification of pollution and pollutants, causes, effects and control technologies. Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Point and non-point sources of pollution, Major pollutant of water and their sources, drinking water quality standards, Waste water treatment methods: effluent treatment plants (ETP), Sewage treatment plants

(STP), common and combined effluent treatment plants (CETP). Soil Pollution: Soil as sink for pollutants, Impact of modern agriculture on soil degradation of soil, Marine Pollution: Misuse of International water for dumping of hazardous waste, coastal pollution due to sewage and marine disposal of industrial effluents. Noise Pollution: Sources, Industrial Noise- Occupational Health hazards, standards, Methods of control of Noise. Thermal Pollution: Thermal Comforts, Heat Island effect, Radiation effects. Nuclear Pollution: Nuclear power plants, nuclear radiation, disasters and impacts, genetical disorders. Solid waste: types, Collection processing and disposal of industrial and municipal solid wastes composition and characteristics of e-Waste and its management.

UNIT-V: GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFORTS
: Green house effect, Green House Gases (GHG), Global Warming, Sea level rise, climate change and their impacts on human environment, Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT-VI: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND ENVIRONMENTAL MANAGEMENT PLAN: Definition of Impact; classification of impacts, Positive and Negative, Reversible and irreversible, light, moderate and severe, methods of baseline data acquisition, Impacts on different components; such as human health resources, air, water, flora, fauna and society. Prediction of impacts and impact assessment methodologies. Environmental Impact Statement (EIS). Environmental Management Plan (EMP): Technological Solutions, preventive methods, Control technologies, treatment technologies: green-belt-development, rain water harvesting, Remote sensing and GIS methods.

UNIT-VII: ENVIRONMENTAL POLICY, LEGISLATION, RULES AND REGULATIONS

National Environmental Policy, Environmental Protection act, Legal aspects Air (Prevention and Control of pollution) Act- 1981, Water Prevention and Control of pollution) Act-1974, Water pollution Cess Act-1977, Forest Conservation Act, Municipal solid waste management

and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules.

UNIT-VIII — TOWARDS SUSTAINABLE FUTURE

Concept of Sustainable Development, Threats to Sustainability, Population and its explosion, Crazy Consumerism, Over-exploitation of resources, Strategies for Achieving Sustainable development, Environmental Education, Conservation of Resources, Urban Sprawl, Sustainable Cities and Sustainable Communities, Human health, Role of IT in Environment, Environmental Ethics, Environmental Economics, Concept of Green Building, Clean Development Mechanism (CDM).

SUGGESTED TEXT BOOKS:

1. Environmental studies , From crisis to cure by R.Rajagopalan, 2005
2. Text book of Environmental Science and Technology by M.Anji Reddy 2007
3. Environmental studies by Erach Bharucha 2005, University Grants Commission, University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela .2008 PHI Learning Pvt. Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 II Year B.Tech. Ch.E. I Sem L T/P/D C
 4 1/- 4

(53028) ANALYTICAL CHEMISTRY

UNIT - I

Principle of Analytical Methods: Quantitative analysis. Precipitation, types of precipitates, impurities, co-precipitation, post-precipitation, conditions for precipitation, precipitation from homogeneous solution. Gravimetric determination of Fe, Ni and Cu, calculations.

UNIT-II

Volumetric analysis: Acid base titrations: Indicators, Oxidation-reduction titrations; Complexation using ligands, complexometric titration with EDTA, metal ion indicators; simple calculations; analysis of Na_2CO_3 , Fe_2O_3 , Brass, Solder etc.

UNIT - III

Molecular Spectrophotometry: Absorption spectra, Lambert's Law, Beer's Law - Combined law equation; Derivations from Beer's Law. Block diagram of a uv-visible spectrophotometer - quantitative analysis. Direct method for the determination of metal ions; Chromium, Manganese, Iron etc in alloys.

UNIT - IV

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; Application of IR Spectroscopy to functional group analysis (-OH, -NH₂, -CHO, -CO-R, -CONH).

UNIT V:

Chromatography: Principles, planar chromatography, paper chromatography, RF value. Thinlayer chromatography, identification of spots by spraying and other methods.

UNIT - VI:

Gas Chromatography: Principles of Gas Chromatography, block diagram of gas chromatograph, Function 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.

UNIT VII:

HPCL: Principles of high performance liquid chromatography, Block diagram of HPCL, Systems, functions of each component, stationary phases, eluting solvents, pumps, detectors, quantitative applications of HPLC.

UNIT - VIII:

Analysis of water: Hardness, definition, Types of Hardness, estimation of hardness by EDTA method, Alkalinity, Acidity, Chlorides, Chlorine, dissolved oxygen, BOD, COD.

Text BOOK:

- Quantitative analysis, R.A. Day & A.L.Underwood Printice-Hall of India, pvt. Ltd. 5th edition, 2000.
- Vogel's Text book of Quantitative chemical analysis, J.Mendham, R.C Denny, J.D. Barnes, M.J.K.Thomas, pearson education, 6th edition, 2002.

REFERENCES:

- Analytical Chemistry – Y.Anjaneylu, K. Chandrasekhar, V. Manickam- Pharma book syndicate, 2007.
- Instrumental methods of analysis, Willand merrit and dean, caps publications & Distribution, 1999.
- Instrumentation methods of analysis, Chatwal & Anand, Himalaya Publications, 2003.
- Principles of Analytical Chemistry by Vacarcel, Springer Publications, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 II Year B.Tech. Ch.E. I Sem L T/P/D C
 4 1/- 4

(53029) CHEMICAL PROCESS CALCULATIONS

Unit-1:

Stoichiometric relation: basis of calculations, methods of expressing compositions of mixtures and solutions, density and specific gravity, Baume and API gravity scales.

Unit-2:

Behavior of Ideal gases: application of ideal gas law to gaseous mixtures, gases in chemical reactions, including combustion processes.

Unit-3:

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.

Unit-4:

Humidity and Saturation: Properties of Air-water vapor mixtures: Absolute Humidity, Molal humidity, Relative and percentage saturation, dew point, humid heat, wet bulb and dry bulb temperatures, use of humidity charts for engineering calculations.

Unit-5:

Material balances: Tie substance, Yield, conversion, limiting reactant, excess reactant, processes involving chemical reactions, Material balances with the help of stoichiometric equations, Material balances involving drying, dissolution, & crystallization.

Unit-6:

Material balance calculations for processes involving recycle, bypass and purge.

Unit-7:

Thermophysics: 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.

Unit-8:

Thermochemistry: Calculation and applications of heat of reaction, combustion, formation and neutralization, Kirchoff's equation, enthalpy concentration change, calculation of theoretical and actual flame temperatures.

TEXTBOOKS

1. Chemical process principles, Part-I, Material and Energy Balance by Hougen O.A, Watson K.M. and Ragatz R.A. John Wiley and Sons, New York, 1963, 2nd Ed.

REFERENCES:

1. Basic principles and calculation in chemical engineering by D.H. Himmelblau, 5th Ed. PHI, 2001
2. Stoichiometry by B.I. Bhatt and S.M. Vora (3rd Ed.) Tata McGraw Hill publishing company, Ltd. New Delhi (1996)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD		
II Year B.Tech. Ch.E. I Sem	L T/P/D	C
	0 -/3/-	2

(53610) ELECTRICAL ENGINEERING LAB

PART-A

1. Verification of KVL and KCL.
2. Serial and Parallel Resonance – Timing, Resonant frequency, Bandwidth and Q-factor determination for RLC network.
3. Time response of first order RC/RL network for periodic non-sinusoidal inputs – time constant and steady state error determination.
4. Two port network parameters – Z-Y Parameters, chain matrix and analytical verification.
5. Two port network parameters – ABCD and h- Parameters.
6. Verification of Superposition and Reciprocity theorems.
7. Verification of maximum power transfer theorem. Verification on DC, and AC Excitation with Resistive and Reactive loads.
8. Experimental determination of Thevenin's and Norton's equivalent circuits and verification by direct test.
9. Constant – k Low Pass Filter and High Pass Filter – Design and Test.

PART-B

1. Magnetization characteristics of D.C. Shunt generator. Determination of critical field resistance.
2. Swinburne's Test on DC shunt machine (Predetermination of efficiency of a given DC Shunt machine working as motor and generator).
3. Brake test on DC shunt motor. Determination of performance characteristics.
4. OC & SC tests on Single-phase transformer (Predetermination of efficiency and regulation at given power factors and determination of equivalent circuit).
5. Load Test on Single Phase Transformer.

Note: Any 12 of the above experiments are to be conducted

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD		
II Year B.Tech. Ch.E. I Sem	L T/P/D	C
	0 -/3/-	2

(53611) ANALYTICAL CHEMISTRY LAB

1. Estimation of ferrous iron (II) in solution using Potassium Dichromate.
2. Estimation of cooper (II) using standard sodium thiosulphate.
3. Estimation of total, permanent and temporary hardness of water by EDTA.
4. Estimation of Total alkalinity of water.
5. Estimation of Iron in cement using Spectrophotometer.
6. Estimation of Zinc using potassium ferrocyanide.
7. Percentage purity of lime stone.
8. Estimation of Chlorides in water.
9. Estimation of Dissolved oxygen in water.
10. Determination of stability constant by Job's method.
11. Determination of sulphates through turbidometry.
12. Assay of paracetamol/ Ibuprofen sample using spectrophotometer.

TEXT BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson Education.
2. Chemistry Practical – Lab Manual by Chandra Sekhar and Jayaveera.

APPARATUS AND EQUIPMENT REQUIRED**GLASSWARE:**

Burettes, Pipettes (10ml, 20 ml, 25 ml), Conical Flasks (250 ml), Standard Flasks (25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000 ml) Graduated Pipettes, Beakers (100 ml, 250 ml, 500 ml, 1000 ml) Reagent Bottles (100 ml, 250 ml, 500 ml), Test Tubes, Test Tube Stands, Burette Stands, Porcelain Tiles, Brushes, Wash Bottles, Droppers, Conical Flaks (250 ml, 100 ml), Weighing Bottles.

EQUIPMENT:

Colorimeter, UV- Visible Spectrophotometer, Hot Water Bath, Hot Plates, Distilled Water, Plant/De - ionizer, Magnetic- Stirrer, Chemical Balances, Weighing Boxes and Electrical Balance.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
II Year B.Tech. Ch.E. II Sem L T/P/D C

(54001) PROBABILITY AND STATISTICS

UNIT-I: Probability

Sample space and events – Probability – The axioms of probability – Some

**Elementary theorems - Conditional probability – Baye's theorem,
Random variables – Discrete and continuous.**

UNIT-II: Distributions

Binomial , Poisson & normal distributions related properties . Sampling distributions –Sampling distribution of means (known and Unknown)

UNIT-III: Testing of Hypothesis I

Tests of hypothesis point estimations – interval estimations Bayesian estimation. Large samples, Null hypothesis – Alternate hypothesis type I, & type II errors – critical region confidential interval for mean testing of single variance. Difference between the mean.

UNIT-IV: Testing of Hypothesis III

Confidential interval for the proportions. Tests of hypothesis for the proportions single and difference between the proportions.

UNIT-V: Small samples

Confidence interval for the t-distribution – Tests of hypothesis – t-distributions. F-distributions distribution. Test of Hypothesis –

UNIT-VI

Correlation & Regression

Coefficient of correlation – Regression Coefficient – The lines of regression – The rank correlation

UNIT-VI

Queuing Theory

Arrival Theorem - Pure Birth process and Death Process M/M/1 Model

UNIT-VII

Stochastic processes

Introduction to Stochastic Processes – Markov process classification of states – Examples of Markov Chains; Stochastic Matrix, limiting probabilities.

TEXT BOOKS:

1. Probability & Statistics by D.K. Murugesan & P.Guru Swamy, Anuradha Publications.
 2. Probability & Statistics for Engineers by G.S.S.Bhima Rao, Scitech Publications.

REFERENCES:

1. Probability & Statistics by T.K.V.Iyengar & B.Krishna Gandhi & Others, S.Chand.
 2. Probability & Statistics by William Mendenhall & Others, Cengage Publications.
 3. Higher Engineering Mathematics by B.S. Grewal, Khanna Publications.
 4. Higher Engineering Mathematics by Jain & S.K.R. Iyengar, Narasa Publications.
 5. A first course in Probability & Statistics by B.L.S. Prakasa Rao, World Scientific.
 6. Probability & Statistics for Engineers, Miller and John E. Freund, Prentice Hall of India.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 II Year B.Tech. Ch.E. II Sem L T/P/D C

3 1/- 3

(54017) MANAGEMENT SCIENCE

Unit I: Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

Unit II: Designing Organisational Structures: Departmentation and Decentralisation, Types of Organisation structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

Unit III: Operations Management: Principles and Types of Plant Layout- Methods of production (Job, batch and Mass Production), Work Study - Basic procedure involved in Method Study and Work Measurement- Statistical Quality Control: chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

Unit IV: A) Materials Management: Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records - Supply Chain Management

B) Marketing: Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle., Channels of distribution.

Unit V: Human Resources Management (HRM): Evolution of HRM, Concepts of HRM, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation,

Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

Unit VI: 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)

Unit VII: Strategic Management: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

Unit VIII: Contemporary Management Practices: Basic concepts of Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma and Capability Maturity Model (CMM) Levels, Value Chain Analysis, Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering 5S Model, Deming's PDCA, Kaizen, Poka-Yoke, Muda, Benchmarking, Balanced Score Card.

TEXT BOOKS:

1. Aryasri: Management Science, TMH, New Delhi, 2009
2. Gupta & Sharma, Management of Science, Mac Millan, 2008

REFERENCE BOOKS:

1. Stoner, Management, Pearson, 2009
2. Kotler Philip & Keller Kevin Lane: Marketing Management PHI, 2009.
3. Koontz & Weihrich: Essentials of Management, TMH, 2009.
4. Thomas N.Duening & John M.Ivancevich Management—Principles and Guidelines, Cengage, 2009.
5. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2009.
6. Memoria & S.V.Ganker, Personnel Management, Himalaya, 2009

7. Schermerhorn: Management; Wiley, 2009.
8. Parnell: Strategic Management, Biztantra, 2009.
9. L.S.Srinath: PERT/CPM, Affiliated East-West Press, 2009.

Pre-requisites: Managerial Economics

Objective: To familiarize with the process of management and to provide basic insights into select contemporary management practices.

Codes/Tables: Normal Distribution Function Table need to be permitted into the examination Hall.

Question Paper Pattern: 5 Questions to be answered out of 8 questions.

Each question should not have more than 3 bits.

Unit VIII will have only short questions, not essay questions.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E. II Sem

L T/P/D C

4 -/- 4

(54018) MOMENTUM TRANSFER

UNIT-I

Unit operations and unit processes, unit systems, basic concepts, nature of fluids, hydrostatic equilibrium, applications of fluid statics.

UNIT-II

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, differential momentum balance; equations of motion, Macroscopic momentum balances, Bernoulli's equation, Mechanical energy equations

UNIT-III

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 Rayleighs method

UNIT-IV

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

UNIT-V

Flow past immersed bodies, Drag and Drag coefficient, flow through beds of solids, Kozhney-Karman, Blake-Plummer and Ergun's equations, motion of particles through fluids, Stoke's Law ..

UNIT-VI

Fluidization, Conditions for fluidization, Minimum fluidization velocity, Types of fluidization, Expansion of fluidized bed, Applications of fluidization, Continuous fluidization: slurry and pneumatic transport

UNIT-VII

Transportation and Metering of fluids- Pipes, fittings and valves, pumps,

positive displacement pumps, and centrifugal pumps; Fans, blowers, and compressors.

UNIT-VIII

Measurement of flowing fluids- full bore meters, Orifice meter, Venturi meter, Magnetic flow meter insertion meters Pitot tube, Area meters.

Text Books:

- Unit Operations of Chemical Engineering by W.L.McCabe, J.C.Smith & Peter Harriot, McGraw-Hill, 7th ed, 2007

References:

- Transport processes and unit operations by Christie J. Geankoplis, PHI
- Unit operations, Vol-1 –Chattopadhyay, Khanna publishers
- Principles of Unit Operations, Foust et. al., 2nd ed., John Wiley, 1999
- Chemical Engineering, Vol-I, Coulson and Richardson, Pergamon Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E. II Sem

L	T/P/D	C
3	1/-	3

(54019) ORGANIC CHEMISTRY

UNIT I:

Polar effects – Inductive effect, electromeric effect, resonance, Hyper conjugation, steric inhibition of resonance – examples.

UNIT II:

Electrophilic reactions: a) Friedel-Craft reaction b) Rieger- Teimenn Reaction c) Backmann rearrangement.

UNIT – III:

Nucleophilic reaction : a) Aldol condensation b) Perkin Reaction c) Benzoin condensation.

UNIT – IV:

- Free radical reaction a) Halogenation of Alkane b) Addition of HBr to Alkene in the presence of peroxide.
- Allylic halogenation Using N-Bromo succinamide (NBS) 3) Thermal halogenation of Alkanes.

UNIT – V:

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 – VI:

Polymerization Reactions – Basic concepts. Types of Polymerization – Addition and Condensation Polymerizations. Plastics- Thermosetting and Thermoplastics - Differences. Compounding, Moulding of Plastics- Compression, injection, transfer, and Extrusion molding methods. Preparation, Properties and Engineering use of the Following: Polyethylene, PVC, Teflon, Bekelite, Nylon, Polyester, Polyurethane and Silicone Resins, Rubber - Processing of Natural Rubber, Vulcanization and Compounding: Elastomers-Buna S, Buna N, Thiokol, Polyurethane Rubber

UNIT – VII

Heterocyclic compounds and Nomenclature; Preparation, Properties and uses of (1) Pyrrole (2) Furan (3) Thiophene (4) Pyridine (5) Quinoline (6) Iso-quinoline.

UNIT – VIII

Dyes - Colour and Constitution : Classification of Dyes, Preparation and uses of (1) Malachite green (2) Rosaniline (3) Congored (4) Bismark brown (5) Fluroscien.

TEXTBOOKS:

1. Text book of Organic chemistry – Ferguson, LN EAST – Westpress.
2. Text book of Organic Chemistry – Morrison and Boyd.

REFERENCES:

1. Polymer Science – Gaurikar and others.
2. Reaction mechanism – Peter Skyes.
3. Text book of Organic Chemistry – R.K. Bansal.
4. Text book of Organic Chemistry – P.L. Soni.
5. Organic Chemistry Vol- I-IL Finar.
6. Reactions and Reagents – O.P. Agrawal.
7. Intermediates of Organic Synthesis by V.K. Ahulwalia, Pooja Bhagat, Renu Aggrwal, Ramesh Chandra, I.K. International Publishing House Pvt. Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E II Sem

L	T/P/D	C
4	1/-	4

(54020) CHEMICAL ENGINEERING THERMODYNAMICS-I**UNIT I**

Introduction: The scope of thermodynamics, temperature, defined quantities, volume, pressure, work, energy, heat, Joules Experiments.

Unit-II:

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 polytropic processes.

Unit-III:

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.

Unit-IV:

The second law of thermodynamics: Statements of the second law, heat engines, thermodynamic temperatures scales, thermodynamic temperature and the ideal gas scale

Unit-V:

Entropy, Entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point

Unit-VI:

Thermodynamics of flow processes ; principles of conservation of mass and energy for flow systems; analysis of expansion processes ; turbines, throttling ; compression processes – compressors and pumps ; calculation of ideal work and lost work.

Unit-VII:

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-VIII:

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

1. J.M.Smith and HC Van Ness, Introduction to Chemical Engineering Thermodynamics, 6th ed, McGraw Hill,2003.

REFERENCE

1. Y.V. C.Rao, Chemical Engineering Thermodynamics, University publications.
2. K. V. Narayanan, Chemical Engineering Thermodynamics, PHI,2001
3. Chemical and Process Thermodynamics, B.G. Kyle, 3rd edition, Pearson, Prentice Hall, 1999

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E. II Sem

L	T/P/D	C
4	1I-I-	4

(54021) MECHANICAL UNIT OPERATIONS**Unit-I:**

Properties, handling and mixing of particulate solids: Characterization of solid particles, properties of particulate masses, storage and mixing of solids, types of mixers, mixers for cohesive solids, mixers for free flowing solids.

Unit-II:

Transportation of solid particulate mass, belt, screw, apron conveyors, bucket elevators, pneumatic conveying

Unit-III:

Size reduction: Principles of comminution, computer simulation of milling operations, size reduction equipment-crushers, grinders, ultra fine grinders, cutting machines, Equipment operation. Three laws of crushing: Kick's law, Bond's law, Rittinger's law.

Unit-IV:

Screening, Industrial screening equipments, Effectiveness of the screen, differential & cumulative analysis Filtration, cake filters, centrifugal filters, cyclone separators, electro-static precipitators.

Unit-V:

Principles of cake filtration. Clarifying filters, liquid clarification, gas cleaning, principles of clarification. Cross flow filtration, types of membranes, permeate flux for ultra-filtration, Concentration polarization, particle rejection of solutes

Unit-VI:

Micro filtration, 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 -VII:

Agitation and mixing of liquids: Agitation of liquids, circulation velocities, power consumption in agitated vessels. Blending and mixing

of liquids, suspension of solid particles, dispersion operations.

Unit-VIII:

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

TEXT BOOK:

1. Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, Mc Graw Hill 5th ed. 1993.

REFERENCES:

1. Chemical engineers hand book, J.H. Perry, 7th ed. Mc Graw Hill
2. Introduction to Chemical Engineering by J.T.Banchero & W.L. Badger, TMH, 1997
3. Unit Operations by Foust et.al

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Ch.E. II Sem

L	T/P/D	C
0	-/3/-	2

(54611) Momentum Transfer Lab

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
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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
II Year B.Tech. Ch.E. II Sem

L	T/P/D	C
0	-/-/-	2

(54612) MECHANICAL UNIT OPERATION LAB

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. Major equipment – Jaw Crusher, Sieve shaker, Different sizes of sieves, Weighing Balance, Energy meter
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 thickener 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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
4	-/-/-	4

(55033) CHEMICAL ENGINEERING THERMODYNAMICS –II

Unit -I

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.

Unit-II

Standard heat of reaction, Standard heat of formation, Standard heat of combustion, temperature dependence of heat of reaction

Unit-III

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 -IV

Solution thermodynamics: applications: the liquid phase properties from VLE data, models for the excess Gibbs energy, property changes of mixing.

Unit -V

VLE at low to moderate pressures: The nature of equilibrium, the phase rule, Duhems theorem, VLE: Qualitative behavior, the gamma / Phi formulation of VLE, Dew point and bubble point calculations, flash calculations, solute (1)/solvent (2) systems

Unit -VI

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 -VII

Topics in phase equilibria: Equilibrium and stability, liquid-liquid

equilibrium (LLE), vapor- liquid-liquid equilibrium (VLLE), solid-liquid equilibrium (SLE), solid vapor equilibrium (SVE), equilibrium absorption of gases on solids.

Unit-VIII

Chemical reaction equilibria: The reaction coordinate, application 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.

TEXT BOOK:

- Introduction to Chemical Engineering Thermodynamics, 6th ed., J.M. Smith, H.C. Van Ness and M.M. Abbott, Tata McGraw-Hill, New Delhi, 2003.

REFERENCE:

- Chemical Engineering Thermodynamics, Pradeep Ahuja, PHI Learning Pvt. Ltd., New Delhi, 2009
- A Text Book of Chemical Engineering Thermodynamics, K.V. Narayanan, PHI Learning Pvt. Ltd., New Delhi, 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
4	-/-	4

(55034) CHEMICAL REACTION ENGINEERING-I

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.

Unit-II

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-III

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-IV

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

Unit-V

Design for single reactions- Size comparison of single reactors,

Multiple- reactor systems, Recycle reactor, Autocatalytic reactions.

Unit-VI

Design for parallel reactions- introduction to multiple reactions, qualitative discussion about product distribution, quantitative treatment of product distribution and of reactor size.

Unit-VII

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-VIII

Temperature and Pressure effects- single reactions- heats of reaction from thermodynamics, heats 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:

- Chemical Reaction Engineering, 3rd ed., O. Levenspiel, John Wiley & Sons, 1999.

REFERENCES:

- Elements of Chemical Reaction Engineering, 2nd ed., H.S. Fogler, PHI Learning Pvt. Ltd., New Delhi, 2010.
- Chemical Engineering Kinetics, 3rd ed., J.M. Smith, McGraw-Hill, New York, 1981.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
4	-/-	4

(55035) MASS TRANSFER OPERATIONS-I

UNIT- I : The Mass Transfer Operations: Classification of the Mass-Transfer Operations, Choice of Separation Method, Methods of Conducting the Mass-Transfer Operations, Design Principles, Molecular Diffusion In Fluids: Molecular Diffusion, Equation of Continuity, binary solutions, Steady State Molecular Diffusion in Fluids at Rest and in Laminar Flow, estimation of diffusivity of gases and liquids.

UNIT- II : Momentum and Heat Transfer in Laminar flow Diffusion: Diffusion in Solids, Fick's Diffusion, Unsteady State Diffusion, Types of Solid Diffusion, diffusion through polymers, diffusion through crystalline solids, Diffusion through porous solids & hydrodynamic flow of gases.

UNIT-III : Mass Transfer Coefficients: Mass Transfer Coefficients, Mass Transfer Coefficients in Laminar Flow (Explanation of equations only and no derivation), Mass Transfer Coefficients in Turbulent Flow, eddy diffusion, Film Theory, Penetration theory, Surface-renewal Theory, Combination Film-Surface-renewal theory, Surface-Stretch Theory, Mass, Heat and Momentum Transfer Analogies, Turbulent Flow in Circular Pipes. Mass transfer data for simple situations.

UNIT-IV : Inter phase Mass Transfer: Concept of Equilibrium, Diffusion between Phases, Material Balances in steady state co-current and counter current stage processes, Stages, Cascades, Kremser – Brown equations (No derivation)

UNIT-V : Equipment For Gas-Liquid Operations: Gas Dispersed, Sparged vessels (Bubble Columns), Mechanical agitated equipments(Brief description),Tray towers, General characteristics, Sieve design for absorption and distillation (Qualitative Treatment), Different types of Tray Efficiencies, Liquid Dispersed venturi Scrubbers, Wetted-Wall Towers, Packed Towers, Counter current flow of Liquid & Gas through packing, Mass transfer coefficients for packed towers, End effects and Axial Mixing Tray tower vs Packed towers.

UNIT-VI : Absorption And Stripping: Absorption equilibrium; ideal and non ideal solutions selection of a solvent for absorption, one component transferred material balances. Determination of number of Plates (Graphical), Absorption Factors, estimation of number of plates by Kremser Brown equation, Continuous contact equipment; HETP, Absorption of one component, Determination of number of Transfer Units and Height of the Continuous Absorber, overall coefficients and transfer units, dilute solutions, overall height of transfer units.

UNIT-VII : Humidification Operations: Vapor-Pressure Curve, Definitions, Psychometric Charts, Enthalpy of gas-vapor Mixtures, Humidification and Dehumidification, Operating lines and Design of Packed Humidifiers, Dehumidifiers and Cooling towers, Spray Chambers.

UNIT-VIII : Drying: Equilibrium, Definitions, Drying Conditions- Rate of Batch Drying under constant drying conditions, Mechanisms of batch drying, Drying time Through Circulation Drying, Classification of Drying Operations: Batch and Continuous Drying Equipment, Material and Energy Balances of Continuous Driers,

TEXT BOOK:

1. Mass Transfer Operations, 3rd ed., R. E. Treybal, McGraw-Hill, New York, 1980.

REFERENCES:

1. Transport Processes and Separation Process Principles 4th ed., C. J. Geankolis, PHI Learning Pvt. Ltd., New Delhi, 2009.
2. Fundamentals of Momentum, Heat and Mass Transfer, 3rd ed., J.R. Welty, C.E. Wicks and R.E. Wilson, John Wiley & Sons, New York, 1984.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
3	1/-	3

(55036) PROCESS HEAT TRANSFER

UNIT I Introduction: Nature of heat flow, conduction, convection, natural and forced convection, radiation.

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, thermal contact resistance, plane wall: variable conductivity

Unsteady state heat conduction: Equation for one-dimensional conduction, Semi-infinite solid, finite 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, free convection in enclosed spaces, mixed free & forced convection.

Unit- V Heat transfer to fluids with phase change: Heat transfer from condensing vapors, heat transfer to boiling liquids.

Unit VI Heat exchange equipment: General design of heat exchanger equipment, heat exchangers, condensers, boilers and calandrias, extended surface equipment, heat transfer in agitated vessels, scraped surface heat exchangers, heat transfer in packed beds, heat exchanger effectiveness (NTU method)

Unit VII Evaporators: Evaporators, performance of tubular evaporators, capacity and economy, multiple effect evaporators, vapor recompression.

Unit VIII 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.

TEXT BOOK:

1. Unit Operations of Chemical Engineering, 6th ed., W.L. McCabe, J.C. Smith and P. Harriot, McGraw-Hill, New York, 2001

REFERENCES:

1. Process Heat Transfer, D.Q. Kern, Tata McGraw-Hill, New Delhi, 1997.
2. Heat Transfer, 4th ed., J.P. Holman, McGraw-Hill, New York, 1976.
3. Chemical Engineering, Vol-I, J. Coulson and R.F. Richardson, Pergamon Press.
4. Transport Processes and Separation Process Principles 4th ed., C. J. Geankolis, PHI Learning Pvt. Ltd., New Delhi, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
3	1/-	3

(55037) ENERGY ENGINEERING

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.

Unit II

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 III

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

Unit IV

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 V

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

Unit VI

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 VII

Waste heat recovery, sources of waste heat and potential application,

various types of heat recovery systems, regenerators, recuperators, waste heat boilers

Unit VIII

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

TEXT BOOKS:

1. Fuels, Furnaces and Refractories, O.P.Gupta
2. Fuels and Combustion, 3rd ed., Samir Sarkar, Universities Press, 2009.

REFERENCES:

1. Non-conventional Energy Resources, G.D.Rai, Khanna Publishers
2. Solar Energy, S.P.Sukhatme
3. Fuel and Energy, Harker and Backhurst, Academic press London 1981
4. Fuel Science- Harker and Allen, Oliver and Boyd, 1972
5. Energy Management, 1st ed. W.R. Murphy, G. McKay, Butterwolfer & Co. Ltd., 2001
6. Energy management, Turner

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E I-Sem

L	T/P/D	C
---	-------	---

3	1/-/-	3
---	-------	---

(55038) BIOPROCESS ENGINEERING

(OPEN ELECTIVE)

Unit I

Introduction: Biotechnology and bioprocessing. An overview of biological basics. Basics of enzyme and microbial kinetics.

Unit II

Operating considerations for bioreactors: cultivation method, modifying batch and continuous reactors, immobilized cell systems, solid state fermentations.

Unit III

Selection, scale-up, operation and control of bioreactors: Scale-up and its difficulties, bioreactor instrumentation and control, sterilization of process fluids.

Unit IV

Recovery and purification of products: Strategies to recover and purify products, separation of insoluble products, cell disruption, separation of soluble products.

Unit V

Bioprocess considerations in using animal cell cultures: Structure and biochemistry of animal cells, methods for the cultivation of animal cells, bioreactors for animal cell culture, products of animal cell culture.

Unit VI

Bioprocess considerations in using plant cell cultures: Plant cells in culture compared to microbes, bioreactors for plant cell cultures.

Unit VII

Genetically engineered organisms: Influence of product on process decisions, guidelines for choosing host- vector systems, metabolic engineering, protein engineering.

Unit VII

Mixed cultures: Simple models describing mixed culture interactions.

mixed cultures in nature, industrial utilization of mixed cultures. Biological wastewater treatment – an example of industrial utilization of mixed cultures.

TEXT BOOK:

1. Bioprocess Engineering, 2nd ed., M. L. Shuler and F. Kargi, PHI Learning Pvt. Ltd, New Delhi, 2009

REFERENCES:

1. Biochemical Engineering Fundamentals, 2nd ed., J.E. Bailey and D.F. Ollis, McGraw-Hill, New York, 1987.
2. Bioprocess Engineering Principles, P. M. Doran, Elsevier, Gurgaon, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
3	1/-	3

(55039) NANOTECHNOLOGY

(OPEN ELECTIVE)

Unit I

Introduction: Background and definition of nanoscience and nanotechnology, possible applications of nanotechnology. Band structure and density of states at nanoscale: energy bands, density of states at low dimensional structures.

Unit II

Growth techniques of nanomaterials: Top-down versus bottom-up techniques, lithographic process and its limitations, non-lithographic techniques, plasma arc discharge, sputtering, film deposition in a glow discharge, thermal evaporation, e-beam evaporation.

Unit III

Growth techniques of nanomaterials: Chemical vapor deposition, types of CVD processes, pulsed laser deposition, molecular beam epitaxy, sol-gel technique, electrodeposition, other processes – ball-milling, chemical bath deposition, ion beam deposition.

Unit IV

Investigating and manipulating materials in the nanoscale: Electron microscopies, scanning probe microscopies, optical microscopies for nanoscience and nanotechnology, other kinds of microscopies – secondary ion mass spectrometry (SIMS), photoelectron spectroscopy (PES), X-ray diffraction.

Unit V

Fullerenes: synthesis and purification of fullerenes, mass spectrometry and ion/molecule reactions, chemistry of fullerenes in the condensed phase, endohedral chemistry of fullerenes, orientational ordering, conductivity and super conductivity in doped fullerenes, optical properties.

Unit VI

Carbon nanotubes: synthesis and purification, filling of nanotubes,

mechanism of growth, electronic structure, transport properties, mechanical properties, physical properties, applications, nanotubes of other materials.

Self-assembled monolayers: Monolayers on gold, growth process, phase transitions, patterning monolayers, mixed monolayers, SAMS and applications.

Unit VII

Monolayer-protected metal nanoparticles: method of preparation, characterization, functionalized nanoparticles, applications. Core-shell nanoparticles: characterization, properties and applications. Nanoshells: properties, characterization and applications.

Unit VIII

An overview of nanobiology, nanosensors, nanomedicines, molecular nanomachines.

TEXTBOOKS:

1. Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay and A.N. Banerjee, PHI Learning Pvt. Ltd., New Delhi, 2009. (Unit I to III)
2. Nano: The Essentials, T. Pradeep, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2007. (Unit IV to VIII)

REFERENCE:

1. Springer Handbook of Nanotechnology, Bhushan, Bharat (Ed.), Springer International Edition, 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. I-Sem

L T/P/D C

3 1/- 3

(55040) INTELLECTUAL PROPERTY RIGHTS

(OPEN ELECTIVE)

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks : Purpose and function of trade marks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

UNIT – IV

Law of patents : Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT – V

Trade Secrets : Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.

UNIT – VI

Unfair competition : Misappropriation right of publicity, False advertising.

UNIT – VII

New development of intellectual property: new developments in trade mark law ; copy right law, patent law, intellectual property audits.

UNIT – VIII

International overview on intellectual property, international – trade mark law, copy right law, international patent law, international development in trade secrets law.

References & Text Books :

1. Intellectual property right, Deborah. E. Bouchoux, cengage learning.
2. Intellectual property right – neashmy the knowledge economy, prabuddha ganguli, Tate Mc Graw Hill Publishing company ltd.,

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 III Year B.Tech. Ch.E. I-Sem L T/P/D C
 0 -/3/- 2

(55610) ADVANCED ENGLISH COMMUNICATION SKILLS LAB

1. Introduction

The introduction of the English Language 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 an integrated theory and lab course to enable students to use 'good' English and perform the following:

- Gather ideas and information, to organise ideas relevantly and coherently.
- Engage in debates.
- Participate in group discussions.
- Face interviews.
- Write project/research reports/technical reports.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- To take part in social and professional communication.

2. Objectives:

This Lab focuses on using computer-aided multimedia 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.

3. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

- Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- Vocabulary Building – synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.
- Reading Comprehension – reading for facts, guessing meanings from context, scanning, skimming, Inferring meaning, Critical reading.
- Writing Skills – structure and presentation of different types of writing – Resume writing / e-correspondence/Technical report writing/Portfolio writing – planning for writing – research abilities/ data collection/organizing data/tools/analysis – improving one's writing.
- Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- Presentation Skills – Oral presentations (individual and group) through JAM sessions/seminars and written presentations through posters/projects/reports/PPTs/e-mails/assignments etc.
- Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.

4. Minimum Requirement:

The English Language Lab shall have two parts:

- i) The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self-study by learners.
- ii) The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

- (iii) P – IV Processor
- a) Speed – 2.8 GHZ
- b) RAM – 512 MB Minimum
- c) Hard Disk – 80 GB
- iv) Headphones of High quality

5. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

Suggested Software:

- Clarity Pronunciation Power – part II
- Oxford Advanced Learner's Compass, 7th 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
- Team Building;
- Decision making
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge
- 6. Books Recommended:
- 1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.

2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. English Language Communication : A Reader cum Lab Manual Dr. A. Ramakrishna Rao, Dr G. Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.
4. English Vocabulary in Use series, Cambridge University Press 2008.
5. Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
7. Handbook for Technical Writing by David A McMurrey & Joanne Buckley CENGAGE Learning 2008.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
10. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.
11. Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/ Cambridge University Press.
12. International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:**Advanced Communication Skills Lab Practicals:**

1. The practical examinations for the English Language 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 a 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 with the help of another member of the staff of the same department of the same institution.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
0	-/-	2

(55611) PROCESS HEAT TRANSFER LAB

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
4	-/-	4

(56033) CHEMICAL TECHNOLOGY

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

Unit – II : Industrial gases: carbon dioxide, hydrogen and oxygen – products of water gas, producer gas. Nitrogen industries: synthetic ammonia, urea, nitric acid (ammonium nitrate), ammonium chloride, ammonium phosphate and complex fertilizers

Unit – III : Sulphur and sulphuric acid, manufacture of sulphuric acids, hydrochloric acid and some other chemicals –Aluminum sulphate and alum, barium salts rare earth compounds.

Unit – IV : Cement manufacture, special cements, miscellaneous calcium compounds, magnesium compounds.

Unit – V : Manufacture of phenols, formaldehyde, vinyl chloride and vinyl acetate, manufacture of phenol- formaldehyde resin and polyvinyl chloride polymer, SBR.

Unit – VI : Oils: Definition, constitution, extraction and expression of vegetable oils, refining and hydrogenation of oils.

UNIT-VII : Soaps and detergents: Definitions, continuous process for the production of fatty acids, glycerin and soap, production of detergents.

Unit – VIII : Pulp and paper industry: methods of pulping, production of sulphate and sulphite pulp, production of paper –wet process

TEXT BOOKS:

1. Shreve's Chemical Process Industries, 5th, Austin (editor), McGraw-Hill, 1985.
2. Dryden's Outlines of Chemical Technology, 2nd ed., M. Gopal Rao and M. Sittig (editors), 1973.

REFERENCE:

1. Chemical technology, V. Sujatha, P. Rajendra Prasad and V.M Mohan, Scitech Publications (India) Pvt Ltd. 2010.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
4	-/-	4

(56034) MASS TRANSFER OPERATIONS-II

UNIT-I

Distillation: Fields of applications, VLE for miscible liquids, immiscible liquids, steam distillation, Positive and negative deviations from ideality, enthalpy-concentration diagrams, flash vaporization and differential distillation for binary and multi component mixtures.

UNIT-II

Continuous rectification-binary systems, multistage tray towers –method of Mc Cabe and Thiele, enriching section, exhausting section, feed introduction, total reflux, minimum and optimum reflux ratios, use of steam, condensers, partial condensers, cold reflux, multiple feeds , tray efficiencies, continuous-contact equipment (packed towers)

UNIT-III

Multistage (tray) towers –the method of Ponchon and Savarit, the enriching and stripping sections, feed tray location, total reflux, minimum and optimum reflux ratios, reboilers, use of open steam, condenser and reflux accumulators, Azeotropic distillation, extractive distillation, comparison of Azeotropic and extractive distillation.

UNIT-IV

Liquid-Liquid operations: fields of usefulness, liquid-liquid equilibrium, equilateral triangular co-ordinates, choice of solvent, stage wise contact, multistage cross-current extraction, Multi stage counter current without reflux

UNIT-V

Multi stage counter current with reflux, Differential (continuous contact) extractors, spray towers, packed towers, mechanically agitated counter-current extractors, centrifugal extractors, dilute solutions, super critical fluid extraction, fractional extraction.

UNIT-VI

Leaching: Fields of applications, preparation of solid for leaching, types of leaching, leaching equilibrium, single stage and multi stage leaching

calculations, constant under flow conditions, equipment for leaching operation.

UNIT-VII

Adsorption: Adsorption, types of adsorption, nature of adsorbents, adsorption equilibrium, single gases and vapors. Adsorption Hysteresis, effect of temperature, Heat of adsorption, vapor and gas mixtures: One component adsorbed, Effect of change of temperature or pressure. Liquids, Adsorption of solute from dilute solution, The Freundlich equation, Adsorption from concentrated solutions, adsorption operations, stage wise operation, application of Freundlich equation to single and Multistage adsorption (cross current & counter current).

UNIT-VIII

Adsorption of vapor from a gas, fluidized bed, continuous contact, steady state moving bed adsorbers, unsteady state-fixed bed adsorbers, adsorption wave, elution, adsorption-desorption operations- thermal desorption of gases, activated carbon solvent recovery, pressure swing and vacuum swing adsorption (qualitative treatment), regeneration with purge and desorbent, ion-exchange: principles of ion exchange, techniques and applications, ion-movement theory, ion exclusion.

TEXT BOOK:

1. Mass Transfer Operations, 3rd ed., R. E. Treybal, McGraw-Hill, New York, 1980.

REFERENCES:

1. Transport Processes and Separation Process Principles 4th ed., C. J. Garkoplis, PHI, Learning Pvt. Ltd., New Delhi, 2009.
2. Principles of Mass Transfer and Separation Processes, B.K. Dutta, PHI Learning Pvt. Ltd., New Delhi, 2007.
3. Mass Transfer Operations, A. Suryanarayana, New Age International Publishers, Hyderabad, 2002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
4	-/-	4

(56035) CHEMICAL REACTION ENGINEERING – II

UNIT I

Basics of non-ideal flow: E, the exit age distribution function of fluid, the RTD, conversion in non-ideal flow reactors, diagonalizing reactors ill's (qualitative discussion only)

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

Unit VI

Heterogeneous reactions: Introduction. 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 VII

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

Unit-VIII

Fluid-fluid reactions: kinetics- the rate equation.

Fluid-particle reactions: kinetics- selection of a model, shrinking core model for spherical particles of unchanging size, rate of reaction for shrinking spherical particles, extensions, determination of rate controlling step.

TEXT BOOKS:

1. Chemical Reaction Engineering, 3rd ed., O. Levenspiel, John Wiley & Sons, 1999.
2. Elements of Chemical Reaction Engineering, 4th ed., H.S. Fogler, PHI Learning Pvt. Ltd., New Delhi, 2010.

REFERENCES:

1. Chemical Engineering Kinetics, 3rd ed., J.M. Smith, McGraw-Hill, New York, 1981.
2. The Engineering of Chemical Reactions, 2nd ed., L.D. Schmidt, Oxford University Press, New Delhi, 2010

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 III Year B.Tech. Ch.E. II-Sem L T/P/D C
 3 1/-/ 3

(56036) CHEMICAL ENGINEERING MATHEMATICS

UNIT I

Mathematical formulation of the Physical Problems: (i) Application of the law of conservation of mass-Salt accumulation in a stirred tank-starting an equilibrium still-solvent extraction in two stages- Diffusion with chemical reaction. (ii) Application of the law of conservation of energy-Radial heat transfer through a cylindrical conductor-Heating a closed Kettle-Flow of heat from a fin.

UNIT II

Analytical (explicit) solution of Ordinary differential equation encountered in chemical engineering problems. (i) First order differential equations- Method of separation of variables- Equations solved by Integration factors-certain examples involving Mass and Energy balances and Reaction Kinetics. (ii) Second order differential equations-Non-linear equations-linear equations- Simultaneous Diffusion and Chemical reaction in a Tubular reactor- Continuous hydrolysis of Tallow in a spray column.

UNIT III

(i) Formulation of partial differential equations-Unsteady state heat conduction in one dimension-Mass transfer with axial symmetry- Continuity equations. (ii) Boundary conditions-function specified-Derivative specified and Mixed conditions.

UNIT IV

(i) Iterative solution of algebraic equations. (a) Jacobi's method (b) Gauss-Siedel Method. (ii) Successive over-relaxation (S.O.R) method.

Unit V

(i) The difference operator-Properties of the difference operator- Difference tables and other difference operators. (ii) Linear finite difference equations-the complimentary solution of the particular solution-Simultaneous linear differential equations.

UNIT VI

Non-linear finite difference equations-analytical solution. Solution of the following type of problems by finite difference method.

- (a) Calculation of the number of plates required for an absorption column. (b) Calculation of the number of theoretical plates required for distillation column. (c) Number of steps required for a counter-current extraction and leaching operations.

UNIT VII

Application of Statistical Methods.

- (i) Propagation of errors of experimental data. (ii) Parameter estimation of algebraic equations encountered in Heat and Mass Transfer, Kinetics and Thermodynamics by (a) The method of averages (b) Linear least squares and (c) Weight linear least squares methods.

UNIT VIII

Design of experiments, Fractional factorial methods.

TEXT BOOKS:

1. "Applied Mathematics in Chemical Engineering" by H.S. Mickley, T. K. Sherwood and C.E.Reed, 2nd ed., Tata McGraw-Hill, Publications, 1975.
2. Applied Mathematical Methods for Chemical Engineers, Norman W. Loney, 2nd edition CRC press, 2007

REFERENCES:

© 2014 NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech., Ch.E. II-Sem.

L T/P/D C
3 1/-/- 3

(56037) MATERIALS SCIENCE FOR CHEMICAL ENGINEERS

UNIT-1

UNIT-1

Introduction: Engineering Materials – Classification – levels of structure.

Crystal Geometry and Structure Determination: Space lattice and Unit cell. Bravais lattices, crystal systems with examples. Lattice coordinates, Miller indices, Bravais indices for directions and places; crystalline and non crystalline solids; ionic, covalent and metallic solids; packing efficiency, ligancy and coordination number, structure determination by Bragg's X-ray diffraction and powder methods.

UNIT-II

Crystal Imperfection: Point defects, line defects-edge and screw dislocation, Berger's circuit and Berger's vectors, dislocation reaction, dislocation motion, multiplication of dislocations during deformation , role of dislocation on crystal properties, surface defects, dislocation density and stress required to move dislocations.

UNIT-HI

UNIT-III
Basic thermodynamic functions: phase diagrams and phase transformation: Primary and binary systems-general types with examples, tie line & lever rules, non equilibrium cooling: phase diagrams of Fe-Fe₃C, Pb-Sn, Cu-Ni systems.

UNIT-IV

Phase transformations in Fe-Fe₃C steels, Time-Temperature-Transformation (TTT) curves for eutectoid steels and plain carbon steels, effect of alloying elements on properties of steels; types of steels, alloys and other metals used in chemical industry.

UNIT-V

Elastic, an elastic and plastic deformations in solid materials; rubber like elasticity, viscoelastic behaviour (models); shear strength of real and perfect crystals work hardening mechanisms cold working, hot working; dynamic recovery, recrystallisation; grain growth, grain size

and yield stress Brief description of heat treatment in steels

UNIT-VI

Diffusion in solids: Fick's laws of diffusion, solution to Fick's second law, applications based on the second law solution, Kirkendall effect, atomic model diffusion, and other diffusion processes.

Magnetic materials: Terminology and classification, magnetic moments due to electron spin, ferro-magnetism and related phenomena, domain structure, hysteresis loop, soft and hard magnetic materials.

UNIT-VII

Fracture in ductile and brittle materials creep: mechanism of creep and methods to reduce creeping in materials, creep rates and relations. Fatigue-mechanisms and methods to improve fatigue resistance in materials. Composite materials: types; stress-strain relations in composite materials, applications.

UNIT-VIII

Oxidation and Corrosion: Mechanisms of oxidation, oxidation resistant materials, principles and types of corrosion, protection against corrosion.

TEXT BOOK:

1. Materials Science and Engineering, 5th ed. V. Raghavan, PHI Learning Pvt. Ltd., New Delhi, 2009.

REFERENCES:

1. Elements of Materials Science, L.R. Van Vlack,
 2. Science of Engineering Materials, vols. 1&2, Manas Chanda, McMillan Company of India Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 III Year B.Tech. Ch.E. II-Sem L T/P/D C
 3 1/- 3

(56038) BIOCHEMICAL ENGINEERING
 (Elective - I)

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.

Unit-II

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-III

Immobilized enzyme technology: enzyme immobilization, industrial processes, utilization and regeneration of cofactors. Immobilized enzyme kinetics: effect of external mass transfer resistance, analysis of intraparticle diffusion and reaction.

Unit-IV

Kinetics of cellular growth in batch and continuous culture, models for cellular growth – unstructured, structured and cybernetic models.

Thermal death kinetics of cells and spores

Unit-V

Introduction to metabolic pathways, biosynthesis, transport across cell membranes, end products of metabolism, stoichiometry of cell growth and product formation.

Unit - VI

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 – VII

Transport phenomena in bioprocess systems: Gas-liquid mass transfer in cellular systems, determination of oxygen transfer rates, overall k_{La} ' estimates and power requirements for sparged and agitated vessels, scaling of mass transfer equipment, heat transfer.

Unit – VIII

Down stream 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:

1. Biochemical Engineering Fundamentals, 2nd ed., J.E. Bailey and D.F. Ollis, McGraw-Hill, New York, 1987.
2. Bioprocess Engineering, 2nd ed., M. L. Shuler and F. Kargi, PHI Learning Pvt. Ltd, New Delhi, 2009.

REFERENCES:

1. Biochemical Engineering, J. M. Lee, Prentice-Hall, New Jersey 1992.
2. Bioprocess Engineering Principles, P. M. Doran, Elsevier, Gurgaon, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 III Year B.Tech. Ch.E. II-Sem L T/P/D C
 3 1/- 3

(56039) CORROSION ENGINEERING

(Elective - I)

Unit-I : Introduction: Corrosion principles, Electro- chemical aspects of Corrosion -environmental effects, Metallurgical aspects- corrosion rate expressions- methods of estimation of corrosion rates

Unit-II : Forms of corrosion 1: uniform attack, galvanic, crevice, pitting Corrosion

Unit-III : Forms of corrosion 2: Inter -granular corrosion, selective leaching, erosion- corrosion and stress corrosion cracking and remedial measures in brief.

Unit-IV : Corrosion testing procedures

Unit-V : Corrosion prevention: Material selection, alteration of environment-organic and inorganic coatings, linings, cladding, Passivity

Unit VI : Design principles, Cathodic Protection and Anodic Protection

Unit VII : Modern Theory, Mixed potential theory, Principles, Thermodynamics and Electrode Kinetics,

Unit VIII : Predicting corrosion behaviour, corrosion prevention and rate measurement

TEXT BOOK:

- Corrosion Engineering, 3rd ed., M.G. Fontana, McGraw Hill.

REFERENCES:

- Corrosion and Corrosion Control, H.H Uhlig
- Handbook of Corrosion Engineering, Pierre Roberge, McGraw-Hill, New York, 2000.
- Corrosion Basics: An Introduction, 2nd ed., Pierre Roberge, NACE Press Book, 2006.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 III Year B.Tech. Ch.E. II-Sem L T/P/D C
 3 1/- 3

(56040) PLASTICS MATERIALS

(Elective- I)

Unit I

Introduction : Fed stock of polymers- naphtha, liquefied petroleum gas, cracking of naphtha, etc., Polymer structure and its effect on polymer properties. Effect of light, moisture, gases, chemicals and heat on polymers.

Unit II

Manufacturing process of PE by Ziegler Natta, HDPE by low pressure process, nylon and poly vinyl chloride

Unit III

Properties, application and processing of commodity plastics-I: Polyolefins – Low density polyethylene (LDPE), linear low density polyethylene (LLDPE), high density polyethylene (HDPE), high molecular high density polyethylene (HMHDPE), Ultra high molecular weight polyethylene (UHMWPE).

Unit IV

Properties, application and processing of commodity plastics-II: polypropylene (PP), polypropylene copolymers, vinyl polymers – polyvinyl acetate (PVA), polyvinyl chloride (PVC), acrylic plastics – poly methyl methacrylate (PMMA), styrene polymers – polystyrene (PS), high impact polystyrene (HIPS), acrylonitrile butadiene styrene (ABS), styrene acrylonitrile (SAN), expanded polystyrene (EPS)

Unit V

Properties, application and processing of commodity plastics-III: Cellulosics – cellulose acetate (CA), cellulose acetate butyrate (CAB), cellulose nitrate (CN). Introduction to properties and application of polyvinyl dichloride (PVDC), polyvinyl alcohol (PVOH), ethyl vinyl acetate (EVA) and ethyl cellulose.

Unit VI

Properties, application and processing technique of engineering

plastics: polyamides – nylon 6, nylon 6-6, nylon 6-12, polyesters – poly butylenes terephthalate (PBT), poly ethylene terephthalate (PET), polycarbonate, polyacetal, poly tetra fluoroethylene (PTFE).

Unit VII

Properties, application and processing of thermosets materials:
phenol formaldehyde, urea formaldehyde, melamine formaldehyde,
epoxy resin, polyurethane.

Unit VII

Additives: introduction to additives and their function – fillers, plasticizers, colorants, heat stabilizers, antioxidants, UV absorber, antistatic agents, flame retardant, blowing agent, lubricants.

TEXTBOOKS:

1. Polymer Science, V.R. Gowariker,
 2. Plastics Materials, J.A. Brydson, Newnes-Butterworth (London) 1989.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. II-Sem

L-1 T/P/D

0 -/3/- 2

(56611) MASS TRANSFER OPERATIONS LAB

1. Estimation of diffusivity coefficients
Major equipment - Diffusivity apparatus
 2. Distillation, a) Steam distillation b) Differential distillation
Major equipment – a) Steam Distillation unit,
 b) Differential Distillation unit
 3. Packed towers, HETP evaluation
Major equipment - Packed column unit
 4. Vapor Liquid Equilibria
Major equipment - VLE apparatus
 5. Batch Drying
Major equipment - Tray Dryer
 7. Evaluation of Mass transfer coefficients
(a) Surface Evaporation (b) Wetted wall column
Major equipment – a) Surface Evaporation unit
 b) Wetted wall column unit
 8. (a) Liquid- Liquid Equilibria (Tie line data)
(b) Ternary Liquid Equilibria (binodal curve)
Major equipment – LLE setup

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
0	-/3/-	2

(56612) CHEMICAL REACTION ENGINEERING LAB

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
Major equipment - Packed bed set up
9. Determination of RTD and dispersion number in a tubular reactor using a tracer.
Major equipment - PFR set up

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
4	-/-/-	4

(57058) TRANSPORT PHENOMENA

Unit-I

Viscosity and the mechanisms of momentum transfer: Newton's law of viscosity (molecular momentum transport), generalization of Newton's law of viscosity, pressure and temperature dependence of viscosity, molecular theory of the viscosity of gases at low density, molecular theory of the viscosity of liquids.

Unit-II

Thermal conductivity and the mechanisms of energy transport: Fourier's law of heat conduction (molecular energy transport), temperature and pressure dependence of thermal conductivity, and theory of thermal conductivity of gases at low density.

Unit-III

Diffusivity and the mechanisms of mass transport: Fick's law of binary diffusion (molecular mass transport), temperature and pressure dependence of diffusivities, theory of diffusion in gases at low density.

Unit-IV

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-V

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-VI

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-VII

The equations of change for isothermal systems: the equation of continuity, the equation of motion, the equation of mechanical energy, the equation of angular momentum, the equations of change in terms of the substantial derivative, use of the equations of change to solve flow problems. Velocity distributions in turbulent flow: comparisons of laminar and turbulent flows, time- smoothed equations of change for incompressible fluids, the time- smoothed velocity profile near a wall.

Unit- VIII

The equations of change for non- isothermal systems: the energy equation, special forms of the energy equation, the Boussenq's equation of motion for forced and free convection, use of the equations of change to solve steady state problems. The equations of change for multi component systems: the equations of continuity for a multi component mixture.

TEXT BOOK:

1. Transport Phenomena, by R.B. Bird, W.C Stewart, F.N. Lightfoot, 2nd ed., John Wiley & Sons Inc, U.S.A, 2002.

REFERENCES:

1. Transport Processes and Separation Process Principles 4th ed., C. J. Geankoplis, PHI Learning Pvt. Ltd., New Delhi, 2009.
2. Fundamentals of Momentum, Heat and Mass Transfer, 3rd ed., J.R. Welty, C.E. Wicks and R.E. Wilson, John Wiley & Sons, New York, 1984.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
4	-/-	4

(57059) PROCESS DYNAMICS AND CONTROL

UNIT I : Introduction to process dynamics and control. Response of First Order Systems. Physical examples of first order systems

Unit-II: Response of first order systems in series, Higher order systems: Second order and transportation lag

Unit-III: Control system, Controllers and final control elements, Block diagram of a chemical reactor control system

Unit-IV: Closed loop transfer functions, Transient response of simple control systems

Unit-V: Stability, Root locus

Unit-VI: Transient response from root locus, Application of root locus to control systems, Introduction to frequency response, Control systems design by frequency response

Unit-VII: Advanced control strategies, Cascade control, feed forward control, ratio control, Smith predictor, dead time compensation, internal model control.

Unit -VIII: Controller tuning and process identification, Control valves

TEXT BOOK

1. Process Systems Analysis and Control, 2nd ed., D.R. Coughanowr, McGraw-Hill, 1991

REFERENCES

1. Chemical Process Control, G. Stephanopoulos, PHI Learning Pvt. Ltd., New Delhi, 2010
2. Process Control, B.W. Bequette, PHI Learning Pvt. Ltd., New Delhi, 2010
3. Outlines of Chemical Instrumentation and Process Control, 3rd ed., A. Suryanarayana, Khanna Publishers, New Delhi, 2010.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L T/P/D C

4 -/- 4

(57060) CHEMICAL PROCESS EQUIPMENT DESIGN

Unit-I: Introduction; development of flow diagrams from process description, material and energy balance, sizing of equipment, design preliminaries, design codes, MOC selection procedure, fabrication methods and testing methods.

Unit-II : Stresses in thin and thick walled shells, theories of failure, design of storage vessels

Unit-III : Design of pressure vessels

Unit-IV : Design of shell and tube heat exchangers

Unit-V : Design of single effect evaporator

Unit-VI : Design of distillation and absorption columns

Unit-VII : Design of batch reactor, CSTR and PFR

Unit-VIII : Optimum pipe diameter

TEXT BOOK:

1. Coulson & Richardson's Chemical Engineering Design, Vol.6, 4th ed., R.K. Sinnott, Butterworth-Heinemann (Elsevier), Oxford, 2005

REFERENCES:

1. Joshi's Process Equipment Design, 4th ed., V.V. Mahajani and S.B. Umarji, Macmillan Publishers India Ltd. Delhi, 2009.
2. Process Equipment Design-Vessel Design, Brownell L.E., Wiley Eastern Ltd.,(1986)
3. Introduction to Chemical Equipment Design-Mechanical Aspects, Bhattacharya B.C., CBS Publishers, 1991
4. Process Heat Transfer, D.Q. Kern., Tata McGraw-Hill, New Delhi1997.
5. Mass Transfer Operations, R.E. Treybal, McGraw-Hill, New York, 1982
6. Perry's Chemical Engineers Handbook, 8th ed., McGraw-Hill, New York, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L T/P/D C

3 1/- 3

(57061) PROCESS MODELING AND SIMULATION

UNIT-I

Mathematical models for chemical engineering systems, fundamentals, introduction to fundamental laws

UNIT -II

Examples of mathematical models of chemical engineering systems, constant volume CSTRs, two heated tanks, gas phase pressurized CSTR, non-isothermal CSTR.

UNIT -III

Examples of single component vaporizer, batch reactor, reactor with mass transfer, ideal binary distillation column, batch distillation with holdup.

UNIT -IV

Iterative methods, bisection, false position, Newton –Raphson, successive approximation methods, comparison of iterative methods, solution of linear simultaneous algebraic equations, Computation of Eigen values and Eigen vectors, Gauss elimination method, Gauss-Jordan and Gauss-Seidel's method.

UNIT -V

Numerical integration by Trapezoidal and Simpson's rules, numerical solution of differential equations, Euler method, Runge-Kutta fourth order method, Milne predictor corrector method.

UNIT -VI

Interpolation, Lagrange interpolation, forward difference, backward difference and central difference interpolation methods, least square approximation of functions, linear regression, polynomial regression.

UNIT -VII

Computer simulation, examples, gravity flow tank, three CSTRs in series, binary distillation column, batch reactor

UNIT -VIII

Simulation of Non-isothermal CSTR, VLE dew point, bubble point calculations, countercurrent heat exchanger

TEXTBOOKS:

1. Process modeling, Simulation and Control for Chemical Engineers, 2nd ed., W. L. Luyben, McGraw-Hill, New York, 1990.
2. Numerical Methods for Engineers, S.K. Gupta, Wiley Eastern, New Delhi, 1995.

REFERENCE:

1. Modeling and Analysis of Chemical Engineering Processes, K. Balu and K. Padmanabhan, I.K. International Private Limited, 2007
2. Introduction to Numerical Methods in Chemical Engineering, P. Ahuja, PHI learning Pvt. Ltd., New Delhi, 2010
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, New Delhi, 2009

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
3	1/-	3

(57062) INDUSTRIAL SAFETY AND HAZARD MANAGEMENT**Unit I**

Introduction: Safety program, Engineering ethics, Accident and loss statistics, Acceptable risk, Public perception.

Unit II

Toxicology: How toxicants enter biological organisms, How toxicants are eliminated from biological organisms.

Unit III

Industrial Hygiene: Government regulations, Identification, Evaluation, Control.

Unit IV

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 V

Designs to prevent fires and explosions: Inerting, Explosion proof equipment and instruments, Ventilations, Sprinkler systems.

Unit VI

Introduction to Reliefs: Relief concepts, Definitions, Location of reliefs, Relief types, Data for sizing reliefs, Relief systems.

Unit VII

Relief Sizing: Conventional spring operated relief's in liquids, Conventional spring operated relief's in vapor or gas service, Rupture disc relief's in liquid, vapour or gas service.

Unit VIII

Hazards Identification: Process hazards checklists, Hazard surveys, Hazop safety reviews.

TEXT BOOK:

1. Chemical Process Safety (Fundamentals with applications), D.A.Crowl & J.F.Louvar, Prentice Hall, New Jersey,(1990).

REFERENCES:

1. Safety and Accident Prevention in Chemical Operations, 2nd ed., H. H. Fawcett and W.S. Wood, John Wiley and Sons, New York 1982
2. Coulson and Richardson's – Chemical Engineering, Vol.6, R.K.Sinnot, , Butterworth-Heinemann Limited 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
3	1/-/-	3

(57063) ENVIRONMENTAL BIOTECHNOLOGY

(Elective- II)

Unit I

Environmental monitoring: sampling; physical, chemical and biological analysis, recombinant DNA technology, determination of biodegradable organic material, monitoring pollution, bioindicators, biomarkers, toxicity testing using biological material, biosensors.

Unit II

Biological sewage treatment: pollution caused by biodegradable material; function of wastewater treatment system, sewage treatment methods, modifications to existing processes, removal of nitrogen and phosphorous, sludge treatment and disposal, anaerobic digestion, agricultural waste and industrial waste.

Unit III

Bioremediation: synthetic compounds, petrochemical compounds, inorganic wastes, bioremediation strategies, bioremediations techniques in situ and ex situ, Phytoremediation, metals and gaseous bioremediation, biochemical pathways of biodegradation.

Unit IV

Biotechnology and sustainable technology: provision of bulk and fine chemicals, microbial polymers and plastics, industrial processes and clean technology.

Unit V

Biofuels: finite supply of fossil fuels, emissions from fossil fuels, greenhouse gases, natural sources of greenhouse gases, ozone, sulfur dioxide, effects of industrial activity, remediation of the emissions form fossil fuels, alternative non-fossil energy sources, biological energy sources, combustion of biomass, biogas, biodiesel, ethanol, hydrogen.

Unit VI

Natural resource recovery: oil recovery, recovery of metals.

Agricultural biotechnology: detection and diagnostics, micro propagation, somatic cell genetics, production of transgenic plants, safety of transgenic crops, transgenic plants and animals, disease control, germplasm and biodiversity.

Unit VII

Biotechnology of the marine environment: pharmaceuticals, molecular biology products, polymers, enzymes and transgenic organisms, micro algae and marine population.

Unit VIII

Specific topics: Exxon Valdez oil spill, acid mine drainage, Wheal Jane, environmental legislation.

TEXTBOOK:

1. Environmental Biotechnology, A., Scraag, Oxford University Press, New Delhi, 2005

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
3	1/-	3

(57064) POLYMER TECHNOLOGY

(Elective - II)

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) resin
- iv) cellulose v) proteins.

Unit-III

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-IV

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-V

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-VI

Brief description of manufacture, properties and uses of: i) Polyethylene (HDPE&LDPE), ii) Poly propylene iii) Polyvinylchloride iv) Polystyrene v) Polytetra fluoroethylene vi) Polymethyl methacrylate vii) Polyvinylacetate & Polyvinylalcohol.

Unit-VII

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

Unit-VIII

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:

1. Polymer Science & Technology, 2nd ed., J.R. Fried, PHI Learning Pvt. Ltd., New Delhi, 2009
2. Plastic materials, J.A. Brydson, Newnes-Butterworth (London) 1989.

REFERENCES:

1. Text book of polymer science, F.W.Jr. Bill Meyer, (3rd ed.) John Wiley&sons 1984
2. Introduction to Plastics, J.H. Brison and C.C. Gosselin, Newnes-Butterworth, London 1968.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
3	1/-	3

(57065) PETROLEUM AND PETROCHEMICAL TECHNOLOGY (Elective - II)

UNIT I

Origin, formation and composition of petroleum: Origin and formation of petroleum, Reserves and deposits of world, Indian Petroleum Industry.

Unit-II

Petroleum processing data: Evaluation of petroleum, thermal properties of petroleum fractions, important products, properties and test methods.

Unit-III

Fractionation of petroleum: Dehydration and desalting of crudes, heating of crude pipe still heaters, distillation of petroleum, blending of gasoline.

Unit-IV

Treatment techniques: fraction-impurities, treatment of gasoline, treatment of kerosene, treatment of lubes.

Unit-V

Thermal and catalytic processes: Cracking, catalytic cracking, catalytic reforming, Naphtha cracking, coking, Hydrogenation processes, Alkylation processes, Isomerization process.

Unit-VI

Petrochemical Industry – Feed stocks

Unit-VII

Chemicals from methane: Introduction, production of Methanol, Formaldehyde, Ethylene glycol, PTFE, Methylamines.

Unit-VIII

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.

TEXT BOOKS:

1. Petroleum Refining Engineering, 4th ed., W.L. Nelson, McGraw-Hill, New York, 1958.
2. Modern Petroleum Refining Processes, 4th ed., B.K. Bhaskara Rao, Oxford & IBH Publishing, 2002.

REFERENCES:

1. Shreve's Chemical Process Industries, 5th ed., G.T.Austin, McGraw-Hill, New York, 1984.
2. Chemical Technology of Petroleum, W.S.Gruese and D.R. Stevens, McGraw-Hill, 1980

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem

L	T/P/D	C
0	/3/-	2

(57611) PROCESS DYNAMICS AND CONTROL LAB

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. I-Sem L T/P/D C
 0 -/3/- 2

(57612) SIMULATION LAB

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

MATLAB

1. Gravity Flow tank.
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

Major requirements are Personal Computer and MATLAB Software.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
3	1/-	3

(58043) INDUSTRIAL POLLUTION CONTROL ENGINEERING**Unit-I**

Types of emissions from chemical industries and effects of environment, environment legislation, Type of pollution, sources of wastewater, Effluent guidelines and standards,

Unit-II

Characterization of effluent streams, oxygen demands and their determination (BOD, COD, and TOC), Oxygen sag curve, BOD curve mathematical, controlling of BOD curve, self purification of running streams, sources and characteristics of pollutants in fertilizer, paper and pulp industry, petroleum and petroleum industry.

Unit-III

General methods of control and removal of sulfur dioxide, oxides of nitrogen and organic vapors from gaseous effluent, treatment of liquid and gaseous effluent in fertilizer industry.

Unit-IV

Air pollution sampling and measurement: Types of pollutant and sampling and measurement, ambient air sampling: collection of gaseous air pollutants, collection of particulate air pollutants. Stack sampling: sampling system, particulate sampling, and gaseous sampling. Analysis of air pollutants: Sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and Ozone, hydrocarbons, particulate matter.

Unit-V

Air pollution control methods and equipments: Source collection methods: raw material changes, process changes, and equipment modification. Cleaning of gaseous equipments particulate emission control: collection efficiency, control equipment like gravitational settling chambers, Cyclone separators, fabric filters, ESP and their constructional details and design aspects. Scrubbers: wet scrubbers, spray towers, centrifugal scrubbers, packed beds and plate columns,

venturi scrubbers, their design aspects. Control of gaseous emissions: absorption by liquids, absorption equipments, adsorption by solids, equipment and the design aspects.

Unit-VI

Introduction to waste water treatment, biological treatment of wastewater, bacterial and bacterial growth curve, aerobic processes, suspended growth processes, activated aerated lagoons and stabilization ponds,

Attached growth processes, trickling filters, rotary drum filters, anaerobic processes.

Unit-VII

Methods of primary treatments: screening, sedimentation, flotation, neutralization, and methods of tertiary treatment. A brief study of carbon absorption, ion exchange, reverse osmosis, ultra filtration, chlorination, ozonation, treatment and disposal.

Unit-VIII

Hazardous waste management: Nuclear wastes: health and environment effects, sources and disposal methods; chemical wastes: health and environmental effects, treatment and disposal: treatment and disposal by industry, off site treatment and disposal, treatment practices in various countries. Biomedical wastes: types of wastes and their control.

TEXT BOOKS:

- Environmental Pollution and Control Engineering, C. S. Rao – Wiley Eastern Limited, India, New Delhi, 1993.
- Pollution Control in Process Industries, S.P. Mahajan, Tata McGraw-Hill, New Delhi, 1985.

REFERENCES:

- Wastewater Treatment, M. Narayana Rao and A.K.Datta, Oxford and IHB publ. New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
3	1/-	3

(58044) MEMBRANE TECHNOLOGY

(Elective-III)

UNIT-I

Introduction: Separation process, Introduction to membrane processes, definition of a membrane, classifications membrane processes.

UNIT-II

Preparation of Synthetic membranes: Types of Membrane materials, preparation of Synthetic membranes, phase inversion membranes, preparation technique for immersion precipitation, preparation technique for composite membranes.

UNIT-III

Characterization of membranes: Introduction, membrane characterization, characterization of porous membranes, characterization of non-porous membranes.

UNIT-IV

Transport in membranes: introduction, driving forces, non equilibrium thermodynamics, transport through porous, non-porous, and ion exchange membranes.

UNIT-V

Membrane Processes: Introduction, osmosis, pressure driven membrane processes: Introduction, microfiltration, membranes for microfiltration, industrial applications, ultrafiltration: membranes for ultrafiltration, industrial applications, reverse Osmosis and nanofiltration: membranes for reverse osmosis and nanofiltration, industrial applications, Electrically Driven processes: Introduction, electrodialysis, Process parameters, membranes for electrodialysis, applications, Membrane electrolysis, Bipolar membranes, Fuel Cells

UNIT-VI

Concentration driven membrane processes: gas separation: gas separation in porous and non porous membranes, membranes for

gas separation, applications, pervaporation, membranes for pervaporation, applications, dialysis: membranes for dialysis, applications, liquid membranes: aspects, liquid membrane development, choice of the organic solvent and carrier, applications, introduction to membrane reactors,

UNIT-VII

Polarization phenomenon and fouling: Introduction to concentration polarization, turbulence promoters, pressure drop, gel layer model, osmotic pressure model, boundary layer resistance model, concentration polarization in diffusive membrane separations and electro dialysis, membrane fouling, methods to reduce fouling, compaction.

UNIT-VIII

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:

1. Membrane Separations, M.H.V. Mulder, Springer Publications, 2007
2. Rate-Controlled Separations, P. C. Wanket, Elsevier Applied Science, London, 1994.

REFERENCES:

1. Membrane Technology in the Chemical Industry, S.P. Nunes, K.V. Peinemann, Wiley-VCH
2. Membrane Processes in Separation and Purification, J.G.Crespo, K.W.Bodekes, Kluwer Academic Publications.
3. Membrane Separation Processes, K. Nath, PHI Pvt. Ltd., New Delhi, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
3	1I-I-	3

(58045) FLUIDIZATION ENGINEERING

(Elective-III)

Unit-I

Introduction: The phenomenon of fluidization; liquid like behaviour of a fluidized bed; Comparison with other contacting methods; Advantages and disadvantages of fluidized beds.

Unit-II

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 phthalic anhydride; Acrylonitrile; Polymerization of olefins; FCCU; Fluidized combustion of coal; incineration of solid waste; Activation of carbon; gasification of waste; bio-fluidization.

Unit-III

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; turbulent fluidization; pneumatic transport of solids; fast fluidization; solid circulation systems; Voidage diagram; Mapping of regimes of fluidization.

Unit-IV

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

Unit-V

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

Unit-VI

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-VII

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

Unit-VIII

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

TEXT BOOK:

- Fluidization Engineering, 2nd ed., D. Kunii and O. Levenspiel, Butterworth-Heinemann, London, 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E II-Sem

L	T/P/D	C
3	1/-	3

(58046) PLANT DESIGN AND ECONOMICS**(Elective- III)****Unit-I**

Introduction, Process Design development. General design considerations, Cost and asset accounting.

Unit-II

Cash flow for industrial operations, factors effecting investment and production cost, capital investments, estimation of capital investments, cost indices, cost factors in capital investment.

Unit-III

Organizations for presenting capital investments, estimates by compartmentalization, estimation of total product of cost direction, production costs, fixed charges, plant overhead costs, financing.

Unit - IV

Interest and investment cost, type interest, nominal and effective interest rates, continuous interest, present worth and discount annuities, cost due interest on investment, source of capital.

Unit-V

Taxes and insurances, type of taxes: federal income taxes, insurance-types of insurance, self insurance.

Unit – VI

Depreciation : types of depreciation, services life, salvage value, present value, methods for determining depreciation, single unit and group depreciation.

Unit-VII

Profitability: alternative investments and replacements, profitability standards, discounted cash flow, capitalized cost, pay out period, alternative investments, analysis with small investments, increments and replacements.

Unit- VIII

Optimum design and design strategy, incremental cost, general procedure for determining optimum condition, comparison of graphical and analytical methods, optimum production rates, semi continuous cyclic operation, fluid dynamics, mass transfer strategy of linearization

TEXT BOOK:

1. Plant Design and Economics for Chemical Engineering, 4th ed., M.S. Peters and K.D. Timmerhaus, McGraw-Hill, 1991

REFERENCE:

1. Process Engineering Economics, Schweyer,

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Ch.E. II-Sem

L T/P/D C

3 1/- 3

(58047) DESIGN AND ANALYSIS OF EXPERIMENTS

(Elective - IV)

Unit I

Introduction to the role of experimental design; basic statistical concepts; sampling and sampling distribution;

Unit II

Testing of hypotheses about differences in means- randomized designs and paired comparison designs; testing of hypotheses about variances

Unit III

Analysis of variance (ANOVA) –one-way classification ANOVA; analysis of fixed effects model; comparison of individual treatment means; the random effects model; the randomized complete block design

Unit IV

Factorial design of experiments; two-factor factorial design-fixed effects and random effects model;

Unit V

General factorial design; analysis of 2^k and 3^k factorial designs

Unit VI

Conforming in the 2^k factorial design in 2^p block; confounding in the 3^k factorial design in 3^p block;

Unit VII

Fractional replication of the 2^k factorial design and the 3^k factorial design

Unit VIII

Regression analysis- Simple and multiple linear regression and hypothesis testing; response surface methodology-the method of steepest ascent : response surface designs for first-order and second-order models. Evolutionary operation(EVOP)

TEXT BOOK:

1. Design and analysis of experiments, 2nd ed., D.C.Montgomery, John Wiley and Sons, New York, 2003.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
IV Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
3	1/-	3

**(58048) TECHNOLOGY OF PHARMACEUTICALS
AND FINE CHEMICALS
(Elective - IV)**

Unit I

A brief outline of grades of chemicals, sources of impurities in chemicals, principles (without going into details of individual chemicals) of limit test for arsenic, lead, iron, chloride and sulfate in Pharmaceuticals.

Unit II

Outlines of Preparation, properties, uses and testing of the following Pharmaceuticals - sulfacetamide, paracetamol, riboflavin, nicotinamide,

Unit III

Outlines of Preparation, properties, uses and testing of the following fine chemicals - Methyl orange, fluorescence, procaine hydrochloride, paramino salicylic acid, isonicatinic acid hydrazide.

Unit IV

Manufacture with flowsheets, properties uses and testing of the following Pharmaceuticals – aspirin, penicillin, calcium gluconate,

Unit V

Manufacture with flowsheets, properties uses and testing of the following ferric ammonium citrate, phthalic anhydride and phenol fluorobenzene process and benzene sulfate process, other processes in outline only.

Unit VI

Tablet making and coating, granulation equipments

Unit VII

Preparation of capsules, extraction of crude drugs.

Unit VIII

Sterilization: introduction, risk factor, methods of sterilization, heat (dry

and moist), heating with bactericide, filtration, gaseous sterilization and radiation sterilization, suitable example to be discussed.

TEXT BOOKS:

1. Remington's Pharmaceutical Science, 16th ed, Mac publishing company, 1980.
2. Industrial Chemicals, 3rd ed., Faith, Kayes and Clark, John Wiley & Sons., 1965.

REFERENCE:

1. Blently's Text Book of Pharmaceutical Chemistry, 8th ed, H A Rawlins, B Tindell and Box., Oxford University Press, London, 1977.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
IV Year B.Tech. Ch.E. II-Sem

L	T/P/D	C
3	1/-	3

**(58049) OPTIMIZATION OF CHEMICAL PROCESSES
(ELECTIVE - VII)**
Unit-I : Nature and organization of optimization problems:

what optimization is all about, Why optimize, scope and hierarchy of optimization, examples of applications of optimization, the essential features of optimization problems, general procedure for solving optimization problems, obstacles to optimization. Classification of models, how to build a model, fitting functions to empirical data, the method of least squares, factorial experimental designs, fitting a model to data subject to constraints.

Unit-II : Basic concepts of optimization:

Continuity of functions, unimodal versus Multimodal functions. Convex and Concave functions, Convex region, Necessary and sufficient conditions for an extremum of an unconstrained function, interpretation of the objective function in terms of its quadratic approximation.

Unit-III : Optimization of unconstrained functions: one-dimensional search:

Numerical methods for optimizing a function of one variable, scanning and bracketing procedures, Newton's, Quasi-Newton's and Secant methods of uni-dimensional search, region elimination methods, polynomial approximation methods, how the one- dimensional search is applied in a multi-dimensional problem, evaluation of uni-dimensional search methods.

Unit-IV

Unconstrained multivariable optimization: Direct methods, random search, grid search, uni-variate search, simplex method, conjugate search directions, Powell's method, indirect methods- first order, gradient method, conjugate method, indirect method- second order; Newton's method forcing the Hessian matrix to be positive definite, movement in the search direction, termination, summary of Newton's method, relation between conjugate gradient methods and Quasi-

Newton method.
Unit – V : Linear programming and applications:

Basic concepts in linear programming, Degenerate LP's – graphical solution, natural occurrence of linear constraints, the simplex method of solving linear programming problems, standard LP form, obtaining a first feasible solution, the revised simplex method, sensitivity analysis, duality in linear programming, the Karmarkar algorithm, LP applications.

Unit-VI

Optimization of Unit operations-1 recovery of waste heat, shell & tube heat exchangers, evaporator design, liquid liquid extraction process, optimal design of staged distillation column.

Unit-VII

Optimization of Unit operations-2 Optimal pipe diameter, optimal residence time for maximum yield in an ideal isothermal batch reactor, chemostat, optimization of thermal cracker using liner programming.

Unit-VIII

Genetic Algorithms: (Qualitative treatment) Working principles, differences between GAs and traditional methods, similarities between GAs and traditional methods, GAs for constrained optimization, other GA operators, real coded GAs, Advanced Gas

TEXT BOOKS:

1. Optimization of Chemical Processes, T.F. Edgar and D.M. Himmelblau, McGraw-Hill, New York, 2001.
2. Optimization for Engineering Design, Kalyan Moy Deb, PHI Pvt. Ltd., New Delhi, 2000

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 IV Year B.Tech. Ch.E. II-Sem L T/P/D C
 0 -/-/ - 2

(58621) INDUSTRY ORIENTED MINI PROJECT

- a. Observation of operating chemical plants. Noting down operating procedures, construction details, management procedures. Doing a project related to the selected industry.
- b. Developing experimental setup and studying the effect of operating parameters on process performance

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 IV Year B.Tech. Ch.E. II-Sem L T/P/D C
 0 -/6/- 2

(58622) SEMINAR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
 IV Year B.Tech. Ch.E. II-Sem L T/P/D C
 0 -/15/- 10

(58623) 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