

**ANIL NEERUKONDA
INSTITUTE OF TECHNOLOGY AND SCIENCES
(AUTONOMOUS)**

ACCREDITED BY NBA & NAAC WITH 'A' GRADE

Affiliated to Andhra University



**Academic Regulations
Curriculum &
Syllabi (First Year I & II Sem)**

**DEPARTMENT OF
CHEMICAL ENGINEERING**

**ANIL NEERUKONDA INSTITUTE OF
TECHNOLOGY AND SCIENCES
(AUTONOMOUS)**

VISION

ANITS envisions to emerge as a world-class technical institution whose products represent a good blend of technological excellence and the best of human values.

MISSION

To train young men and women into competent and confident engineers with excellent communicational skills, to face the challenges of future technology changes, by imparting holistic technical education using the best of infrastructure, outstanding technical and teaching expertise and an exemplary work culture, besides moulding them into good citizens.

QUALITY POLICY

ANITS is engaged in imparting quality technical education. It constantly strives towards achieving high standards of teaching, training and development of human resources by encouraging its faculty and staff to work as a team and to update their knowledge and skills continually to match the needs of industry.

Foreword

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES (ANITS) was founded by Anil Neerukonda Educational Society (ANES) in the fond memory of Anil Neerukonda, son of Dr. B R Prasad Neerukonda.

Its humble journey started in 2001 with an intake of 220 students into four undergraduate B.Tech programmes. Within 14 years of its establishment, the institute registered phenomenal growth and is accredited by NAAC with ‘A’ and by NBA for the second time. It is permanently affiliated to Andhra University and has achieved autonomous status in 2015. Further, the institute has been currently ranked as 4th among the private engineering colleges in Andhra Pradesh by APSCHE. It has been recognised as “Centre for Excellence” by Infosys and is accorded by Andhra University as “Centre for Research”.

Today, the institute offers seven B.Tech. programmes and four M.Tech. programmes with an annual total intake about 1100 students. The institute offers amenities like separate hostels for boys and girls, indoor and outdoor games, transport covering all the major locations of Visakhapatnam and medical aid provided by Anil Neerukonda hospital and NRI Institute of Medical Sciences, another educational institution of ANES.

Apart from the State-of-the-Art laboratories, well established teaching methodology and implementation of the best practices, the wonderful co-ordination of the Management, Faculty and Parents has so far played a crucial role in shaping the future of the ANITIANS and has been the talisman of the Institute’s phenomenal growth.

The success stories of our champions at several qualifying exams for the higher studies like GRE, TOEFL, CAT and GATE, the impressive track record of the placements with highest known packages in MNCs like Google, Oracle, Infosys, TCS and so on are the sweetest fruits of our efforts.

PRAGNANAM BRAHMA, the motto of ANITS, is truly practiced by all the members of ANITS family, a direct effort to serve the society, nation and the mankind as well.

Hearty welcome to ANITS family.

Prof. T.V. Hanumantha Rao
PRINCIPAL

Achievements & Highlights

- Autonomous since May 2015
- NAAC with 'A' Grade
- Accredited and reaccredited by NBA, New Delhi
- UGC recognition under 2(f) and 12(B)
- Permanent affiliation to Andhra University, Visakhapatnam
- Among top 3 most preferred colleges in A.P.
- "AAA" rating accorded by "Careers Digest 360"
- Recognized as a Research Center by Andhra University
- Selected as Skill Development Center (SDC) by Govt. of A.P.
- First institute to be accorded "Center for Excellence" by Infosys
- Ranked 3rd among the Promising Private Engineering Colleges for excellence as per Competition Success Review (CSR) magazine in the year 2016.
- Recognized as "Silver Partner" of Keane India (Chennai) for the year 2007-2008
- Collaborated with "Mission (R&D)" funded by Wipro
- "On Campus Training" by IBM for the students
- Collaboration with Unisys Global Solutions India (Bangalore) for internship
- Highest package offer around 2 crores including perks – highest offer in South India
- 8 lacs to 10 lacs packages –for majority ANITIANS

Contents

1. Department Profile
2. Vision & Mission of the Department
3. Program Educational Objectives
4. Program Outcomes & Program Specific Outcomes
5. Academic Regulations
6. Curriculum
7. First Year Syllabi (I-Sem& II-Sem)

Department Profile

The Department of **Chemical Engineering**, ANITS was started in the year 2012. The department offers B. Tech. Chemical Engineering with an intake of 60 students and M. Tech. Biotechnology with an intake of 18 students. The department has 15 qualified faculty members who have their degrees from premier institutes like IITs, IISc, NITs, BITS Pilani and Andhra University and a few of them have more than 30 years of teaching and research experience in Chemical Engineering. The department is sanctioned with a UGC major research project for an amount of Rs. 12.39 lakhs in 2014. The department is offering consultancy to various industries in and around Visakhapatnam. The faculty members have expertise in core Chemical Engineering and interdisciplinary research in the areas of Computational Biology, Bio-process Engineering, Bio-fuels, Photo-Catalytic Degradation, Chemical Reaction Engineering, Process Simulation and Industrial Pollution Control. The faculty published research papers in national and international journals of high repute. The department is well equipped with laboratories of worth Rs.50 lakhs in addition to major equipment like gas chromatography, UV spectrophotometer and bioreactor. The students are exposed to latest and innovative developments in Chemical Engineering as well as to co-curricular activities like attending workshops, seminars and presenting research papers in various conferences and seminars. Some of them have secured prizes in paper presentations, technical quiz etc. at reputed institutes like NIT, Warangal and across India.

DEPARTMENT OF CHEMICAL ENGINEERING

VISION

To train the students to meet the challenging needs of Chemical Engineering practices and attain global recognition in research.

MISSION

- *To provide high quality engineering education to cater to the needs of industry and society.*
- *To train young and budding engineers with fundamentals of Chemical Engineering principles and mould them as competent engineers to choose their career path either in industry or research in core and multidisciplinary fields.*
- *To nurture industry-academia relationship for mutual benefit and growth.*

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO-1. To prepare students with adequate academic knowledge in basic sciences like Mathematics, Physics and Chemistry while giving more emphasis on subjects in Chemical Engineering, so as to enable them to meet the needs of chemical and related industries and to excel in postgraduation programmes.
- PEO-2. To provide academic training in the fundamentals of Chemical Engineering and application of its knowledge to interdisciplinary fields like Biotechnology and Nanotechnology. The major thrust is towards the integration of the theoretical knowledge of Chemical Engineering with the hands-on experience such that graduates will be competent to solve problems in industry and society.
- PEO-3. To train students in the advanced and interdisciplinary fields of Chemical Engineering and also to provide hands-on experience in obtaining relevant data for the design of equipment and to optimize the parameters needed for the manufacture of chemicals, pharmaceutical and biotechnology products.
- PEO-4. To provide entrepreneurship skills, to motivate them to professional and ethical issues, to encourage them to carry out interdisciplinary projects in the field of Biotechnology, Nanotechnology and Environmental Pollution Control and also to enhance ability for solving Chemical Engineering tasks concerned with broader social context.
- PEO-5. The programme also provides facilities conducive to make measurements and interpret data from living systems, addressing the problems associated with the interaction between living and non living materials and systems.

PROGRAM OUTCOMES (POs)

- PO - 1 : The graduates will have necessary background in basic sciences including Mathematics, Physics and Chemistry and Chemical Engineering core subjects particularly Fluid Mechanics, Heat Transfer, Mass Transfer, Chemical Technology, Chemical Reaction Engineering, Transport Phenomena, Chemical Process Equipment and Design, Process Dynamics and Control & Process Modeling.
- PO - 2 : Graduates will be confident to identify the Chemical Engineering problems and will be able to formulate in terms of mathematical modeling and simulation and eventually will solve industrial problems.
- PO - 3 : Graduates will demonstrate the ability not only to design and conduct experiments in Chemical Engineering laboratories but also interpret and analyze resulting data that will be useful for chemical equipment design.
- PO - 4 : Graduates will have the ability to analyze the problems and give solutions related to Chemical Engineering industry.
- PO - 5 : Graduates will be competent to carry out interdisciplinary research in Bioprocess Engineering, Biofuels, Nanotechnology, Industrial Pollution Control etc.
- PO - 6 : Graduates will gain skills to use modern engineering tools, including softwares like C-Language, Mathematica, Aspen, Fluent and MATLAB for the design, modeling and analysis studies.

- PO - 7 : Graduates will be conscious about the impact of Chemical Engineering for solving issues concerned with the society like the need for tackling contemporary issues like global warming and pollution control, etc.
- PO - 8 : Graduates will understand their professional and ethical responsibility.
- PO - 9 : Graduates will have effective communication skills in both verbal and non-verbal and will have the spirit of team work.
- PO - 10 : Graduates will realize the need of self education and life-long learning process in order to keep abreast with the ongoing rapid developments in the field of Chemical Engineering.
- PO - 11 : Graduates will have motivation to participate and succeed in competitive exams like GATE, CAT, GRE etc.,

PROGRAM SPECIFIC OUTCOMES (PSOs)

- PSO-I To develop fundamental knowledge of various unit operations and processes by making use of the concepts of Mathematics, Basic and Engineering sciences.
- PSO-II To identify, formulate, analyze and design the problems related to the Chemical Engineering background.
- PSO-III To endure their professional practice in Chemical Engineering to accomplish the contemporary needs of Chemical and related industries.

ACADEMIC REGULATIONS

ACADEMIC REGULATIONS FOR B.TECH PROGRAMME UNDER AUTONOMOUS STATUS

(W.E.F. THE ADMITTED BATCH OF 2015-16)

I. Admissions:

Admissions into first year of B.Tech.Programme and admissions into second year (lateral entry) of B.Tech.Programme of the Institute will be as per the norms stipulated by Andhra University & Andhra Pradesh State Council for Higher Education (APSCHE), Govt. of Andhra Pradesh. The academic regulations of Autonomous status mentioned herewith will be applicable from 2016-17 in case of Lateral Entry admissions.

II. Programmes Offered:

The following are the B.Tech. Programmes offered by the Institute.

- 1 Chemical Engineering
- 2 Civil Engineering
- 3 Computer Science & Engineering
- 4 Electrical & Electronics Engineering
- 5 Electronics & Communication Engineering
- 6 Information Technology
- 7 Mechanical Engineering

III. Structure of the B. Tech. Programme:

The programme consists of Humanities, Basic Sciences, Engineering Sciences and Technology. The complete programme is distributed over eight semesters with two semesters per academic year. Every branch of B.Tech programme will have a curriculum and syllabi for the courses recommended by the Board of Studies and approved by the Academic Council. The academic programmes of the Institute follow the credit system. The curriculum of B.Tech programme is designed to have a total of about 189 credits of which a student should acquire a minimum of 180 credits to get the degree awarded. If a student earns all the total credits, then the best 180 credits are considered to determine the final CGPA. The lateral entrants shall have a total of about 146 credits of which one should acquire a minimum of 137 credits to get the degree awarded. If a lateral student takes all the credits, then the best 137 credits are considered to determine the final CGPA.

Criteria for achieving the minimum credits:

❖ Mandatory courses

All courses mentioned in the programme excluding open electives, professional electives and MOOCS come under mandatory courses.

❖ Open Elective- A course offered by any department other than home department

The student has to choose one open elective out of the open electives offered by other departments during third year first semester or Final year first semester.

Professional Electives

The student has to register for at least (n-1) no. of professional electives (n = no. of professional electives offered by the department during the programme) as per his choice as provided in the curriculum. However, he can register for all the professional electives offered by the department.

❖ MOOCs- Massive Open Online Courses

The student is required to register for one MOOCs course any time during second year first semester to fourth year second semester. However, its grade will be accorded at the end of fourth year second semester along with the fourth year second semester courses of the programme.

For the award of the degree, the student has to secure a minimum pass grade or above in all the mandatory courses, registered open elective, registered professional electives. However, the degree will still be awarded even if the student fails / opts out of MOOCs.

IV. Duration of the Programme:

The duration of the programme is four academic years consisting of two semesters in each academic year. A student is permitted to complete the programme in a stipulated time frame of 8 consecutive academic years from the date of initial admission. Students joining the programme in the 2nd year through lateral entry scheme shall have to complete the programme in a stipulated time frame of 6 consecutive academic years from the date of initial admission.

V. Medium of Instruction:

The medium of instruction and examination is English.

VI. Minimum Instruction Days:

Each semester normally consists of a minimum of 16 weeks of instruction.

VII. Academic Calendar:

The dates of all important events, such as commencement of class work, examinations, vacations, etc., during the academic year will be specified in the Academic Calendar of the Institute, as approved by the Academic Council.

VIII. Examinations & Evaluation Process:

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks each for theory and practical/drawing subjects.

(A) Theory Course:

For all lecture based theory courses, the assessment shall be for 40 marks through internal evaluation and 60 marks through external semester-end examination of three hours duration except for the subjects with 100% internal assessment in which case an internal examination will be conducted for 60 marks along with the semester-end examinations.

i) Internal evaluation:

The sessional marks shall be awarded through internal evaluation by the teachers concerned based on the continuous assessment which includes class tests, quiz, viva-voce, assignments, student regularity, two mid-examinations etc., according to a scheme notified by the department at the beginning of the semester.

Out of the 40 internal evaluation marks, 20 marks are assigned for 2 internal-mid exams, 10 marks for assignments, 5 marks for projects/ case studies /quiz/tests and 5 marks for attendance. The average of 2 internal-mid exams is considered for the 20 marks allocated.

Under any circumstances, no re-examination shall be conducted for the internal mid examinations.

ii) External evaluation:

The question paper shall be set externally and the answer scripts are valued through a double valuation system.

The average of the two valuations will be taken for the award of marks. In case, the difference of the marks obtained in the two valuations is more than 20%, then a third examiner shall value the script. Out of the three valuations, the average of marks obtained in third valuation and the marks obtained nearer to third valuation out of first two valuations shall be considered. No revaluation for any subject/course shall be entertained as already double valuation system is in existence. However, recounting is allowed on the request of the candidate on payment of specified fee. Challenge valuation shall also be entertained on payment of specified fee.

(B) Laboratory Course:

Each student will perform about 10 to 12 experiments in each laboratory course. Laboratory course will be evaluated for 100 marks, out of which 50 marks are for external examination and 50 marks are for internal evaluation. The internal marks are awarded based on continuous assessment, record work, internal lab examination and student regularity. The external examination will be conducted by two examiners, one of them being laboratory class teacher as internal examiner (nominated by the Principal on recommendation of HOD) and an external examiner nominated by the Principal from the panel of experts recommended by the HOD.

A candidate shall be declared to have passed any theory subject/course if he secures not less than 40% in external theory examination and also a minimum of 40% of total marks of that course which assures a minimum of 'P' grade.

A candidate shall be declared to have passed any practical course if he secures not less than 50% in external laboratory examination and also a minimum of 50% of total marks of that course which assures a minimum of 'C' grade.

Only in the case of quantitative and verbal aptitude – I & II, if a candidate fails he is given an opportunity to improve to pass grade (P) irrespective of the score he gets over and above pass mark in the reexamination within one month on payment of special examination fee.

Any student appearing for the semester-end practical examination is eligible only if he submits the bonafide record certified by the laboratory class teacher and the HOD.

(C) Project Work:

The project work is evaluated for 300 marks out of which 100 through internal assessment in the IV Year I semester through continuous assessment followed by final evaluation by a committee nominated by the HOD. For the 200 marks in IV year II semester, assessment is done for 100 marks internally and for the remaining 100 marks by the committee consisting of at least one external expert nominated by the Principal. If a student fails in the fourth year first semester project he has to appear for reassessment within one month for which he has to pay the reexamination fee.

(D) Industrial Training:

The industrial training is assessed internally for 100 marks by an internal evaluation committee constituted by the HOD.

(E) Supplementary Exam:

There will be supplementary examination for the programme such that for odd semester courses the supplementary exams will be conducted during summer vacation and for the even semester courses, the supplementary exams will be conducted during the winter vacation.

IX. Attendance Regulations:

Attendance of a student is computed by considering total number of periods conducted in all courses as the denominator and the total number of periods actually attended by the student in all courses, as the numerator. It is desirable for a student to put in 100% attendance in all the subjects. However, a candidate shall be permitted to appear for the semester end examination provided he maintains a minimum of 75% overall attendance in the semester.

The shortage of attendance on medical grounds can be condoned up to a maximum of 9% provided the student puts in at least 66% attendance and provided the Principal is satisfied with the genuineness of the reasons. The Medical Certificates are to be submitted to the Head of the Department when the candidate reports to the classes immediately after the absence. Certificates submitted afterwards shall not be entertained. Condonation fee as fixed by the college for those who put in attendance between $\geq 66\%$ and $<75\%$ shall be charged before the semester-end examinations.

In the case of students who participate in co-curricular, extra-curricular activities like student seminars, N.S.S, N.C.C, Inter-collegiate tournaments and any such other activities involving the representation of the Institute,

with the prior approval of the Principal, the candidate may be deemed to have attended the classes during the actual period of such activity, solely for the purpose of attendance.

A student, who could not satisfy the minimum attendance requirement of 66% in any semester, shall be declared 'Detained'. He is not eligible to appear for the semester end examinations. He will not be promoted to the next semester and shall have to repeat that semester with the next batch(es) of students. Such students who are detained and seek readmission, should submit an undertaking/a declaration that they will abide by the regulations existing at the time of readmission.

X. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No. IX.

- A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory subject if only he secures not less than 40% marks in the semester-end examination and a minimum of 40% marks in the sum of the internal evaluation and semester-end examination taken together. In the labs/projects, the student should secure a minimum of 50% marks in the external examination and a minimum of 50% marks in the sum of internal evaluation and external examination evaluation taken together.
- Further, a candidate has to secure a minimum of 40 % in theory examination (excluding sessional marks) and a minimum of 50 % (excluding sessional marks) in the Practical Examination / Project / Field Work / Viva Voce / Industrial Training in Semester –End / Year – End Examination and 50% aggregate to pass.
- A student will be promoted to the next semester, if only he satisfies the minimum attendance requirement.
- A student shall be promoted from II Year to III Year only if he fulfills the academic requirement of total 50 % of all credits from regular and supplementary examinations of I Year and II Year – I Semester { i.e., total 3 semesters} examinations, irrespective of whether the candidate takes the examination in all the subjects or not.

- A student shall be promoted from III Year to IV Year only if he fulfills the academic requirements of total 50% of credits from regular and supplementary examinations of I Year, II Year and III Year- I Semester {i.e., total 5 semesters}, irrespective of whether the candidate takes the examinations in all the subjects or not.
- For lateral entry students, there is no credit based restriction for promotion from II year to III year. But a lateral entry student shall be promoted from III year to IV year only if he fulfills the academic requirements of total 50% of credits from regular and supplementary examinations of II year and III year- I Semester {i.e., total 3 semesters} irrespective of whether the candidate takes the examinations in all the subjects or not.
- Students, who fail to complete their B.Tech. Programme within eight academic years from the year of their admission or fail to acquire the credits stipulated for the programme shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled. For lateral entry students they have to complete the programme in six years from their year of admission.
- A candidate can avail the betterment chances during the validity of all courses.

XI. Award of Grades:

The absolute grading system is adopted as follows:

S.No	Range of marks %	Grade	Grade Points	
1	> 90 ≤ 100	O	10	Out Standing
2	> 80 ≤ 90	A+	9	Excellent
3	> 70 ≤ 80	A	8	Very Good
4	> 60 ≤ 70	B+	7	Good
5	> 55 ≤ 60	B	6	Above Average
6	≥ 50 ≤ 55	C	5	Average
7	≥ 40 < 50	P	4	Pass
8	< 40	F	0	Fail
9			0	Ab (Absent)

Note: Minimum grade to pass in a laboratory course is ‘C’.

The performance of a student at the end of the each semester is indicated in terms of Semester Grade Point Average (SGPA). The SGPA is calculated as below:

$$\text{SGPA} = \frac{\sum (\text{Credits of a course} \times \text{Grade points awarded for a course})}{\sum (\text{Credits of a course})}$$

SGPA is calculated for the candidates who have passed in all the courses in that semester.

Cumulative Grade Point Average (CGPA) will be calculated from II semester onwards up to the final semester and its calculation is similar to that of SGPA, considering all the courses offered from the first semester onwards.

CGPA is calculated for those who clear all the courses in all the previous semesters.

XII. Award of Class:

For award of class, a total of best 180 credits are considered in case of four year programme and best 137 credits in case of lateral entry admitted students. A candidate, who becomes eligible for the award of B.Tech.Degree, shall be placed in one of the following classes.

S.No.	Class	CGPA
1	First Class with Distinction	7.0 or more*
2	First Class	6.0 or more but less than 7.0
3	Second Class/Pass	5.0 or more but less than 6.0

***First class with Distinction will be awarded only to those students who clear all the subjects of the program in first attempt of regular examinations.**

The CGPA can be converted to aggregate percentage by multiplying CGPA with 10, in case of requirement by any other university or for any other purpose.

XIII. Eligibility for Award of B.Tech. Degree:

A student shall be eligible for the award of the B.Tech degree if he fulfills all the following conditions:

- 1) Registered and successfully completed all the components prescribed for eligibility in the Programme of study to which he/she is admitted within the stipulated period,
- 2) Obtained CGPA greater than or equal to 5.0 (Minimum requirement for Pass),
- 3) No disciplinary action is pending against him/her and
- 4) Has no dues to the Institute including hostels.

XIV. Malpractices:

The Controller of Examinations/Dean of Examinations shall refer the cases of suspected malpractices in mid examinations and semester-end examinations to Malpractice Enquiry Committee constituted by the Institute. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action against the erring students based on the recommendations of the committee.

XV. Amendments To Regulations:

The Institute may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabi and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

XVI. 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 case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.**

CURRICULUM

First Year I – Semester

CODE	SUBJECT NAME	Category	Instruction periods per week				Max.Marks			Credits
			Lecture	Tutorial	Lab	Total	Sessional Marks	Semester End Marks	Total Marks	
CHE111	English	HS	3	1	-	4	40	60	100	3
CHE 112	Engineering Mathematics I	BS	3	1	-	4	40	60	100	3
CHE 113	Engineering Physics	BS	3	1	-	4	40	60	100	3
CHE 114	Engineering Drawing	ES	1	-	3	4	40	60	100	3
CHE115	Environmental Sciences	BS	3	1	-	4	40	60	100	3
CHE116	Engineering Physics Lab	BS	-	-	3	3	50	50	100	2
CHE117	Programming with C Lab	ES	2	-	3	5	50	50	100	3
CHE118	Work Shop	ES	-	-	3	3	50	50	100	2
CHE AC1	NCC/NSS/Sports	AC	-	-	3	3	-	-	-	-
Total			15	4	15	34	350	450	800	22

First Year II – Semester

CODE	SUBJECT NAME	Category	Instruction periods per week				Max.Marks			Credits
			Lecture	Tutorial	Lab	Total	Sessional Marks	Semester End Marks	Total Marks	
CHE121	Engineering Mathematics II	BS	3	1	-	4	40	60	100	3
CHE122	Engineering Chemistry	BS	3	1	-	4	40	60	100	3
CHE123	Professional Ethics & Human Values	HS	2	1	-	3	100	-	100	2
CHE124	Physical Chemistry	BS	3	1	-	4	40	60	100	3
CHE125	Introduction to Chemical Engineering	PC	3	1	-	4	40	60	100	3
CHE126	Engineering Chemistry Lab	BS	-	-	3	3	50	50	100	2
CHE127	Language Lab	HS	-	-	3	3	50	50	100	2
CHEAC2	NCC/NSS / Sports	AC	-	-	3	3	-	-	-	-
Total			14	5	9	28	360	340	700	18

BS : Basic Sciences; ES : Engineering Sciences; HS : Humanities and Social Sciences; PC : Professional Core; PE : Professional Elective; OE : Open Elective; PW : Project Work; IT : Industrial Training; AC : Audit Course

Second Year I – Semester

CODE	SUBJECT NAME	Category	Instruction periods per week				Max.Marks			Credits
			Lecture	Tutorial	Lab	Total	Sessional Marks	Semester End Marks	Total Marks	
CHE 211	Engineering Mathematics – III	BS	3	1	-	4	40	60	100	3
CHE 212	Organic Chemistry	BS	3	1	-	4	40	60	100	3
CHE 213	Mechanical Engineering and Strength of Materials	ES	3	1	-	4	40	60	100	3
CHE 214	Basic Electrical & Electronics Engineering	ES	3	1	-	4	40	60	100	3
CHE 215	Chemical Process Calculations	PC	4	1	-	5	40	60	100	4
CHE 216	Organic Chemistry Laboratory	BS	-	-	3	3	50	50	100	2
CHE 217	Mechanical Engineering Laboratory	ES	-	-	3	3	50	50	100	2
Total			16	5	6	27	300	400	700	20

Second Year II –Semester

CODE	SUBJECT NAME	Category	Instruction periods per week				Max.Marks			Credits
			Lecture	Tutorial	Lab	Total	Sessional Marks	Semester End Marks	Total Marks	
CHE 221	Engineering Mathematics – IV	BS	3	1	-	4	40	60	100	3
CHE 222	Momentum transfer	PC	4	1	-	5	40	60	100	4
CHE 223	Mechanical Operations	PC	4	1	-	5	40	60	100	4
CHE 224	Process Instrumentation	PC	4	1	-	5	40	60	100	4
CHE 225	Chemical Engineering Thermodynamics - I	PC	4	1	-	5	40	60	100	4
CHE 226	Momentum Transfer Laboratory	PC	-	-	3	3	50	50	100	2
CHE 227	Mechanical Operations Laboratory	PC	-	-	3	3	50	50	100	2
Total			19	5	6	30	300	400	700	23

Third Year I – Semester

CODE	SUBJECT NAME	Category	Instruction periods per week				Max.Marks			Credits
			Lecture	Tutorial	Lab	Total	Sessional Marks	Semester End Marks	Total Marks	
CHE 311	Open Elective – I	OE	3	1	-	4	40	60	100	3
CHE 312	Chemical Engineering Thermodynamics – II	PC	4	1	-	5	40	60	100	4
CHE 313	Heat Transfer	PC	4	1	-	5	40	60	100	4
CHE 314	Mass Transfer – I	PC	4	1	-	5	40	60	100	4
CHE 315	Chemical Reaction Engineering – I	PC	4	1	-	5	40	60	100	4
CHE 316	Elective – I	PE	4	1	-	5	40	60	100	4
CHE 317	Heat Transfer Laboratory	PC	-	-	3	3	50	50	100	2
CHE 318	Soft Skills Laboratory	HS	-	-	3	3	100	-	100	2
CHE 319	Quantitative and Verbal Aptitude – I	HS	4	-	-	4	100	-	100	2
Total			27	6	6	39	490	410	900	29

Third Year II - Semester

CODE	SUBJECT NAME	Category	Instruction periods per week				Max.Marks			Credits
			Lecture	Tutorial	Lab	Total	Sessional Marks	Semester End Marks	Total Marks	
CHE 321	Mass Transfer – II	PC	4	1	-	5	40	60	100	4
CHE 322	Chemical Reaction Engineering – II	PC	4	1	-	5	40	60	100	4
CHE 323	Material Science and Engineering	PC	4	1	-	5	40	60	100	4
CHE 324	Chemical Technology	PC	4	1	-	5	40	60	100	4
CHE 325	Elective - II	PE	4	1	-	5	40	60	100	4
CHE 326	Mass Transfer Laboratory	PC	-	-	3	3	50	50	100	2
CHE 327	Chemical Reaction Engineering Laboratory	PC	-	-	3	3	50	50	100	2
CHE 328	Chem. Tech. and Pollution Control Laboratory	PC	-	-	3	3	50	50	100	2
CHE 329	Quantitative and Verbal Aptitude – II	HS	4	-	-	4	100	-	100	2
Total			24	5	9	38	450	450	900	28

Fourth Year I - Semester

CODE	SUBJECT NAME	Category	Instruction periods per week				Max.Marks			Credits
			Lecture	Tutorial	Lab	Total	Sessional Marks	Semester End Marks	Total Marks	
CHE 411	Open Elective - II	OE	3	1	-	4	40	60	100	3
CHE 412	Transport Phenomena	PC	4	1	-	5	40	60	100	4
CHE 413	Process Dynamics and Control	PC	4	1	-	5	40	60	100	4
CHE 414	Process Modeling and Simulation	PC	4	1	-	5	40	60	100	4
CHE 415	Elective – III	PE	4	1	-	5	40	60	100	4
CHE 416	Process Dynamics and Control Laboratory	PC	-	-	3	3	50	50	100	2
CHE 417	Modeling and Simulation Laboratory	PC	-	-	3	3	50	50	100	2
CHE 418	Project Seminar	PW	-	-	3	3	100	-	100	4
CHE 419	Industrial Training*	IT	-	-	-	-	100	-	100	2
	Total		19	5	9	33	500	400	900	29

*There is Industrial Training at the end of III year II Semester for a minimum of three weeks during summer vacation. Assessment for the Industrial Training is made during IV year I Semester.

Fourth Year II - Semester

CODE	SUBJECT NAME	Category	Instruction periods per week				Max.Marks			Credits
			Lecture	Tutorial	Lab	Total	Sessional Marks	Semester End Marks	Total Marks	
CHE 421	Chemical Engineering Process Equipment Design and economics	PC	4	1	-	5	40	60	100	4
CHE 422	Elective – IV	PE	4	1	-	5	40	60	100	4
CHE 423	Chemical Engineering Process Equipment Design Laboratory	PC	-	-	3	3	50	50	100	2
CHE 424	Project	PW	-	-	6	6	100	100	100	8
CHE 425	MOOCs	OE	-	-	-	-	100	-	100	2
	Total		8	2	9	19	330	270	500	20

LIST OF DEPARTMENT ELECTIVES

ELECTIVE SUBJECTS:

Elective – I

CHE 316 (A) Polymer Technology

CHE 316 (B) Fertilizer Technology

CHE 316 (C) Paper Technology

CHE 316 (D) Pharmaceutical Technology

CHE 316 (E) Technology of Soaps and Detergents

Elective - II

CHE 325 (A) Petrochemicals

CHE 325 (B) Computer Applications in Chemical Engineering

CHE 325 (C) Membrane Technology

CHE 325 (D) Catalysis

CHE 325 (E) Industrial Pollution and Control

Elective – III

CHE 415 (A) Petroleum Refinery Engineering

CHE 415 (B) Computer Aided Design

CHE 415 (C) Nanotechnology

CHE 415 (D) Computational Fluid Dynamics

CHE 415 (E) Fundamentals of Biological Sciences

Elective – IV

CHE 422(A) Reservoir Engineering

CHE 422 (B) Process Optimization

CHE 422 (C) Energy Engineering

CHE 422 (D) Industrial Management

CHE 422 (E) Biochemical Engineering

OPEN ELECTIVES - I

III Year I - Semester

Department	Name of the Course offered
ELECTRONICS AND COMMUNICATION ENGINEERING	ECE 311 (A) Electronic Design with Integrated Circuits ECE 311 (B) Digital Electronics ECE 311 (C) Applications of Fields and Waves ECE 311 (D) Special Topics: Electronics ECE 311 (E) Applied Electronics
ELECTRICAL AND ELECTRONICS ENGINEERING	EEE 311 Renewable Energy Technologies
MECHANICAL ENGINEERING	MEC 311 (A) Robotics MEC 311 (B) Computer Aided Design
COMPUTER SCIENCE & ENGINEERING	CSE311(A) Computer Operating systems CSE311(B) Fundamentals of Computer Networks CSE311(C) Concepts of Object Oriented Programming CSE311(D) Database Management Systems
INFORMATION TECHNOLOGY	IT 311 (A) Essentials of Information Technology IT 311 (B) Data Structures IT 311 (C) Operating Systems IT 311 (D) Database Management Systems
CHEMICAL ENGINEERING	CHE 311(A) Industrial Safety and Hazards Management CHE 311(B) Engineering Biology CHE 311(C) Fuel Cell Technology CHE 311(D) Design of Experiments
CIVIL ENGINEERING	CIV 311 (A) Basic civil engineering CIV 311 (B) Building Planning and construction CIV 311 (C) Basics of Foundation Engineering
MATHEMATICS	MAT 311 (A) Numerical Methods MAT 311 (B) Fuzzy Set Theory & Fuzzy Logic and its Applications MAT 311 (C) Probability Statistics
PHYSICS	PHY 311 Nano Technology and Engineering Applications
CHEMISTRY	CHY 311 (A) Environmental Sciences CHY 311 (B) Characterisation of Materials

OPEN ELECTIVES - II

IV Year I - Semester

Department	Name of the Course offered
ELECTRONICS AND COMMUNICATION ENGINEERING	ECE 411 (A) Introduction to Embedded System Design ECE 411 (B) Introduction to VLSI Design ECE 411 (C) Introduction to Image Processing /Computer Vision
ELECTRICAL AND ELECTRONICS ENGINEERING	EEE 411 Fundamentals of Electric Power Utilization
MECHANICAL ENGINEERING	MEC 411 (A) Finite Element Analysis MEC 411 (B) Operation research
COMPUTER SCIENCE & ENGINEERING	CSE 411(A) Introduction to soft computing CSE 411(B) Cloud computing overview CSE 411(C) Digital Image processing CSE 411(D) Embedded Systems and Applications
INFORMATION TECHNOLOGY	IT 411 (A) Software Engineering Concepts IT 411 (B) Foundations of Web Development & Design IT 411 (C) Open Source Technologies IT 411 (D) Multimedia Concepts
CHEMICAL ENGINEERING	CHE 411(A) Food Processing Technology CHE 411(B) Corrosion Engineering CHE 411(C) Computational Tools for Engineers CHE 411(D) Bioinformatics
CIVIL ENGINEERING	CIV 411 (A) Elements of Environmental Engineering CIV 411 (B) Water Resources conservation CIV 411 (C) Elements of Transportation Engineering
PHYSICS	PHY 411 Principles & Applications of NDT Methods
CHEMISTRY	CHY 411 (A) Environmental Sciences CHY 411 (B) Green Technologies

FIRST YEAR SYLLABI

I- Semester

&

II- Semester

ENGLISH

(Common for all branches)

CHE 111

Instruction : 3 Periods & 1 Tut/Week

End Exam : 3 Hours

Credits:3

Sessional Marks : 40

End Exam Marks: 60

Course Objectives:

- To improve the language proficiency of the students in English with emphasis on Reading and Writing skills.
- To enable the students to study engineering subjects with greater comprehension & cognizance.
- To strengthen the vocabulary of the students.
- To enable the students to write grammatically correct structures with logical flow.
- To equip the students with the knowledge of different formats of business communication.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyze the structure of the phrases, clauses and sentences
2.	Apply his enriched vocabulary to give better shape to his communication skills.
3.	Effectively use different formats of business correspondence.
4.	Use idiomatic expressions and foreign phrases in his communication.
5.	Analyse, interpret and compose meaningful texts.

SYLLABUS

UNIT I

10 Periods

Vocabulary : One Word Substitutes

Grammar : Noun : Noun Phrase, Gerunds

Writing Skills :

- 1) Formal Letter writing – format, style of letter writing and types of letters — complaint, enquiry, requesting quotations, invitation, regret and acceptance.
- 2) Story Building-Developing a story from the key words, giving a title and describing learning outcomes.

UNIT II

10 Periods

Vocabulary : Foreign phrases or expressions

Grammar : Adjectives : Quantifiers, qualifiers, determiners, nouns as adjectives, verbs as adjectives, adjective phrases

Writing Skills:

1. Technical Report writing – Formal reports and types: Informational reports, Analytical reports and Recommendation reports— Status, feasibility, progress, incident and project.
2. Essay writing.

UNIT III

10 Periods

Vocabulary : Idiomatic expressions- meaning and usage.

Grammar : Articles (concept and function; definite, indefinite and omission of articles)

Writing Skills :

1. Preparation of C.V. and Resume-format, style purpose and objective.
2. Précis- writing technique with suitable title.

UNIT IV

9 Periods

Vocabulary : Phrasal Verbs derived from the following dynamic verbs: Go, Get, Run, Take, Look, Put, Hold, Stand etc.

Grammar : Prepositions or prepositional phrases

Writing Skills :

1. Reading comprehension – questions based on facts, interpretation, logical deduction, vocabulary.
2. E-mail etiquette- format, style and language

- Vocabulary** : Synonyms and Antonyms (From the text book only)
- Grammar** : Pronouns: Kinds of pronouns, relative pronouns – who and whom, whose, which Verbs - Aspects, moods, tenses, direct and indirect speech (active and passive voice), concord, Infinites and verb participles, verb phrase, Conditionals – probable, improbable, impossible, If-clause, Correction of sentences

TEXT BOOK:

Life through language Pearson Publication Delhi

REFERENCE BOOKS:

1. G.J.K. Gangal *A Practical Course for Developing Writing Skill in English* PHI
2. Mark Lester and Larry Beason *Handbook of English Grammar & Usage* Tata McGraw Hill.
3. S.M.Gupta *Current English Grammar And Usage* PHI
4. Dr. P. Prasad, Rajendra K Sharma *The Functional Aspects of Communication Skills* Katson Books
5. Abul Hashem *Common errors in English* Ramesh Publishing House
6. M. Ashraf Rizvi *Effective Technical Communication* Tata Mc-Graw Hill
7. Edgar Thorpe & Showick Thorpe *Objective English* Pearson

ENGINEERING MATHEMATICS-I

(Common for all branches)

CHE 112

Credits : 3

Instruction : 3 Periods & 1 Tut/Week

Sessional Marks :40

End Exam : 3 Hours

End Exam Marks : 60

Course Objectives :

- To impart knowledge in basic concepts of functions of several variables and their applications like maxima & minima.
- To enable the students to study the concepts of Fourier series.
- To enable the students to study the concepts of three dimensional figures like sphere, cone cylinder and conicoids.
- To equip the students with the knowledge of multiple integrals and their applications.
- To introduce the concepts of improper integrals like beta, gamma & error functions.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Familiarize with functions of several variables
2.	Apply Fourier series in solving boundary value problems
3.	Apply the concept of three dimensional analytical geometry
4.	Use mathematical tools needed in evaluating multiple integral and their usage.
5.	Use the concepts of improper integrals, Gamma, Beta and Error functions which are needed in Engineering applications

SYLLABUS

UNIT I

12 Periods

Partial Differentiation: Function of two or more variables – Partial Derivatives – which variable is to be treated as constant – Homogeneous functions – Euler's theorem – Total Derivative - Change of Variables .Jacobians – Taylor's theorem for functions of two variables – Maxima and Minima functions of two variables.

UNIT II

12 Periods

Fourier series: Introduction – Euler's formula – conditions for a Fourier expansion – Functions having points of Discontinuity – Change of interval – Even and Odd functions – Half range series-Parseval's formula.

UNIT III

12 Periods

Three Dimensional Analytical Geometry: Equation of a sphere – Plane section of a sphere – Tangent Plane - Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT IV

14 Periods

Multiple Integrals: Double integrals – Change of order of integration – Double integral in polar co-ordinates – Area enclosed by plane curves – Triple Integrals. Volume of Solids- Change of Variables-Area of curved surfaces, Calculation of mass.

UNIT V

10 Periods

Beta & Gamma functions :Beta function – Gamma function relation between Beta and Gamma functions –results and problems, error function.

TEXT BOOK:

1. Dr. B.S. Grewal, Higher *Engineering Mathematics* 43rd edition, Khanna Publishers, New Dehli.

REFERENCE BOOKS:

1. N.P. Bali, Dr . Ashok Saxena, Dr.N.Ch.S. Narayana, *A Text book on Engineering Mathematics* Laxmi pub.(p)Ltd. New Dehli
2. H.K.Dass, *Advanced Engineering Mathematics*, S.chand and company Ltd
3. Dr.M.K. Venkataraman, *Higher Engineering Mathematics* National Pub.Co.Madras.
4. Erwin kreyszig, *Advanced Engineering Mathematics* John Wiley and sons Newyork

ENGINEERING PHYSICS

(Common for all branches)

CHE 113

Instruction : 3 Periods & 1 Tut/Week

End Exam : 3 Hours

Credits:3

Sessional Marks :40

End Exam Marks:60

Course Objectives :

- To impart knowledge in basic concepts of physics relevant to engineering applications
- To introduce advances in technology for engineering applications

Course Outcomes:

By the end of the course, student will be able to:	
1	Understand the fundamental concepts of thermodynamics.
2	Familiar with the fundamentals of electromagnetic induction and Ultrasonics.
3	Aware of the basic concepts of optics like interference, diffraction, polarization and its various applications.
4	Understand the working principle and applications of lasers and fiber optics.
5	Learn fundamentals of modern physics and its importance in modern technology.

SYLLABUS

UNIT I

10 Periods

Thermodynamics: Heat and work, first law of thermodynamics and its applications, reversible and irreversible processes, heat engine, Carnot cycle and its efficiency, Carnot's theorem, second law of thermodynamics, entropy – entropy change in reversible and irreversible processes, entropy and second law, entropy and disorder, entropy and probability, third law of thermodynamics

UNIT II

10 Periods

Electromagnetism: Faraday's law of induction, Lenz's law, Integral and differential forms of Faraday's law, self-inductance, energy stored in electric and magnetic fields, Poynting vector, displacement current, Maxwell's equations in integral form (no derivation), wave equation, propagation of electromagnetic waves in free space

Ultrasonics: Properties of ultrasonic waves, production of ultrasonic waves by magnetostriction and piezoelectric methods, applications of ultrasonics

UNIT III

10 Periods

Optics

Interference: Introduction, principle of superposition, coherence, Young's double slit experiment, conditions for interference, interference in thin films by reflection, wedge shaped film and Newton's rings

Diffraction: Introduction, Fresnel and Fraunhofer diffraction, diffraction at a single slit

Polarisation: Introduction, types of polarized light, double refraction in uniaxial crystals, Nicol's prism, quarter and half-wave plate, production and detection of plane, circular and elliptically polarized light

UNIT IV

10 Periods

Lasers: Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, semiconductor laser, applications of lasers

Fibre optics: Introduction to optical fibers, principle of propagation of light in optical fibers, acceptance angle and acceptance cone, numerical aperture, types of optical fibers, modes of propagation and refractive index profiles, attenuation in optical fibers, advantages of optical fibers in communications, fiber optics communication system, applications of optical fibers, fiber optic sensors

UNIT V

10 Periods

Quantum Mechanics: Planck's hypothesis, wave-particle duality, introduction to quantum theory, de-Broglie concept of matter waves, Heisenberg's uncertainty principle, Schrodinger's time independent and time dependent wave equations, physical significance and properties of the wave function ψ , application of Schrodinger wave equation for a particle in one dimensional well – eigenwavefunctions and energy eigen values of the particle

Elements of Statistical Mechanics: Elementary concepts of Maxwell-Boltzman, Bose-Einstein and Fermi-Dirac statistics (no derivation)

TEXT BOOKS:

1. S.L Gupta and SanjeevGupta *Engineering physics* DhanpatRai publications.
2. M.N. Avadhanulu & P.G.Kshirasagar *A text book of engineering physics*, S.Chand publication
3. Resnick & Halliday *Physics - Volume II*

REFERENCE BOOKS:

- 1) V. Rajendran *Engineering physics* McGrawHill Education Private Ltd
- 2) S.O.Pilai, Sivakami *Engineering Physics* New Age International Publishers
- 3) Young & Freedman *University Physics* Pearson Education
- 4) A.Marikani *Engineering Physics* PHI Learning Private Limited

ENGINEERING DRAWING

(Common for all branches)

CHE 114

Credits :3

Instruction : 1 Theory& 3 Practical Periods/week

Sessional Marks : 40

End Exam : 3 Hours

End Exam Marks : 60

Course Objectives:

- To increase ability to communicate with people and learn to sketch and take field dimensions.
- To make the student familiar to the drawing practices and convection
- To familiarize the student about various engineering curves used in industry
- To enable the student draft simple engineering components and analyze different views of components.
- To introduce basic Auto CAD skills.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Draw various engineering curves and understand the basic geometrical constructions.
2.	Prepare orthographic projections of points and lines
3.	Produce orthographic projections of plane surfaces
4.	Draw orthographic projections of solids in various orientations.
5.	Prepare isometric projections and understand basics of Computer Aided Drafting.

SYLLABUS

UNIT – I

Introduction to Engineering Drawing & basics of geometrical construction. Construction of conic sections, Construction of cycloidal curves (cycloid, epicycloid, and hypocycloid), involutes (over circles and polygon) & Archimedian spiral.

UNIT –II

Orthographic projections – projections of points – projections of straight lines (lines parallel to both HP&VP, lines parallel to one and inclined to other, lines inclined to both the planes)

UNIT – III

Projections of planes – perpendicular planes – oblique planes

UNIT – IV

Projection of solids – Prisms – Cylinder– Pyramids & Cones

UNIT – V

Isometric projections – Plane solids, Combination of solids Demonstration & Practice: Computer aided drafting of lines, planes solids and Dimensioning.

TEXT BOOK:

1. N. D. Bhatt *Engineering Drawing* Charotar Publishing House Pvt. Ltd, 53rd Edition : 2014

REFERENCE BOOKS:

1. K. L. Narayana & P. Kanniah *Engineering Drawing*
2. R. B. Choudary *Engineering Graphics with Auto CAD*
3. Trymbaka Murty *Computer Aided Engineering Drawing*

ENVIRONMENTAL SCIENCES

(Common for all branches)

CHE 115

Credits : 3

Instruction : 3 Periods & 1 Tut/Week

Sessional Marks : 40

End Exam : 3 Hours

End Exam Marks : 60

Course Objectives:

- To gain knowledge on the importance of environment and ecosystems.
- To acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of interdependence.
- To acquire knowledge about environmental pollution- sources, effects and control measures of environmental pollution
- To understand the treatment of wastewater and solid waste management.
- To be aware of the national and international concern for environment for protecting the environment

Course Outcomes:

By the end of the course, student will be able to:	
1	Identify the characteristics of various natural resources and can implement the conservation practices
2	Realize the importance of Ecosystem and Biodiversity for maintaining ecological balance
3	Classify, analyze various pollutants and can develop methods for solving problems related to environment
4	Design and evaluate strategies and methods for sustainable development of environmental systems and for the remediation or restoration of degraded environments
5	Get awareness on various environmental laws and regulations applicable to global issues and play a role in solving social problems

SYLLABUS

UNIT I

10 Periods

Introduction to Environment and Natural Resources : Introduction: Definition, Multidisciplinary nature, Scope and Importance of Environmental Sciences- R & D in environment, green advocacy, green marketing, green media and environment consultancy. Need for public awareness.

Natural Resources: Forest resources-use and overexploitation, deforestation, Big Dams effects on forests and tribal people. Water resources-sources, use and over utilization of surface and ground water, conflicts over water, dams-benefits and

problems. Food resources-environmental impact of modern agriculture-fertilizer and pesticides. Land resources-land degradation- landslides, soil erosion and desertification. Energy resources- renewable and non-renewable energy resources and use of alternate-energy sources.

UNIT II

10 Periods

Ecosystem & Bio Diversity : Ecosystem: Concept of an ecosystem-structure and function of an ecosystem Food chains, food webs and ecological pyramids, Energy flow in an ecosystem, Ecosystem regulation, Ecological succession. Types, characteristic features, structure and function of forest, grass land, desert and aquatic ecosystems.

Biodiversity : Definition, types, India as a Mega diversity Nation, Values of biodiversity, Hot spots of biodiversity, Threats to biodiversity-habitat loss, poaching, human-wildlife conflicts, Endangered and endemic species, Conservation of biodiversity.

UNIT III

10 Periods

Environmental Pollution and Waste Management : Sources, effects and control measures of Air pollution, Noise Pollution, Soil Pollution, Marine pollution, Thermal pollution, Radio Active Pollution. Water Pollution (Sources, Effects, Control measures, DO, BOD, COD, sewage treatment), Green house effect, Ozone depletion, Acid rain –causes and adverse effects.

Solid waste management : Sources and effects of municipal waste, bio-medical waste, Industrial waste, e-waste, Process of waste management-composting, sanitary landfills, incineration.

UNIT IV

8 Periods

Social Issues and Environment : Social Issues and the Environment: From unsustainable to sustainable development, Environmental Impact Assessment, Water conservation, Rain water harvesting, water shed management. Resettlement and rehabilitation of people, Environmental ethics.

Urbanization, Industrialization, Transportation, Human population and the environment-population growth, role of information technology in environment and human health.

UNIT V

10 Periods

Legislations, Conventions & Case Studies : Environmental protection act-Air (prevention and control of pollution) act, Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act.

International Conventions : Stockholm Conference, Brundtland Commission, Rio declaration, Vienna Convention, Kyoto protocol, Johannesburg Summit.

Case Studies: Chipko Movement, Kolleru Lake, Fluorosis, Silent valley project, Narmada Bacho Andolan, Ralegaon Siddhi, Tehri dam, Madhura refinery and Tajmahal

TEXT BOOK:

1. Anubha Kaushik & C.P. Kaushik *Principles of Environmental Studies* New Age International Publications.

REFERENCE BOOKS:

1. B.K. Sharma *Environmental chemistry* Goel publishing house, Meerut, 2001.
2. G. S. Sodhi *Fundamental concepts of Environmental Chemistry*, Narosa publishing house, New Delhi
3. S .S. Dara *A text book of Environmental Chemistry and pollution control* S.Chand and Company Ltd, New Delhi, 2002.

ENGINEERING PHYSICS LAB

(Common for all branches)

CHE 116

Practical / week:3

End Exam : 3Hrs

Credits : 2

Sessional Marks : 50

End Exam Marks : 50

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments

Course Outcomes:

By the end of the course, student will be able to:	
1	Design and conduct experiments as well as to analyze and interpret data.
2	Apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics.

List of experiments (any eight to ten experiments are to be completed)

1. Determination of coefficient of thermal conductivity of a bad conductor- Lee's method.
2. Determination of radius of curvature of a convex lens - Newton's rings.
3. Determination of wavelengths of spectral lines in mercury spectrum-using diffraction grating in normal incidence position.
4. Determination of Cauchy's constants of the material of the prism using spectrometer.
5. Determination of thickness of a thin paper by forming parallel interference fringes-Wedge method.
6. Study of variation of magnetic field along the axis of a current carrying circular coil – Stewart and Gee's apparatus
7. Calibration of a low-range voltmeter using potentiometer.
8. Verification of laws of resistance and determination of specific resistance of wire by using Carey- Foster's bridge.
9. Determination of refractive indices o-ray and e-ray in quartz crystal (double refraction)

10. Determination of the frequency of an electrically maintained tuning fork - Melde's experiment.
11. Determination of Rydberg constant using hydrogen discharge tube.
12. Characteristics of photo cell and determination of Planck's constant – Photoelectric effect.
13. Determination of e/m of an electron by Thomson's method
14. Determination of band gap of semiconductor.

TEXT BOOK:

1. Physics Laboratory Manual prepared by Department of Physics ANITS

REFERENCE BOOKS:

1. D.P Siva Ramaiah and V. Krishna Murthy *Practical physics* Maruti book Depot
2. A.R Vegi *Comprehensive practical Physics* Vegi Publishers Pvt.Ltd.
4. KR Venugopal, SR Prasad *Mastering C* Tata McGraw Hill.
5. B.W. Kernighan, Dennis M. Ritchie *The C – Programming Language* PHI

LIST OF SAMPLE PROGRAMS

1. Write a C program for any three of the following
 - i) To accept the distance between two cities and convert the distance in meters, feet, inches and centimeters. (Note: Input distance in Kilometers).
 - ii) To accept the marks obtained by a student in five different subjects, calculate the total marks and percentage obtained by the student (The

PROGRAMMING WITH C LAB

(Common for all branches)

CHE 117

Credits : 3

Instruction : 2 Periods/Week Practicals : 3 Periods/week

Sessional Marks : 50

End Exam : 3Hrs

End Exam Marks : 50

Course Objectives :

To enable students to

- Understand the program development steps using compilers.
- Strengthen the problem solving skills using programming techniques.
- Design programs using various control structures.
- Develop programs using structures, unions and files.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Gain a working knowledge on programming.
2.	Learn and use the fundamentals of a programming language (such as language-defined data types (int, float, char, double), control constructs (sequence, selection, repetition), program modules (including functions, modules, methods).
3.	Exhibit the ability to formulate a program that correctly implements the algorithm.
4.	Demonstrate the effective use the programming environment used in the course.

SYLLABUS

1. Overview
2. Introduction to Unix
3. Data Types, Constants
4. Operators, Expressions
5. Control Structures
6. Arrays & Strings
7. Pointers
8. Functions.
9. Structures & Unions
10. Files

REFERENCE BOOKS:

1. YashwantKanetkar*Let Us C* 5th Edition.
2. V.Rajaraman*Fundamentals of Computers* 4th Edition, PHI 2005.
3. Programming Techniques through C, M.G. V. Murthy, Pearson Education, 2002
4. KRVenugopal, SR Prasad *Mastering C* Tata McGraw Hill.
5. B.W. Kernighan, Dennis M. Ritchie *The C – Programming Language* PHI

LIST OF SAMPLE PROGRAMS

1. Write a C program for any three of the following
 - i) To accept the distance between two cities and convert the distance in meters, feet, inches and centimeters. (Note: Input distance in Kilometers).
 - ii) To accept the marks obtained by a student in five different subjects, calculate the total marks and percentage obtained by the student (The maximum marks for each subject is 100).
 - iii) To accept a 3-digit number and calculate the sum of its digits.
 - iv) To accept quantity, product code, unit price of five products and calculate the total price for each product and the SUBTOTAL, TAX, TOTAL and print the details in the following format

Qty	Product code	Unit price	Total price
xx	1	400.00	xxxx.xx
xx	2	20.00	xxxx.xx
xx	3	200.00	xxxx.xx
xx	4	100.00	xxxx.xx
xx	5	200.00	xxxx.xx
SUB TOTAL			xxxxx.xx
TAX			xxxx.xx
TOTAL			xxxxx.xx

- v) To evaluate the following expression
 - a) $(ax + by) / (ax - by)$
 - b) $a^2 + b^2 + \text{square root}(2ab)$
2. Write a C program for any three of the following
 - i) To find the maximum and minimum of three numbers.
 - ii) For the above experiment in 1-ii) find and display the grade of the student as prescribed below:

Percentage	Grade
>90	A
>80 and <=90	B
>70 and <=80	C
>60 and <=70	D
>=50 and <=60	E
< 50	F

- iii) To find the roots of a quadratic equation.
- iv) To find the area of a triangle when

- a) Sides are given
 - b) Base and height are given
 - c) Co-ordinates are given
 - v) To accept an alphabet and convert into its opposite case.
(Do not use library functions)
3. Write a C program for any four of the following
- i) To print prime numbers between the specified range (eg. 100 to 200)
 - ii) To generate Pascal triangle format
 - iii) To compute cosine series: $\cos(x) = 1 - x^2/2! + x^4/4! - x^6/6! + \dots$
 - iv) To check whether number is palindrome or not.
 - v) To print set of Armstrong numbers in a specified range. (eg. 100 to 200)
 - vi) To convert the numbers from the following
 - a) Binary to decimal
 - b) Decimal to binary
4. Write a C program to perform the following operations in a given array of 'n' numbers
- i) Sum of all the numbers
 - ii) Minimum and maximum in the array
 - iii) Searching an element
 - iv) To generate random real numbers in the range of 10 to 20 and sort them.
5. Write a C Program to perform the following on the matrices
- i) Transpose of a matrix and check the symmetry
 - ii) Trace and norm of a matrix
 - iii) Addition of matrices
 - iv) Multiplication of two matrices

6. Write a C program to perform any two of the following operations on strings (not using library functions)
- To check whether the given string is palindrome or not.
 - To find the length of the string
 - To concatenate two strings.
 - To check whether the given substring exists in a text and display the frequency.
- 7.
- Write a C program to create a structure for a student with the details name, roll no five subject marks, total marks, percentage and sort the records according to the percentage.
 - Write a C program to add two complex numbers using structures.
 - Write a C program to illustrate difference between union and structure.
- 8.
- Write a program to calculate the sum of an array using pointers.
 - Write a program to search a name in a given list of names using pointers
9. Write a C program using functions
- To illustrate call by value and call by reference
 - To accept a string and character and pass them as parameters to a function, the function shall replace the character in the string with any other specific character and return the modified string.
 - To pass the employee record as a structure to the function. The function shall compute the gross salary (include DA and HRA Calculation), take the savings as input and compute the tax payable as per the prescribed table.

Gross Salary	Tax (%)
Less than 2 Lakhs	NIL
2 Lakhs to 5 Lakhs	10
5 Lakh to 10 Lakh	20
10 Lakhs to 50 Lakhs	30
Above 50 lakhs	50

Note: The employee record shall contain employee name, employee id, hire date, basic salary, DA, HRA.

10. Write a C program for any one program for the following to illustrate recursion
 - i) Factorial of a number
 - ii) GCD and LCM of two numbers
 - iii) Fibonacci series
11. Write a C program to perform any three of the following on files
 - i) To count the number of alphabets, numbers, words, lines in a given file.
 - ii) To merge two files into third auxiliary file and display the content.
 - iii) To print every even position character in a given file.
 - iv) To separate alphabets and integers into two files from the given source file.
12. Write a C program to update the record of a person in a file by accepting person ID.

Hint:

1. Create the file with few records.
2. The fields in a record
 - a. Name of the person
 - b. Identity(ID) of the person
 - c. Age
 - d. Gender
 - e. Occupation
 - f. Salary

WORKSHOP

(Common for all branches)

CHE118

Credits : 2

Practical / week :3

Sessional Marks : 50

End Exam : 3Hrs

End Exam Marks : 50

Course Objectives :

- To provide training and hands on experience to the students on basic Engineering related skills like carpentry, fitting, house wiring and tin smithy.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Make different carpentry joints.
2.	Make simple fitting jobs.
3.	Make simple jobs like funnel, elbow etc. using sheet metal.
4.	Understand and build circuits for different types of applications like stair case wiring, series and parallel connections.

LIST OF EXPERIMENTS

Minimum of three exercises has to be conducted from each trade.

Trade:

Carpentry

1. Cross Lap Joint
2. Dovetail Joint
3. Mortise and Tennon Joint
4. Bridle Joint

Fitting

1. V Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

House Wiring

1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Florescent Lamp Fitting
4. Measurement of Earth Resistance

Tin Smithy

1. Taper Tray
2. Square Box without lid
3. Elbow
4. Funnel

ENGINEERING MATHEMATICS-II

(Common for all branches)

CHE 121

Credits : 3

Instruction : 3 Periods & 1 Tut/Week

Sessional Marks : 40

End Exam : 3 Hours

End Exam Marks : 60

Course Objectives:

- To impart knowledge in basic concepts of solving linear system of equations.
- To enable the students to study the Eigen values and Eigen vectors of matrix.
- To introduce the concepts of ordinary differential equations and their applications to engineers.
- To enable the students to solve any higher order differential equations and to solve differential equations related to simple electric circuits, Newton's law of cooling.
- To introduce the students to Laplace Transforms and their applications.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Solve linear system equations using of matrix algebra techniques
2.	Determine the Eigen values and vectors of a matrix
3.	Apply different techniques in solving differential equations that model engineering problem
4.	Use the application of Differential equations like simple electric circuits, Newton's law of cooling and to solve any higher order linear ordinary differential equation with constant coefficients
5.	Solve linear differential equations and Network analysis using Laplace transforms.

SYLLABUS

UNIT I

11 Periods

Linear Algebra: Rank of matrix-Elementary Transformation of a matrix- Gauss Jordan Method of finding the inverse – Normal form of the matrix- PAQ form – Consistency of linear system of equations – System of homogeneous and non-homogeneous equations .

UNIT II

12 Periods

Linear transformations – Orthogonal transformations- Vectors (Linearly Independent & Dependent), Eigen values, Eigen Vectors, Properties of Eigen values – Cayley Hamilton theorem (without proof).Reduction to diagonal form – Reduction of Quadratic form to canonical form – Nature of quadratic form.

UNIT III

10 Periods

Differential Equations of first order: First order Linear differential equations , Bernoulli's equations , Exact Differential Equations –Equations reducible to exact Equations - Orthogonal trajectories – Simple Electric circuits-Newton law of cooling.

UNIT IV

10 Periods

Higher order Linear Differential Equations : Definitions – Rules for finding the complementary function, rules for finding the particular integral, method of variation of parameters, equations reducible to linear equations with constant coefficient - Cauchy's homogeneous linear equation, Legendre's linear equation.

UNIT V

17 Periods

Laplace Transforms : Introduction – definitions- Transforms of elementary functions - Properties of Laplace transforms- Transforms of Periodic functions – Transforms of Derivatives – Transforms of Integrals- Multiplication by - division by t -Evaluation of integrals by Laplace transforms.

Inverse Laplace transforms – Other methods of finding inverse transforms (Excluding Residue method) Convolution theorem – Application's to Differential Equations – Unit Step function- Unit Impulsive functions.

TEXT BOOK:

1. Dr. B.S. Grewal *Higher Engineering Mathematics* 43rd edition, Khanna Publishers, New Dehli.

REFERENCE BOOKS:

1. N.P. Bali, Dr . Ashok Saxena, Dr.N.Ch.S. Narayana, *A Text book on Engineering Mathematics* Laxmi pub.(p)Ltd. New Dehli.
2. H.K.Dass, *Advanced Engineering Mathematics*, S.chand and company ltd
3. Dr.M.K. Venkataraman, *Higher Engineering Mathematics* National Pub.Co.Madras.
4. Erwin kreyszig. *Advanced Engineering Mathematics* John Wiley and sons, Newyork.

ENGINEERING CHEMISTRY

(Common for all branches)

CHE 122

Credits : 3

Instruction : 3 Periods & 1 Tut/Week

Sessional Marks : 40

End Exam : 3 Hours

End Exam Marks : 60

Course Objectives:

- To provide knowledge on problems associated with impure water and various water treatment technologies
- To enable the students to know the importance of semiconducting materials and preparation techniques
- To provide basic knowledge on conventional energy resources, developments in batteries and fuel cells
- To understand the corrosion of metals, various methods to prevent and control of corrosion
- To create awareness on advanced concepts like nano materials, green chemistry and eco-friendly technologies for future development

Course Outcomes:

By end of the course, student will be able to:	
1	Identify the problems associated with raw water in various applications and can adopt suitable technologies for domestic and industrial feed waters.
2	Identify & generalize the properties of semiconducting materials and can select suitable semiconducting & various ceramic materials for specific applications.
3	Classify and analyze the conventional energy sources and design of suitable batteries/cells for different engineering applications.
4	Select and design of suitable materials to prevent corrosion and protect various parts from corrosion.
5	Implement the green chemistry principles, concept of tribology, unique properties of nano & composite materials in designing of suitable methods and materials to meet the technological challenges.
6	Solve scientific problems related to various engineering fields.

SYLLABUS

UNIT I

10 Periods

Water Chemistry: Impurities in water, Hardness of water - units and calcium carbonate equivalents, -estimation of hardness (EDTA method) - disadvantages of hard water, boiler troubles- Scale & Sludge formation - prevention- Internal treatment - (Phosphate, Carbonate and Calgon conditioning) -Caustic embrittlement

Water treatment techniques: Softening of water -lime-soda process -numerical problems on LS process -Zeolite, -ion exchange methods, Desalination of water – Reverse osmosis and Eelectrodialysis, Municipal water treatment - Screening, sedimentation, coagulation, Sterilization- Chlorination-Break Point chlorination.

UNIT II

10 Periods

Solid State Chemistry: Classification of Solids, Band theory of solids. Chemistry of Semiconductors – Intrinsic, extrinsic, compound and defect semiconductors, Organic semiconductors, Purification and preparation of Semiconductor by zone refining – Single crystal growth(Czochralski method) – epitaxial growth. Liquid crystals, LCD, LED and OLED.

Ceramic Materials: Cement-Manufacture of Portland cement - Setting and hardening of cement -Cement concrete - RCC, Refractories - Classification - properties, Ceramics and its Engineering applications.

UNIT III

10 Periods

Thermal Energy: Fuel –types of fuels -Calorific value and its determination (Bomb calorimeter method) Coal- Ranking of coal - analysis (proximate and ultimate) – COKE – Manufacture (Otto Hoffmann’s process). Petroleum – refining of Crude oil; Synthetic petrol – Fisher - Tropsch and Bergius methods, Knocking in Petrol and Diesel engine – Octane number - Cetane number, LPG and CNG.

Chemical Energy: Electrode potential, electro chemical series – Reference electrodes – SHE, Calomel electrode – Galvanic cells – primary cells (Dry cell) secondary cells (Lead acid, Ni-Cd, Li ion batteries) H_2-O_2 fuel cells.

Solar Energy: Construction and Working of Photovoltaic cell

UNIT IV

08 Periods

Corrosion Chemistry: Origin and theories of corrosion – Types of corrosion - Galvanic corrosion, concentration cell corrosion, pitting corrosion, stress corrosion, inter granular corrosion; Factors affecting corrosion – Corrosion

Prevention & Control of Corrosion:Cathodic protection; Corrosion inhibitors; Protective coatings –Galvanization & Tinning –Anodized coatings - paints & special paints

UNIT V

10 Periods

Nanochemistry: Introduction, growth of nanoparticles (Sol-gel process), Fullerenes and Carbon nanotubes

Green chemistry: Principles of Green chemistry, Alternative Solvents used in green synthesis.

Lubricants: Concept of Tribology -Mechanism of lubrication- Blended oils - properties of lubricating oils -Viscosity Index -Fire & Flash Point -Cloud & Pour Point -Aniline point.

High Polymers & Composites- Basic concepts of Polymers, Effect of polymer structure on properties. Plastics-Thermoplastic and Thermosetting resins, Composites -types- Fiber Reinforced Plastics -Particulate composites -Layer composites, engineering applications of composites.

TEXT BOOK:

1. P.C. Jain and M. Jain *Engineering Chemistry* 16th edition - Dhanapathi Rai & Sons, Delhi

REFERENCE BOOKS:

1. S.S. Dara *A text book of Engineering Chemistry* 15 the edition, S. Chand & Co. New Delhi
2. O.G. Palanna *Engineering Chemistry* Tata McGraw Hill Education pvt ltd, New Delhi.
3. B.K. Sharma *Engineering Chemistry* - Krishna Prakashan Meerut
4. A.K. Bandopadhyay *Nanomaterials* new age international publishers.
5. V.K. Ahluvalia *Green solvents for organic synthesis* Narosa publications.

PROFESSIONAL ETHICS AND HUMAN VALUES

(Common for All Branches)

CHE 123

Credits :2

Instruction: 2 Periods & 1 Tut/Week

Sessional Marks :100

Course Objectives:

- To understand moral values and their significance.
- To draw inspiration for imbibing moral values
- To understand professional ethics and obligations
- To know the code of ethics of relevant Professional societies

Course Outcomes:

By end of the course, student will be able to:	
1.	Understand the right code of conduct.
2.	Assess his/her roles as a proactive member of the society
3.	Solve moral dilemmas and issues
4.	Implement Code of ethics of relevant Professional societies

SYLLABUS

UNIT I: Introduction

Philosophical basis for human values- Human values as enshrined in the Gita, Bible and khoran; Religion- Values propounded in various religions- Need for Religious harmony

UNIT II: Human Values: Inspiration

Inspiration for human values- Mahatma Gandhi, Dr.SarvepalliRadha Krishnan, Swami Vivekananda, Rabindranath Tagore, Mother Theresa- Benefits of Human values- Harmony between Self-interest and human values

UNIT III: Basics of Professional Ethics

Ethical Human Conduct – based on acceptance of basic human values; Humanistic Constitution and Endersal human order – skills, sincerity and fidelity; Scope and characteristics of people-frily and eco-frily production system, Technologies and management systems.

UNIT IV: Professional Ethics in practice

Profession and Professionalism – Professional Accountability, Roles of a professional, Ethics and image of profession; Engineering Profession and Ethics - Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world; Professional Responsibilities – Collegiality, Loyalty, Confidentiality, Conflict of Interest, Whistle Blowing

UNIT V: Indian Constitution, Code of Ethics and Global Issues

Indian Constitution: Fundamental Rights and duties, Freedom, Equality, Fraternity, Justice, Directive principles of state policy. Sample code of Ethics by Professional Societies such as ASME, ASCE, IMEC, IETE, Institution of Engineers (India), Indian Institute of Materials Management etc.

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership.

TEXT BOOKS:

1. K.R. Govindan and S.SenthilKumar *Professional Ethics & Human Values* Anuradha Publications.
2. Mike Martin and Roland Schinzinger *Ethics in Engineering* 3rd edition, McGraw Hill. New York (2012).

REFERENCE BOOKS:

1. R. Subramanian *Professional Ethics* Oxford Endersity Press.
2. A.N. Tripathy *Human values* 2003, New Age International Publishers
3. S.B. Srivasthva *Professional Ethics & Human Values* SciTech Publications (India) Pvt. Ltd. New Delhi.
4. Prof. D.R. Kiran *Professional Ethics & Human Values* TATA McGraw Hill Education.
5. M. Govindrajan, S Natrajan & V.S. Senthil Kumar *Engineering Ethics (including human Values)* Eastern Economy Edition, Prentice hall of India Ltd

PHYSICAL CHEMISTRY
(Only for Chemical Engineering)

CHE 124

Credits : 3

Instruction : 3 Periods & 1 Tut/Week

Sessional Marks : 40

End Exam : 3 Hours

End Exam Marks : 60

Course Objectives:

- To understand about the concept of chemical equilibrium and its importance industrial process
- To get an idea about the thermodynamic functions, laws and its applications
- To know about mobility of ions in dilute solutions and its significance in instrumental methods (conductivity meter)
- To inculcate the concept of order and molecularity of various reactions
- To give an idea about phase diagrams of various heterogeneous equilibria

Course Outcomes:

By the end of the course, the student will be able to:	
1	Apply the principles of laws of thermodynamics in various Industrial Processes and Designing.
2	Develop suitable conditions in reaction equilibria of various Chemical Processes.
3	Identify the changes in heterogeneous systems and understand the role of various physical quantities useful in Chemical Engineering Industry.
4	Adopt suitable catalytic mechanisms to determine kinetic parameters applicable in Chemical Reaction & Bioprocess Engineering
5	Predict the nature of substances and their behaviour by applying advanced electrochemical laws.
6	Implement the various principles for solving the challenges in the field of Chemical Engineering.

SYLLABUS

UNIT I

12 periods

Thermodynamics and Thermo chemistry:First law-Internal Energy, Work and Heat changes, Enthalpy, reversible isothermal expansion of ideal gas, maximum work. Heat capacities at constant pressure and volume, adiabatic expansion of an ideal gas.Heat of Reaction- heat of Formation, Heat of Combustion, Thermochemical Laws, effect of temperature on Heat of Reaction.Second law of Thermodynamics, spontaneous processes, Entropy and physical significance of entropy, Entropy change for an ideal gas.Entropy change accompanying phase change, Gibb's Free Energy and applications.

UNITII

8 periods

Chemical Equilibrium: Reversible reactions, Law of Mass action, Homogeneous equilibria in gaseous and liquid systems and simple example of Heterogeneous equilibria, Le-Chatelier principle- applications, Effect of temperature on equilibrium- VantHoff's equation.

UNITIII

10 periods

Liquid state-vapour pressure, effect of temperature, determination of vapour pressure (static and dynamic method) – surface tension, determination by capillary rise method- viscosity, determination (Ostwald's method)

Phase rule: Definition-explanation of terms-Derivation of phases Rule-One component systems (water system)-Two component systems (Ag-Pb& KI-H₂O), Eutectic mixture-its significance.

UNITIV

10 Periods

Chemical Kinetics and Catalysis: Rate of Reaction- Order &Molecularity, determination of order, first order reaction –illustrations, derivation of rate equation Second order reaction – illustrations, derivation of rate equation, pseudo first order and second order reactions-illustrations,Half life period,numerical problems, Catalysis- Types-Homogeneous-Heterogeneous-Enzyme Catalysis-Mechanisms.

UNIT-V

10Periods

Electrochemistry: Electrolytes-Types-Conductance-Specific, Equivalent, Molar conductance – Conductmetric Titrations , measurement of electrical conductivity and numerical problems ,variation of conductance with temperature, Migration of ions , relative speed of ions, Hittrof's rule-transport number, Determination-Hittrof method, Kohlarsauch's law and applications.

TEXT BOOK:

1. ArunBhal, B.S.Bhal and G.D.Thuli ,*Essentials of Physical chemistry*, , S.Chand and company ltd.

REFERENCE BOOKS:

1. Peter Atkins & Julio de Paula, *Physical Chemistry*,7th edition, oxford university press7th edition.
2. B.R.Puri and L.R.Sharma, *Principles of physical chemistry*, 44th edition b, vishal publishing company, New Delhi.

INTRODUCTION TO CHEMICAL ENGINEERING

(Elementary treatment only)

CHE 125

Credits : 3

Instruction : 3 Periods & 1 Tut/Week

Sessional Marks : 40

End Exam : 3 Hours

End Exam Marks : 60

Course Objectives:

- To discuss the basics and necessity of Chemical Engineering.
- To know the importance of units and dimensions and material and energy balances.
- To gain knowledge in momentum and heat transfer.
- To gain knowledge in mass transfer operations.

Course Outcomes:

By the end of the course, the student will be able to:	
1	Appreciate the need and role of a Chemical Engineer in industries.
2	Use different units and dimensions and make material and energy balances.
3	Use the principles involved in momentum, heat and mass transfer.
4	Identify the usage of different equipments for different operations

SYLLABUS

UNIT I

10 Periods

Introduction : Introduction, role of chemical engineer, unit operations, unit processes, types of chemical reactors, basic laws, mechanical separations, units and dimensions, energy, equivalent mass, solutions, material and energy balances.

UNIT II

10 Periods

Momentum Transfer : Introduction, nature of fluid, viscosity, flow field, conservation of mass and energy, fluidization, pumping of fluids, cavitation.

UNIT III

10 Periods

Heat Transfer : Conduction, convection, radiation, flow arrangements in heat exchangers, heat transfer equipment, evaporation.

UNIT IV

10 Periods

Mass Transfer Operations – I : Diffusion, mass transfer operation, absorption, vapour liquid equilibrium, relative volatility, boiling point diagram, distillation, reflux, plate efficiency, absorption, absorption equipment

UNIT V

10 Periods

Mass Transfer Operations – II : Liquid-liquid extraction, extraction schemes, single stage equilibrium extraction, multi stage equilibrium extraction, humidification and dehumidification, drying, equipment for drying.

TEXT BOOK:

1. Max S. Peters, *Elementary Chemical Engineering*, 2nd edition, Tata-McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. S. K. Ghosal, S. K. Sanyal and S. Dutta, *Introduction to Chemical engineering*, Tata-McGraw Hill, New Delhi.
2. J. T. Banchemo and W. L. Badger, *Introduction to Chemical Engineering*, Tata-McGraw Hill, New Delhi.
3. Warren L. McCabe, Julian C. Smith and Peter Harriot, *Unit Operations of Chemical Engineering*, 7th edition, Tata-McGraw Hill, New Delhi.
4. Kenneth A. Solen, John N. Harb, *Introduction to Chemical Engineering*, 5th Edition, Wiley India Pvt. Ltd., New Delhi.

ENGINEERING CHEMISTRY LAB

(Common for all branches)

CHE 126

Practical / week : 3

End Exam : 3Hrs

Credits : 2

Sessional Marks :50

End Exam Marks : 50

Course Objectives:

- To provide clear idea over quantitative chemical analysis.
- To improve skills in analyzing samples through titration procedures.
- To familiarize with Instrumental methods of analysis for more accuracy.
- To introduce various methods of analyzing the ore samples.

Course Outcomes:

By end of the course, student will be able to:	
1	Apply experimental skills in quantitative chemical analysis of water quality parameters, substances and ores.
2	Select and use a suitable instrumental technique for the quantitative estimation and analyse the data obtained.

List of Experiments (any 10 experiments are to be completed):

1. Preparation of standard solution
2. Estimation of sodium carbonate present in soda ash.
3. Estimation of amount of calcium present in the Portland cement by titrimetrically.
4. Estimation of amount of Copper present in the Copper ore by Iodometrically.
5. Determination of total Hardness present in the given water sample.
6. Estimation of amount of Zinc by titrating with EDTA.
7. Determine the strength of acid by titrating with strong base using **pH meter**.
8. Estimate the individual strength of acids present in the acid mixture by titrating with strong base using **conductivity meter**.
9. Estimate the amount of Mohr's salt present in the given solution by titrating with potassium dichromate using potentiometer.
10. Determination of viscosity of the given liquid by Ostwald viscometer.

11. Determination of rate constant of acid catalyzed hydrolysis of ester.
12. Determination of partition coefficient of iodine distributed between Water and Carbon tetra chloride.

Demonstration

13. Estimation of amount of dissolved oxygen (D.O) present in the given water sample.
14. Synthesize the Phenol-Formaldehyde resin.

TEXT BOOK:

1. S.K. Bhasin and SudhaRani *Laboratory manual on Engineering chemistry*, third edition DhanpatRai Publishing Company.

REFERENCE BOOK:

1. S.S. Dara *Experiments and calculations in Engineering chemistry* 9th edition S. Chand & Company Ltd.

LANGUAGE LAB
(Common for all branches)

CHE127

Practical / week : 3

End Exam : 3Hrs

Credits : 2

Sessional Marks : 50

End Exam Marks : 50

Course Objectives:

- To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning.
- To improve the fluency in spoken English and neutralize mother tongue influence
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking.
- To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.
- 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.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Handle CBT (Computer Based Tests) of the qualifying examinations.
2.	Receive, interpret, remember and evaluate information by practicing effective listening skills.
3.	Speak English with neutralized accent.
4.	Narrate, describe and report incidents and situations using appropriate terminology.

SYLLABUS

I CALL (Computer Aided Language Learning)

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Short and long Reading comprehension exercises (listening skills)
4. Telephoning Skills.

II CSL (Communication Skills Lab)

5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Video talks
8. Situational Dialogues / Role Play.
9. Oral Presentations- Prepared and Extempore.

Suggested Software

- Cambridge Advanced Learners' English Dictionary with CD.
- English Phonetics and Phonology – 2 CDs set
- English Mastery – Alania ABC
- Telephoning English
- Cambridge Grammar of English (Ronald Carter and Michael McCarthy) CD
- English Grammar in Use -Cambridge University Press
- Communication Skills – Oxford U P (Sanjay Kumar and PushpaLatha)

REFERENCE BOOKS:

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. *Spoken English (CIEFL)* in 3 volumes with 6 cassettes, OUP.
2. Daniel Jones *English Pronouncing Dictionary* Current Edition with CD.
3. R. K. Bansaland J. B. Harrison, *Spoken English*-Orient Longman 2006 Ed.
4. Dr A Ramakrishna Rao, Dr G Natanam& Prof SA Sankaranarayanan*English Language Communication : A Reader cum Lab Manual*Anuradha Publications, Chennai
5. Krishna Mohan & NP Singh *Speaking English Effectively* (Macmillan)
6. J. Sethi, KamleshSadanand& D.V. Jindal*A Practical Course in English Pronunciation, (with two Audio cassettes)* Prentice-Hall of India Pvt. Ltd., New Delhi.
7. T. Balasubramanian*A text book of English Phonetics for Indian Students* (Macmillan).
8. *English Skills for Technical Students*, WBSCTE with British Council, OL
9. J.K. Gangal *A Practical Course in Effective English Speaking Skills* PHI.