Academic Rules & Regulations for B. Tech Programme

(As Approved by The Academic Council & The Governing Body of the College)

(Amended in August 2014; Applicable to the students admitted into the First year B.Tech from the academic year 2014-2015 onwards).

1.0 EXTENT: All the rules and regulations, specified herein after, shall be read as a whole for the purpose of interpretation and when a doubt arises, the interpretation of the Chairman, Academic Council, Bapatla Engineering College (Autonomous) is final. As per the requirements of the Statutory Bodies, The Principal, Bapatla Engineering College (Autonomous), shall be the Chairman of the College Academic Council.

2.0 ADMISSIONS:

2.1 Admission into the First year of any Four Year B.Tech Programmes of study in Engineering: Admissions into the first year of B.Tech Programme of Bapatla Engineering College (Autonomous) (***Subsequently referred to as*** **B.E.C**) will be as per the norms stipulated by Acharya Nagarjuna University and the Govt. of Andhra Pradesh from time to time.

2.2 Admission into the Second year of any Four year B.Tech Programmes of study in Engineering: Admissions into the second year of B.Tech Programme of B.E.C will be as per the norms stipulated by Acharya Nagarjuna University and the Govt. of Andhra Pradesh from time to time.

2.3 Admissions with advance standing: These may arise in the following cases:

1) When a student seeks transfer from other colleges to B.E.C and intends to pursue B.Tech at B.E.C in an eligible branch of study.
2) When students of B.E.C get transferred from one regulation to another regulation or from previous syllabus to revised syllabus.
3) When a student, after long discontinuity, rejoins the college to complete his/her Programme of study for the award of the degree.
4) When a student is not able to pursue his/her existing Programme of study but intends to get transferred to another Programme of study.

These admissions may be permitted by the Academic Council of B.E.C as per the norms stipulated by the statutory bodies and the Govt. of Andhra Pradesh from time to time. In all such cases for admission, when needed, permissions from the statutory bodies are to be obtained and the Programme of study at B.E.C will be governed by the transitory regulations stipulated in ***5.3.***

3.0 DURATION OF THE PROGRAMME AND MEDIUM OF INSTRUCTION: The duration of the B.Tech. Programme is for four academic years consisting of two semesters in each academic year. The medium of instruction and examinations is English.

SNo	Activity	Description
1.	Number of Semester in an Academic Year	Two
2.	Regular Semester duration in Weeks	19
3.	Academic Activities Schedule	
	Course Work	15 Weeks
	Examination Preparation	1 Week
	Examinations	2 Weeks
	Declaration of Results	1 Week
4.	Evaluation	Continuous Internal Evaluation (CIE) with a weightage of 40% and Semester End Examinations (SEE) with a weightage of 60% of the student's performance in course/laboratory work and other activities, if any.
5.	Other Items	The total number of working days in an academic year shall be >180;
		Academic schedules prescribed by the college shall be adhered to by all the concerned.
		Students failing in any course (s) shall register for the same again (re-register) and shall secure SEE afresh in each course(s). This shall continue until a pass grade is obtained in the said course(s).

4.0 MINIMUM No. INSTRUCTION DAYS:

Each semester shall consist of a minimum of 90 instruction days.

5.0 Programmes of study in B.Tech:

5.1 The Four year B.Tech Programme is offered in the following branches of study:

S.No.	Title of the UG Programme	Abbreviation
1.	Civil Engineering	CE
2.	Chemical Engineering	CH
3.	Computer Science & Engineering	CS
4.	Electrical & Electronics Engineering	EE
5.	Electrical & Communication Engineering	EC
6.	Electronics & Instrumentation Engineering	EI
7.	Information Technology	IT
8.	Mechanical Engineering	ME

5.2 Structure of the Programme:

5.2.1 Each Programme of a Discipline or a branch of study shall consist of:

1) General courses in Basic Sciences, Basic Engineering Sciences, Social Sciences & Humanities.
2) Interdisciplinary courses in Engineering to impart the fundamentals of Engineering to the student.
3) Compulsory core courses to impart broad based knowledge needed in the branch of study concerned.
4) Elective courses from either discipline or interdisciplinary areas to be chosen by the student based on his/her interest and specialization preferred.
5) A Term paper and a Project approved by the Department to be submitted in the fourth year of study.

Every Programme of study shall be designed to have 45-50 theory courses and 20-25 laboratory courses and the distribution of types of courses from the above is indicated in the following table.

Humanities & Social Science, Basic Science and Engineering Science courses	30 -45%
Professional Core courses	35-45%
Professional Elective and Open Elective Courses	10-15%
Major Project / Seminar, etc	5-10%

***Note**: All components prescribed in the curriculum of any Programme of study shall be conducted and evaluated.*

5.2.2 Contact hours: Depending on the complexity and volume of the course, the number of contact hours per week will be determined.

5.2.3 Credits: Credits are assigned to each course as per norms mentioned in the following table.

Subject	Credits
Theory Course (4 Periods/Week)	03
Theory Course with additional Tutorial Period	04
Laboratory Course (3 Periods/Week)	02
Term paper (2 Periods/Week)	01
Business communication & Presentation Skills Lab (2 Periods/Week)	01
Final year Project (12 Periods/Week)	10

5.3 Transitory Regulations: For students admitted under advance standing (mentioned in 2.3) these transitory regulations will provide the *modus operandi*.

At the time of such admission, based on the Programme pursued (case by case)

1) Equivalent courses completed by the student are established by the BOS concerned.
2) Marks/Credits are transferred for all such equivalent courses and treated as successfully cleared in the Programme of study prescribed by B.E.C.
3) A Programme chart of residual courses not cleared will be derived and a Programme of study with duration specified will be prescribed for pursuit at B.E.C.
4) Marks obtained in the previous system if the case be, are converted to grades and CGPA is calculated accordingly.

All other modalities and regulations governing shall be the same as those applicable to the stream of students with whom such a candidate is included into.

5.4 Curriculum for each Programme of study:

1) The Four year curriculum of any B.Tech Programme of study in any branch of engineering is formulated based on the guidelines mentioned in 5.2 and will be recommended by the Board of Studies concerned and is approved by the Academic council of the college.
2) In the case of students admitted through lateral entry, the respective regular curriculum contents from the second year onwards are to be pursued by such students.
3) In the case of students admitted under advanced standing, the Programme curriculum will be prepared by the Board of Studies concerned and the same shall be approved by the Academic Council.
4) After approval from the Academic Council, Programme curriculum for the same shall be prepared and made available to all the students along with the academic regulations.

Table below shows a typical curriculum frame work for B.Tech Degree program.

S.No.	Subject Area	Average no. of credits
1.	Humanities & Social Sciences courses	14
2.	Basic Science Courses	35
3.	Engineering Science	32
4.	Professional Core courses	96
5.	Professional Elective Courses	16
6.	Major Project / Seminar, etc.	11
7.	Open Electives	3
	TOTAL	**207**

The students admitted through the **Lateral Entry scheme** have to complete **155** credits

5.5 The Maximum duration permitted to pursue the programme and cancellation of admission:

5.5.1 The maximum duration permitted for any student to successfully complete any four year B.Tech. Programme of study shall be:

1) Eight academic years in sequence from the year of admission for a normal student admitted into the first year of any Programme,
2) Six academic years in sequence from the year of admission for a Lateral entry student admitted into the second year of any Programme, and
3) For students admitted with advanced standing, the maximum time for completion of Programme study shall be twice the period in terms of academic years in sequence, stipulated in the Programme curriculum defined at the time of admission.

5.5.2 In case, any student fails to meet the applicable conditions for the eligibility of degree in the maximum stipulated period as mentioned in ***5.5.1***, his/her admission stands cancelled.

6.0 EXAMINATION SYSTEM & EVALUATION:

6.1 The performance of the students in each semester shall be assessed course wise. All assessments will be done on absolute mark basis. However, for the purpose of reporting the performance of a candidate, letter grades and grade points will be awarded as per section ***11.0.*** The performance of a student in each course is assessed with Alternate Assessment Tests, term examinations on a continuous basis during the semester called Continuous Internal Evaluation (CIE) and a Semester End Examination (SEE) conducted at the end of the semester. For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester, except where stated otherwise in the detailed Scheme of Instruction.

6.2 The distribution of marks between Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) to be conducted at the end of the semester will be as follows:

Nature of the Course	**CIE**	**SEE**
Theory subjects	40	60
Drawing	40	60
Practical	40	60
Business communication & presentation Skills Lab	20	30
Term Paper	20	30
Project work	50	100

6.3 Continuous Internal Evaluation (CIE) in Theory and Drawing subjects:

1. In each Semester there shall be two Term examinations and two tests from any of the ***Alternate Assessment Tools (AAT)*** like Home Assignment, Class Test, Problem Solving, Group Discussion, Quiz, Seminar and Field Study in every theory course. The Alternate Assessment Tool with detailed modality of evaluation for each course shall be finalized by the teacher concerned before beginning of the course with the permission of HOD concerned and the PRINCIPAL.

   The Term Examination is conducted in the regular mode according to a schedule which will be common for a particular year of study. The maximum weightage for Term Examinations, AAT and the calculation of marks for CIE in a theory course is given in the following table.

Weightage for different heads to calculate CIE for 40 marks in a Theory course			
Particulars	Term Exams (Max. 25 marks)	AAT (Max. 10 marks)	Attendance (Max.5 marks)
Better Performed exam	75% of marks obtained	50% of marks obtained	5
Other exam	25% of marks obtained	50% of marks obtained	

2. For drawing courses, there shall be only two Term examinations in a semester with no Alternate Assessment Tool. In case of such courses a maximum of 10 marks shall be given for day-to-day class work and a maximum of 25 marks shall be awarded to the Term examinations taking into account the performance of both the Term examinations giving weightage as prescribed above.

3. A maximum weightage of 5 marks will be given in the CIE for attendance in all theory and drawing courses as indicated in ***7.1.1.***

6.4 Semester End Examination (SEE) in Theory and Drawing subjects:

1) For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester for 60 marks. Question paper setting shall be entrusted to external examiners from the panels approved by the respective Boards of Studies.

2) A minimum of 24 (40%) marks are to be secured exclusively in the Semester End Examination (SEE) of theory/drawing course and a minimum total of 40 marks in SEE

and CIE put together in a theory / drawing course is to be secured in order to be declared as passed in that course and for the award of the grade in the course.

6.5 Continuous Internal Evaluation (CIE) in laboratory courses:

1) The evaluation for Laboratory course is based on SEE and CIE. The CIE for 40 marks comprises of 20 marks for day to day laboratory work, 5 marks for record submission and 15 marks for a laboratory examination at the end of the semester.

2) In any semester, a minimum of 90 percent of prescribed number of experiments / exercises specified in the syllabi for laboratory course shall be taken up by the students. They shall complete these experiments / exercises in all respects and get the record certified by the internal lab teacher concerned and the Head of the Department concerned to be eligible to appear for the Final Examination in that laboratory course.

6.6 Semester End Examination (SEE) in laboratory courses:

1) For each laboratory course, the Semester End Examination (SEE) shall be conducted by one internal and one external examiner appointed by the Principal and the duration of the exam shall be for three hours. The SEE is for 60 marks which include 10 marks for write up, 5 marks for record 30 marks for lab experiment / exercise / result analysis and 15 marks for Viva-voce.

2) A minimum of 30 (50%) marks shall be obtained in SEE and a minimum total of 40 marks in SEE and CIE put together in a laboratory course are to be secured in order to be declared as passed in the laboratory course and for the award of the grade in that laboratory course.

6.7. Evaluation of term paper and Business communication & Presentation Skills Lab:

1) A term paper is to be submitted by each student in the 7^{th} semester which would be a precursor to the project work to be done in the 8^{th} semester, and Business Communication & Presentation Skills Lab is to be taken up in the 7^{th} semester. The evaluation is based on CIE for 20 marks, which includes a minimum of two seminars/presentations for 10 marks and the report submitted at the end of the semester which is evaluated for 10 marks.

2) The Semester End Examination (SEE) shall be conducted for 30 marks by one internal and one external examiner appointed by the Principal. The SEE contains Viva-voce and the demonstration of the model developed or work performed as a part of the term paper.

3) A minimum of 15 (50%) marks shall be obtained in SEE and a minimum total of 20 marks in SEE and CIE put together in the term paper are to be secured in order to be declared as passed in the term paper and for the award of the grade in the term paper.

6.8 Evaluation of Project:

1) In case of the Project work, the evaluation shall be based on CIE and SEE. The CIE for 50 marks consists of a minimum of two Seminars/ presentations for 25 marks and the Project Report submitted at the end of the semester which is evaluated for 25 marks.

2) SEE shall be in the form of a Viva- voce and the demonstration of the thesis work for 100 marks. Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner to be appointed by the Principal. A minimum of 50 marks shall be obtained in SEE exclusively and a minimum total of 60 marks in SEE and CIE put together are to be secured in order to be declared as passed in the Project and for the award of the grade.

6.9 A student who could not secure a minimum of 50% aggregate marks in CIE of a semester is not eligible to appear for the Semester End Examinations conducted at the end of the semester and shall have to repeat that semester.

NOTE : A student who is absent for any Test / Exam / Seminar / Presentation as a part of Continuous Internal Evaluation (CIE), for any reason whatsoever, shall be deemed to have scored zero marks in the respective component and no provision for make-up shall be provided.

6.10 Make-up Test: A student can appear for a Make-up Test in a single theory subject of a semester to improve marks in the Continuous Internal Evaluation (CIE/Internal marks) subject to the following:

If the student becomes eligible to appear for the Semester End Examination (SEE) of a semester and is unable to secure 40% internal marks in a particular theory subject due to genuine reasons, he/she may be given an opportunity to appear for makeup test in any one subject of that semester. The makeup test will be conducted for 40 marks and the marks obtained in this test are final. However, the maximum mark awarded will be 16 only irrespective of the marks obtained in the makeup test. Such students have to apply by paying a fee prescribed by the institution and submit the application along with a letter of request indicating the genuineness of his/her candidature to be eligible for the makeup test. Applications should be recommended by the HOD concerned and approved by the principal.

6.11 Course Repetition: The students secured less than 40% in the Continuous Internal Evaluation (CIE) and Semester End Examinations (SEE) may register for the course repetition. The students have to apply to the Principal through the respective HOD by paying prescribed fees. A student can take up a maximum of two courses in a semester immediately after the semester end examinations of that particular semester.

The HODs concerned have to allot a teacher related to that course to conduct class work. The minimum number of periods to be conducted should not be less than 50% of the total prescribed periods for that course. The classes will be conducted in the vacation period or in the weekends or in the afternoons as decided by the HOD concerned. Teacher has to evaluate the student for his performance in CIE as per the autonomous norms and students should appear for a semester end examination. The pass criteria in both CIE & SEE should be as per autonomous norms.

7.0 ATTENDANCE REGULATIONS:

7.1 Regular course of study means a minimum average attendance of 75% in all the courses of study prescribed for a semester in the curriculum, computed by considering total number of hours / periods conducted in all courses as the denominator and the total number of hours / periods actually attended by the student in all courses, as the numerator.

7.1.1 A maximum of 5 marks weightage in CIE in each theory/drawing course shall be given for those students who put in a minimum of 75% attendance in the respective theory/drawing course in a graded manner as indicated below:

Attendance of 65% and above but less than 75%	4 mark
Attendance of 75% and above but less than 80%	6 mark
Attendance of 80% and above but less than 90%	8 marks
Attendance of 90% and above	10 marks

The above marks are scaled and reduced to maximum of 5 marks for the purpose of calculating attendance weightage.

7.2 Condonation of shortage in attendance may be recommended on genuine medical grounds, up to a maximum of 10%, provided the student puts in at least 65% attendance as calculated in *7.1* above and provided the principal is satisfied with the genuineness of the reasons.

7.3 A student, who could not satisfy the minimum attendance requirements, as given above, in any semester, is not eligible to appear for the Semester End examinations and shall have to repeat that semester.

8.0 DETENTION: A student is said to have been detained and not allowed to appear for Semester End Examination (SEE) at the end of the semester when

8.1 The student does not have a minimum average 75% attendance or 65% attendance with condonation in all subjects put together in that semester or the student has not scored a minimum of 50% of marks in CIE in all the courses of that semester put together.

Such a student shall have to repeat the same semester subsequently and satisfy the above requirements afresh to become eligible to appear for the Semester End Examination (SEE), conducted at the end of the semester.

9.0 CONDITIONS FOR PROMOTION:

9.1 A student not detained in the first semester of a year of study shall be promoted to second semester of that year of study.

9.2 A student shall be eligible for promotion to II year of B.Tech. Programme, if he/she is not detained in the second semester of first year B.Tech. Programme irrespective of the number of backlog courses in I year B.Tech.

9.3 A student shall be eligible for promotion to III year of B.Tech. Programme, if he/she is not detained in the second semester of II year B.Tech. Programme and has passed all but **three** courses of I year B.Tech. (Including laboratory courses).

9.4 A student shall be eligible for promotion to IV year of B.Tech. Programme, if he/she is not detained in the second semester of III year B.Tech. Programme and is allowed to keep **FOUR backlog courses of I & II B.Tech. (Including laboratory course) put together**.

10.0 Registration: Every eligible student (not detained and promoted) has to register himself/ herself at the beginning of every semester indicating all the Courses taken up for pursuit by him/her during that Semester.

10.1 When a student is debarred for one or more semesters, his/her registration in the present semester is cancelled and the student is debarred from registering in future during the debarred period.

10.2 In any case, while re-registering in any semester, he or she will have to pay the requisite fee once again.

11.0 GRADING SYSTEM

11.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester for each course. The letter grades and the corresponding grade points are as given in the Table.

Table: Grades & Grade Points

Grade	Grade Points	% of Marks
O	10	90% and above
A+	9	80% – 89%
A	8	70% – 79%
B+	7	60% – 69%
B	6	50% – 59%
C	5	40% – 49%
F	Failed, 0	Less than 40%

11.2 A student who earns a minimum of 5 grade points (C grade) in a course is declared to have successfully completed the course, and is deemed to have earned the credits assigned to that course. **However it should be noted that a pass in any course/term paper/Project shall be governed by the rules mentioned in 6.0**.

12.0 GRADE POINT AVERAGE

12.1 The Grade Point Average (GPA) will be calculated according to the formula:

$$GPA = \frac{\sum C_i G_i}{\sum C_i}$$

Where C_i = number of credits for the course *i*,

G_i = grade points obtained by the student in the course.

12.2 Semester Grade Point Average (SGPA) is awarded to candidates considering all the courses of the semester. Zero grade points are also included in this computation.

12.3 To arrive at Cumulative Grade Point Average (CGPA), the formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time.

12.4 Example

Semester	Course Code.	Credits	Grade	Grade Point	Credit Points	SGPA	CGPA
I	14MA101	4	C	5	20		
I	14PH102	3	B	6	18		
I	14CH103	3	A	8	24		
I	14EL104	3	O	10	30		
I	14ES105	3	A+	9	27		
I	14EG106	4	B+	7	28	**7.73**	**7.73**
I	14CHL101	2	O	10	20	**(201/26)**	**(201/26)**
I	14ELL102	2	A	8	16		
I	14WSL103	2	A+	9	18		
Total		**26**			**201**		
II	14MA201	4	A	8	32		
II	14PH202	3	B	6	18		
II	14CH203	3	A+	9	27		
II	14EE204	3	C	5	15		
II	14EM205	4	O	10	40	**7.96**	**7.84**
II	14CP206	3	B+	7	21	**(207/26)**	**(408/52)**
II	14PHL201	2	A+	9	18		
II	14HWL202	2	A	8	16		
II	14CPL203	2	O	10	20		
Total		**26**			**207**		

13.0 ELIGIBILITY FOR AWARD OF B.TECH. DEGREE: A student shall be eligible for award of the B.Tech degree if he/she fulfils all the following conditions:

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

14.0 AWARD OF CLASS: A candidate who becomes eligible for the award of B.Tech. Degree shall be placed in one of the following Classes based on CGPA.

Table: CGPA required for award of Degree

Distinction	**≥ 8.0***
First Class	**≥ 7.0**
Second Class	**≥ 6.0**
Pass	**≥ 5.0**

* In addition to the required CGPA of 8.0, the student must have necessarily passed all the courses of every semester **in the minimum stipulated period for the Programme**.

14.1 Grade Sheet: A grade sheet (Memorandum) will be issued to each student indicating his performance in all courses taken in that semester and also indicating the Grades and SGPA.

14.2 **Transcripts**: After successful completion of the total Programme of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee. Partial transcript will also be issued up to any point of study to any student on request and by paying the stipulated fee in force.

14.3 Candidates shall be permitted to apply for recounting/revaluation of SEE scripts within the stipulated period with payment of prescribed fee.

14.4 The Governing Body of B.E.C (Autonomous) has to approve and recommend the same to Acharya Nagarjuna University for the award of a degree to any student.

15.0 IMPROVEMENT OF CLASS:

15.1 A candidate, after becoming eligible for the award of the Degree, may reappear for the Final Examination in any of the theory courses as and when conducted, for the purpose of improving the aggregate and the class. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the Degree.
However, this facility shall not be availed of by a candidate who has taken the Original Degree Certificate. Candidates shall not be permitted to reappear either for CIE in any course or for Semester End Examination (SEE) in laboratory courses (including Project Viva-voce) for the purpose of improvement.

16.0 SUPPLEMENTARY EXAMINATIONS: In addition to the Regular Final Examinations held at the end of each semester, Supplementary Final Examinations will be conducted during the academic year. Candidates taking the Regular / Supplementary examinations as Supplementary candidates may have to take more than one Final Examination per day. A student can appear for any number of supplementary examinations till he/she clears all courses which he/she could not clear in the first attempt. However the maximum stipulated period shall not be relaxed under any circumstances.

17.0 INSTANT SUPPLEMENTARY EXAMINATIONS: Candidates who fail in one theory course of 4^{th} year 2^{nd} semester can appear for Instant Supplementary Examination conducted after declaration of the revaluation results of the said exam.

18.0 MALPRACTICES:

The Principal shall refer the cases of malpractices in Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) to an Enquiry Committee constituted by him / her. The Committee will submit a report on the malpractice allegedly committed by the student to the Principal. The Principal along with the members of the Committee is authorized to award a suitable punishment, if the student is found guilty.

19.0 ADDITIONAL ACADEMIC REGULATIONS:

19.1 Any attempt to impress upon the teachers, examiners, faculty and staff of Examinations, bribing for either marks or attendance will be treated as malpractice.

19.2 When a student is absent for final examination, he/she is treated as to have appeared and obtained zero marks in that component and Grade is awarded accordingly.

19.3 When a component of Continuous Internal Evaluation (CIE) or Semester End Examination (SEE) is cancelled as a penalty, he/she is awarded zero marks in that component.

20.0 AMENDMENTS TO REGULATIONS:

The Academic Council of Bapatla Engineering College (Autonomous) reserves the right to revise, amend, change or nullify the Regulations, Schemes of Examinations, and/ or Syllabi or any other matter pertained that meets to the needs of the students, society and industry without any notice and the decision is final.

BAPATLA ENGINEERING COLLEGE: BAPATLA
(Autonomous)
SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CHEMICAL ENGINEERING
With Effective from 2014-2015 Academic Year
First Year B.Tech., (SEMESTER – I)

Code No.	Subject	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	S	Total	CIE	SEE	Total Marks	
14MA101	Engineering Mathematics – I	4	1	0	0	5	40	60	100	4
14PH102	Engineering Physics – I	4	0	0	0	4	40	60	100	3
14CH103	Engineering Chemistry – I	4	0	0	0	4	40	60	100	3
14EL104	English Language and Communication	4	0	0	0	4	40	60	100	3
14ES105	Environmental Studies	4	0	0	0	4	40	60	100	3
14EG106	Engineering Graphics	4	1	0	1	6	40	60	100	4
14CHL101	Chemistry Lab	0	0	3	0	3	40	60	100	2
14ELL102	English Language Laboratory	0	0	3	0	3	40	60	100	2
14WSL103	Workshop	0	0	3	0	3	40	60	100	2
	TOTAL	24	2	9	1	36	**360**	**540**	**900**	**26**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture S: Self Study T: Tutorial P: Practical

BAPATLA ENGINEERING COLLEGE : BAPATLA
(Autonomous)
SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CHEMICAL ENGINEERING
With Effective From 2014-2015 Academic Year
First Year B.Tech., (SEMESTER – II)

Code No.	Subject	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	S	Total	CIE	SEE	Total Marks	
14MA201	Engineering Mathematics – II	4	1	0	0	5	40	60	100	4
14PH202	Engineering Physics – II	4	0	0	0	4	40	60	100	3
14CH203	Engineering Chemistry – II	4	0	0	0	4	40	60	100	3
14EE204	Basic Electrical and Electronics Engineering	4	0	0	0	4	40	60	100	3
14EM205	Engineering Mechanics	4	1	0	0	5	40	60	100	4
14CP206	Computer Programming with C	4	0	0	1	5	40	60	100	3
14PHL201	Physics lab	0	0	3	0	3	40	60	100	2
14HWL202	Hardware Lab	0	0	3	0	3	40	60	100	2
14CPL203	Computer Programming Lab.	0	0	3	0	3	40	60	100	2
	TOTAL	24	2	9	1	36	**360**	**540**	**900**	**26**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture S: Self Study T: Tutorial P: Practical

BAPATLA ENGINEERING COLLEGE: BAPATLA
(Autonomous)
SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CHEMICAL ENGINEERING
With Effective from 2014-2015 Academic Year
Second Year B.Tech., (SEMESTER – III)

Code No.	Subject	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	S	Total	CIE	SEE	Total Marks	
14MA301	Engineering Mathematics-III	4	0	0	0	4	40	60	100	3
14CH302	Material Science and Engineering	4	0	0	0	4	40	60	100	3
14CH303	Organic Chemistry	4	0	0	0	4	40	60	100	3
14CH304	Inorganic Chemical Technology	4	0	0	1	5	40	60	100	3
14CH305	Material & Energy Balance	4	1	0	0	5	40	60	100	4
14CH306	Momentum Transfer	4	1	0	0	5	40	60	100	4
14CHL301	Basic Simulation Lab	0	0	3	0	3	40	60	100	2
14CHL302	Organic Chemistry Lab	0	0	3	0	3	40	60	100	2
14CHL303	Momentum Transfer Lab	0	0	3	0	3	40	60	100	2
	TOTAL	24	2	9	1	36	**360**	**540**	**900**	**26**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture S: Self Study T: Tutorial P: Practical

BAPATLA ENGINEERING COLLEGE : BAPATLA
(Autonomous)
SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CHEMICAL ENGINEERING
With Effective From 2014-2015 Academic Year
Second Year B.Tech., (SEMESTER – IV)

Code No.	Subject	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	S	Total	CIE	SEE	Total Marks	
14MA401	Probability & Complex Analysis	4	0	0	0	4	40	60	100	3
14CH402	Organic Chemical Technology	4	0	0	0	4	40	60	100	3
14CH403	Process Heat Transfer	4	1	0	0	5	40	60	100	4
14CH404	Engineering Thermodynamics	4	1	0	0	5	40	60	100	4
14CH405	Mechanical Unit Operations	4	0	0	1	5	40	60	100	3
14CH406	Process Instrumentation	4	0	0	0	4	40	60	100	3
14CHL401	Process Heat Transfer Lab	0	0	3	0	3	40	60	100	2
14CHL402	Mechanical Operations Lab	0	0	3	0	3	40	60	100	2
14CHL403	Chemical Technology Lab	0	0	3	0	3	40	60	100	2
	TOTAL	24	2	9	1	36	**360**	**540**	**900**	**26**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture S: Self Study T: Tutorial P: Practical

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For
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With Effective from 2014-2015 Academic Year
Third Year B.Tech., (SEMESTER – V)

Code No.	Subject	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	S	Total	CIE	SEE	Total Marks	
14CH501	Mass Transfer operations-I	4	1	0	0	5	40	60	100	4
14CH502	Process Dynamics and Control	4	0	0	1	5	40	60	100	3
14CH503	Chemical Thermodynamics	4	1	0	0	5	40	60	100	4
14CH504	Chemical Reaction Engineering-I	4	0	0	0	4	40	60	100	3
14CH505	Petroleum Refinery Engineering	4	0	0	0	4	40	60	100	3
14CH506	Elective-1	4	0	0	0	4	40	60	100	3
14ELL501	Soft Skills	0	0	3	0	3	40	60	100	2
14CHL502	Mass Transfer operations lab-I	0	0	3	0	3	40	60	100	2
14CHL503	Instrumentation and Process Control Laboratory	0	0	3	0	3	40	60	100	2
	TOTAL	24	2	9	1	36	**360**	**540**	**900**	**26**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture S: Self Study T: Tutorial P: Practical

Elective-I:
14CH506/A: Creativity, Innovation and New Product Development
14CH506/B: Current Good Manufacturing Practices
14CH506/C: Rural Technology and Development
14CH506/D: Biofuels

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Third Year B.Tech., (SEMESTER – VI)

Code No.	Subject	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	S	Total	CIE	SEE	Total Marks	
14CH601	Professional Ethics & Human Values	4	0	0	0	4	40	60	100	3
14CH602	Chemical Process Equipment and Design-I	4	1	0	0	5	40	60	100	4
14CH603	Mass Transfer Operations-II	4	0	0	1	5	40	60	100	3
14CH604	Chemical Reaction Engineering-II	4	1	0	0	5	40	60	100	4
14CH605	Industrial Pollution Control	4	0	0	0	4	40	60	100	3
14CH606	Elective-II	4	0	0	0	4	40	60	100	3
14CHL601	Environmental Engineering Lab	0	0	3	0	3	40	60	100	2
14CHL602	Mass Transfer Operations Laboratory-II	0	0	3	0	3	40	60	100	2
14CHL603	Chemical Reaction Engineering Laboratory	0	0	3	0	3	40	60	100	2
	TOTAL	24	2	9	1	36	**360**	**540**	**900**	**26**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture S: Self Study T: Tutorial P: Practical

Elective-II:
14CH606/A: Membrane Technology
14CH606/B: Nano Technology
14CH606/C: Polymer Technology
14CH606/D: Particulate Technology

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Final Year B.Tech., (SEMESTER – VII)

Code No.	Subject	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	S	Total	CIE	SEE	Total Marks	
14CH701	Industrial Management & Entrepreneurship Development	4	0	0	0	4	40	60	100	3
14CH702	Chemical Process Equipment Design-II	4	0	0	0	4	40	60	100	3
14CH703	Transport Phenomenon	4	1	0	0	5	40	60	100	4
14CH704	Process Modeling and Simulation	4	0	0	0	4	40	60	100	3
14CH705	Elective -III	4	1	0	0	5	40	60	100	4
14OE706	Open Elective	4	0	0	0	4	40	60	100	3
14CHL701	Business Communication & Presentation Skills Lab			2		2	20	30	50	1
14CHL702	Chemical Process Equipment Design Lab	0	0	3	0	3	40	60	100	2
14CHL703	Computer Aided Design Lab	0	0	3	0	3	40	60	100	2
14CHL704	Term paper	0	0	2	0	2	20	30	50	1
	TOTAL	24	2	10	0	36	**360**	**540**	**900**	**26**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture S: Self Study T: Tutorial P: Practical

Elective-III

14CH705/A: Computer Aided Design
14CH705/B: Energy Engineering.
14CH705/C: Pilot Plant models and scale up methods in Chemical Engineering
14CH705/D Interfacial science.

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With Effective From 2014-2015 Academic Year
Final Year B.Tech., (SEMESTER – VIII)

Code No.	Subject	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	S	Total	CIE	SEE	Total Marks	
14CH801	Optimization of Chemical Process	4	0	0	1	5	40	60	100	3
14CH802	Bio Chemical Engineering	4	0	0	0	4	40	60	100	3
14CH803	Elective IV	4	0	0	0	4	40	60	100	3
14CH804	Elective-V	4	1	0	0	5	40	60	100	4
14CHL801	Bio Chemical Engineering Lab	0	0	3	0	3	40	60	100	2
14CHL802	Project Work	0	0	12	0	12	50	100	150	10
	TOTAL	16	1	15	1	33	**250**	**400**	**650**	**25**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture S: Self Study T: Tutorial P: Practical

Elective IV

14CH803/A: Safety and Hazards in chemical Process Industries.
14CH803/B: Drugs & Pharmaceutical Tech
14CH803/C: Biomedical Engineering.
14CH803/D: Electrochemical Engineering.

Elective V

14CH804/A: Petrochemical Technology
14CH804/B: Design and Analysis of Experiments
14CH804/C: Corrosion Engineering
14CH804/D: Pinch Technology

LIST OF OPEN ELECTIVES

14OE706

DEPARTMENT	SUBJECT NAME	SUBJECT CODE
Chemical Engineering.	Industrial Pollution & Control	14OE706/CH01
	Energy Engineering	14OE706/CH02
Civil Engineering.	Air Pollution & Control	14OE706/CE01
	Remote Sensing & GIS	14OE706/CE02
Computer Science & Engineering.	Database Management Systems	14OE706/CS01
	Java Programming	14OE706/CS02
Electrical & Electronics Engineering.	Optimization Techniques	14OE706/EE01
	Non-Conventional Energy Sources	14OE706/EE02
Electronics & Communication Engineering.	Consumer Electronics	14OE706/EC01
	Embedded Systems	14OE706/EC02
Electronics & Instrumentation Engineering.	Virtual Instrumentation Using LABVIEW	14OE706/EI01
	Sensors & Transducers	14OE706/EI02
Information Technology.	Web Programming	14OE706/IT01
	JAVA programming	14OE706/IT02
Mechanical Engineering.	Robotics	14OE706/ME01
	Power Plant Engineering	14OE706/ME02
BOSCH REXROTH Centre	Automation Technology	14OE706/BR01

Engineering Mathematics – I

(Common for all branches)

I B.Tech – I Semester (Code: 14MA101)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT - I

Matrix Algebra: Rank of a Matrix, Linear Independence, Vector Space, Solutions of Linear Systems, Inverse of a Matrix by Gauss-Jordan Elimination, Vector Spaces, Inner Product Spaces, Linear Transformations. Eigen Values, Eigen Vectors, Some applications of Eigen value problems. Symmetric, Skew-Symmetric and Orthogonal Matrices.

UNIT II

Matrix Algebra: Complex Matrices: Hermitian, Skew-Hermitian and Unitary, Similarity of Matrices, Basis of Eigen Vectors, Diagonalization.

Differential Calculus: Rolle's Theorem, Lagrange's Mean Value Theorem and Taylor's Theorem (without Proofs), Taylor's and, Maclaurin's Series for functions of one variable. Maxima and Minima of functions of Two Variables, Lagrange's method of Multipliers.

UNIT III

Fourier Series: Periodic Functions, Trigonometric Series, Fourier Series, Functions of Any Period P = 2L, Even and Odd Functions, Half Range Expansions, Complex Fourier Series.

UNIT IV

Integral Calculus: Evaluation of double integrals (Cartesian & Polar), Changing the order of integration, Evaluation of triple integrals, Applications of triple integrals to find area and volume.

TEXT BOOK:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", Peter V. O'Neil, Thomsons Brooks/Cole.
2. "Advanced Calculus", Murray R Spiegel, Schaum's outline series.

Engineering Physics – I

(Common for all branches)

I B.Tech – I Semester (Code: 14PH102)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT – I

OPTICS:

INTERFERENCE: Coherence, spatial and temporal coherences, interference due to thin films(reflected system), cosine law, anti-reflection coating, Michelson interferometer and its applications, (determination of wavelengths of monochromatic light and resolution of two nearby wavelengths)., Newton's rings theory and applications(determination of wavelength of light, and refractive index of transparent liquid).

DIFFRACTION: Fresnel &Fraunhoffer diffraction, Fraunhoffer diffraction due to single slit, plane diffraction grating, dispersive and resolving powers of a grating.

POLARISATION: Introduction, double refraction,Nicol prism, quarter wave plate, half wave plate, production and detection of circularly and elliptically polarised lights and optical activity, Electro optic effect(Kerr effect),Magneto optic effect(Faraday effect).

UNIT II

LASERS & FIBER OPTICS:

LASERS: Properties of lasers**,** Spontaneous and stimulated emissions, Population inversion, Solid state (Ruby) laser, Gas(He-Ne) laser, semiconductor (Ga-As) laser, Applications.

HOLOGRAPHY: Principle, recording and reproduction of holography, Applications.

FIBER OPTICS: Structure and types of optical fibers, acceptance angle, Numerical aperture, losses in optical fibers, fiber optic communication and its advantages.

UNIT III

ELECTRICITY & MAGNETISM:

Gauss's law in static electricity (qualitative only), Gauss's law of magnetism, circulating charges, Cyclotron-construction, working and limitations, Hall effect and its applications, displacement current, Maxwell's equations (qualitative treatment), E M oscillations, velocity of EM waves, energy transport and the pointing vector, AC circuit containing series LCR circuit-resonance condition and quality factor.

UNIT IV

MODERN PHYSICS:

Dual nature of light, de-Broglie's concept of matter waves, Davisson-Germer electron diffraction experiment, Heisenberg's uncertainty principle and applications (non-existence of electron in a nucleus and finite width of spectral lines), one dimensional time- independent and dependent

Schrödinger wave equations, physical significance of wave function, applications of time-independent Schrödinger wave equation to particle in a box(one dimensional), tunneling, the scanning tunneling microscope.

TEXT BOOK:

1. "A Text Book of Engineering Physics", M.N. Avadhanulu, P.G. Kshirasagar, S.Chand& Co.,(Edition – 2013).

REFERENCE BOOKS:

2. "Engineering physics" by R.K.Gour and S.L.Gupta. Dhanpat rai publications.
3. "Basic Engineering Physics" by P.Srinivasa rao & K.Muralidhar,Himalaya publications.
4. "Engineering physics" by M.R.Sreenivasan. New age international publications
5. "Engineering physics" by Palani swamy. Scitech publications

Engineering Chemistry – I

(Common for all branches)

I B.Tech – I Semester (Code: 14CY103)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT – I

Water Technology:

Characteristics: **Alkalinity** – types of alkalinity and determination (problems); **Hardness** – types and estimation by EDTA method (problems); **Domestic water treatment** – disinfection methods (Chlorination, ozonation, UV treatment); **Boiler feed water** --disadvantages of using hard water in boilers: Scales, Sludges, Caustic embrittlement, boiler corrosion, Priming and foaming; **Internal conditioning** - phosphate, calgon and carbonate methods; **External conditioning** - Ion exchange process, Lime Soda process; **Desalination** of brackish water by electro dialysis and reverse osmosis.

UNIT II

Polymers: Classification, polymerization: types – addition and condensation polymerization; Mechanism of free radical polymerization with suitable example; Polymer Tacticity and Ziegler Natta polymerization (mechanism).

Plastics: Classification; Preparation, properties and uses of PVC, Teflon, Bakelite, Nylon-6, 6.

Rubbers: Natural rubber**,** Vulcanization of rubber; Synthetic rubbers: Buna-S, Buna-N and Poly urethane.

Surface Chemistry: Solid surfaces, types of adsorption, Frendlich and Longmuir adsorption isotherm, Applications of adsorption: Role of adsorbents in catalysis.

UNIT – III

Renewable and Non Renewable Energy Sources:

Thermal and Chemical energy: Introduction to solid fuels; Calorific value (lower, higher) – determination of calorific value (Bomb Calorimeter), Coal ranking, Carbonization of coal (Bee Hive method and Otto-Hoffman by-product method); Proximate and ultimate analysis of coal.

Solar cells-Introduction, Solar Panels, Applications; **Fuel Cells**: Hydrogen – Oxygen Fuel Cell; **Batteries** – Alkaline Battery, Lead – acid, Nicad and Lithium Batteries

UNIT – IV

Engineering Materials:

Refractories: Classification – Acidic, Basic and Neutral refractories; Properties: refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling; Properties and applications of alumina, magnesite and zirconia bricks,

Abrasives – Natural and synthetic abrasives: quartz, corundum, emery, garnet, diamond silicon carbide and boron carbide.

Composites: definition, types, polymer matrix composites.

Lubricants: Mechanism of lubrication, Liquid lubricants - properties: viscosity index, flash and fire points, cloud and pour points, oiliness; Solid lubricants - graphite and molybdenum sulphide.

TEXT BOOK:

1. P.C. Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2010), 15^{th} edition.

REFERENCE BOOKS:

1. S.S Dara & Mukkanti K. "A text book of engineering chemistry" S. Chand & Co. Ltd., New Delhi (2006).
2. "Text Books of Engineering Chemistry" by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
3. B.K. Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
4. B. Sivasankar "Engineering Chemistry" Tata McGraw Hills co., New Delhi (2008).
5. Engineering Chemistry J.C Kuriacase & J.Rajaram, Tata McGraw Hills co., New Delhi 1. (2004).
6. "Chemistry of Engineering Materials" by R.P. Mani and K.N. Mishra, CENGAGE learning.
7. "Applied Chemistry – A test for Engineering & Technology" – Springar (2005).
8. "Text Book of Engineering Chemistry" - Shasi Chawla, Dhanpat Rai publishing company, New Delhi (2008).
9. "Engineering Chemistry" – R. Gopalan, D. Venkatappayya, D.V. Sulochana Nagarajan – Vikas Publishers (2008).

Communicative English

(Common for all branches)

I B.Tech – II Semester (Code: 14EL204 / 14EL104)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment		:	40	Semester End Examination (3 Hours)		:	60

UNIT – I

a) Text: (i) *Study Skills for a Successful Semester (*page 5)
(ii) *Concerning the Unknown Engineer* (page 27)

b) Grammar: Parts of Speech, Subject-Verb agreement

c) Vocabulary Development: Vocabulary in the lessons *Study Skills for a Successful Semester and Concerning the Unknown Engineer*

d) Writing Skills: Writing a Good Paragraph with Notes, Writing a cohesive text, clutter free writing.

UNIT – II

a) Text: (i) A Shadow by R.K.Narayanan (page no116)
(ii) Clutter (page no 69)

b) Grammar: Tenses.

c) Vocabulary Development: Vocabulary in the lessons *A Shadow and Clutter.*

d) Writing Skills: Essay Writing.

UNIT – III

a) Text: (i)*Bionics* (pg.no:157)
(ii) *Primping the pump* by Zig Ziglar (Pg.No: 138)

b) Grammar: Auxiliary Verbs, Conditionals, Articles and Determiners.

c) Vocabulary Development: Vocabulary in the lessons *Bionics and primping the pump* by Zig Ziglar.

d) Writing Skills: Letter writing, E-Mail writing

UNIT – IV

a) Text: (i) *Human Cloning* (Pg.no 194)
(ii) *The Stranger within* (Pg.No: 237)

b) Grammar: Voice, Reported Speech, Gerund

c) Vocabulary Development: Vocabulary in the Lessons *Human Cloning* and *the Stranger Within.*

d) Writing Skills: Abstract, Proposal and executive summary writing on Technical basis.

TEXT BOOK: "*Innovate with English*" by T.Samson, First Edition,Cambridge University Press:

REFERENCE BOOKS:

1. "Practical English Usage" by Michael Swan, 3rd Edition, OUP.
2. "Intermediate English Grammar" by Raymond Murphy, CUP.
3. "Study: Reading" by Eric H .Glendinning, 2nd Edition CUP.
4. "Business Correspondence and Report writing" by R.C Sharma, Tata McGrawhill.

Environmental Studies

(Common for all branches)

I B.Tech – II Semester (Code: 14ES205 / 14ES105)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Introduction: Definition, Scope and Importance, Need for public awareness. Ecosystems: Definition, Structure and Functions of Ecosystems, types - Forest, Grassland, Desert, Aquatic (Marine, pond and estuaries).

Biodiversity: Definition and levels of Biodiversity; Values of Biodiversity - Consumptive, Productive, Social, Aesthetic, Ethical and Optional; Threats and Conservation of Biodiversity; Hot Spots of Biodiversity, Bio-geographical Classification of India, India as a mega diversity nation.

UNIT – II

Natural resources: Land: Land as a resource, Causes and effects of land degradation - Soil erosion, Desertification. Forest: Use of forests, Causes and effects of deforestation, Afforestation, Mining - benefits and problems. Water: Uses, floods and drought, Dams - benefits and problems. Energy: Importance of energy, Renewable and Non renewable energy resources.

Sustainability: Definition, Concept and Equitable use of resources for sustainable development; Rain water harvesting and Watershed management.

UNIT – III

Pollution: Definition; Causes, effects and control of air, water and nuclear pollution; Solid Waste: urban, Industrial and hazardous wastes; Integrated waste management - 3R approach, composting and vermicomposting.

Environmental issues: Green house effect & Global warming, Ozone layer depletion, Acid rains, Green Revolution, Population Growth and environmental quality, Environmental Impact Assessment.

UNIT – IV

Environmental acts: Water and air (Prevention and Control of pollution) acts, Environmental protection act, Forest Conservation act. Case Studies: Silent Valley Project, Chipko movement, Narmada Bachao Andolan, Bhopal Tragedy, Mathura Refinery and TajMahal, Chernobyl Nuclear Disaster and Ralegan Siddhi (Anna Hazare).

Field work: Visit to a local area to document environmental assets – Pond/Forest/Grassland. Visit to a local polluted site- Urban and industry/ Rural and Agriculture.

TEXT BOOKS:

1. “Environmental Studies” by Benny Joseph, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. “Comprehensive environmental studies”- JP Sharma, Laxmi Publications.

REFERENCE BOOKS:

1. “Environmental studies”, R.Rajagopalan, Oxford University Press.
2. “Introduction to Environmental Science”, Anjaneyulu Y, B S Publications
3. “Environmental Science”, 11th Edition – Thomson Series – By Jr. G. Tyler Miller.

Engineering Graphics

(Common for all branches)

I B.Tech – II Semester (Code: 14EG206 / 14EG106)

Lectures	4	Tutorial	1	Practical	0	Self Study	1
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

INTRODUCTION: Introduction to Drawing instruments and their uses, geometrical construction procedures.

CURVES: Conic sections – general construction methods for ellipse, parabola and hyperbola. Other methods to construct ellipse only, cycloid, involute of a circle.

UNIT – II

METHOD OF PROJECTIONS: Principles of projection - First angle and third angle projection of points. Projection of straight lines. Traces of lines.

UNIT – III

PROJECTIONS OF PLANES: Projections of plane figures: circle, square, rhombus, rectangle, triangle, pentagon and hexagon.

UNIT – IV

PROJECTIONS OF SOLIDS: Projections of Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions.

UNIT – V

ISOMETRIC PROJECTIONS: Isometric Projection and conversion of Orthographic views into isometric views. (Treatment is limited to simple objects only).

ORTHOGRAPHIC PROJECTIONS: Conversion of pictorial views into Orthographic views. (Treatment is limited to simple castings).

TEXT BOOK:

1. “Engineering Drawing” by N.D. Bhatt & V.M. Panchal. (Charotar Publishing House, Anand). (First angle projection)

REFERENCE BOOKS:

1. “Engineering Drawing” by Dhananjay A Jolhe, Tata McGraw hill publishers
2. “Engineering Drawing” by Prof.K.L.Narayana& Prof. R.K.Kannaiah.

Chemistry Laboratory

(Common for all branches)

I B.Tech – II Semester (Code: 14CYL201 / 14CYL101)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment		:	40	Semester End Examination (3 Hours)		:	60

LIST OF EXPERIMENTS

1. **Introduction to Chemistry Lab** (the teachers are expected to teach fundamentals like Calibration of Volumetric Apparatus, Primary, Secondary Solutions, Normality, Molarity, Molality etc. and error, accuracy, precision, theory of indicators, use of volumetric titrations).
2. **Volumetric Analysis:**
    a. Estimation of acid content in un-known solution
    b. Estimation of Active Chlorine Content in Bleaching Powder
    c. Estimation of Mohr's salt by permanganometry.
3. **Analysis of Water:**
    a. Estimation of total hardness of ground water sample by EDTA method
    b. Estimation of Alkalinity of water.
    c. Estimation of Dissolved oxygen in water.
4. **Estimation of properties of oil**:
    a. Estimation of Acid Number
    b. Estimation of Saponification value
5. **Preparations:**
    a. Preparation of Soap
    b. Preparation of Urea-formaldehyde resin
    c. Preparation of Phenyl benzoate
6. **Demonstration Experiments (Any two of the following):**

    5.1 Determination of dissociation constant of weak acid by pH meter.
    5.2 Determination of conductivity of given sample by conductometer
    5.3 Determination of Mohr's salt/Iron by potentiometric method

TEXT BOOKS:

1. "Practical Engineering Chemistry" by K.Mukkanti, Etal, B.S. Publicaitons, Hyderabad.
2. Inorganic quantitative analysis, Vogel.

REFERENCE BOOK:

1. "Text Book of engineering chemistry" by R.N. Goyal and Harrmendra Goel.
2. "A Text book on experiments and calculations- Engineering Chemistry". S.S. Dara.
3. "Instrumental methods of chemical analysis", Chatwal, Anand, Himalaya Publications.

English Communication and Skills Laboratory

(Common for all branches)

I B.Tech – II Semester (Code: 14ELL202 / 14ELL102)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Communication Skills: Introduction to Communication, differences between communication and communication skills, Types of communication: Verbal and Non-Verbal, Barriers to communication, LSRW Skills.

UNIT – II

Functional English: Small talk, Conversation Starters, Greeting, Parting, Offering, Requesting, Daily activities, Asking about activities, General activities, Meeting at Railway Station, Asking Questions at railway station, Getting Information at Airport, Asking Directions, Finding one's way, Asking about busses, Travelling by Bus, Going by Taxi, Taking A Trip by Car, Arriving Early or Late, Using the Telephone, Getting Help in stores, Going Shopping, Talking about shopping, Shopping for Clothes, Asking about Prices, Talking About money, Shopping for Groceries, Talking about eating, Ordering food, Personal Health and Common health problems, At the Doctor's office.

UNIT – III

Phonetics (Oral drills), British English and American English, Stress and Rhythm, intonation

UNIT – IV

Vocabulary Development: Classified Vocabulary, Word Roots, Prefixes and Suffixes Idioms (100) and Phrasal verbs (100), Homonyms, Homophones, Homographs and Eponyms and One word Substitutes.

UNIT – V

Oratory Skills: JAM, Elocution

UNIT – VI

Manners and Etiquette: Giving & Receiving Feedback, Telephone &E-mail Etiquettes, and Gender Sensitive Language, Discussion forum, web notes.

REFERENCE BOOKS:

1. **New Interchange**, 3rd Edition by Jack C Richards, Cambridge University Press.
2. **English Conversation Practice** by Grant Taylor, Mc Graw Hill
3. **English Vocabulary in Use** by Micheal Mc Carthy, Felicity O dell.

Software:

Buzzers for conversations, New Interchange series.
English in Mind series, telephoning in English.
Speech Solutions, A course in Listening and Speaking.
Face to Face series.

Workshop

(Common for all branches)

I B.Tech – II Semester (Code: 14WSL203 / 14WSL103)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)		:	60

LIST OF EXPERIMENTS

1. **Carpentry**
   a. Half Lap joint
   b. Dovetail joint
   c. Mortise &Tenon joint
2. **Welding using electric arc welding process/gas welding**
   a. Lap joint
   b. Tee joint
   c. Butt joint
3. **Sheet metal operations with hand tools**
   a. Trapezoidal tray
   b. Funnel
   c. T-joint
4. **House wiring**
   a. To control one lamp by a single switch
   b. To control two lamps by a single switch
   c. Stair-case wiring

Engineering Mathematics – II

(Common for all branches)

I B.Tech – II Semester (Code: 14MA201)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

First Order Differential Equations: Basic concepts, Geometrical meaning, Separable Differential Equations, Exact Differential Equations, Integrating Factors, Linear Differential Equations, Bernoulli's Equation, Orthogonal Trajectories of curves, Some Engineering Applications: Growth-Decay and Newton's Law of Cooling.

UNIT – II

Linear Differential Equations of Second Order: Homogeneous Linear Equations of Second Order, Second Order Homogeneous Equations with Constant Coefficients, Case of Complex Roots, Euler-Cauchy Equations, Non-Homogeneous Equations, Solution by Undetermined Coefficients, Solution by Variation of Parameters, Applications-Modeling of Electric Circuits.

UNIT – III

Laplace Transforms: Laplace Transform, Inverse Transform, Linearity, Shifting, Transforms of Derivatives and Integrals, Differential Equations, Unit Step Function, Second Shifting Theorem, Dirac's Delta Function, Convolution theorem (without proof).

UNIT – IV

Vector calculus: Scalar and vector point functions, Gradient of a scalar field, Directional derivative, Divergence of a vector field, curl of a vector field, Line integrals, Line integrals independent of path, Green's theorem in the plane (without proof), Surface integrals, Triple integrals, Divergence theorem of Gauss (without proof), Applications to Engineering problems, Stokes theorem(without proof).

TEXT BOOK:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, 9^{th} edition, John Wiley & Sons.

REFERENCE BOOK:

1. "Advanced Engineering Mathematics", Peter V. O'Neil, Thomsons Brooks/Cole.

Engineering Physics – II

(Common for all branches)

I B.Tech – II Semester (Code: 14PH202)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Electron theory of solids & semiconductor physics:

Electron theory of solids: Failure of classical free electron theory, quantum free electron theory, Fermi-Dirac distribution and its temperature dependence, Kronig-Penny model (Qualitative), effective mass of electron, concepts of energy band gap and hole.

Semiconductor physics: Classification of semiconductors, density of states, carrier concentration in intrinsic and extrinsic semiconductors, law of mass action, conductivity in semiconductors (drift and diffusion), Equation of continuity, P-N junction diode and its V-I characteristics.

UNIT – II

Magnetic, Dielectric and Ferro-electric materials:

Origin of magnetic moment of an atom, Bohr magneton, Domain theory of Ferro magnetism, curie-weiss law(Qualitative), Hysteresis curve, soft and hard magnetic materials, ferrites and its applications.

Dielectric materials: Types of polarizations, internal field (qualitative), Classius – Mossotti equation, Frequency dependence of polarization, Ferroelectrics and its applications, strength of dielectrics and dielectric breakdown.

UNIT – III

Advanced materials:

Nano-materials: Introduction to nano-materials, surface to volume ratio, quantum confinement, properties of nano materials, Fabrication of nano-materials(CVD and sol-gel methods) , carbon nano tubes and its properties, Applications of nano materials.

Superconductivity: Critical temperature, critical magnetic field and critical current. Meissner effect, type-I and type-II superconductors, attractive interactions, qualitative treatment of BCS theory and, Josephson's junction, Applications of superconductors.

Opto-electronic devices: Working and applications of solar cell, LED, LCD, Photo Diode.

UNIT – IV

Analytical techniques:

Nuclear techniques: Radio isotopes and its applications (Medical and Industrial), GM-counter, scintillation counter.

Ultrasonics: Properties of ultrasonics, General applications of ultrasonics.

Medical applications: Cardiology and Ultrasonic imaging.

Industral applications: NDT (Pulse echo technique) and cavitation effect. Time of flight diffraction technique.

Structure determination: Crystal lattices (Bravais), and planes, Miller indices, Bragg's law, structural analysis of crystals using X-Ray powder diffraction method.

TEXT BOOK:

1. "A Text Book of Engineering Physics", M.N.Avadhanulu& P. Krushisagar, S.Chand Publication., (Edition – 2013).

REFERENCE BOOKS:

2. "Engineering physics" by R.K.Gour and S.L.Gupta. Dhanpat rai publications.
3. "Basic Engineering Physics" by P.Srinivasa rao & K.Muralidhar,Himalaya publications.
4. "Engineering physics" by M.R.Sreenivasan. New age international publications.
5. "Engineering physics" by Palani swamy. Scitech publications.

Engineering Chemistry – II

(Common for all branches)

I B.Tech – II Semester (Code: 14CY203)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)		:	60

UNIT – I

Electro Chemistry:

Electrode potential, Determination of single electrode potential; Nernst equation (problems); Electrochemical series – significance; Electro chemical cells, Reversible and irreversible cells, EMF – measurement of emf, Reference electrodes – Standard Hydrogen electrode, Calomel electrode, Ion selective electrode – glass electrode – measurement of pH; Potentiometric titrations (redox – Fe^{2+} *vs* dichromate, and precipitation – Ag^{+} *vs* Cl^{-} titrations) and Conductometric titrations (acid-base).

UNIT – II

Corrosion and Corrosion Control:

Types of corrosion - Chemical or dry corrosion, Pilling – Bedworth rule; Electrochemical or wet corrosion; Galvanic corrosion, pitting, stress and differential aeration corrosion; factors influencing corrosion; Corrosion control – sacrificial anode method and impressed current cathodic methods, corrosion inhibitors; Protective coatings: Paints – constituents and functions, Metallic coatings – electro plating (Au) and electroless plating (Ni).

Green Chemistry: Introduction, principles of green chemistry; engineering applications.

UNIT – III

Liquid and Gaseous Fuels:

Petroleum based: Petroleum processing and fractions; Cracking – catalytic cracking methods; Knocking and anti- knocking Agents, Octane number and Cetane number; Synthetic petrol: Fischer- Tropsch and Bergius processes.

Gaseous fuels: Water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus.

Phase rule:

Statement and explanation of terms involved: One component system – water system; Condensed phase rule – Construction of phase diagram by thermal analysis, Simple eutectic systems (lead-silver system only).

UNIT – IV

Analytical Techniques:

Beer-Lambert's law; Principle, instrumentation (with block diagram) and applications of UV-visible spectroscopy and IR spectroscopy; Estimation of iron by Colorimetry; Flame photometry: principle, instrumentation (with block diagram) and estimation of sodium; Atomic absorption spectroscopy: principle, instrumentation (with block diagram) and estimation of nickel.

TEXT BOOK:

1. P.C. Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2010), 15^{th} edition.

REFERENCE BOOKS:

1. S.S Dara & Mukkanti K. “A text book of engineering chemistry” S. Chand & Co. Ltd., New Delhi (2006).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw Hills co., New Delhi (2008).
3. B.K. Sharma “Engineering Chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
4. ‘Engineering Chemistry” J.C Kuriacase & J.Rajaram, Tata McGraw Hills co., New Delhi 1. (2004).
5. “Chemistry of Engineering Materials” by R.P. Mani and K.N. Mishra, CENGAGE learning.
6. “Applied Chemistry – A test for Engineering & Technology” – Springar (2005).
7. “Text Book of Engineering Chemistry” - Shasi Chawla, Dhanpat Rai publishing company, New Delhi (2008).
8. ‘Engineering Chemistry” – R. Gopalan, D. Venkatappayya, D.V. Sulochana Nagarajan – Vikas Publishers (2008).

Basic Electrical and Electronics Engineering

(Common for all branches)

I B.Tech – I Semester (Code: 14EE104 / 14EE204)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment		:	40	Semester End Examination (3 Hours)		:	60

UNIT – I

Basic Concepts of Electric Circuits: Introduction, Electric Current, Ohm's Law, Work, Power, and Energy, Dynamically Induced EMF and Statically Induced EMF, Self-induced EMF and Mutually Induced EMF, Self-inductance of a Coil, Mutual Inductance, Energy Stored in a Magnetic Field, Electrical Circuit Elements, Energy Stored in a Capacitor, Capacitor in Parallel and in Series.

DC Networks and Network Theorems: DC Network Terminologies, Voltage and Current Sources, Series Parallel Circuits, Voltage and Current Divider Rules, Kirchhoff's Laws, Maxwell's Mesh Current Method, Nodal Voltage Method (Nodal Analysis), Network Theorems (Superposition Theorem, Thevenin's Theorem, Norton's Theorem).

UNIT – II

AC Fundamentals: Introduction, Generation of Alternating Voltage in an Elementary Generator, Concept of Frequency, Cycle, Time Period, Instantaneous Value, Average Value, and Maximum Value, Sinusoidal and Non-sinusoidal Wave Forms, Concept of Average Value and Root Mean Square (RMS) Value of an Alternating Quantity, Analytical Method of Calculation of RMS Value, Average Value, and Form Factor, RMS and Average Values of Half-wave rectified Alternating Quantity, Concept of Phase and Phase Difference.

Transformers: Introduction, Basic Principle and Constructional Details, EMF Equation.

UNIT – III

Semiconductor Devices: Introduction, Review of Atomic Theory, Binding Forces Between Atoms in Semiconductor Materials, Extrinsic Semiconductors, Semiconductor Diodes; Volt-ampere Characteristic of a Diode, An Ideal Diode, Diode Parameters and Diode Ratings, Zener Diode; Zener Diode As Voltage Regulator, Zener Diode As a Reference Voltage, Bipolar Junction Transistors; Working of a n-p-n Transistor, Working of a p-n-p Transistor, Transistor Configurations, Transistor As an Amplifier, Transistor As a Switch, Rectifiers and Other Diode Circuits.

Rectifiers: Introduction, Half-Wave, Full wave Rectifiers and their analysis, Comparison of Half-Wave and Full-Wave Rectifiers.

UNIT – IV

Digital Electronics: Introduction, Number System, Octal Number System, Hexadecimal Number System, Application of Binary Numbers in Computers, Logic Gates, Boolean Algebra, De

Morgan's Theorem, Combinational Circuits, Simplification of Boolean Expressions Using De Morgan's Theorem.

Integrated Circuits: Introduction, Fabrication of Monolithic ICs, Hybrid Integrated Circuits, Linear and Digital ICs.

TEXT BOOK: "Basic Electrical and Electronics Engineering", S.K. Bhattacharya, Pearson Publications

REFERENCE BOOKS:

1. "Basic Electrical, Electronics and Computer Engineering", Muthusubramanian R, Salivahanan S and Muraleedharan K A, Tata McGraw Hill, Second Edition, (2006).
2. "Basics of Electrical and Electronics Engineering", Nagsarkar T K and Sukhija M S, Oxford press University Press.

Engineering Mechanics

(Common for all branches)

I B.Tech – I Semester (Code: 14EM105 / 14EM205)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Concurrent Forces in a Plane: Principles of statics – composition and resolution of forces – equilibrium of concurrent forces in a plane –Method of moments.

Parallel Forces in a Plane: Two parallel forces – general case of parallel forces in a plane – center of parallel forces – Centroids of composite plane figures and curves-Distributed force in a plane.

General Case of Forces in a Plane: Composition of forces in a plane – Equilibrium of forces in a plane – Plane trusses: methods of joints.

UNIT – II

Forces in space: Concurrent forces in space: method of projections – parallel forces in space.

Friction: Characteristics of friction – problems involving dry friction.

Principle of Virtual Work: Equilibrium of Ideal systems.

UNIT – III

Rectilinear Translation: Kinematics of rectilinear motion – principles of dynamics – Differential equations of rectilinear motion D'Alemberts principle – momentum and impulse – work and energy – ideal systems: conservation of energy.

Curvilinear Translation: Kinematics of curvilinear motion – Differential equations of curvilinear motion – D'Alembert's principle – Work and Energy.

UNIT – IV

Moments of Inertia of Plane Figures: Moment of inertia of a plane figure with respect to an axis in its plane – Moment of Inertia with respect to an axis perpendicular to the plane of the figure – Parallel axis theorem.

Moments of Inertia of Material Bodies: Moment of inertia of rigid body – Moment of inertia of a lamina – Moments of inertia of three – dimensional bodies.

Rotation of a Rigid Body about a Fixed Axis: Kinematics of rotation – Equation of motion for a rigid body rotating about a fixed axis – D'Alembert's principle.

TEXT BOOKS:

1. 'Engineering mechanics" by S. Timoshenko and D. H. Young – Mc Graw-Hill International edition (For concepts and symbolic problems)
2. "Engineering mechanics statics and dynamics" by R. C. Hibbeler and Ashok Gupta - Pearson (For numerical problems using S.I. system of units)

REFERENCE BOOKS:

1. "Vector mechanics for engineers statics and dynamics" by Beer and Johnston, Tata Mc Graw-Hill publishing company, New Delhi
2. 'Engineering mechanics statics and dynamics" by A. K. Tayal – Umesh publication, Delhi (For numerical problems using S.I. system of units)

Problem Solving with Programming

(Common for all branches)

I B.Tech – I Semester (Code: 14CP106 / 14CP206)

Lectures	4	Tutorial	0	Practical	0	Self Study	1
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Basics and Introduction to C, The C Declarations, Operators and Expressions, Input and Output in C, Decision Statements, Programming Exercises for Unit I: C-expressions for algebraic expressions, evaluation of arithmetic and Boolean expressions. Syntactic errors in a given program, output of a given program, values of variables at the end of execution of a program fragment, filling the blanks in a given program. Programs using Scientific and Engineering formulae. Finding the largest of the three given numbers. Computation of discount amount on different types of products with different discount percentages. Finding the class of an input character, finding the type of triangle formed with the given sides, computation of income-tax, computation of electricity bill and conversion of lower case character to its upper case.

UNIT – II

Loop Control, Data Structure: Array, Programming Exercises for Unit – II**:** To print the sum of the digits of a given number and to display the image of a given number. To find whether a given number is prime, printing Fibonacci sequence and to find prime factors of a given number. To print graphic patterns of symbols and numbers and computation of statistical parameters of a given list of numbers. To find the length of a string, compare strings, reverse a string, copy a string and to find whether the given string is palindrome or not. Transpose of a matrix, product and sum of matrices and sorting of names using arrays.

UNIT – III

Strings and Standard Functions, Pointers, Dynamic Memory Allocation and Linked List: Dynamic Memory Allocation, Memory Models, Memory Allocation Functions.

Functions, Storage Class, Programming Exercises for Unit - III**:** Functions - Insertion sort, Linear search. Recursive functions to find factorial & GCD (Greatest Common Divisor), string operations using pointers and pointer arithmetic and dynamic memory allocation. Swapping two variable values. Sorting a list of names using array of pointers.

UNIT – IV

Preprocessor Directives: Introduction, The #define Directive, Undefining a Macro, Token Pasting and Stringizing Operators, The #include Directive, Conditional Compilation, The #ifndef Directive.

Structure and Union, Files, Programming Exercises for Unit - IV: Operations on complex numbers, matrix operations with the matrix and the size of the matrix as a structure, sorting a list of student records on register number using array of pointers and to read an input file of marks and generate a result file, sorting a list of names using command line arguments.

TEXT BOOK:

1. Ashok N.Kamthane, "Programming in C", PEARSON 2nd Edition.

REFERENCE BOOKS:

1. Kernighan BW and Dennis Ritchie M, "C programming language", 2nded, Prentice Hall.
2. Yashavant P. Kanetkar, "Let us C", BPB Publications.
3. E.Balagurusamy, "Programming in ANSI C", 4thed, Tata Mcgraw-Hill.
4. Herbert Schildt, "C: The Complete Reference", 4th edition, Tata Mcgraw-Hill.

Physics Laboratory

(Common for all branches)

I B.Tech – I Semester (Code: 14PHL101 / 14PHL201)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment		:	40	Semester End Examination (3 Hours)		:	60

LIST OF EXPERIMENTS

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. Study the variation of intensity of magnetic field along the axis of a circular coil using Stewart-Gee's apparatus.
3. Determination of thickness of thin wire using air wedge interference bands.
4. Determination of radius of curvature of a Plano convex lens by forming Newton's rings.
5. Determination of wavelengths of mercury spectrum using grating normal incidence method.
6. Determination of dispersive power of a given material of prism using prism minimum deviation method.
7. Draw the resonant characteristic curves of L.C.R. series circuit and calculate the resonant frequency.
8. Draw the characteristic curves of a photocell and calculate the maximum velocity of electron.
9. Verify the laws of transverse vibration of stretched string using sonometer.
10. Determine the rigidity modulus of the given material of the wire using Torsional pendulum.
11. Draw the load characteristic curves of a solar cell.
12. Determination of Hall coefficient of a semiconductor.
13. Determination of voltage and frequency of an A.C. signal using C.R.O.
14. Determination of Forbidden energy gap of Si &Ge.
15. Determination of wavelength of laser source using Diode laser.

TEXT BOOK:

1. "Engineering physics laboratory manual" P.Srinivasa rao & K.Muralidhar,Himalaya publications.

Hardware Laboratory

(Common for all branches)

I B.Tech – I Semester (Code: 14HWL102 / 14HWL202)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment		:	40	Semester End Examination (3 Hours)		:	60

LIST OF EXPERIMENTS

1. Identification and testing of various electronic components. (Resistors, Inductor, Capacitor, Transistor, ICs and Bread board)
2. Study of Oscilloscope, Function generator, Power supply and Multi meter.
3. KCL & KVL verification for simple circuits on Bread board.
4. Study of Ceiling fan.
5. Study of Florescent lamp.
6. Study of Single Phase Transformer.
7. Identifying all parts of computers.
8. Install and Uninstall system and application software.
9. Assembling a Computer.
10. Connecting computers in a network.

Problem Solving with Programming Laboratory

(Common for all branches)

I B.Tech – I Semester (Code: 14CPL103 / 14CPL203)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

LIST OF EXPERIMENTS

1. A program for electricity bill taking different categories of users, different slabs in each category. (Using nested if else statement).

Domestic Customer:		
Consumption Units	**Rate of Charges(Rs.)**	
0 – 200	0.50 per unit	
201 – 400	100 plus	0.65 per unit
401 – 600	230 plus	0.80 per unit
601 and above	390 plus	1.00 per unit
Commercial Customer:		
Consumption Units	**Rate of Charges(Rs.)**	
0 – 50	0.50 per unit	
100 – 200	50 plus	0.6 per unit
201 – 300	100 plus	0.70 per unit
301 and above	200 plus	1.00 per unit

2. Write a C program to evaluate the following (using loops):
   a) $1 + x^2/2! + x^4 / 4!+$ …upto ten terms
   b) $x + x^3/3! + x^5/5!+$ … upto 7 digit accuracy
3. Write a C program to check whether the given number is
   a) Prime or not.
   b) Perfect or Abundant or Deficient.
4. Write a C program to display statistical parameters (using one – dimensional array).
   a) Mean
   b) Mode
   c) Median
   d) Variance.
5. Write a C program to read a list of numbers and perform the following operations
   a) Print the list.
   b) Delete duplicates from the list.
   c) Reverse the list.
6. Write a C program to read a list of numbers and search for a given number using Binary search algorithm and if found display its index otherwise display the message “Element not found in the List”.
7. Write a C program to read two matrices and compute their sum and product.

8. A menu driven program with options (using array of character pointers).
    a) To insert a student name
    b) To delete a student name
    c) To print the names of students
9. Write a C program to read list of student names and perform the following operations
    a) To print the list of names.
    b) To sort them in ascending order.
    c) To print the list after sorting.
10. Write a C program that consists of recursive functions to
    a) Find factorial of a given number
    b) Solve towers of Hanoi with three towers (A, B & C) and three disks initially on tower A.
11. A Bookshop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book the sales person inputs the title and the author, and the system searches the list and displays whether it is available or not. If it is not, an appropriate message is displayed, if it is, then the system displays the book details and request for the number of copies required ,if the requested copies are available the total cost of the requested copies is displayed otherwise the message “required copies not in stock” is displayed. Write a program for the above in structures with suitable functions.

12. Write a C program to read a data file of students’ records with fields(Regno, Name, M1,M2,M3,M4,M5) and write the successful students data (percentage > 40%) to a data file.

Engineering Mathematics-III

II B.Tech – III Semester (Code: 14MA301)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Fourier integrals: From Fourier series to the Fourier integral, Application of the Fourier integral, Fourier Cosine and Sine integral, Evaluation of integrals, Fourier cosine and sine Transforms: Fourier Cosine Transforms, Fourier Sine Transforms, Linearity, Transforms of Derivatives, Fourier Transform: Complex form of the Fourier integral, Fourier Transform and its inverse, Linearity. Fourier Transform of Derivatives, Convolution.

UNIT – II

Partial differential equations: Basic concepts, Modeling-Vibrating string, Wave Equation Separation of Variables Use of Fourier series, D'Alembert's Solution of the Wave Equation, Heat Equation-Solution Fourier series, Steady-State Two-Dimensional Heat Flow

UNIT – III

Numerical Methods in general: Introduction, Solution of Equations by Iteration, newton's Method for Solving Equations f(x) = 0, Convergence of Newton's method, Interpolation: Lagrange interpolation, Newton's divided difference interpolation, Equal spacing: Newton's forward Difference formula, Newton's Backward Difference formula, Inverse interpolation, Numerical integration and Differentiation: Trapezoidal Rule, Error Bounds and Estimate for the Trapezoidal Rule, Simpson's Rule of integration, Error of Simpson's rule.

UNIT – IV

Numerical methods in linear algebra: Linear Systems: Gauss Elimination, LU Factorization, Gauss-Seidel iteration Method, Method of least Squares, Methods of First order Differential Equations: Euler's method, Runge-Kutta methods, Methods for Elliptic Partial Differential Equations: Laplace equation, Poisson equation

TEXT BOOK:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, 9th edition, John Wiley & Sons.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", Peter V. O'Neil, Thomsons Brooks/Cole.

Material Science and Engineering

II B.Tech – III Semester (Code: 14CH302)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Atomic structure and chemical bonding: Structure of an atom, quantum states, periodic table, Ionization potential, electron affinity and Electro negativity.

Chemical bonding: Types of bonds, Ionic covalent, metallic and secondary bonding, properties and bond characteristics.

Crystal geometry and structure determination geometry of crystals: space lattices, crystal structures, miller indices of crystallographic phases and directions, structure determination by x-ray diffraction, Bragg law powder method.

Structures of solids and crystal imperfections: crystalline and non crystalline solids, inorganic solids, ionic solids, metals and alloys, cubic systems packing efficiency and co-ordination number.

Crystal imperfections: point, line and surface imperfections.

UNIT – II

Phase diagrams and phase transformations: Constitution of alloys, phase rule, single component systems, two component systems, binary phase diagrams – tie line rule, lever rule, isomorphus, eutectic, eutectoid, peritectic and peritectoid systems with examples. Non equilibrium cooling: coring, Phase transformation, solidification and crystallization.

Strengthening of metals and alloys: Grain refinement, solid solution strengthening, dispersion strengthening, strain hardening and precipitation hardening.

Heat treatment of steels applied to the materials used in chemical industry: Annealing, normalising, hardening and tempering.

UNIT – III

Elastic behavior of materials Plastic deformation: Mechanism of slip and twinning.

Creep: Mechanism and methods to reduce Creep in materials.

Fracture in ductile and brittle materials, Fatigue-Mechanism and preventive methods

Oxidation and corrosion: Basic principle, types of corrosion, various combating methods.

UNIT – IV

Types of metals and alloys used in chemical process industry, Criteria of selection of materials of construction in process industry. Brief study of Composite materials.

TEXT BOOKS

1. Material Science and Engineering, V.Raghavan, PHI
2. Material Science and Engineering, William D.Callisters Jr, Weily & Sons

REFERENCE BOOKS

1. Material Science and Metallurgy, Dr.V.D.Kodgire,New age India.
2. Material Science and Engineering, R.K.Rajput, S.K.Kataria & Sons.

Organic Chemistry

II B.Tech – III Semester (Code: 14CH303)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Structure and Properties: Elemental Analysis: Qualitative and Quantitative, Empirical and molecular formula determination, Problems based on Molecular and Empirical formula determinations.

Electron Displacements in a molecule: Inductive, mesomeric and electromeric effects, resonance, hyper conjugation, Reaction mechanisms of SN1, SN2, E1, and E2 reactions, Free radical, cationic & anionic polymerization, Zigler-natta polymerization, hydrogen bonding in organic molecules and its effect.

Stereo Chemistry: Basics of optical and geometrical isomerisms - Enantiomers, Diastereoisomers, Meso compounds, sequence rules, 'R' and 'S', E&Z configuration, Keto-enol tautomerism.

UNIT – II

Alkanes: Classification, conformations of Ethane and n-butane. Preparation methods – Wurtz reaction, Kolbes electrolytic method. Halogenation in alkanes (alkyl halides) – Free radical substitution method.

Cyclo alkanes: Stability of cyclo alkanes, Bayers strain theory, conformation analysis of cyclo hexane and di-substituted cyclo hexanes.

Alkenes: Preparation by de-hydration of alcohols, de-hydro halogenation of alkyl halides (Saytzeff rule). Addition reactions. Markownikoff's and Anti Markownikoff''s rule. 1,2 and 1, 4 additions in dienes.

Benzene: Aromaticity, Huckels rule, Electrophilic aromatic substitution, Mechanism of Nitration, Friedel-Crafts alkylation and acylation – Orientation in disubstituted benzenes, activating and deactivating groups, aryl halides, aralkyl halides.

UNIT – III

Heterocyclic compounds: Furan, Thiphene, Pyrrole, Pyridine, Indole, their important derivatives.

Hydroxy compounds: Manufacture of alcohol from molasses, Phenols: acidity comparison with alcohol. Reactions of phenol – Riemer Tiemann reaction, Kolbe's reaction, Fries re-arrangement.

Carbonyl compounds: Aldehydes and ketones–Preparation–Grignards reagent, Gatterman, Koch reaction. Nucleophilic addition reactions of carbonyl compounds, Cannizzaro reaction, aldol condensation, Perkin, Reformatsky, Claisen condensation, Clemmenson reduction, Wolfkishner reduction, Pinacol–Pinacolone rearrangement, Tishenko reaction, Haloform reaction, Benzoin condensation.

UNIT – IV

Carboxylic acids: Acidity, influence of substitutents on acidity, functional derivatives of carboxylic acids – acid halides, amides, anhydrides, esters.

Aliphatic and Aromatic amines: 1^o, 2^o, 3^o amines – distinguishing tests, preparation by Hofmann's degradation of amides, basicity of amines, diazonium salts, preparation and synthetic importance – sand mayer reaction.

Biomolecules: Nomenclature, classification of Carbohydrates, Proteins & Lipids, structure and general reactions of glucose and fructose and their inter conversions, muta rotation.

TEXT BOOKS

1. Text Book of Organic Chemistry, R.T.Morrison and R.N.Boyd, 6^{th} edition, PHI, Delhi.
2. Fundamentals of Biochemistry, J.L. Jain

Inorganic Chemical Technology

II B.Tech – III Semester (Code: 14CH304)

Lectures	4	Tutorial	0	Practical	0	Self Study	1
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT – I:

Introduction: Objectives, unit processes and unit operations. General Fundamentals
Water: Water conditioning and waste water treatment.
Alkali Industries: Soda ash, caustic soda and chlorine.

UNIT – II:

Ceramic industries: Raw materials and manufacturing process's, refractories.
Cement: manufacture, special cements
Glass: Raw materials, manufacture, special glasses
Industrial gases: Nitrogen, Carbon dioxide, hydrogen and oxygen

UNIT – III:

Nitrogen industries: Synthetic ammonia, urea, other nitrogenous fertilizers, nitric acid.
Phosphate Industries: Phosphoric Acid, calcium phosphate and super phosphate
Potassium Industries: Potassium chloride and potassium sulphate.

UNIT – IV:

Sulfur and sulfuric acid: manufacture of sulfur and sulfuric acid.
Hydrochloric acid: Manufacture of Hydrochloric acid
Aluminum Industries: Aluminum sulfate and alum
Nuclear industries: Uranium and thorium fission, nuclear fuels

TEXT BOOKS:

1. Shreve's Chemical Process Industries, Austin,G.T., McGraw Hill, 5th edition, 1985
2. Dryden's Outlines of chemical technology, M.Gopal Rao and M.Sittig, 3rd edition, East West Press.

REFERENCE BOOKS:

1. Text Book of Chemical Technology (Inorganic), G.N.Panday, Vikas Publishers
2. Chemical Process Technology, Jacob A.Moulijin, MIchie**l** Maker and Annelies Van Diepen, John Wiley & Sons Ltd

Material and Energy Balance

II B.Tech – III Semester (Code: 14CH305)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT – I

Units & dimensions: Units in different systems, conversion of units.

Stoichiometric and composition relations: Stoichiometric reaction, Stoichiometric principles – excess reactant, limiting reactant, percent excess, percent conversion; method of expressing composition of mixture and solutions, density, specific gravity and gravity scales.

Behavior of ideal gases and governing equations: Kinetic theory of gases, application of ideal gas law, gaseous mixtures, gases in chemical reactions.

UNIT – II

Vapor Pressure: Liquefaction and liquid state, vaporization, boiling point, effect of temperature on vapor pressure, vapor pressure plots, vapor pressures of immiscible liquids and solutions, Raoult's law and its limitations.

Humidity and saturation: Relative and percent saturation, dew point, wet and dry bulb temperatures, use of humidity charts for solving engineering problems.

UNIT – III

Material balances: Law of conservation of mass, mass calculation for mixing, evaporation, crystallization, distillation, drying, extraction, chemical and combustion reactions, analysis of system with by-pass, recycle with and without chemical reaction.

UNIT – IV

Thermo physics: Concept of energy, energy balance equation, heat capacity of gases, liquids and mixtures in energy balance problems, Kopp's rule, latent heat, heats of fusion and vaporization, Trouton's and Kishtyakowsky equations.

Thermo chemistry: Calculation and application of heat reaction, combustion, formation and neutralization in reaction and their heat effect. Enthalpy concentration charts.

Text Books

1. Chemical process Principles Part–1, Material and Energy Balances, Hougen,O.A., Watson, K.M., and Ragatz, R.A., 2nd Edition, New Age International

Reference Books

1. Basic Principles and Calculations in Chemical Engineering, David Himmelblau, Printice Hall of India
2. Stoichiometry, B. I. Bhatt and Vora, Tata McGraw Hill
3. Stoichiometry and Process Calculations, K. V. Narayanan and B. Lakshmikutty, Prentice-Hall of India Private Limited, New Delhi.

Momentum Transfer

II B.Tech – III Semester (Code: 14CH306)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Basic Concepts: Units and dimensions, dimensional analysis, similarity.

Fluid Statics: Nature of fluids, pressure concept, hydrostatic equilibrium, manometers and decanters.

Fluid flow phenomena: Concept of stream lines, stream tubes, velocity field, viscosity, types of fluids, turbulence and its nature, flow in boundary layers, its formation and growth in tubes and on plates.

UNIT – II

Basic equations of fluid flow: Continuity, momentum and Bernoulli's equations.

Flow of incompressible fluids: Relation between skin friction and wall shear, laminar flow in pipes, Hagen-Poiseuille equation, turbulent flow in pipes, velocity distribution equations, friction factor, flow through channels of non-circular cross section, friction from changes in velocity or direction, flow of liquids in thin layers.

UNIT – III

Flow of compressible fluids: Continuity equation, total energy balance, processes of compressible flow, isentropic flow, adiabatic frictional flow.

Flow past immersed bodies: Friction in flow through beds of solids, fluidization, mechanism of fluidization, pressure drop in fluidization, applications of fluidization.

UNIT – IV

Transportation of fluids: Pipes, fittings, valves, pumps, fans, blowers, compressors, vacuum pumps, jet ejectors.

Metering of fluids: Venturi meter, Orifice meter, Rotameter, Pitot tube, Brief introduction to target meters, Turbine meters, Magnetic meters, Ultrosonic meters, Thermal meters.

TEXT BOOKS:

1. Unit Operations of Chemical Engineering, Warren L.McCabe, Julian C.Smith, Peter Harriot, 7th Edition, McGraw Hill.

REFERENCE BOOKS:

1. Unit Operations, Brown et al. – Asia Publishing House.
2. Perry's Chemical Engineers Hand Book, Robert H. Perry, 7th edition, McGraw Hill
3. Coulson & Richardson's Chemical Engineering, Volume-1, J.F. Richardson, J. H. Harker and J. R. Backhurst, 4th edition, Elsevier.

Basic Simulation Laboratory
II B.Tech – III Semester (Code: 14CHL301)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

List of Experiments

1. EXCEL AND MATLAB BASICS: Introduction, Plotting Graphs, Using Built in Functions to Solve Regression and Iterative Solutions, Using Macros, Programming in Excel and MATLAB.
2. Numerical Methods: Roots of algebraic equation; Solution of Simultaneous Equations; Regression Analysis; Interpolation, Extrapolation and Numerical Differentiation; Numerical Integration; Solution of ordinary differential equations.

Organic Chemistry Laboratory

II B.Tech – III Semester (Code: 14CHL302)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

List of Experiments

1. Preparation of Aspirin
2. Preparation of Benzanilide
3. Preparation of m-dinitrobenzene
4. Preparation of Benzoic acid
5. Preparation of Dibromo aniline
6. Preparation of Methyl Orange
7. Preparation of Parabenzoquinone
8. Preparation of Nerolin
9. Detection of Extra elements
10. Analysis of compound-1
11. Analysis of compound – 2
12. Analysis of compound – 3
13. Analysis of compound – 4
14. Analysis of compound – 5
15. Analysis of compound – 6.

Note: Analysis of organic compound with single functional groups containing phenol, aldehyde, ketone, carboxylic acid, amides, amines, monosaccharides with two derivatives

Momentum Transfer Laboratory

II B.Tech – III Semester (Code: 14CHL303)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment		:	40	Semester End Examination (3 Hours)		:	60

List of Experiments

1. Determination of Friction factor
2. Determination of Minor losses
3. To study the effect of Reynolds number on coefficient of discharge of orifice meter
4. To study the effect of Reynolds number on coefficient of discharge of ventury meter
5. To determine the overall efficiency and to study Characteristics of centrifugal pump
6. To determine the overall efficiency and to study Characteristics of Reciprocating Pump
7. To determine the type of flow using Reynolds apparatus
8. To verify Bernoulli's principle using Bernoulli's Apparatus
9. To verify minimum fluidization velocity of Packed Bed
10. To measure point velocity in a pipe using Pitot tube
11. To determine the discharge coefficient of rota meter

Probability and Complex Analysis

II B.Tech – IV Semester (Code: 14MA401)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Complex numbers and functions:

Introduction to Complex Numbers, Complex Plane, Polar form of Complex numbers, Powers and roots, Derivative, Analytic Function, Cauchy - Riemann Equations, Laplace's equation.

Complex Integration: Cauchy's Integral Theorem, Cauchy's Integral Formula.

UNIT – II

Taylor, Laurent series and Residue Integration:

Taylor Series (without proof) and Maclaurin series, Laurent Series(without proof), singularities and zeros, infinity, Residue Integration method, Evaluation of real integrals.

UNIT – III

Probability Densities: Continuous Random Variables, Normal Distribution, Normal Approximation to the Binomial Distribution, Uniform Distribution, Joint Distributions, Discrete and Continuous.

Sampling Distribution: Populations and Samples, Sampling Distribution of the Mean (σ known), Sampling Distribution of the Mean (σ Unknown), Sampling Distribution of the Variance.

UNIT – IV

Inferences Concerning Means: Point Estimation, Interval Estimation, Tests of Hypotheses, Null Hypotheses and significance of tests, Hypotheses Concerning one Mean, Inferences Concerning Two Means.

Inferences Concerning Variances: Estimation of Variances, Hypotheses Concerning One Variance, Hypotheses Concerning Two Variances.

Inferences Concerning Proportions: Estimation of Proportions, Hypotheses Concerning One Proportion

TEXT BOOK:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, 9th Edition, John Wiley, 2000.
2. Miller & Freund's "Probability and Statistics for Engineers", Richard A. Johnson, 8th Edition, PHI.

REFERENCE BOOK:

1. "Theory and Problems of Complex Variables", Murray R Spiegel, Schaum's outline series.

Organic Chemical Technology

II B.Tech – IV Semester (Code: 14CH402)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Rubbers: Classification, natural rubber, monomers of synthetic rubber, manufacture of SBR.
Synthetic Fibers: Classification, manufacture of nylon 6,6, polyester fiber, viscose rayon fiber.
Petroleum Refining: Constituents of petroleum, Products of Refining, petroleum refining process- Cracking, reforming, polymerization, alkylation, isomerization, hydro-cracking, esterification and hydration.

UNIT – II

Plastic industry: Classification of plastics, outlines and manufacture of phenols, formaldehyde, vinyl chloride and vinyl acetate, manufacture of phenol-formaldehyde resin and polyvinyl resins.
Paints and Varnishes: Constituents of paints and varnishes and their manufacturing procedures.

UNIT – III

Sugar and starch industry: Manufacture of cane sugar, production of starch from maize.
Fermentation industry: manufacture of alcohol from molasses, manufacture of penicillin.
Pulp and paper industry: Methods of pulping, production of sulphate and sulphite pulp, production of paper–wet process. Cellulose and its derivatives.

UNIT – IV

Oils, soaps and detergents: Definitions, constitution of oils, extraction and expression of vegetable oils, refining and hydrogenation of oils, continuous process for the production of fatty acids and soap, production of detergents.

Text Books:

1. Shreve's Chemical Process Industries Ed. By Austin, G.T., McGraw Hill, 5th edition, 1985
2. Dryden's Outlines of chemical technology Ed. By M.Gopal Rao and M.Sitting, 3rd edition, East West Press.

Reference Books:

1. Text Book of Chemical Technology (Organic), G.N.Panday, Vikas Publishers
2. Chemical Process Industries, Vol. II, CBS Publishers & Distributors

Process Heat Transfer

II B.Tech – IV Semester (Code: 14CH403)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Introduction: Modes of heat transfer, basic laws of heat transfer, Analogy between heat flow and electric flow.

Conduction: The Fourier heat conduction equation, steady state one dimensional heat conduction through plane wall, cylindrical wall, spherical wall and composite structures. Critical insulation thickness. Unsteady state heat conduction for lumped parameter systems.

UNIT – II

Convection: The convective heat transfer coefficient, introduction to thermal boundary layer, Dimensionless numbers in heat transfer and their significance. Dimensional analysis.

Forced Convection: Heat transfer by forced convection, inside tubes and ducts in laminar, transition and turbulent flow. Analogy between heat and momentum transfer, Reynold's, Prandtl and Colburn analogies.

Natural convection: Grashoff number, natural convection from vertical and horizontal surfaces.

UNIT – III

Heat transfer to fluids with phase change: Heat transfer from condensing vapours, film wise and drop wise condensation. Derivation and practical use of Nusselt equation.. Heat transfer to boiling liquids. Boiling of saturated liquid. Maximum heat flux and critical temperature drop-minimum flux and film boiling. Sub-cooled boiling.

Heat transfer by Radiation: Thermal radiation, Black body radiation, Kirchhoff's law, emissivity, Grey body and laws of black body radiation. Geometric factor, Radiation in enclosures with concentric cylinders and spheres.

UNIT – IV

Heat Exchange equipment: Types of heat exchangers, log-mean temperature difference (LMTD) Correction factor. Energy balances, overall heat transfer coefficients. Fouling factors, Design and description of heat transfer equipment, Double Pipe Heat Exchanger, Shell & Tube Heat Exchanger (1-1, 1-2, 2-4), Plate Heat Exchanger and Extended Surface Heat Exchanger.

Evaporation: Types of evaporators. Capacity and economy of evaporators, boiling point elevation and Duhring's rule. Material and energy balances in single effect evaporator. Multi effect evaporators, methods of feeding, capacity and economy of multiple effect evaporators.

TEXT BOOK

1. Unit Operations of Chemical Engineering, Warren,L., McCabe, Julian C.Smith, Peter Harriot, 7th Edition, McGraw Hill .

REFERENCE BOOKS

1. Fundamentals of Heat and Mass Transfer , Incropera, De Witt, Bergman, Lavine.
2. Fluid Dynamics and Heat Transfer, James G.Knudsen, Donald L.Katz.
3. Process Heat Transfer, Donald, Q.Kern, McGraw Hill

Engineering Thermodynamics

II B.Tech – IV Semester (Code: 14CH404)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Relevance and scope of chemical engineering thermodynamics, internal energy, first law of thermodynamics, energy balance for closed systems, thermodynamic state and state functions, equilibrium, the phase rule, the reversible process, constant volume and constant pressure processes, enthalpy, heat capacity, mass and energy balances for open systems.

UNIT – II

PVT behavior of pure substances, Virial equations of state, the ideal gas, applications of Virial equations, cubic equations of state, generalized correlations for gases and liquids.

Second law of thermodynamics, heat engines, thermodynamic temperature scales, entropy, entropy and probability, entropy changes of an ideal gas, mathematical statement of second law, entropy balance for open systems, calculation of ideal work and lost work, third law of thermodynamics.

UNIT – III

Property relations for homogeneous phases, Maxwell's equations, residual properties, two phase systems, thermodynamic diagrams, generalized property correlations for gases.

Thermodynamics of flow processes –duct flow of compressible fluids, Turbines, compression processes**.**

UNIT – IV

Refrigeration, Carnot refrigeration, vapor – compression cycle, choice of refrigerant, absorption, refrigeration, heat pump, liquefaction process.

TEXT BOOK

1. Introduction to Chemical Engineering Thermodynamics, Smith, J.M., Van Ness,H.C., and Abbott,M.M., 6th Edition, McGraw Hill.

REFERENCE BOOKS

1. Chemical Engineering Thermodynamics, Daubert McGraw Hill
2. Chemical Engineering Thermodynamics, Y.V.C.Rao, Universities press.

Mechanical Unit Operations

II B.Tech – IV Semester (Code: 14CH405)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Properties and handling of particulate solids: Characterization of solid particles, shape and size, mixed particle size analysis, specific surface of mixtures, average particle size, screen analysis and standard screen series. Properties of particulate masses, different types of conveyers and storage of solids.

Size Reduction: Principles of comminution, size reduction equipment–crushers, grinders, ultra fine grinders and cutting machines. Open circuit and closed circuit operation.

UNIT – II

Size separation: Screening, screening equipment–grizzlying, gyratory, vibrating, revolving screens. Capacity and effectiveness of screens.

Materials Separation: Magnetic separators, Electro- static separators and froth flotation.

UNIT – III

Filtration: Theory of filtration and filtration equipment, Principles of Cake filtration: Pressure drop calculations, constant rate filtration, constant pressure filtration and principles of centrifugal filtration.

UNIT – IV

Motion of particles through fluids: Drag coefficient – free and hindered settling. Sink and float method, classifiers and thickness, cyclones, hydroclones, centrifuges, jigging and tabling.

Agitation and mixing: Purpose of agitation, agitation equipment, power consumption in agitated vessels, mixing equipment.

TEXT BOOKS

1. Unit Operations of Chemical Engineering, Warren,L., McCabe, Julian C.Smith, Peter Harriot, 7th Edition. – McGraw Hill.
2. Unit Operations, R. S. Kulakarni and Hiremath, Everest Publishers.

REFERENCE BOOKS

1. Chemical Engineering vol. – II, Coulson, J.H., and Richardson, Paragon Press and ELBS.
2. Unit Operations, Brown George, CBS
3. Mechanical Operations for Chemical Engineers, C. M. Narayana and B.C.Bhattacharyya, Khanna Publishers.
4. Coulson & Richardson's Chemical Engineering, Volume:2, 4th edition, J.F. Richardson, J. H. Harker and J. R. Backhurst, Elsevier.
5. Perry's Chemical Engineers Hand Book, Perry Rober H, 7th edition,McGraw Hill

Process Instrumentation

II B.Tech – IV Semester (Code: 14CH406)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Elements of instruments, static characteristics, dynamic characteristics, dynamic response of 1st order systems.

Process Instrumentation: Recording instruments, indicating and signaling instruments, transmission of instrument readings, the control center, instrumentation diagram, diagrammatic control center layout, process analysis.

UNIT – II

Temperature measurement: Expansion thermometers, thermo- electric temperature measurement. Resistance thermometers, radiation temperature measurement.

UNIT – III

Measurement of pressure and vacuum, measurement of head and level, flow metering.

UNIT IV

Methods for composition analysis: Absorption spectroscopy, emission spectroscopy, mass spectroscopy, color measurement by spectrometers, gas analysis by thermal conductivity, refractometer, Gas chromatography.

TEXT BOOK

1. Industrial Instrumentation, Donald P. Eckman, Wiley Eastern Ltd.,

REFERENCE BOOKS

1. Principles of Industrial Instruments, Patrenabis, Tata McGraw Hill
2. Electronics Devices – circuits, Milliman and Haiking.
3. Introduction to Chemical Analysis, Robert D.Braun, McGraw Hill.

Process Heat Transfer Laboratory

II B.Tech – IV Semester (Code: 14CHL401)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

1. Determining the thermal conductivity of a metal rod
2. Estimating the natural convective heat transfer coefficient for a vertical tube
3. Determining the temperature distribution along a pin fin under natural convection and forced convection
4. Estimating the heat transfer coefficient in forced convection flow of fluid.
5. Determining the overall heat transfer coefficient of fluid in parallel and counter flow in double pipe heat exchanger.
6. Finding the Stefan- Boltzmann constant.
7. Estimating the emissivity of a test plate
8. Finding the thermal conductivity of lagged materials in a lagged pipe.
9. Analyzing the temperature distribution through composite walls.
10. Studying the boiling heat transfer phenomena
11. Estimating the overall heat transfer coefficient for a fluid flow in a shell and tube heat exchanger.
12. Calculating the heat transfer coefficient from a metal rod by unsteady state heating and cooling processes.
13. Estimating the overall heat transfer coefficient for a fluid flow in agitated vessels.
14. Estimating the overall heat transfer coefficient for a fluid flow in a jacketed kettle.
15. Calculating the rate of evaporation in Single effect evaporator.
16. Estimating the heat transfer coefficient in Drop wise & film wise type condensation.
17. Finding the heat flux for a fluid flow through heat pipe.

Mechanical Unit Operations Laboratory

II B.Tech – IV Semester (Code: 14CHL402)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

1. Sampling by Riffle, Cone & Quartering and Bulk method
2. Determining the Grindability index (G.I.) of coal.
3. Verification of crushing laws using Ball Mill
4. Verification of crushing laws using Jaw Crusher
5. Verification of crushing laws using Roll Crusher
6. Demonstration of sink and float Principle
7. Find the optimum time of sieving.
8. Determining the effectiveness of a given screen by hand sieving
9. Determining effectiveness of a given screen using vibrating/ Rotap sieving
10. Estimation of terminal settling velocity in viscous medium.
11. Estimation of cake resistance in Plate and Frame filter press
12. To demonstrate the principle of centrifugal separator.
13. To demonstrate the principle of cyclone separator.

Chemical Technology Laboratory

II B.Tech – IV Semester (Code: 14CHL403)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)		:	60

1. Preparation of dyes and pigments
    a. preparation of azodyes
    b. preparation of copper pigment
    c. preparation of chrome yellow pigment
2. Preparation of winter green oil (Methyl salcylate)
3. Preparation of linear alkyl benzene sulphonate
4. Analysis of water: chlorides and sulphates
5. Analysis of oil: Acid value and iodine number
6. Analysis of coal: Proximate analysis
7. Analysis of lime: Estimation acid insolubles, available lime and calcium carbonate
8. Analysis of starch/ Glucose: Estimation of total reducing sugars
9. Analysis of saw dust: Estimation of total cellulose
10. Estimation copper present in brass alloy
11. Estimation of urea
12. Testing of fuels by Orast analysis
13. Preparation of soap; determination of total active matter and total fatty matter in soaps
14. Preparation of Resign
15. Determination of adulteration in food and oils.

Mass Transfer Operations-I

III B.Tech – V Semester (Code: 14CH501)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Introduction to Mass Transfer Operations. **Molecular diffusion in fluids**: Steady-state molecular diffusion in fluids at Rest and in laminar flow.

Mass transfer coefficients: Mass transfer coefficients in laminar and turbulent flow, Analogy between momentum, heat and mass transfer in laminar and turbulent flow - correlations for mass transfer coefficients in simple situations, diffusion in solids.

UNIT – II

Inter phase Mass Transfer: Equilibrium, Diffusion between phases, Material balances in steady state co-current and counter-current processes.

Equipment for gas-liquid operations: **Gas Dispersed:** Sparged vessels (bubble columns), mechanically agitated vessels, mechanical agitation of single phase liquids, mechanical agitation, gas liquid contact tray towers. Sieve trays (qualitative treatment), Murphee tray efficiency, and overall tray efficiency.

Liquid dispersed: Venturi scrubbers, wetted–wall towers, spray chambers, packed towers, mass transfer coefficients and packed towers, counter current flow of gas and liquid, end effects and axial mixing, tray Vs packed towers.

UNIT – III

Humidification Operations: Definitions of fundamental terms, psychrometric charts- theory of adiabatic saturation and wet bulb temperature - Lewis relation, gas liquid contact operations – Design of packed bed for humidification and dehumidification, cooling towers, Non-adiabatic operation - evaporative cooling.

Drying: Equilibrium, batch drying, drying rate curve, time of drying calculations, mechanism of batch drying, continuous drying, equipment for batch and continuous drying operations.

UNIT – IV

Absorption: Solubility of gases in liquids, two component systems - ideal and non-ideal solutions - choice of solvent for absorption, single component absorption material balance – counter current multi stage operations, HETP, HTU, NTU concepts for single component absorption in continuous contact equipment – graphical construction for transfer units,

TEXT BOOK

1. Mass Transfer Operations, Robert E. Treybal, 3rd edition, International Edition, McGraw Hill.
2. Principles of Mass Transfer and Separation Process, Binay K. Dutta, PHI, New Delhi.

REFERENCE BOOKS

1. Unit Operations of Chemical Engineering, Warren,L., McCabe, Julian C.Smith, Peter Harriot, 7th Edition, McGraw Hill.
2. Transport process and separation process principles, Christie John Geankoplis, 4th ed, PHI
3. Separation Process Principles, J D Seader and E J Henly, John Wiley & sons.
4. Perry's Chemical Engineers Hand Book, Robert H. Perry, 7th edition, McGraw Hill

Process Dynamics and Control
III B. Tech – V Semester (Code: 14CH502)

Lectures	4	Tutorial	0	Practical	0	Self Study	1
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

Course Objectives :

To provide a conceptual and methodological frame work for describing a process and its control system. To learn the fundamental principles of classical control theory, including different types of controllers, control strategies and tuning. To gain a brief exposure to advanced control strategies and control valve.

Pre-Requisites: CH 211, CH 215, CH 216, CH 223, CH 226.

UNIT – I

Basic Principles: Laplace Transform, Inversion by Partial Fractions and Properties of Transforms.

Linear Open-Loop Systems: Response of First-Order Systems, Physical Examples, Response of First-Order Systems in Series, Second-Order Systems and Transportation Lag.

UNIT – II

Linear Closed-Loop Systems: Control System, Controllers and Final Control Elements, Block Diagram of a Chemical-Reactor Control System, Closed-Loop Transfer Functions, Transient Response of Simple Control Systems, Stability and Root Locus.

UNIT – III

Frequency Response: Introduction to Frequency Response: Introduction, Substitution Rule, Bode Diagrams; Control System Design by Frequency Response: Tank-Temperature Control Systems, Bode Stability Criterion, Gain and Phase Margins, Ziegler–Nichols Control Settings, Transient Responses.

UNIT – IV

Process Applications: Advanced control strategies: Cascade Control, Feed Forward Control, Ratio Control, Dead Time Compensation, Internal Model Control; Controller Tuning and Process Identification: Controller Tuning, Tuning Rules, Process Identification. Control Valves: Control Valve Construction, Sizing, Characteristics, Positioner.

TEXT BOOK:

Process systems analysis and control, Donald R Coughanowr, McGraw-Hill, Inc.

REFERENCE BOOKS:

Chemical Process Control, George Stephanopoulos, PHI.

Process Control: Modeling, Design and Simulation, B. Wayne Bequette, Prentice Hall International Series in the Physical and Chemical Engineering Sciences series.

Process Dynamics and Control, Seborg, Edgar, Melluchamp & Doyle, Wiley.

Chemical Engineering Thermodynamics

III B.Tech – V Semester (Code: 14CH503)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT – I

Heat effects: Sensible heat effects, temperature dependence of heat capacity, heat effects accompanying the phase changes, the standard heat of reaction, formation and combustion, temperature dependence of ΔH^0, heat effects of industrial reactions.

UNIT – II

Solution thermodynamics: Fundamental property relation, chemical potential, criterion for phase equilibria, partial properties, ideal gas mixtures, fugacity and fugacity coefficients, generalized correlations for fugacity coefficients, the ideal solution, excess properties.

Solution Thermodynamics Applications: Liquid phase properties from VLE data, activity coefficient, excess Gibb's energy, Gibb's Duhem equation, data reduction, thermodynamic consistency, models for excess Gibb's energy, property changes of mixing, heat effects of mixing processes.

UNIT – III

Phase equilibria, VLE: Nature of equilibrium, Phase rule, Duhem's Theorem, VLE: Qualitative behavior, simple models for VLE, VLE, modified Raoult's Law, VLE from k – values correlations. The Gamma / Phi formulation of VLE, VLE from cubic equations of state, equilibrium and stability, LLE, VLLE, SLE, SVE.

UNIT – IV

Chemical Reaction Equilibrium: The reaction coordinate, application of equilibrium criteria to chemical reactions, the standard Gibbs-Energy change and the equilibrium constant, effect of temperature on the equilibrium constant, evaluation of equilibrium constants, relation of equilibrium constants to composition, equilibrium conversions for single reactions, phase rule and Duhem's theorem for reacting systems, multireaction equilibria, Fuel cells.

TEXT BOOK

Introduction to Chemical Engineering Thermodynamics, Smith, J.M., Van Ness,H.C., and Abbott,M.M., 6th Edition, McGraw Hill.

REFERENCE BOOKS

Chemical Engineering Thermodynamics, Daubert, McGraw Hill.

Chemical Engineering Thermodynamics, Y.V.C.Rao, University Press.

Chemical Reaction Engineering-I

III B.Tech – V Semester (Code: 14CH504)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Thermodynamics, chemical kinetics, classification of reactions, variables affecting the rate of reaction, definition of reaction rate.

Kinetics of homogeneous reactions: Concentration dependent term of rate equation, temperature dependent term for rate equation, searching for a mechanism, predictability of reaction rate from theory.

UNIT – II

Interpretation of Batch Reactor Data: Constant volume batch reactor, variable volume batch reactor, temperature and reaction rate, search for a rate equation.

UNIT – III

Introduction to Reactor design.

Single ideal Reactor: Ideal batch reactor, space time and space velocity, steady state mixed flow reactor, steady state plug flow reactor, holding time and space time for flow systems.

UNIT – IV

Design for Single Reactions: Size comparison of single reactors, multiple reactor systems, recycle reactor, autocatalytic reactions.

Design for multiple reactions: Reactions in parallel, reactions in series, contacting patterns, product distribution.

TEXT BOOK

Chemical Reaction Engineering, Octave Levenspiel, 3rd edition, Wiley Eastern

REFERENCE BOOKS

1. Elements of chemical reaction engineering, H.S.Fogler, 2nd edition, PHI
2. Chemical Engineering Kinetics, J.M.Smith, 3rd edition, McGraw Hill.
3. Chemical Reaction Engineering, Octave Levenspiel, 2nd edition, Wiley Eastern.

Petroleum Refinery Engineering

III B.Tech – V Semester (Code: 14CH505)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT-I

Introduction: Composition of petroleum, laboratory tests, refinery feed stocks and products.

General Definitions; Introduction to petroleum refinery; Classification of Crude oil; Characterization of crude oil; Composition of crude; Physical properties; Crude oil; analysis and distillation ; Introduction to refinery "feedstock/s" and refinery products.

Crude Pre Treatment: dehydration and desalting, pipe still heater, atmospheric and vacuum distillation of crude oil.

UNIT – II

Catalytic cracking

Catalytic cracking, Cracking reactions, Zeolite catalysts ; Cracking Feed stocks and reactors, Effect of process variables; FCC Cracking, Catalyst coking and regeneration.

Hydro cracking

Objectives & Hydro cracking Reactions, Hydro cracking feed stocks, Modes of Hydro cracking Effects of process variables;

Thermal Processes

Solvent deasphalting, Delayed coking, Visbreaking,;

UNIT - III

Hydro treating and Catalytic reforming

Hydro treating process and catalysts hydro processing, Effects of process variables, Reactor design concepts.

Objective and application of catalytic reforming process reforming catalysts; Reformer feed reforming reactor design continuous and semi regenerative process.

UNIT - IV

Isomerization, Alkylation and Polymerization.

Isomerization process, Reactions, Effects of process variables;

Alkylation process, Feed stocks, reactions, products, catalysts and effect of process variables;

Polymerization: Objectives, process,

TEXT BOOK

1. Modern petroleum Refining Processes, B.K.B.Rao, Oxford IBH.

REFERENCE BOOKS

1. Petroleum Refining Engineering, Nelson, McGraw Hill
2. Hand Book of Petroleum Processing, David S J Stan Jones & Peter R Pujado, Spinger

CREATIVITY, INNOVATION &NEW PRODUCT DEVLOPMENT
(ELECTIVE)
III B.Tech – V Semester (Code: 14CH506/A)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	: 40			Semester End Examination (3 Hours)		:	60

UNIT- I

The Process of Technological Innovation; Introduction Factors contributing to successful technological innovation;The need for creativity and innovation;Creativity and Problem solving; Brain storming- different techniques.

UNIT- II

Project Selection and Evaluation: Collection of ideas and purpose of project; Selection criteria; Screening ideas for new products; Evaluation Techniques.

UNIT- III

New Product Development and Planning: Research and new product development; Design of Proto type, Testing, Quality standards; Marketing research;introducing new concepts
Patent- Patent search; Patent laws; International codes for patents; Intellectual Property Rights (IPR).

UNIT- IV

Good Laboratory Practice (GLP)and**Good Manufacturing Practice (GMP)**
Laboratory: Creative design - Model Preparation - Testing - Cost evaluation - Patent application.

Text Books:

1. Creativity and Innovation, Harry Nystrom, John Wiley & Sons.
2. Managing Technological Innovation, Brain Twiss, Pitman Publishing Ltd.
3. New Product Planning, Watton HB, Prentice-Hall Inc.
4. Fourth Eye (Excellence through Creativity), Khandwalla PN, Wheeler Publishing

CURRENT GOOD MANUFACTURING PRACTICES
(ELECTIVE)
III B.Tech – V Semester (Code: 14CH506/B)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT- I

Overview of good manufacturing practices. Different Regulatory agencies and compliance (FDA, USDA, EPA, OSHA, ISO).Material safety data sheets (MSDS). Handling, storage, and disposal of laboratory materials. Maintenance and validation of laboratory equipment

UNIT- II

Good Laboratory Pratices (Glp) & Standard Operating Procedures (Sop): Introduction to Good Laboratory Practices, Responsibilities in GLP, Quality assurance and facilities for GLP, Standard Operating Procedures (SOP) and Guidelines and regulations.

UNIT- III

Good Manufacturing Practices (Gmp): Introduction to GMP; Manufacturing & Quality control facilities; Sanitation & Hygiene; Control of raw materials, Packaging Materials, manufacturing processes, Minimization or Zero Contamination, and finished products; Documentation and compliance of GMP.

UNIT- IV

Current good clinical practices (cGCP)and **Current good environmental practices (cGEP)** Layouts and Designs of Manufacturing Areas, Equipment designs and operations, Standard operating procedures for Production, Quality control, Labeling, Records and Waste Disposal; Health & hygiene of Persons involved.

Text Books:

1. How to Practice GMPs?- PP Sharma.
2. Good Laboratory Practice- Jurg P Seiler.
3. Current Good Manufacturing Practices-Manohar Potdar-Pharma Book Syndicate

RURAL TECHNOLOGY AND DEVELOPMENT
(ELECTIVE)
III B.Tech – V Semester (Code: 14CH506/C)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Rural Energy requirements: Community Bio-gas plants, design and operation, economics of community bio-gas plants, water pumps based on bio-gas.

UNIT – II

Renewable energy technology and rural development, rural applications of solar energy, solar cookers, solar drying and distillation, design of photo voltaic systems for water pumping, lighting, integrated rural energy planning.

UNIT – III

Aquaculture: Principles of aquaculture systems, aquaculture engineering, location, layout, design and construction of aquaculture farms, water intake systems, aeration and aerators, water quality management in aquaculture, aquaculture in India.

UNIT – IV:

Technology of food: Introduction, constituents of food, nutritive aspects, unit operations for food processing.

Food preservation, dehydration and concentration, food fermentations, food additives, milk and milk products.

Text Books:

1. National Energy: Policy, Crisis and Growth, V.S.Mahajan, Ashish Publishing House.
2. Advance in Bio-gas technology, O.P.Chawla, Indian Council of agriculture and research.

Reference Books:

1. Renewable Energy sources and conversion technology, N.K.Bansal, et.al., Tata McGraw-Hill.
2. Aquaculture management, James W.Meade, Van Nostrand Reinhold, New York.
3. Aquaculture, Vol. 1 &2, edited, Gilbert Bernabe, Ellis harwood New York, English edition.
4. Food Science, Norman potter, The AVI Publishing co.

BIOFUELS

(ELECTIVE)

III B.Tech – V Semester (Code: 14CH506/D)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Sources of energy, introduction of biofuels, availability of bio mass, composition of biomass, terrestrial biomass, aquatic biomass. Physical and chemical properties of biomass. useful features of biofuels, undesirable features of biofuels, energy crops, modes of utilization of biomass and their environmental impacts.

UNIT – II

Biogas: The substrate, the digester, the microorganisms, the process of bio gas production, factors affecting bio gas yields, advantages, disadvantages.

Bioethanol: Bioethanol vs. Petrol, production of bio ethanol, ethanol recovery. Bio butanol.

UNIT –III

Bio diesel: Sources of lipids, production of lipids, methods of production of bio diesel, comparison of bio diesel with conventional diesel. Standards of bio diesel.

UNIT – IV

Bio hydrogen: Production of bio hydrogen from anaerobic bacteria, photosynthetic algae, photosynthetic–hydrogenase system.

Fuel cells: Enzymatic fuel cells, microbial fuel cells.

Text Book:

1. Bio Technology – Expanding horizons, B.D.Sing, Kalyani Publishers, Ludhiana.

Reference Books:

1. Fundamentals of Renewable Energy systems, D.Mukherjee, S.Chakrabarti, New Age International Publishers.
2. A Text Book of Biotechnology, R.C.Dubey, S.Chand & Company Ltd.,
Non-Conventional energy sources, G.D.Rai, Khanna Publishers.

SOFT SKILLS LABORATORY

III B.Tech – V Semester (Code: 14ELL501)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

1. **BODY LANGUAGE**
   a. Facial Expressions.
   b. Kinesics.
   c.. Oculesics.
   d. Haptics.
   e.. Proxemics.
   f. Para Linguistics.

5. LIFE SKILLS
   a. Positive Attitude
   b. Social Behaviour &Social Norms.
   c. Ethics, Values and Positive Work Ethics.
   d. Time Management
   e. Goal Setting, Vision, Mission.

6. EMOTIONAL INTELLIGENCE
   a. Self Awareness through Johari Window and SWOT analysis.
   b. Self Control.
   c. Self Motivation.
   d. Empathy.
   e. Social Skills.
   f. Self Esteem.
   g. Managing stress.
   h. Assertiveness.

7. PROBLEM SOLVING SKILLS
   a. Critical Thinking and Brain Storming
   b. Lateral Thinking and Six Thinking Hats.
   c. Creative Thinking.
   d. Conflict Management.

8. EMPLOYABILITY SKILLS
   a. Group Discussion.
   b. Team Building and Leadership Qualities
   c. Interview Skills.

RFFERENCE BOOKS:

1. "The Definitive Book Of Body Language", Allan & Barbara Pease
2. "You Can Win", Shiv Khera.
3. ""Lateral Thinking", Edward De Bono.
4. "How To Prepare For Group Discussions And Interview", Hari Mohan Prasad, Rajnish Mohan, 2nd Edition, TMH.
5. "Emotional Intelligence", Daniel Goleman.
6. " The 7 Habits Of Highly Effective People", Stephen R. Covey
7. "Working in Teams", Sandy Pokras.

MASS TRANSFER OPERATIONS LABORATORY-I

III B.Tech – V Semester (Code: 14CHL502)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)		:	60

1. Determination of Cell Constant for liquid-Liquid System
2. Determination of Diffusion coefficient of organic vapors through Air
3. Determination of Gas Phase Mass transfer coefficient in surface evaporation also find the Himus Constant
4. Calculation of Rate of Drying and generating the drying Curve
5. Study of Humudification & De Humidificatin Phenomena & Determine mass transfer coefficients.
6. Estimation of volumetric mass transfer coefficient in a Spray column
7. Determination of effective interfacial area as a function of superficial liquid velocity in a packed column.
8. Hydrodynamics of single drop extraction
9. Hydrodynamics in a spray column
10. Determination of mass transfer coefficient in packed bed absorption column

INSTRUMENTATION & PROCESS CONTROL LABORATORY

III B.Tech – V Semester (Code: 14CHL503)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

1. Study the response of Hg –Glass bare thermometer for a step change in input variable
2. Study the response of a two tank non-interacting liquid level system and determining the time constant
3. Study the response of a two tank interacting liquid level system and determining the time constant
4. Study of inherent characteristics of Control valve
5. Study EMF Vs temperature relationship of the thermocouple.
6. Characteristics of P/I & I/P Converter
7. Study the performance of Level control system for different sets of control parameters and for different load disturbances.
8. Study the performance of Flow control system for different sets of control parameters and for different load disturbances.
9. Study the performance of Pressure control system for different sets of control parameters and for different load disturbances.
10. Study the Characteristics of Pressure, Level & Flow Transmitters
11. Study the performance of a Feed Forward Temperature Control
12. Study the performance of a Cascade Control
13. Study the performance of a Ratio Controller
14. Controlling of traffic signals using PLC
15. Determining the characteristics of inductive sensor

PROFESSIONAL ETHICS AND HUMAN VALUES

III B.Tech – VI Semester (Code: 14CH601)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT-I

Human Values: Integrity, work ethics, service and learning, civic virtue, respect for others, living peacefully, caring and sharing, honesty, courage, value time, cooperation, commitment and empathy, spirituality, character. .

Introduction to Industrial Ethics: Introduction, Industrial Ethics, Some Definitions, Some Benefits of Ethics to Industry, Some Ethical Roles of the Industrial Worker,

UNIT-II

Industrial Responsibility: Introduction,What is Industrial Responsibility,Types of Responsibility, Some Areas of Employer Responsibility, Measurement of Industrial Responsibility, What Happens When Responsibility is Present or Absent, Some Areas of Industrial Responsibility and their Implications, What Industrial Organizations are Doing to Curb Irresponsibility, Industrial Responsibility and Industrial Productivity

UNIT-III

Worker – Oriented Values: Honesty, Self-Control, and Self- Respect : Introduction

Team- Oriented Values: Fairness, Tolerance of Diversity, Mutual Assistance, and Respect for Others

UNIT-IV

Integrity: The Epitome of Industrial Success : Introduction, Major Components of Industrial Integrity, Success and Failures in Industrial Integrity, Integrity

Case Readings in Industrial Ethics: Product integrity versus public safety, the roots of ethical problems, Industrial carelessness, Industrial waste mismanagment, Industrial deceptive practices.

Text Books

1. A hand book of productive industrial ethics - Professor Samuel C. Obi.
2.Engineering Ethics, Govindarajan M, Natarajan S, Senthil Kumar V.S, Prentice hall of India, New Delhi.

Reference Books

1.Ethics in Engineering, Fourth Edition, Mike W. Martin, Rolan Schinzinger, Mc Graw Hill publishers
2.Engineering Ethics–An industrial Perspective, Gail Dawn Baura
3.Ethics and Values in Industrial-Organizational Psychology, Joel Lefkowitz

CHEMICAL PROCESS EQUIPMENT DESIGN- I

III B.Tech – VI Semester (Code: 14CH602)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Introduction: Overall design considerations-chemical engineering plant design, factors effecting profitability of investments, Optimum Design, Practical considerations in design, Design approach.

Process Design Development: Development of design database, feasibility survey, Types of design and flow diagrams, Preliminary design with a specific example, comparison of different processes, Equipment design and specifications, Materials of construction.

General Design Considerations: Health and safety hazards, Fire and Explosion hazard, Loss prevention, Environmental Protection, Plant Location and Layout, Plant operation and control, utilities, storage and material handling, Patent considerations, Design Repots.

UNIT – II

Fluids Handling Equipments: Basic concepts of fluid Transports, design of centrifugal pumps, pumping devices for gases, pipeline design, design of relief valve.

Design of filters: design of plate and frame filter press, rotary drum filters;

UNIT – III

Heat transfer equipment design: Basic theory of heat transfer in exchangers, determination of heat transfer coefficients and pressure drop in heat exchangers, selection of heat exchange equipment. Design of Double Pipe heat exchangers; Shell and Tube heat exchanger: design of fixed tube sheet, U-tube type heat exchangers;

UNIT – IV

Design of separating columns: Choice between plate and packed columns.

Design of plate columns: selection of plate type, estimating number of ideal stages using McCabe Thiele diagram; Design of sieve trays: operating characteristics of sieve trays, liquid flow arrangement, tower diameter, perforations and active area, weir crest, weir height, plate pressure drop, down comer liquid backup, check for flooding, weeping velocity, entrainment.

Design of packed columns: Types of packing, estimation of packed bed height for absorption and distillation columns, HTU concept, column diameter, column internals, wetting rates.

Text Books

1. Plant Design and Economics for Chemical Engineers, Peters. M. S. and Timmerhaus, K.D., 4th Edition, McGraw Hill.

Reference Books

1. Process Equipment Design, Shrikant D.Dawande, Volume 1, Dennet & Co, 5th edition.

2.Coulson & Richardson's Chemical Engineering, Volume:2, J.F. Richardson, J. H. Harker and J. R. Backhurst, 4th edition, Elsevier.

3. Chemical Engineering, Vol-6, Coulson J.M., Richardson J.F. and Sinnott, R.K., Pergamon press.

MASS TRANSFER OPERATIONS–II

III B.Tech – VI Semester (Code: 14CH603)

Lectures	4	Tutorial	0	Practical	0	Self Study	1
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT – I

Distillation: Principles of VLE for binary systems–phase diagrams, relative volatility, azeotropes, enthalpy concentration diagrams, flash vaporization, partial condensation, differential distillation, steam distillation, continuous distillation–McCabe Thiele method–Ponchon Savarit method, Tray efficiencies, batch distillation with reflux open steam process, reboilers and condensers, azeotropic and extractive distillation.

UNIT – II

Liquid-Liquid Extraction: Introduction, liquid–liquid equilibria, Analytical and graphical solutions for single and multi stage operations, continuous counter-current operations without reflux, fractional extraction, equipment for liquid-liquid contacting operations–single stage, multi stage and continuous contact.

UNIT – III

Leaching: Preparation of solid, steady and unsteady state operation, Equipment for leaching operations, methods of calculation for single and multi stage operations.

UNIT – IV

Adsorption: Theory of adsorption, industrial adsorbents, adsorption equilibria, Freundlich equation, single and multi stage operations, unsteady state adsorption, equipment for stage and continuous contact.

Text Books:

1. Mass Transfer Operations, Robert E. Treybal, Third Edition, International Edition,McGraw Hill.
2. Principles of Mass Transfer and Separation Process, Binay K. Dutta, PHI, New Delhi.

Reference Books:

1. Unit Operations of Chemical Engineering, Warren, L., McCabe, Julian C.Smith, Peter Harriot, 7^{th} Edition, McGraw Hill.
2. Transport process and separation process principles, Christie John Geankoplis, 4^{th} edition, PHI
2. Separation Process Principles, J D Seader and E J Henly, John Wiley & sons, NY 1998.
3. Perry's Chemical Engineers Hand Book, Robert H. Perry, 7^{th} edition, McGraw Hill

CHEMICAL REACTION ENGINEERING – II

III B.Tech – VI Semester (Code: 14CH604)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT – I

Temperature and pressure effects: Single reaction and multiple reactions

Thermal characteristics and design of reactors: Batch reactor, PFR, CSTR under adiabatic conditions for first order irreversible reactions

UNIT – II

Non-ideal reactors: Residence time distribution of fluid in vessel, measurement of the RTD (Tracer Techniques), Characteristics of the RTD, RTD in ideal reactors, Reactor modeling with the RTD: Segregation model, the Tanks in series model, the Dispersion (plug flow) model for closed vessel. Concept of micro and macro mixing

UNIT – III

Introduction to design for heterogeneous reacting systems: Rate equations for heterogeneous reactions, contacting patterns for two phase systems.

Fluid particle reactions: Selection of a model, un-reacted core model for spherical particles, rate of reaction for shrinking spherical particles, determination of rate controlling steps.

UNIT – IV

Heterogeneous catalysis: Catalyst properties, Estimation of surface area, pore volume, physical adsorption and chemisorptions, adsorption isotherms-Derivations of rate equations for various mechanisms with rate limiting steps(Adsorption, surface reactions, desorption controlling etc.,) Data analysis for heterogeneous catalytic reactors, isothermal packed bed (PFR) reactor design, Diffusion and reaction within porous solids: effectiveness factor and internal pore diffusing criteria for internal pore diffusing limitation.

Text Books:

1. Chemical Reaction Engineering, Levenspiel, Octave, 3rd edition, Wiley Eastern (UNIT-I to III)
2. Chemical Engineering Kinetics, Smith J.M. McGraw Hill.(UNIT-IV)

Reference Book:

Elements of Chemical Reaction Engineering, Fogler, H.S., 2nd edition, PHI

INDUSTRIAL POLLUTION & CONTROL

III B.Tech – VI Semester (Code: 14CH605)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Man & Environment, Types of Pollution, Pollution control aspects, Industrial emissions-Liquids, Gases, Environmental Legislation, Water quality management in India, Air (Prevention & Control of Pollution) Act.

UNIT – II

Removal of BOD, Biological oxidation, Anaerobic treatment, Removal of Chromium, Removal of Mercury, Removal of Ammonia, Urea, Treatment of Phenallic effluents.

UNIT – III

Removal of Particulate matter, Removal of Sulfur Oxides, Removal of Oxides of Nitrogen, Removal of Organic vapors from Effluent.

UNIT – IV

Pollution control in Chemical Industries, General considerations, pollution control aspects of Fertilizer industries, Pollution control in Petroleum Refineries and Petrochemical units, Pollution control in Pulp and Paper Industries.

Text Book

1. Pollution control in Process Industries, S.P .Mahajan, Tata McGraw Hill Publishing Company Ltd, New Delhi

Reference Books

1. Environmental Pollution Control Engineering, C.S.Rao, Wiley Eastern Ltd., New Age International Ltd.,
2. Air pollution, M.N.Rao, H.V.N.Rao, Tata McGrawhill.
3. Water Pollution control, W.Wesley Eckenfelder Jr.Industrial, Tata McGrawHill.

MEMBRANE TECHNOLOGY
(Qualitative Treatment Only)
(Elective)
III B.Tech – VI Semester (Code: 14CH606/A)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Introduction: Introduction to barrier separation processes, Definitions and principles membrane separation process, mechanism of membrane action, classification of membrane process, modules, modes of operation (Cross-flow and dead end flow), process configuration, requirements for ideal membrane, comparison with conventional separation processes.

UNIT – II

Membranes: Synthetic membranes for various processes, Characteristics of Membrane Materials, classification, methods of preparation, Membrane Characterization, structural properties, liquid membranes.

UNIT – III

Driving forces and transport through microfiltration, ultrafiltration, nanofiltration, reverse osmosis, Dialysis and electrodialysis, gas permeation, pervaporation, vapor permeation, liquid membrane separations and their Industrial applications.

UNIT – IV

Driving forces and transport through porous and non-porous membranes, Concentration polarization, Fouling, factors affecting fouling, Methods to reduce fouling and flux enhancement, cleaning of membranes.Membrane modules. Introduction to membrane reactors.

Text Book

1. Basic principles of membrane technology, Marcal Mulder, Kluwer Academic publications

Reference Books

1. Industrial membranes, Scott, Elsevier.
2. Ultrafiltration and Microfiltration, Munir Cheryan, Technomic Publishing Co.,
3. Progress in separation and purification, Vol. I, E. S. Perry, Inter Science Publishers.
4. Process in Separation and Purification, Vol.-III edited, E. S. Perry and C. J. Vaness, Inter science Publishers.
5. Synthetic Polymeric membranes, R. E. Kesting, McGraw Hill
6. Diffusing and Membrane Technology, S. B. Tuwiner, Reinhold Publishing Corpn.NY.
7. Perry's Chemical Engineers Hand Book, Robert H. Perry, 7^{th} edition, McGraw Hill

NANOTECHNOLOGY

(Elective)

III B.Tech – VI Semester (Code: 14CH606/B)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT-I

Introduction to nanotechnology, molecular and atomic size, surface and dimensional spaces.

Molecular nanotechnology: Atoms by inference, electron microscopes (SEM) nanomanipulator, nanotweezers, atom manipulation, nanodots, nanolithography, spectroscopy techniques.

UNIT-II

Nanopowders and nanomaterials: Preparation, plasma arcing, chemical vapor deposition, sol-gels, electrodeposition, ball milling, applications.

Carbon nanotubes: Types, formation, assemblies, purification, properties and uses.

UNIT-III

Molecular mimics: Catenanes and rotaxanes, various molecular switches, synthesis of rotaxanes and catenanes, molecular computers, chemical rotors, prodders, flippers, atom shuttles, actuators, contacts.

Optics, photonics and solar energy: Properties of light and nanotechnology, interaction.

UNIT-IV

Nanobiometrics: Lipids as nano-bricks and mortar, self-assembled monolayers, proteins, 3-D structures arising from amines acids, nanoscale motors, biological computing, ion channels as sensors, information in DNA structure, using DNA to build nano-cubes, hinges, smart glue, wire template.

Text Book

1. Nanotechnology (Basic Science and Engineering technologies) Mick Wilson, KKGeoff Smithj, Michella Simmons, Burkhard Raguge, Overseas Press.

Reference Book

1. Introduction to Nanotechnology, Charles P. Poole, Jrl and Frank J Owens, Wiley - Interscience

POLYMER TECHNOLOGY

(Elective)

III B.Tech – VI Semester (Code: 14CH606/C)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT–I

Definitions – Monomer, polymer, functionality, homo and copolymers, heterochain and homochain polymers, polymer blends.

Classification of Polymers: Based on origin, applications, thermal behavior and polymerization. Structural formulae of some common polymers. Average molecular weights and their distribution of polymers.

Measurement of Molecular Weights: By end group analysis, colligative properties, intrinsic viscosity, Gel permeation chromatography and light scattering methods.

Chemical structure and physical states of polymers: Configuration & conformations, crystalline and amorphous states.

General properties of polymers: Mechanical, chemical, thermal, electrical and optical properties.

UNIT – II

Mechanism and kinetics of: (I) step growth or condensation polymerization, (II) addition or chain growth a) free radical, b) anionic, c) cationic and d) coordination polymerizations.

Copolymerization of binary monomer system: Kinetics and relation of copolymer composition to monomer ratio.

Role of: Initiator, catalyst, solvents, inhibitors, chain transfer agents in polymerization.

Methods of polymerization: Bulk or mass, solution, suspension and emulsion polymerization techniques.

Polymer chemical reactions: Degradation, curing or cross linking and vulcanization

UNIT – III

Compounding of polymers: Role of various additives such as fillers, reinforcing agents, stabilizers, antioxidants, lubricants, fire retardants, coupling agents.

Brief description of processing methods: a) Extrusion, b) moulding, c) injection moulding, d) calendaring, e) fibre spinning.

Brief description of manufacture, properties and applications of addition polymers:

a) polyethylene, b) polypropylene, c) polyvinyl chloride, d) polystyrene, e) polymethyl methacrylate, f) polytetra fluoroethylene and g) natural rubber.

UNIT – IV

Brief description of preparation, properties and application of condensation polymers:

a) phenolic resins, b) polyesters c) unsaturated and saturated: PET & polycarbonate, d) Polyamides (nylon 6 & nylon 6,6) e) polyurethanes, f) epoxy resins, g) silicone resins, h) cellulose and its derivatives.

Brief description of FRP composites.

Structural formulae and applications of engineering and specialty polymers.

Brief description of analysis and testing of polymers: Identification, chemical analysis, spectroscopic and x-ray methods, DSC, TGA.

Text Book

1. Polymer science, Gowarikar R.A., New Age publishers.

Reference Books

1. Polymer science and technology, Joel R. Fried, PHI publishers.
2. Polymer science and technology of plastics and rubbers, Premamoy Ghosh, Tata McGraw Hills, New Delhi
3. Text Book of polymer science, Fred Billmayer.Jr., John Wiley & Sons,

PARTICULATE TECHNOLOGY

(Elective)

III B.Tech – VI Semester (Code: 14CH606/D)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT I

Introduction: industrial significance of Solid Particulate systems, in particular fluidized bed systems. Single Particle Suspension: Motion of solid particles in a fluid, Drag coefficient, Terminal setting velocity, Particle characterization; Multiple Particle Systems: Momentum balance for multiphase system Fluid flow through particle beds, Ergun's equation, Fixed bed reactors

UNIT –II

Fluidization: Fundamentals, Minimum fluidization velocity, Geldart's classification of powders, Bubble mechanics, Stability and quality of fluidization; Fluidization Flow Regimes:

UNIT –III

Flow regime diagrams for G/S, bubble column and GLS systems, Hydrodynamics of bubbling, turbulent, and fast fluidized beds, and pneumatic conveying, Flow regime characterization and transitions through signals

UNIT –IV

Signal Analysis Methods: Statistical and spectral analysis methods, Chaos, fractal and wavelet transformation analysis; Fluidized Bed Reactor Modeling, Two-phase flow model, Numerical model, CFD for multiphase systems.Design and Scaling of Fluidized Bed Reactors: Scale-up issues, Scaling low, Cyclone, hopper, distributor plate design, Industrial applications

Text Book

Fluidization Engineering, Kunii, D. and Levenspiel, O., Butterworth-Heinemann, Boston (1991),

Reference Books

1. Particulates and Continuum: Multiphase Fluid Dynamics, Soo, S.L., (1989).
2. Theory of Multicomponent Fluids, Drew, D.A. and Passman, S.L. Springer, New York (1999)
3. Fluidization-Dynamics: the Formulation and Application of a Predictive Theory for the Fluidized State, Gibilaro, L.G., Butterworth-Heinemann, Boston (2001).
4. Multiphase Flow and Fluidization: Continuum and Kinetic Theory Descriptions, Gidaspow, D., Academic Press, Boston (1994).
5. Thermo-Fluid Dynamic Theory of Two-Phase Flow, Ishii, M., Eyrolles, Paris (1975).
6. Bubbles, Drops, and Particles, Clift, R., Weber, M.E. and Grace, J.R., Academic Press, New York (1978).
7. Introduction to Particle Technology, Rhodes, M., John Wiley & Sons, New York (1998).

ENVIRONMENTAL ENGINEERING LABORATORY

III B.Tech – VI Semester (Code: 14CHL601)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)		:	60

1. Suspended solids in air sample using high volume sampler.
2. CO_2 and CO concentrations in a given sample.
3. SO_2 concentrations in a given sample.
4. Hardness
5. pH value
6. Dissolved oxygen content.
7. BOD.
8. COD.
9. Iron content in a given industrial effluent sample.
10. Determination of Fluoride content in a given sample.
11. Determination of Chloride content in a given sample.
12. Nitrates
13. Determination of optimum dose of coagulant.
14. Determination of MLSS and MLVSS in a given industrial effluent sample.
15. Noise Measurement

MASS TRANSFER OPERATIONS LABORATORY-II

III B.Tech – VI Semester (Code: 14CHL602)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

1. Demonstrate the principles of immiscible liquid mixtures.
2. Verification of Rayleigh's equation & modified Rayleigh's equation
3. Determination of H.E.T.P for a given system at total reflux condition.
4. Obtain equilibrium data & plot boiling point diagram and equilibrium curve.
5. Obtain equilibrium data for ternary liquid mixtures. And determine the plait point.
6. Determine Mass transfer coefficient in a single drop extraction
7. Find Stage efficiency in single and multi stage extraction operations (batch process)
8. To verify the applicability of Freundlich's equation for a given system.
9. Obtain solid- liquid equilibrium data and draw ponchon savarit diagrams.
10. Determination of Mass transfer coefficient using spray column (Extraction)

CHEMICAL REACTION ENGINEERING LABORATORY

III B.Tech – VI Semester (Code: 14CHL603)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

1. Determination of the order of a reaction using a Batch reactor and analyzing the data by (a) differential method, (b) integral method.
2. Determination of activation energy of a reaction using a batch reactor.
3. Determination of Temperature-dependency of rate constant.
4. To determine the specific reaction rate constant of a reaction of known order using a batch
5. reactor
6. To determine the specific reaction rate constant of a reaction of known order using a CSTR (Continuous Stirred Tank Reactor).
7. To determine the order of the reaction and the rate constant using tubular reactor.
8. To determine the order of the reaction and the rate constant using a plug flow reactor
9. To determine the RTD and the dispersion number in a CSTR
10. To determine the RTD and the dispersion number in a CSTR's in series.
11. To determine the RTD and the dispersion number in a combined reactor.
12. Langmuir adsorption isotherm. To determine the surface area of activated charcoal.

INDUSTRIAL MANAGEMENT AND ENTREPREUNERSHIP DEVELOPMENT

IV B.Tech – VII Semester (Code: 14CH701)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT- I

General management:Management definition, functions of management and principles of management. Forms of Business Organization:Salient features of Sole Proprietorship, Partnership, Joint Stock Company; Private Limited and Public Limited companies; Cooperative and Government owned companies; Merits and Demerits of above types;

Marketing Management: Functions of Marketing; Concepts of Selling and Marketing-Difference; Market Research; Product pricing; Distribution channels; Marketing mix (4 Ps); Advertising and sales promotion; Product life cycle.

UNIT- II

Production and Materials Management: Functions of Production planning and control; Production systems-Types; Inventory control-Relevant costs, EOQ,Deterministic single item model with static demand, ABC, VED and FSN analysis; Introduction to MRP; **Financial Management**:Concept of time value of money; Interest formulae; Present and Future worth amounts for different cash flow patterns; Evaluation of alternative investment proposals (Capital budgeting); Types of Capital-Fixed and Working capital; Working capital management- Factors and Principles; **Depreciation**- Straight line depreciation, declining balance and Sum of Years digits methods.

UNIT- III

Personnel Management:Functions of personnel management, human resource planning, recruitment, selection, placement, training and development and performance appraisal.
Motivation theories, leadership styles.

UNIT- IV

Entrepreneur Development: Introduction, Entrepreneural characteristics, Functions of an Entrepreneur; Factors affecting entrepreneurship; Role of communication in entrepreneurship; Entrepreneurial development-Objectives, Need of Training for enterprises; Finance for the enterprises; Product, Process and Plant Design- Product analysis and Product Design process. Steps in process design and Plant Design.

Text Books

1. Industrial Engineering and Operations Management, S.K.Sharma, Savita Sharma and Tushar Sharma.
2. Industrial engineering and production management, Mahajan
3. Industrial Economics, R.R.Bharatwal

Reference Books

1. Operations Management, Joseph G Monk.
2. Production, Planning and Control, Samuel Eilon.

3. Marketing Management, Phillip Kotler.
4. Financial Management I.M.Pandey.
5. Projects, Prasanna Chandra.
6. The Essence of Small Business, Barrow colin.
7. Small Industry Ram K Vepa.

CHEMICAL PROCESS EQUIPMENT DESIGN- II

IV B.Tech – VII Semester (Code: 14CH702)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Design of Reactor Systems: Types of Reactors and Selection of Reactors, Design of Ideal Batch reactors, Plug flow reactors and Back mix reactors, Fluidized bed reactors.

UNIT – II

Stress and Strain: Simple stress and strain, Hooke's Law, factor of safety, thermal stresses, Lateral strain, modules of rigidity, bulk modules, strain energy. Theories of failures, Stresses induced in the vessel design

Thin and Thick Cylinders: Thin and thick circular cylinders subjected to internal and external pressure. Thin and thick cylinders with spherical ends. Lame's theorem and application to thick cylinders.

UNIT – III

Mechanical Design of Process Equipment: Design of Cylindrical and Spherical Vessels under internal pressure, Optimum size of the vessel. Design of different types of heads or closures.

Nozzles: Design of nozzles, nozzle reinforcements.

UNIT – IV

Flanges: Types of Flanges; classification, selection and design of gaskets, flange thickness.

Vessel Supports: Types of Supports and Stresses induced in supports, Design of Skirt support, Bracket support, Leg support and Saddle support.

Text Books

1. Plant Design and Economics for Chemical Engineers, Peters. M. S. and Timmerhaus, K.D., 4th Edition, McGraw Hill, (UNIT-I)

2. Process Equipment Design, Joshi, M.V. and Mahajani V.V, Macmilan India Ltd. (UNIT-II, III, IV)

Reference Books

1. Coulson & Richardson's Chemical Engineering, Volume:1, sixth edition, Coulson J.M., Richardson J.F. with J. R. Backhurst and J. H. Harker

2. Coulson & Richardson's Chemical Engineering, Vol-6, Third edition, 'Chemical Engineering design' by R.K.Sinnott, Butterworth Heinemann Pub Ltd.

3. Process Plant Design, Backhurst J.R. and Harker.J.H. Heineman, Educational Books.

4. Process Equipment Design, Shrikant D.Dawande, Volume 2, Dennet & Co.

TRANSPORT PHENOMENA

IV B.Tech – VII Semester (Code: 14CH703)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Introduction to momentum transport, viscosity and the mechanism of momentum transport, Newton's law of viscosity, non-Newtonian fluids, pressure and temperature dependence of viscosity of liquids and gases. Estimation of the viscosity of a gas mixture. Viscosity distribution in laminar flow, shell momentum balances and boundary conditions, flow of falling film-flow through circular tubes and annulus, adjacent flow of two immiscible liquids.

UNIT – II

Equations of continuity and motion-application of Navier strokes equation and Euler equation for laminar, steady flow problems tangential annular flow of a Newtonian fluid-shape of the surface of a rotating liquid.

UNIT – III

Energy transport by steady state conduction, thermal conductivity mechanism of energy transport, Fourier's law, effect of temperature and pressure on thermal conductivity.

Temperature distribution in solids and in laminar flow, shell energy balances, boundary conditions, heat conduction with electrical heat source, viscous heat source, forced convection and free convection. Heat transfer coefficients–forced convection in tubes & around submerged objects, Heat transfer coefficients for forced convection through packed beds, heat loss by free convection from a horizontal pipe.

UNIT – IV

Diffusivity and mechanism of mass transport, definition of concentration, velocities and mass fluxes, Fick's law of diffusion, temperature and pressure dependence of mass diffusivity, shell mass balances, boundary conditions and applications diffusion through a stagnant gas film, diffusion with heterogeneous and homogeneous chemical reactions. Diffusing into falling liquid film. Equation of continuity for binary mixtures.

Text Books

Transport Phenomena, R.B.Bird, Warrin.E, Stewat and Edwin N.Light Foot, Wiley International Edition.

Reference Books

1. Transport process and separation process principles, Christie John Geankoplis, 4th edition, PHI
2. Transport Phenomena, A Unified approach, Roberts, Broadkey and Harry C. Hershey, McGraw Hill.

PROCESS MODELLING AND SIMULATION

IV B.Tech – VII Semester (Code: 14CH704)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

UNIT – I

Mathematical models for chemical engineering systems: Introduction, Use of mathematical models, Scope of coverage, Principles of formation, Fundamental laws, Continuity equation, Energy equation, Equation of motion, Transport equations, Equations of state, Equilibrium, Chemical kinetics.

UNIT – II

Examples of mathematical models of chemical engineering systems: Introduction, Series of isothermal, constant hold up CSTRs, CSTRs with variable hold-ups, Two heated tanks, Gas phase pressurized CSTR, Non-isothermal CSTR, Single component vaporizer, Multi-component flash drum, Batch reactor, Reactor with mass transfer, Ideal binary distillation: Batch distillation with holdup, pH systems.

UNIT – III

Methods for solving non-linear equations

General Concepts of Simulation for Process Design: Introduction, Process simulation models, Recycle partitioning and tearing, Simulation examples.

UNIT – IV

Computer simulation: Simulation examples, Gravity flow tank, Three CSTRs in series, Non-isothermal CSTR, Binary distillation column, Multi-component distillation column, Batch reactor.

Text Books

1. Process Modeling Simulation and Control for Chemical Engineers, 2nd edition, W.L.Luyben, McGraw Hill.
2. A.W.Westerberg, H.P.Hutchison, R.L.Motard and P.Winter – Process Flowsheeting – Cambridge University Press – 1985.

Reference Books

1. Process Dynamics: Modelling, Analysis and simulation, B.W.Bequette, Prentice Hall

COMPUTER AIDED DESIGN

(Elective)

IV B.Tech – VII Semester (Code: 14CH705/A)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT-I

Introduction of computer aided design (CAD) a review of tools for CAD (computer systems: file and data management)**.** Scope of computer aided design of process equipment. The techniques of digital simulation: Construction of Information flow Diagram and encoding IFD into various numerical forms.

CAD of fluid flow systems: Pipe line design calculations for Newtonian and Non-Newtonian flow, Design of pipe line networks, Pipe line design calculations for two phase flows in pipes (Gas-solid, liquid-solid), Sizing of pumps (calculation of power requirements).

UNIT – II

CAD of heat transfer equipment: Performance calculations of Triple effect Evaporators, heat exchangers (double pipe, shell and tube), condensers and vertical thermo siphon reboilers.

UNIT – III

CAD of mass transfer equipment: Flash Calculations, Performance of distillation columns for binary systems by McCabe-Thiele method, multicomponent systems by Tomich method, Performance calculations of Tray and packed absorbers, Performance of single stage and multi-stage counter current (without reflux) extraction columns.

UNIT – IV

CAD of chemical reactors: Calculation of equilibrium compositions of a set of simultaneous reactions, Performance calculation for batch reactor, plug flow reactor and CSTRs, homogeneous and heterogeneous flow reactors for specific reactions (Pyrolysis of Ethane for manufacture of ethylene, manufacture of Ethanol amines, Hydrogenation of Benzene in an adiabatic fixed bed reactor)

Text Books

1. Chemical Process Computations, Raghu Raman, Elsevier Applied Science Publishers
2. Computer Aided Process Plant Design, M.E.Leesley, Gulf Publishing Co.,

Reference Books

1. Computer Applications in chemical Engineering: Process Design & simulation, Robert G. Squires.
2. Fortran programs for Chemical Process Design, Analysis and Simulation, Coker A.K, Gulf Publishing Co.
3. Catalytic Reactor Design, Orhan Tarhan, McGraw Hill
4. Chemical Engineering Vol.6, Sinnot, Pergamon Press.

ENERGY ENGINEERING

(Elective)

IV B.Tech – VII Semester (Code: 14CH705/B)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	: 40			Semester End Examination (3 Hours)		:	60

UNIT – I

Introduction to Energy Sources: Conventional & Non Conventional Energy resources, the present scenario, scope for future development.

Fuels & Fuel Analysis: Combustion Stoichiometry, Theoretical & Actual Combustion processes, Air to Fuel ratios

Coal: Origin, occurrence and reserves, Composition, Classification, Ranking, Analysis. Coal Conversion Technologies

UNIT – II

Solar Energy Fundamentals and its Applications, Solar Thermal Energy Conversion systems, solarthermalpower plants, Solar PhotoVoltaic Systems

UNIT – III

Bio-Energy (Thermal conversion), wind energy, hydrogen energy, geothermal and ocean thermal energy, fuel cells.

UNIT – IV

Energy storage, mechanical energy storage, water storage, solar pond, phase change storage, chemical storage.

Energy Conservation: Conservation methods in process industries, Theoretical analysis, practical limitations, equipment for energy saving / recovery.

Text Books

Conventional Energy technology, S.B.Pandy, Tata McGraw Hill
Fuel Science, Harker and Allen, Oliver & Boyd.
Energy conversion, Culp, Mc Graw Hill.

Reference Books

Hand book of energy technology, Considine D. M.
Fuels and energy, Harker and Backhusst, Academic press
Solar Energy Thermal Process, John A Duffie.

PILOT PLANTS, MODELS AND SCALE-UP METHODS IN CHEMICAL ENGINEERING

(Elective)

IV B.Tech – VII Semester (Code: 14CH705/C)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	: 40			Semester End Examination (3 Hours)		:	60

UNIT-I

Introduction, Pilot Plants and Models, Principles of similarity

Dimensional Analysis: Dimensional homogeneity, Buckingham's theorem, Rayleigh's method of indices

Differential equations: Mechanical processes, thermal processes, Diffusion processes, chemical processes.

The Regime concept: Different Regimes, conditions for reliable scale up or down, effect of temperature, effect of agitation, Mixed Regime

UNIT - II

Similarity criteria and Scale Equations: Static Regime, Load controlling, Mass controlling, Mixed Regime, Fluid systems, viscosity control, gravity control, surface tension control, thermal Regime, Natural convection control, Radiation control, Chemical Regime, Surface control (Heterogeneous reactions), Mixed Regime.

Extrapolation, Boundary effects in Scale-up, Scale up of Ducts and flow passages, Filters, Scale up of mixing equipment.

UNIT -III

Scale up of heat transfer equipment, Heat exchange systems

Scale up of Packed Towers: Similarity criteria, liquid distribution, Flooding point Pressure drop, height of packing Gas absorption, evaporation, Liquid extraction

UNIT -IV

Scale up of Chemical Reactors: Tubular Reactors, Catalytic Reactors, Continuous Stirred-tank Reactors Scale up of Equipment: Ball Mills, Pressure-jet spray nozzles, Centrifugal disc atomizers, Screw Extruders.

Scale up of Furnaces and kilns: Furnace Aerodynamics, Geometry of flames, Behaviour of solid fuel beds, Heat transfer, physical and Chemical changes in the charge, flow of molten material and slags, Flow of cooling water, Behaviour of Refractories.

Textbooks

1. Pilot Plants, Models and scale-up Methods in Chemical Engineering, R. E. Johnstone and M. W. Thring, McGraw Hill Book Company.
2. Process Plant Design – J.R. Backhurst and J.H. Harker, Heinemann Educational Books, London.

Reference Books

1. Pilot Plants and Scale up studies – Ibrahim and Kulhor

INTERFACIAL SCIENCE

(Elective)

IV B.Tech – VII Semester (Code: 14CH705/D)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT-I

Thermodynamics of surfaces: Introduction, surface energy and its consequences, Thermodynamics of surfaces, The Gibbs adsorption equation.

Thermodynamic behavior of small particles, Equilibrium shape of a crystal, behaviour of liquids in capillaries, homogeneous nucleation.

UNIT-II

Limits of applicability of the Kelvin and Young-Laplace equations, Contact angle and wetting behaviour, theoretical estimation of surface properties, contact angle hysteresis, measurements of surface tension and contact angle: maximum bubble pressure method, drop weight method, ring method, wilhelmy side method, pendant method, sessile drop or bubble method, flow methods, capillary waves method.

Vander Waals Forces: Introduction, van der Waals forces and their importance in colloid and surface chemistry, molecular interactions and power laws, molecular origins and the microscopic implications of van der Waals forces, van der Waals forces between large particles and over large distances.

UNIT -III

Calculating vander Waals forces between macroscopic bodies, theories of van der Waals forces based on bulk properties, effect of the medium on the van der Waals attraction; The electrical Double Layer and Double-layer Interactions: Introduction, surface charges and electrical double layer: background.

The capacitor model of the double layer, the diffuse double layer: The Debye-Huckel approximation, The Debye-Huckel approximation: results, the electrical double layer: Gouy-Chapman theory, overlapping double layers and inter particle Repulsion, “Not-Quite-Indifferent” electrolytes: stern adsorption.

UNIT -IV

Adsorption at Gas-Liquid Interfaces: Introduction, experimental and theoretical treatments of adsorption: an overview, Thermodynamics of adsorption: Phenomenological Perspective, Thermodynamics of adsorption: A statistical Perspective, Multi layer adsorption: The Brunauer-Emmett-Teller Equation, energetic of adsorption, adsorption in porous solids.

Wetting, Flotation and Detergency: Introduction, Wetting, water repellency, Flotation, Detergency.

Textbooks

1. Foundations of Colloid Science by Robert J. Hunter, Oxford science Publications, Vol-I

2. Principles of Colloid and Surface Chemistry, Third edition, Revised and Expanded, By Paul C. Hiemenz and Raj Rajagopalan.

3. Physical Chemistry of Sciences by Arthur Adamson.

OPEN ELECTIVE
AIR POLLUTION AND CONTROL
14OE706/CE01

Lectures	:	3 Periods/Week, 1 Tutorial	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT –I

Air Pollution –Definitions, AirPollutants–Classifications –NaturalandArtificial– Primaryand Secondary,pointandNon-Point,Line and ArealSourcesofairpollution-stationaryand mobilesources.
EffectsofAirpollutantsonman,materialand vegetation:Globaleffects ofairpollution – Green Houseeffect,HeatIslands, Acid Rains,Ozone Holesetc.

UNIT –II

Meteorology and plume Dispersion; properties of atmosphere; Heat, Pressure, Windforces, Moisture and relative Humidity, Influence of Meteorological phenomenaon Air Quality-windrosediagrams.

UNIT – III

Lapse Rates, PressureSystems, Winds and moisture plume behavior and plume Rise Models; Gaussian Model for Plume Dispersion.
Control of particulates –Control at Sources,Process Changes,Equipment modifications,Design and operation of control. Equipment's–Settling Chambers, Centrifugal Separators, filters Dry and Wet scrubbers, Electrostatic precipitators.

UNIT – IV

General Methods of Control of NOx and Sox emissions–In-plant Control Measures, process changes, dry and wet methods of removal and recycling.
Air Quality Management–Monitoring of SPM, SO; NO and CO Emission Standards.

NOTE:

Two questions of 12 marks each will be given from each unit out of which one is to be answered. Twelve questions of one mark each will be given from entire syllabus which is a compulsory question.

TEXTBOOKS:

1.Air pollutionByM.N.Raoand H.V.N.Rao –Tata Mc.GrawHillCompany.
2.Air pollutionbyWarkand Warner.-Harper&Row,NewYork.

REFERENCE BOOK:

1.An introductiontoAirpollution by R.K.Trivedy andP.K.Goel,B.S.Publications.

OPEN ELECTIVE
REMOTE SENSING AND GIS
14OE706/CE02

Lectures	:	3 Periods/Week, 1 Tutorial	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Concepts and Foundations of Remote Sensing: Introduction, Energy sources and radiation principles, Energy interactions in the atmosphere, Energy interactions with Earth surface features, an ideal remote sensing system, characteristics of remote sensing systems, application of remote sensing .

UNIT – II

Visual Image Interpretation: Introduction, Fundamentals of visual image interpretation, basic visual image interpretation equipment, land use and land cover mapping, geologic and soil mapping, agricultural applications, forestry applications, water resources applications, urban and regional planning applications.

UNIT – III

Digital Image Processing: Introduction, Image rectification and restoration, Image enhancement, contrast manipulation, spatial feature manipulation, Image Classification, Supervised classification, the classification stage, the training stage, Un-supervised classification, Classification accuracy assessment.

UNIT – IV

Geo-graphical Information Systems (GIS):Introduction, spatial information system: an overview, conceptual model of spatial information, concept of databases, digitizing, editing, and structuring map data, data quality and sources of errors in GIS, spatial data analysis (vector based), spatial data analysis (raster based), Fundamental concepts of GPS, Types of GPS, GPS satellite, Application of GPS in resource surveys, mapping and navigation.

TEXT BOOKS:

1. Lillisand.T.M, Keifer.R.W, and Chipman.J.WRemotesensind Image interpretation, 2004, John Wlley and Sons.
2. Chrisman, N.R. (1997), Exploring Geographic Information systems, John Willey and sons
3. Remote Sensing and its applications by LRA Narayana University Press 1999.
4. Principals of Geo physical Information Systems - Peter ABurragh and Rachael A. Me Donnell, Oxford Publishers 2004.

REFERENCE BOOKS:

1. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Remote Sensing and Geographical Information systems by M.Anji Reddy JNTU Hyderabad
3. B.S.Publications.GIS by Kang - tsungchang, TMH Publications & Co.
4. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications.
5. Fundamental of GIS by Mechanical designs John Wiley & Sons.

OPEN ELECTIVE
DATABASE MANAGEMENT SYSTEMS
14OE706/CS01

Lectures	:	3 Periods/Week, Tutorial: 1	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Databases and Database Users: Introduction - An Example - Characteristics of Approach - Actors on the Scene - Workers behind the Scene - Advantages of Using the DBMS Approach - A Brief History of Database Applications - When Not to Use a DBMS.

Database System Concepts and Architecture: Data Models, Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs - Classification of Database Management Systems.

Data Modeling Using the Entity-Relationship (ER) Model: Using High-Level Conceptual Data Models for Database Design - An Example Database Application - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints - Weak Entity Types - Refining the ER Design for the COMPANY Database - ER Diagrams, Naming Conventions, and Design Issues.

UNIT – II

The Relational Data Model and Relational Database Constraints: Relational - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations - Relational Database Design Using ER-to-Relational Mapping.

SQL-99: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types - Specifying Constraints in SQL - Schema Change Statements in SQL - Basic Queries in SQL - More Complex SQL Queries - INSERT, DELETE, and UPDATE Statements in SQL - Views (Virtual Tables) in SQL.

UNIT – III

Functional Dependencies and Normalization for Relational Databases: Guidelines for Relation Schemas - Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Relational Database Design Algorithms and Further Dependencies: Properties of Relational Decompositions - Algorithms for Relational Database Schema Design – Multivalued Dependencies and Fourth Normal Form - Join Dependencies and Fifth Normal Form.

UNIT – IV

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing - Transaction and System Concepts - Desirable Properties of Transactions - Characterizing Schedules Based on Recoverability - Characterizing Schedules Based on serializability.

Concurrency Control Techniques: Two-Phase Locking Techniques for Concurrency Control - Concurrency Control Based on Timestamp Ordering – Multiversion Concurrency Control Techniques - Validation (Optimistic) Concurrency Control Techniques - Granularity of Data Items and Multiple Granularity Locking.

TEXT BOOK:

1. "Fundamentals of Database Systems", RamezElmasri and Navate Pearson Education, 5th edition.

REFERENCE BOOKS:

1. "Introduction to Database Systems", C.J.Date Pearson Education.
2. "Data Base Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rdEdition.
3. "Data base System Concepts", Silberschatz, Korth, McGraw hill, 5th edition.

OPEN ELECTIVE
JAVA PROGRAMMING
14OE706/CS02

Lectures	:	3 Periods/Week, Tutorial: 1	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT - I

Introduction: Introduction to java, data types, dynamic initialization, scope and life time, operators, control statements, arrays, type conversion and casting, finals & blank finals.

Classes and Objects : Concepts, methods, constructors, usage of static, access control, this key word, garbage collection, overloading, parameter passing mechanisms, nested classes and inner classes.

Inheritance: Basic concepts, access specifires, usage of super key word, method overriding, final methods and classes, abstract classes, dynamic method dispatch, Object class.

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.

Packages: Creating a Package, setting CLASSPATH, Access control protection, importing packages.

Strings: Exploring the String class, String buffer class, Command-line arguments.

UNIT – II

Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes.

Multithreading: Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiplethreads, Synchronization, thread priorities.

Applets: Concepts of Applets, life cycle of an applet, creating applets, passing parameters to applets, accessing remote applet, Color class and Graphics

UNIT-III

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling events.

AWT: AWT Components, windows, canvas, panel, File Dialog boxes, Layout Managers, Event handling model of AWT, Adapter classes, Menu, Menubar.

UNIT-IV

Swing-I – swings introduction, JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons.

JDBC Connectivity: Jdbc connectivity, types of Jdbc Drivers, connecting to the database, Jdbc Statements, Jdbc Exceptions, Manipulations on the database, Metadata.

TEXT BOOKS:

1. "The Complete Reference Java J2SE", 7th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi.

2. "Big Java", 2nd Edition, Cay Horstmann, John Wiley and Sons, Pearson Education.

REFERENCE BOOKS:

1. "Java How to Program", Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. "Core Java 2", Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
3. "Core Java 2", Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
4. "Beginning in Java 2", Iver Horton, Wrox Publications.
5. "Java", Somasundaram, Jaico.
6. "Introduction to Java programming", By Y.DanielLiang, Pearson Publication.

OPEN ELECTIVE
OPTIMIZATION TECHNIQUES
14OE706/EE01

Lectures	:	3 Periods/Week, 1 Tutorial	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Linear Programming: Introduction and formulation of models – Convexity - simplex method - Bid method - two phase method – degeneracy – nonexistent and unbounded solutions - duality in L.P. - dual simplex method - sensitivity analysis - revised simplex method - transportation and assignment problems.

UNIT – II

Non-linear Programming: Classical optimization methods - equality and inequality constraints - Lagrange multipliers and Kuhn-Tucker conditions - quadratic forms - quadratic programming and Bessel's method.

UNIT – III

Search Methods: One dimensional optimization - sequential search - Fibonacci search - multi dimensional search method - Univariate search - gradient methods - steepest descent / ascent methods - conjugate gradient method -Fletcher – Reeves method - penalty function approach.

UNIT – IV

Dynamic Programming: Principle of optimality recursive relation - solution of linear programming problem - simple examples

TEXT BOOKS:

1. Engineering Optimization: Theory and Practice by S.S. Rao, 3rd Ed., New Age International, 1998
2. Optimization Methods in Operations Research and Systems Analysis by K.V. Mittal and C. Mohan, 3rd Ed, New Age International, 1996.

REFERENCE BOOKS:

1. Non-linear Programming by P.L. Mangassarian.
2. Operations Research by S.D. Sharma.
3. Operations Research: An introduction by H.A. Taha, 6th Edition, PHI.
4. Linear Programming by G. Hadley.

OPEN ELECTIVE
NON-CONVENTIONAL ENERGY SOURCES
14OE706/EE02

Lectures	:	3 Periods/Week, 1 Tutorial	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Principle of Renewable Energy: Comparison of renewable and conventional energy sources - Ultimate energy sources - natural energy currents on earth - primary supply to end use - Spaghetti & Pie diagrams - energy planning - energy efficiency and management.

UNIT – II

Solar Radiation: Extra terrestrial solar radiation - terrestrial solar radiation - solar thermal conversion - solar thermal central receiver systems - photovoltaic energy conversion - solar cells – 4 models.

UNIT – III

Wind energy: Planetary and local winds - vertical axis and horizontal axis wind mills - principles of wind power - maximum power - actual power - wind turbine operation - electrical generator.

UNIT – IV

Energy from Oceans: Ocean temperature differences - principles of OTEC plant operations - wave energy - devices for energy extraction – tides - simple single pool tidal system.
Geothermal energy: Origin and types - Bio fuels – classification - direct combustion for heat and electricity generator - anaerotic digestion for biogas - biogas digester - power generation.

TEXT BOOK:

1. Renewable Energy Sources by John Twidell& Toney Weir : E&F.N. Spon.

REFERENCE BOOKS:

1. Power plant technology by EL-Wakil, McGraw-Hill.
2. Non-Conventional Energy Sources by G.D.Rai, Khanna Pub.

OPEN ELECTIVE
CONSUMER ELECTRONICS
14OE706/EC01

Lectures	:	3 Periods/Week, Tutorial: 1	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Microphones, Headphones and Headsets, Loud Speakers, Disc Recording and Reproduction, Amplifying Systems Equalizers and Mixers, Electronic Music Synthesizers.

UNIT – II

Commercial Sound, Theatre Sound System, Audio Systems , Color TV standards and Systems, Remote Controls, Video Systems.

UNIT – III

Electronic Gadgets and Home Appliances:
Telecommunication Systems, Switching Systems, Modulation Techniques, Carrier Systems, Fibre Optics

UNIT – IV

Data Services, Mobile Systems, Facsimile fax, Xerography

TEXT BOOK:

1.Consumer Electronics by S.P.Bali, Pearson Education, ISBN: 9788131717592.

REFERENCE BOOKS:

1. Consumer Electronics for Engineers by Philip Herbert Hoff, Cambridge University Press (July 28, 1998), **ISBN-10:** 0521582075
2. Digital Consumer Electronics Handbook by RonadlK.Jurgen, (Editor) by McGraw Hill Professional Publishing, 1997. **ISBN-10:** 0070341435.

OPEN ELECTIVE
EMBEDDED SYSTEMS
14OE706/EC02

Lectures	:	3 Periods/Week, Tutorial: 1	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Introduction to embedded systems, design challenges, processor technology, IC technology, design technology, tradeoffs, single purpose processor, RT level combinational logic, sequential logic (RT level) custom single purpose processor design, optimizing custom single purpose processors. General purpose processors: basic architecture, pipelining, programmers view, development environment, ASIPS, microcontrollers and digital signal processors

UNIT – II

State machine and concurrent process models: models vs. languages, FSMD, using state machines, PSMM, concurrent process model, concurrent processes, communication and synchronization among processes, data flow model and real time systems. Need for communication interfaces, RS232/UART, RS422/RS485, USB, Infrared, IEEE 802.11, and Bluetooth.

UNIT – III

Embedded system and RTOS concepts: Architecture of kernel, tasks and task scheduler, interrupt service routines, semaphores, mutex. Mail boxes, message queues, event registers, pipes and signals.

UNIT – IV

Embedded system and RTOS concepts: Timers, memory management, priority inversion problem, embedded OS and real time OS, RT Linux, and Handheld OS. Design technology: Introduction, automation, synthesis, parallel evolution of compilation and synthesis, logic synthesis, RT synthesis, behavioural synthesis, system synthesis, HW / SW co- design, verification, and co-simulation.

TEXT BOOKS:

1. Frank Vahid, Tony D Givargis, Embedded system design – A unified HW/ SW Introduction, John Wily & sons, 2002.
2. KVKK Prasad, Embedded and real time systems, Dreemtech Press, 2005.

REFERENCE BOOKS:

1. Raj Kamal, Embedded system architecture, programming and design, TMH edition.
2. Mohammad Ali Mazidi, Janice G., The 8051 microcontroller and embedded systems, Pearson edition.
3. Jonathan W Valvano, Embedded Microcomputer Systems, Brooks/cole, Thompson Learning.
4. David E. Simon, An Embedded Software Primer, Pearson edition.

OPEN ELECTIVE
VIRTUAL INSTRUMENTATION USING LABVIEW
14OE706/EI01

Lectures	:	4 Periods/Week, Tutorial: 0	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT - I

REVIEW OF VIRTUAL INSTRUMENTATION: Historical perspective, Need of VI, Advantages of VI, Define VI, block diagram & architecture of VI, data flow techniques, graphical programming in data flow, comparison with conventional programming.

PROGRAMMING TECHNIQUES: VIS and sub-VIS, loops & charts, arrays, clusters, graphs, case & sequence structures, formula modes, local and global variable, string & file input. Graphical programming in data flow, comparison with conventional programming.

UNIT - II

DATA ACQUISITION BASICS: ADC, DAC, DIO, Counters & timers, PC Hardware structure, timing, interrupts, DMA, Software and Hardware

Installation. GPIB/IEEE 488 concepts, and embedded system buses - PCI, EISA, CPCI, and USB & VXI. A

UNIT - III

COMMON INSTRUMENT INTERFACES: Current loop, RS 232C/RS 485, GPIB, System basics, interface basics: USB, PCMCIA, VXI, SCXI, PXI etc,

networking basics for office & industrial application VISA & IVI, image acquisition & processing, Motion Control. ADC, DAC, DIO, DMM, waveform generator.

UNIT - IV

USE OF ANALYSIS TOOLS AND APPLICATION OF VI: Fourier transforms, Power spectrum, Correlation methods, windowing & flittering. Application in Process Control projects, Major equipments- Oscilloscope, Digital Multimeter, Pentium Computers, temperature data acquisition system, motion control employing stepper motor.

TEXT BOOKS

1. Gary Johnson, LABVIEW Graphical Programming, 2nd Edition, McGraw Hill, 1997.
2. Lisa K. Wells and Jeffrey Travis, LABVIEW for Everyone, PHI, 1997.
3. Skolkoff, Basic concepts of LABVIEW 4, PHI, 1998.

REFERENCE BOOKS

1. S. Gupta, J.P. Gupta, PC Interfacing for Data Acquisition and Process Control, ISA, 2nd Edition, 1994.
2. Technical Manuals for DAS Modules of Advantech and National Instruments.
3. L.T. Amy, Automation System for Control and Data Acquisition, ISA, 1992.

OPEN ELECTIVE
SENSORS & TRANSDUCERS
14OE706/EI02

Lectures	:	4 Periods/Week, Tutorial: 0	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Introduction: Definition related to measurements /instrumentation, static and dynamic characteristics of instruments, classification of transducers.

UNIT – II

Displacement Measurement: Variable resistance devices, variable inductance devices, variable capacitance devices, digital displacement transducers.

Strain measurement: Stress-strain relations, resistance strain gauges, types of strain gauges, strain gauge measurement techniques, static measurements, dynamic measurements. Calibration of strain gauge, strain gauge load cell, force and torque measurements using strain gauge.

UNIT – III

Pressure measurement: Diaphragm, Bellows, Bourdon tubes, Resistive inductive and capacitive transducers, piezo-electric transducers.

Low pressure measurement: McLeod gauge, Knudson gauge, Ionization gauge.

Temperature measurement: RTD, Thermocouple and thermistor.

UNIT – IV

Flow measurement: Head type flow meters, Rotometer, Electromagnetic flow meter. Measurement of liquid level, viscosity, humidity and moisture.

TEXT BOOKS:

1. A.K.Ghosh, Introduction to Instrumentation and Control, PHI.
2. BC Nakra, KK Chaudhry, Instrumentation measurement and analysis, TMH, New Delhi second edition.

REFERENCE BOOKS:

1. PatranabisD,"Sensors and transducers", second edition, PHI, New Delhi 2003.
2. Ernest O Doeblin, "Measurement Systems Application and Design", TMH.

OPEN ELECTIVE
WEB PROGRAMMING
14OE706/IT01

Lectures	:	4 Periods/Week, Tutorial: 0	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Introduction to XHTML, Cascading Style Sheets (CSS), JavaScript: Introduction to Scripting, Control Statements, Part 1, Control Statements, Part 2, Functions, Arrays, Objects.

UNIT - II

Dynamic HTML: Object Model and Collections, Dynamic HTML: Event Model, XML, RSS (Really Simple Syndication).

UNIT – III

Building Ajax-Enabled Web Applications, Web Servers (IIS and Apache).

UNIT - IV

Servlets and Java Server Pages.

TEXT BOOK:

1. Harvey M. Deitel and Paul J. Deitel,“Internet & World Wide Web How to Program”, 4/e,Pearson Education.

REFERENCE BOOKS:

1. Jason Cranford Teague, “Visual Quick Start Guide CSS, DHTML &AJAX”, 4e, Pearson Education.
2. Tom NerinoDoli smith, “JavaScript & AJAX for the web”, Pearson Education 2007.
3. Joshua Elchorn, “Understanding AJAX”, Prentice Hall 2006.
4. Marty Hall, Larry Brown, “Core Servlets and JavaServer Pages™: Volume 1: Core Technologies”, 2nd Edition, Prentice Hall.

OPEN ELECTIVE
JAVA PROGRAMMING
14OE706/IT02

Lectures	:	4 Periods/Week, Tutorial: 0	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Introduction: Introduction to java, data types, dynamic initialization, scope and life time, operators, control statements, arrays, type conversion and casting, finals & blank finals.

Classes and Objects : Concepts, methods, constructors, usage of static, access control, this key word, garbage collection, overloading, parameter passing mechanisms, nested classes and inner classes.

Inheritance: Basic concepts, access specifires, usage of super key word, method overriding, final methods and classes, abstract classes, dynamic method dispatch, Object class.

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.

Packages: Creating a Package, setting CLASSPATH, Access control protection, importing packages.

Strings: Exploring the String class, String buffer class, Command-line arguments.

Library: Date class, Collection, Enumerations and Wrapper classes.

UNIT – II

Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes.

Multithreading : Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiplethreads, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups.

I/O Streams: Streams, Byte streams, Character streams, File class, File streams.

UNIT – III

Applets: Concepts of Applets, life cycle of an applet, creating applets, passing parameters to applets, accessing remote applet, Color class and Graphics.

AWT: AWT Components, Windows, Canvas, Panel, File Dialog boxes, Layout Managers.

UNIT – IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling events.

Swing-I– Introduction to swing, Introduction to the following components: JApplet, JFrame and JComponent, JIcons, JLabels, JTextField,JButton, JCheckBox and JRadioButton.

Swing- II: Introduction to the following swing components: JComboBox, JTabbedPane, JScrollPane, JTree, and JTable.

TEXT BOOKS:

1. "The Complete Reference Java J2SE", 7th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi (UNTI – I and UNIT – II).

REFERENCE BOOKS:

1. "Java How to Program", Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. "Core Java 2", Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
3. "Core Java 2", Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.

OPEN ELECTIVE
ROBOTICS
14OE706/ME01

Lectures	:	3 Periods/Week, 1 Tutorial	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

Introduction to Robotics, major components of a robot, robotic like devices, classification of robots – Classification by coordinate system and by control method, Specifications of robots, fixed versus flexible automation, economic analysis, overview of robot application.

UNIT – II

Robot end Effectors: Introduction, end effectors, interfacing, types of end effectors, grippers and tools, considerations in the selection and design of remote centered devices.

UNIT – III

Robotic sensory devices: Objective, Non-optical position sensors – potentiometers, synchros, inductocyn, optical position sensors – optic interrupters, optical encoders (absolute & incremental).

Proximity sensors: Contact type, non contact type – reflected light scanning laser sensors.

Touch & slip sensors: Touch sensors – proximity rod & photo detector sensors, slip sensors – Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors.

UNIT – IV

Transformations and Kinematics: Objectives, homogenous coordinates, basic transformation operations, forward solution – DenavitHartenberg procedure. Simple problems involving planar manipulators, inverse or backward solution – problems involved, techniques.

Introduction to Trajectory Planning, the manipulator jacobian.

TEXT BOOKS:

1. Robotic Engineering by Richard D.Klafter.
2. Industrial Robotics by MikellP.Groover.

REFERENCE BOOKS:

1. Introduction to Robotics – John J.Craig.
2. Robotics – K.S.Fu, Gonzalez & Lee.
3. Robotics for Enginers by YoramKoren.
4. Robotics Technology and Flexible Automation by S.R.Deb.
5. Robotics by Saeed.B.Niku.

OPEN ELECTIVE
POWER PLANT ENGINEERING
14OE706/ME02

Lectures	:	3 Periods/Week, 1 Tutorial	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT – I

INTRODUCTION: Various Energy sources, types of power plants.

HYDRO ELECTRIC POWER PLANT: Hydrology, Rainfall, Run off and their measurement, hydrograph, Flow duration curve, Mass curve and calculation of storage capacity, site selection of hydro plant, different types of hydro plants.

DIESEL AND GAS TURBINE POWER PLANTS: Classification, main components of plant, plant layout, application and comparison with other plants.

UNIT – II

THERMAL POWER PLANT: General layout, Fuels, Coal analysis, Coal handling, burning of coal - stoker and pulverized systems, Ash handling systems, ESP, Need for Draught, High-pressure boilers, Condensers, cooling ponds and towers (wet and dry types), Deaeration.

UNIT – III

NUCLEAR POWER PLANTS: Nuclear Fission, Nuclear Fuels, Components of Reactor, types of Nuclear Reactors, Breeding, Fast Breeder Reactor, Radiation shields, nuclear waste disposal.

FLUCTUATING LOADS ON POWER PLANTS: Various performance Factors (load factor, diversity factor, use factor etc.).

POWER PLANT ECONOMICS: Fixed costs, operating costs, cost per kWh, comparison of fixed and operating costs of hydro, thermal, nuclear plants, power tariffs.

POLLUTION AND CONTROL: Introduction, particulate and gaseous pollutants, thermal pollution and solid waste pollution, methods to control pollution - brief description.

UNIT – IV

SOLAR ENERGY: Solar collectors, solar energy storage, solar ponds, solar energy utilization and applications.

POWER: Basic principle, different types of wind mills, wind energy conversion systems, other applications.**GEOTHERMAL POWER:** sources, energy conversion system. **OTEC:** ocean thermal energy conversion systems, introduction to tidal power.

DIRECT ENERGY CONVERSION SYSTEMS: Fuel cells, MHD, Solar cell.

TEXT BOOKS:

1. Power Plant Engineering - G.R. Nagpal, Khanna publ, New Delhi
2. Power Plant Engineering –P.K.Nag, TMH
3. Non Conventional Energy Sources - G.D. Rai, Khanna publ, New Delhi.

REFERENCE BOOKS:

1. Power Plant Technology - M.M. El Wakil, MGH, New York.
2. Principles of Energy Conversion - A.W.Culp, MGH, New York.

OPEN ELECTIVE
AUTOMATION TECHNOLOGY
14OE706/BR01

Lectures	:	3 Periods/Week, 1 Tutorial	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT-I

FUNDAMENTAL PRINCIPLES

Industrial prime movers - A brief system comparison: An electrical system, A hydraulic system, A pneumatic system, A comparison - Definition of terms: Mass and force, Pressure, Work, energy and power, Torque - Pascal's law - Gas laws.

HYDRAULIC PUMPS AND PRESSURE REGULATION

Pressure regulation - Pump types: Gear pumps, Vane pumps - Loading valves - Filters.

AIR COMPRESSORS, AIR TREATMENT AND PRESSURE REGULATION

Piston compressors - Air receivers and compressor control - Stages of air treatment - Pressure regulation: Relief valves, Non-relieving pressure regulators and Relieving pressure regulators - Service units.

UNIT -II

CONTROL VALVES

Graphic symbols - Types of control valve: Poppet valves, Spool valves, Rotary valves - Pilot-operated valves - Check valves: Pilot-operated check valves, Restriction check valves - Shuttle and fast exhaust valves - Sequence valves - Time delay valves

ACTUATORS

Linear actuators - Mounting arrangements and Cylinder dynamics - Seals - Rotary actuators: Constructional details - Applications: Speed control, Actuator synchronization, Regeneration, Counter balance and dynamic braking, Pilot-operated check valves, Pre-fill and compression relief.

UNIT-III

SENSORS

Sensors and Transducers - Performance Terminology – Sensors: Displacement, Position, and Proximity - Velocity and Motion - Force - Fluid Pressure - Liquid Flow - Liquid level - Temperature - Light Sensors - Selection of Sensors - Inputting data by switches.

UNIT-IV

PROGRAMMABLE LOGIC CONTROLLER

Programmable - Basic PLC structure - Input / Output Processing - Ladder Programming - Instruction lists - Latching and internal relays - Sequencing - Timers and Counters - Shift registers - Master and Jump Controls - Data Handling - Analog input / output.

MECHATRONIC SYSTEMS: Mechatronic designs, Case studies: Timed switch, A pick-and-place robot and Car park barriers.

Text Books:

1. Andrew Parr, Hydraulics and Pneumatics - A Technician's and Engineer's Guide, Jaico Publishing House, 2005

2. W. Bolton, Mechatronics, Fourth Edition, Pearson Education, 2010

Reference Books:

1. Anthony Esposito, Fluid Power with Applications, Fifth Edition, Pearson Education, 2005
2. W. Bolton, Pneumatic and Hydraulic Systems, Butterworth Heinemann, 1997
3. Ernest. O. Doebelin, Measurement Systems - Applications and Design, Fifth Edition, TMH
4. Gary Dunning, Introduction to Programmable Logic Controllers, 3rd Edition, 2007

BUSINESS COMMUNICATION & PRESENTATION SKILLS Lab
IV B.TECH-VII SEMESTER (Code: 14CHL701)

Contact periods	:	2 Periods/Week, Tutorial: 0	Continuous Assessment	:	40
Final Exam	:	3 hours	Final Exam Marks	:	60

UNIT-I

Identity Management Communication: – Face to Face Impression Management & Mediated Communication (Self Introduction & Self Promoting– Over Stating and Under Stating – Strategies to Overcome Communicative Inhibitions – Creating Positive Self-image through words - Appearance- Verbal and Non Verbal Manners) – Giving Polite Yet Assertive Responses – Responsive strategies to handle criticism - Accepting Failure and Declaring Success.

UNIT-II

Business Presentations:– Oral and Power Point Presentations; Preparing Successful Presentations; Assessing Audience, Making Effective Use of Visual Aids, Delivering Presentation, Using Prompts, Handling With Questions and Interruptions, Mock Presentations.

UNIT-III

Oratory Skills: –Advanced Group Discussion skills, Extempore, Mock Parliament and Mock Press.

UNIT-IV

Interview Management: – Resume Preparation, Types of Interviews, Preparing For Interviews, Facing Interviews, Handling Tough & Tricky Questions, Reviewing Performance, Participating In Mock Interviews.

REFERENCES:

1. "Personality Development and Soft Skills", Barun K.Mitra, Oxford University Press, Delhi:2007
2. Technical Communication Principles and Practices, Meenakshi Raman, Sangeeta Sharma: OUP: 2011.

CHEMICAL PROCESS EQUIPMENT DESIGN LABORATORY

IV B.Tech – VII Semester (Code: 14CHL702)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

1. Flow chart symbols
2. Engineering drawings

Design of:

3. Storage tanks
4. Shell and Tube heat exchangers (1-2 or 2-4)
5. Plate type heat exchanger
6. Condenser and reboiler
7. Multiple effect evaporators
8. Fractionating columns: Plate and packed
9. packed bed absorber
10. Strippers
11. Batch Reactors
12. Stirred Tank Reactors
13. Continuous tubular reactor (homogeneous and heterogeneous)
14. Batch Distillation

COMPUTER AIDED DESIGN LABORATORY

IV B.Tech – VII Semester (Code: 14CHL703)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40	Semester End Examination (3 Hours)	:	60		

Coding Using Matlab

1. N-R Technique
2. R-K Method

Application Using Simulink

3. Feed Back control using P, PI and PID controllers.

Simulations using C/C++/ Fortran/ Matlab4. Gravity flow tank

4. Heat Exchanger.
5. Bubble point / Dew point calculation.
6. Binary distillation column
7. Non-isothermal CSTR.
8. PFR

Using CHEMCAD

10. Rating of shell and tube heat exchanger using Aspen Plus software.
11. Rating of Distillation column using Aspen Plus/Chemcad software.
12. Simulation of Recycle Processes.
13. Simulation of PFR and CSTR.

TERM PAPER

IV B.Tech – VII Semester (Code: 14CHL704)

Lectures	0	Tutorial	0	Practical	2	Self Study	0
Continuous Internal Assessment	:	20		Semester End Examination (3 Hours)	:	30	

PURPOSE:

The Term paper helps to supplement the final year Project Work of the B.Tech students. It helps to identify their research area / topic and complete the groundwork and preliminary research required for it comfortably. It trains the students to make use of research tools and material available both in print and digital formats.

PROCEDURE:

The topic of term paper is chosen from the B.Tech curriculum. Based on the topic a hypothesis is to be made by the student. The hypothesis may be a null hypothesis also. The students are then required to collect literature and support information for their term paper from standard reference books, journals and magazines- Both printed and online. Each student should refer a minimum of 5 reference sources outside the prescribed Text Books.

The term paper contains:
The Aim and Objective of the study.
The need for Rationale behind the study.
Identify the work already done in the field.
Hypothesis and Discussion
Conclusion
Appendix with support data (Illustrations, Tables, Graphs etc.,)

OPTIMIZATION OF CHEMICAL PROCESESS

IV B.Tech – VIII Semester (Code: 14CH801)

Lectures	4	Tutorial	0	Practical	0	Self Study	1
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

Course Objectives: The course will cover fundamental concepts in optimization theory, algorithmic approaches as well as modelling optimization problems and their numerical solution. In particular, formulation of optimization problems, selection of the optimization techniques and application of optimization procedures for various chemical operations.

Prerequisites: CH 111, CH 211

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

Developing Models for Optimization: Classification of Models, How to build a Model, Selecting Functions to Fit Empirical Data, Degrees of Freedom, Examples of Inequality and Equality Constraints in Models

UNIT – II

Economic Objective Function; Basic concepts of Optimization: NLP Problem Statement, Convexity and its Applications

Optimization of Unconstrained Functions: one dimensional search: Numerical methods for Optimization of One Variable , Scanning and Bracketing Procedures, Newton and Quasi-Newton Methods of Unidimensional Search, Polynomial Approximation Methods

UNIT – III

Linear Programming (LP) and Applications: Geometry of Linear Programs, Basic Linear Programming Definitions and Results, Simplex Algorithm

UNIT – IV

Optimal pipe diameter, Optimization recovery of waste heat, shell and tube heat exchanger, liquid-liquid extraction process, optimal design of staged distillation column, optimization of a thermal cracker using linear programming.

Text Book

1. Optimization of Chemical Process, Edgar T.F., and Himmelblau. D.M., Second Edition, McGraw Hill Chemical Engineering Series

Reference Book

Optimization: Theory and Applications, S. S. Rao, Second Edition, Wiley Eastran Ltd

BIO-CHEMICAL ENGINEERING

IV B.Tech – VIII Semester (Code: 14CH802)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

Objectives: To understand the fundamentals and key aspects of biological processes and to enhance skills to apply principles of chemical engineering in the areas of biochemical processes.

Prerequisites: CH 213, CH 215, CH 223, CH 311, CH 314, CH 321, CH 324

UNIT – I

An overview of industrial bio chemical processes and comparing with chemical processes. Industrially important microbial strains, their structure and classification. Chemicals of life: Lipids, proteins, polysaccharides & Nucleic acids.

UNIT – II

The kinetics of enzyme–catalyzed reactions: The enzyme substrate complex, Michaelis-Menten kinetics, enzyme inhibition, other factors affecting on enzyme activity–pH and temperature.

Applied enzyme catalysis: Applications of enzymes, enzyme immobilization, immobilized enzyme kinetics.

UNIT – III

The kinetics of cell cultures: Monod growth kinetics, growth cycle phases for batch cultivation.

Bio reactors: Ideal batch reactor, Chemostat, Chemostat with cell recycle.

Multiphase Bio reactors: Packed bed bio reactors, fluidized bed bio reactors, Air lift loop reactors.

UNIT – IV

Product recovery operations: Recovery of particulates - Filtration, centrifugation, sedimentation.

Production Isolation: Extraction, precipitation, membrane separations. Purification - Chromatographic techniques. Final production isolation: Drying and crystallization.

Text Book

1. Biochemical Engineering fundamentals, J.B.Bailey and D.F.Ollis, McGraw Hill

Reference Books

1. Biochemical Engineering, 2nd edition, A.Aiba, E.Humphrey and N.R.Milli.
2. Bio process Engineering Basic Concepts, 2nd edition, Michel L. Shuler, Fikeet Kargi.

SAFETY AND HAZARD ANALYSIS

(Elective)

IV B.Tech – VIII Semester (Code: 14CH803/A)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Definition of safety. The basis for safety. Chemical hazards and worker safety. Hazards of commercial chemical reactions and operations.

Hazop studies, Fault Tree analysis, Event Tree Analysis.

UNIT – II

Process design, instrumentation for safe operations, safety education and training.

UNIT – III

Effect of toxic agents, flammable materials, Risk assessment, Work permit systems.

UNIT – IV

Personnel protective equipment, fire extinguishing agents and their applications, measuring safety effectiveness.

Text Book

1. Industrial safety practices, Bob skeltor
2. Safety and accident prevention in chemical operations, Fewcett H.H. and W.S.Wood, John Wiley and Sons Inc.

Reference Book

1. Safety Handling of Hazardous Chemicals Enterprises, R.Pjatgo.A.K

DRUGS AND PHARMACEUTICAL TECHNOLOGY

(Elective)

IV B.Tech – VIII Semester (Code: 14CH803/B)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	: 40			Semester End Examination (3 Hours)		:	60

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 and fine chemicals, sulfacetamide, paracetamol, methyl orange, riboflavin, nicotinamide, fluoresence, procaine hydrochloride, paraamino salicylic acid, isonicatinic acid hydrazide.

UNIT – III

Manufacture with flow sheets, properties uses and testing of the following pharmaceuticals-aspirin, penicillin, calcium gluconate, ferric ammonium citrate, pthallic anhydride and phenol flourobenzene process and benzene sulfate process, other processes in outline only.

UNIT IV

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, Mac Publishing company, 13th edition.
2. Text book of Pharmaceutical chemistry by Blently and Driver, Oxford University Press, London, 8th Edition.
3. Blently's Text book of Pharmaceutical chemistry by H.A.Rawlins, B,Tindell and Box, 8th edition. O.U.Press, London

BIO-MEDICAL ENGINEERING

(Elective)

IV B.Tech – VIII Semester (Code: 14CH803/C)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Cell and its function, Nervous system, Cardio Vascular system, Respiratory system, Penal physiology, basis of bio-potertials, principles of BCG, BBG, EMG.

UNIT – II

Introduction to bio-mechanics, bio-dynamic models and their applications, cardiac assist devices bio-mechanics of head injury, Amplifier constants and specifications, recording systems, electrical grounding and patient safety, transducers, electrodes for recording bio-potentials, introduction to data acquisition, extraction of signals from noise, introduction to pattern recognition.

UNIT – III

Regulation of body temperature, regulation and control in the CV system, Rheology of blood, radiation dosimetry, newtron activation analysis, safety procedure for radiation diagnostics, ultrasound effects.

UNIT – IV

Introduction to nature and composition of polymers used as prosthetic devices with special reference to heart valves, artificial bones, densture, sutures etc., Introduction to renal and respiratory system, lung oxygenator and their characteristics, Artificial kidney and their design features.

TEXT BOOKS

1. Biomedical Engineering by B.Brown, Davis Philacelphia, U.S.A.
2. Advances in Biomedical Engineering by K.Kenredy, Academic Press.

ELECTRO - CHEMICAL ENGINEERING

(Elective)

IV B.Tech – VIII Semester (Code: 14CH803/D)

Lectures	4	Tutorial	0	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Review of basics of Electro - chemistry : Faraday's law, Nernst potential, galvanic cells, polarography.

The electrical double layer: Its role in Electro-chemical process, Electro-capillary curve, Helmota layer, Gucy, Steven's layer, fields at the interface.

UNIT – II

Mass transfer in Electro-chemical systems: Diffusion controlled Electro-chemical reaction, the importance of convection and the concept of limiting current, mass transfer over potential or concentration polarisation. Secondary current distribution, the rotating disc electrode.

UNIT – III

Primary and Secondary batteries: Lechlanche dry cell, Alkaline manganese cell, mercury cell, reverse electrolyte cells like Mg-$CuCl_2$, Mg-Pbo_2, Zh-PbO_2, secondary cells like lead and Ni-Cd, Ni-Fe, AgC-Zn, AgC-Cd, sodium-sulphur, Li-S, fuel cells.

UNIT – IV

Electrodes used in different electrochemical industries: Metals, graphite, lead dioxide, titanium substrate insoluble electrodes, iron oxide, semi conducting type etc., Metal finishing: Electro deposition, Electro refining, Electro forming, Electro polishing, anodizing, selective solar coatings, cell design.

TEXT BOOK

1. Electrochemical Engineering by Picket , Prentice Hall Inc.

REFERENCE BOOKS

1. Electrochemical Systems by J.S.Newman, prentice Hall Inc.
2. Electrochemical Power sources Primary and Secondary Batteries by M.Barak (ed.) and L.K.Steverge,
3. Electrochemical Engineering by C.Martell, McGraw Hill.

Petrochemical Technology
(Elective)
IV B.Tech – VIII Semester (Code: 14CH804/A)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	: 40			Semester End Examination (3 Hours)		:	60

UNIT – I

Petrochemical industry in India, feed stocks for petro chemicals. Chemicals from ethylene, vinyl chloride monomer, vinyl acetate monomer, ethylene oxide, ethylene glycols, acetaldehyde.

UNIT – II

Chemicals from C_3, C_4 and higher carbon atoms, isopropyl alcohol, acrylonitrile, acrylic acid, phenol, bisphenol A, iso and n-butanol, maleic anhydride.

Polymers of olefins, polymer structure, methods of polymerization, high pressure polyethylene, low pressure polyethylene, PVC.

UNIT – III

Petroleum aromatics, benzoic acid, carpolactum, terphthalic acid.

Production techniques of synthetic fibres, nylon-6,6, nylon-6, acrylic fibres (orlon).

UNIT – IV

Plastics, phenol-formaldehyde resins, urea formaldehyde resins, poly carbonates.

Synthetic detergents, classification of detergents, general manufacture of sulphonates, keryl benzene sulphonate.

Text Book:

1. A Text Book on petrochemicals, Dr. B.K. Bhaskara Rao, Khanna publishers, New Delhi.

Reference Book:

1. Petroleum Refining Engineering, Nelson, McGraw Hill

DESIGN AND ANALYSIS OF EXPERIMENTS

(Elective)

IV B.Tech – VIII Semester (Code: 14CH804/B)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT- I

Introduction to probability, probability laws, Baye's theorem. Probability distributions, parameters and statistics

Normal and t-distributions, central limit theorem, random sampling and declaration of independence significance tests

UNIT- II

Randomization and blocking with paired comparisons significance tests and confidence interval for means, variances, proportions and frequencies.

Analysis of variance, experiments to compare k-treatment means

UNIT-III

Two-way factorial designs, blocking, Yate's algorithm

Fractional factorial designs at two levels, concept of design resolution

UNIT-IV

Simple modeling with least squares (regression analysis), Matrix versions of normal equations

Mechanistic model building, Empirical and mechanistic models, model building process, model testing with diagnostic parameters.

Text Book:

1. Statistics for experimenters by G.E.P. Box, William G. Hunter and J.S. Hunter, John Wiley & Sons.

Reference:

1. "Design and analysis of experiments" by D.C. Montgomery, 2nd edition John Wiley and sons, NewYork (1984).

CORROSION ENGINEERING

(Elective)

IV B.Tech – VIII Semester (Code: 14CH804/C)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	: 40			Semester End Examination (3 Hours)		:	60

UNIT – I

Introduction and Scope : Corrosion, definition, Wet and dry corrosion, mechanisms, Electro-chemical principles and aspects of corrosion, Faradays laws, specific conduction, specific resistance, transport no. mobility etc., various forms of corrosion, a brief review, corrosion rate expression, thermodynamic aspects of corrosion, equilibrium potential, Nernst equation for electrode potential, EMF series, over voltage, application of Nernst equation to corrosion reactions, calculation of Corrosion Rates.

UNIT – II

Polarisation and Corrosion potentials, reference electrodes for corrosion measurements, types of polarisation, concentration, activation and resistance polarisations, Tafel equation, Tafel constant, Evans diagrams, anodic control, cathodic control. Mixed control : Fourbaix diagram for Fe-H_2O system, galvanic corrosion, uniform attack, pitting corrosion, dezincification, cavitation erosion. Fretting corrosion, inter-granular and stress corrosion cracking, some remedial measures for the above.

UNIT – III

High temperature oxidation, pilling bedworth ratio, mechanisms of oxidation, corrosion testing procedures & evaluation.

Corrosion of iron and steel in aqueous media, effect of velocity, temperature and composition of media.

UNIT – IV

Prevention techniques, modification of the material by alloying, appropriate surface or core treatment, chemical and mechanical methods of surface treatment. Coatings, metallic, non-metallic linings, cathodic protection, passivity and anodic protection.

Text Book

1. Corrosion & Corrosion Control by H.H.Uhlig.

Reference Books

1. Electrochemistry by Samuel Glasstone
2. Corrosion engineering by Fontana and Greene.

PINCH TECHNOLOGY

(Elective)

IV B.Tech – VIII Semester (Code: 14CH804/D)

Lectures	4	Tutorial	1	Practical	0	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

UNIT – I

Introduction to Pinch Technology: Definition of pinch technology. Basis of Pinch Technology. Objectives of Pinch Analysis. Process Integration by Pinch Analysis. Development of Pinch Technology. Areas of applications of Pinch Technology. The concept of process synthesis. The role of thermodynamics in process design.

UNIT – II

Heat recovery: Basic concepts of heat exchange, the temperature-enthalpy diagram, Composite curves, A targeting procedure. The grand composite curve and shifted composite curves. The pinch and its significance.

Heat exchanger network design: Network grid representation, design for maximum energy recovery. Choosing dTmin, Supertargeting.

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UNIT – III

Methodology of Pinch Analysis: The range of pinch analysis techniques, Application of pinch study

Data Extraction: Data extraction: Heat and mass balance, stream data extraction, calculating heat loads and heat capacities, choosing streams, mixing, heat losses.

Energy targeting: dTmin contributions for individual streams, Threshold problems.

UNIT – IV

Process change and evolution: Basic objective, The plus-minus principle, appropriate placement applied to unit operations, reactor systems, distillation columns.

Organics distillation plant – a case study.

Text Books

1. A user guide on process integration for the efficient use of energy, B. Linnhoff, David W. Townsend, D. Boland and G.F. Hewitt
2. Pinch Anlysis and Process Integration, second edition: A user guide on process integration for the efficient use of energy, Ian C. Kemp, IChemE

BIO-CHEMICAL ENGINEERING LAB

IV B.Tech – VIII Semester (Code: 14CHL801)

Lectures	0	Tutorial	0	Practical	3	Self Study	0
Continuous Internal Assessment	:	40		Semester End Examination (3 Hours)	:	60	

ENZYME BASED EXPERIMENTS:

1. Preparation of Buffers.
2. Effect of pH on enzyme activity.
3. Effect of Temperature on enzyme activity.
4. Effect of substrate concentration on enzyme activity.
5. Effect of time interval on enzyme activity.
6. Evaluation of enzyme kinetic parameters (Michaeli-Menten approach)
7. Enzyme/cell immobilization.

CULTURE BASED EXPERIMENTS:

8. Formulation of simple and complex culture media for fermentations
9. Medium optimization: Plackett-Burman design.
10. Sterilization techniques and thermal death kinetics
11. Determination of growth curve of a supplied microorganism
12. Estimation of growth kinetics.
13. Fed batch culture techniques.

DESIGN BASED EXPERIMENTS:

14. Bioreactor instrumentation and control
15. Determination of K_La by dynamic gassing out technique.
16. Determination of K_La by sulphite oxidation technique.
17. Determination of power number
18. Design exercises on fermenters.

PROJECT WORK

IV B.Tech – VIII Semester (Code: 14CHL802)

Lectures	0	Tutorial	0	Practical	12	Self Study	0
Continuous Internal Assessment	:	50		Semester End Examination (3 Hours)	:	100	

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 / Experimentation

   (Process as well as mechanical design with drawing, including computer programs where possible, of heat transfer equipment / separation equipment / 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.