HINDUSTAN UNIVERSITY

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

(Estd. u/s 3 of the UGC Act, 1956)
Padur, Kancheepuram District - 603 103.

DEPARTMENT OF BIOTECHNOLOGY

CURRICULUM & SYLLABUS 2013-14

B.Tech. (BIOTECHNOLOGY)

ACADEMIC REGULATIONS (B.Tech)

(Full /Part Time) (Effective 2012-13)

1. Vision, Mission and Objectives

1.1 The Vision of the Institute is "To make every man a success and no man a failure".

In order to progress towards the vision, the Institute has identified itself with a mission to provide every individual with a conducive environment suitable to achieve his / her career goals, with a strong emphasis on personality development, and to offer quality education in all spheres of engineering, technology, applied sciences and management, without compromising on the quality and code of ethics.

1.2 Further, the Institute always strives

- To train our students with the latest and the best in the rapidly changing fields of Engineering, Technology, Management,Science & Humanities.
- To develop the students with a global outlook possessing, state of the art skills, capable of taking up challenging responsibilities in the respective fields.
- To mould our students as citizens with moral, ethical and social values so as to fulfill their obligations to the nation and the society.
- To promote research in the field of Science, Humanities, Engineering, Technology and allied branches.

1.3 Aims and Objectives of the Institute are focused on

- Providing world class education in engineering, technology, applied sciences and management.
- Keeping pace with the ever changing technological scenario to help the students to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and nation.
- To inculcate a flair for research, development and entrepreneurship.

2. Admission

2.1 The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, following guidelines issued by Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each branch of the B.Tech programme will be decided by BOM as per the directives from MHRD, Government of India and taking into account the market demands. Some seats for Non Resident Indians and a few

seats for foreign nationals shall be made available.

2.2 **(i) Full-Time :**

At the time of applying for admission, the candidates should have passed / appeared and be awaiting results of the final examination of the 10+2 system or its equivalent with Mathematics, Physics and Chemistry as subjects of study.

(ii) Part -Time:

At the time of applying for admission, the candidates should have a Diploma in Engineering/Technology in the relevant branch of specialization awarded by the State Board of Technical Education, Tamil Nadu or any other authority accepted by the Board of Management of the University as equivalent thereto and a minimum of one year practical experience.

2.3 The selected candidates will be admitted to the B.Tech. programme after he/she fulfills all the admission requirements set by the Institute and after the payment of the prescribed fees.

2.4 In all matters relating to admission to the B.E. / B.Tech. programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.

2.5 If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.

3. Structure of the programme

3.1 The programme of instruction will have the following structure:

i) A general (common) core programme comprising basic sciences, engineering sciences, humanities, technical arts and mathematics.

ii) An engineering core programme introducing the student to the foundations of engineering in the respective branch.

iii) An elective programme enabling the student to opt and undergo a set of courses of interest to him/ her.

iv) Professional practice including project, seminar and industrial training.

v) General elective courses, such as, Environmental Studies, Physical Education, Professional ethics, and National Service Scheme.

The distribution of total credits required for the degree programme into the above five categories will nominally be 20%, 50%, 15%, 5%,

and 10% respectively.

3.2 (i) Full-Time:

The duration of the programme will be a minimum of 8 semesters. Every branch of the B.E. / B.Tech. programme will have a curriculum and syllabi for the courses approved by the Academic Council.

ii) Part - Time:

The duration of the programme will be a minimum of 7 semesters. Every branch of the B.Tech. programme will have a curriculum and syllabi for the courses approved by the Academic Council

3.3 The academic programmes of the Institute follow the credit system. The general pattern is:

- One credit for each lecture hour per week per semester;
- One credit for each tutorial hour per week per semester;
- One credit for each laboratory practical (drawing) of three (two) hours per week per semester.
- One credit for 4 weeks of industrial training and
- One credit for 4 hours of project per week per semester

3.3 (i) Full-Time:

For the award of degree, a student as to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits of 180-190.

(ii) Part-Time:

For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits of 110-120.

3.5 The medium of instruction, examination and the language of the project reports will be English.

4. Faculty Advisor

4.1 To help the students in planning their courses of study and for getting general advice on the academic programme, the concerned Department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor.

5. Class Committee

5.1 A Class Committee consisting of the following will be constituted by the Head of the Department for each

class:

(i) A Chairman, who is not teaching the class.

(ii) All subject teachers of the class.

(iii) Two students nominated by the department in consultation with the class.

The Class Committee will meet as often as necessary, but not less than three times during a semester.

The functions of the Class Committee will include:

(i) Addressing problems experienced by students in the classroom and the laboratories.

(ii) Analyzing the performance of the students of the class after each test and finding ways and means of addressing problems, if any.

(iv) During the meetings, the student members shall express the opinions and suggestions of the class students to improve the teaching / learning process.

6. Grading

6.1 A grading system as below will be adhered to.

Range of Marks	Letter Grade	Grade points
95-100	S	10
85 - 94	A	09
75- 84	B	08
65-74	C	07
55-64	D	06
50-54	E	05
< 50	U	00
	I (Incomplete)	--

6.2 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i " and the grade points Pi earned for that course taken over all courses "i" registered by the student to the sum of Ci for all "i ". That is,

$$GPA = \frac{\Sigma iC\ i\ Pi}{\Sigma iCi}$$

CGPA will be calculated in a similar manner, at any semester, considering all the courses enrolled from the first semester onwards.

6.3 For the students with letter grade I in certain subjects, the same will not be included in the computation of GPA and CGPA until after those grades are converted to the regular grades.

6.4 Raw marks will be moderated by a moderation board appointed by the Vice Chancellor of the University. The final marks will be graded using an absolute grading system. The

Constitution and composition of the moderation board will be dealt with separately.

7. Registration and Enrolment

7.1 Except for the first semester, registration and enrollment will be done in the beginning of the semester as per the schedule announced by the University.

7.2 A student will be eligible for enrollment only if he/she satisfies regulation 10 (maximum duration of the programme) and will be permitted to enroll if (i) he/ she has cleared all dues in the Institute, Hostel and Library up to the end of the previous semester and (ii) he/she is not debarred from enrollment by a disciplinary action of the University.

7.3 Students are required to submit registration form duly filled in.

8. Registration requirement

8.1 (i). Full -Time:

A full time student shall not register for less than 16 credits or more than 26 credits in any given semester.

(ii). Part -Time:

A part time student shall not register for less than 10 credits or more than 20 credits in any given semester

8.2 If a student finds his/her load heavy in any semester, or for any other valid reason, he/she may withdraw from the courses within three weeks of the commencement of the semester with the written approval of his/her Faculty Advisor and HOD. However the student should ensure that the total number of credits registered for in any semester should enable him/her to earn the minimum number of credits per semester for the completed semesters.

9. Continuation of the programme

9.1 For those students who have not earned the minimum required credit prescribed for that particular semester examination, a warning letter to the concerned student and also to his/her parents regarding the shortage of his/her credit will be sent by the HOD after the announcement of the results of the university examinations.

10. Maximum duration of the programme

10.1 (i) Full - Time

The normal duration of the programme is eight semesters. However a student may complete the programme at a slower pace by taking more time, but in any case not more than 14 semesters excluding the semesters withdrawn on medical grounds or other valid reasons.

(ii) Part - Time

The normal duration of the programme is seven semesters. However a student may complete the programme at a slower pace by taking more time, but in any case not more than 12 semesters excluding the semesters withdrawn on medical grounds or other valid reasons

11. Temporary discontinuation

11.1 A student may be permitted by the Dean (Academic) to discontinue temporarily from the programme for a semester or a longer period for reasons of ill health or other valid reasons. Normally a student will be permitted to discontinue from the programme only for a maximum duration of two semesters.

12. Discipline

12.1 Every student is required to observe discipline and decorous behavior both in-side and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

12.2 Any act of indiscipline of a student reported to the Dean (Academic) will be referred to a Discipline Committee so constituted. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also authorize the Dean (Academic) to recommend to the Vice Chancellor the implementation of the decision. The student concerned may appeal to the Vice Chancellor whose decision will be final. The Dean (Academic) will report the action taken at the next meeting of the Council.

12.3 Ragging and harassment of women are strictly prohibited in the University campus and hostels.

13. Attendance

13.1 A student whose attendance is less than 75% for a course is not eligible to appear for the end - semester examination for that course. The details of all students who have less than 75% attendance in a course will be announced by the teacher in the class. These details will be sent to the concerned HODs and Dean (Academic).

13.2 Those who have 75% or more attendance for the period other than their medical leave will be considered for condonation of shortage of attendance provided the overall attendance including the period of illness does not fall below 65%. Application for condonation recommended by the Faculty

Advisor, concerned faculty member and the HOD is to be submitted to the Dean (Academic) who, depending on the merits of the case, may permit the student to appear for the end semester examination. A student will be eligible for this concession at most in two semesters during the entire degree programme. Application for medical leave, supported by medical certificate with endorsement by a Registered Medical Officer, should reach the HOD within seven days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier.

13.3 As an incentive to those students who are involved in extra-curricular activities such as representing the University in
Sports and Games, Cultural Festivals, and Technical Festivals, NCC/ NSS events, a relaxation of up to 10% attendance will be given subject to the condition that these students take prior approval from the officer - in-charge. All such applications should be recommended by the concerned HOD and forwarded to Dean (Academic) within seven instructional days after the programme / activity.

14. Assessment Procedure

14.1 The Academic Council will decide from time to time the system of tests and examinations in each subject in each semester.

14.2 For each theory course, the assessment will be done on a continuous basis as follows:

Test / Exam	**Weightage**	**Duration of Test / Exam**
First Periodical Test *	10%	2 Periods
Second Periodical Test *	10%	2 Periods
Model Exam	20%	3 hours
Seminar/ Assignments/Quiz	10%	-
Attendance	10%	
End - semester examination	50%	3 Hours

*Best out of the two test will be considered.

14.3 For practical courses, the assessment will be done by the subject teachers as below:

(i) Weekly assignment/Observation note book / lab records - weightage 60%.

(ii) End semester examination of 3 hours

duration including viva - weightage 40%.

14.4 For courses on Physical Education, NSS, etc the assessment will be as satisfactory/not satisfactory only.

15. Make up Examination/Model Exam

1. Students who miss the end-semester examinations / model examination for valid reasons are eligible for make-up examination /model examination. Those who miss the end-semester examination / model examination should apply to the Head of the Department concerned within five days after he / she missed examination, giving reasons for absence.

2. Permission to appear for make-up examination / model examination will be given under exceptional circumstances such as admission to a hospital due to illness. Students should produce a medical certificate issued by a Registered Medical Practitioner certifying that he/she was admitted to hospital during the period of examination / model exam and the same should be duly endorsed by parent / guardian and also by a medical officer of the University within 5 days.

16. Project evaluation

16.1 For Project work, the assessment will be done on a continuous basis as follows:

Review / Examination	Weightage
First Review	10%
Second Review	20%
Third Review	20%
End-semester Examination	50%

For end - semester examination, the student will submit a Project Report in a format specified by the Director (Academic). The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end - semester examination will be conducted by a Committee constituted by the Registrar / Controller of examination. This will include an external expert.

17. Declaration of results

17.1 A candidate who secures not less than 50% of total marks prescribed for a course with a minimum of 50% of the marks prescribed for the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

(ii) To be Eligible to appear for the end semester examinations for a particular course, a candidate will have to secure a minimum of 40%

marks in the sessional for that course.

(iii) Candidates are required to obtain all credits assigned to the first two semesters of the programme within the first four semesters of the programme. Candidates failing to satisfy this requirement will not be allowed to proceed to the fifth semester until the condition is satisfied. Further, candidates will not allowed to proceed to seventh semester if they have not cleared all the courses assigned during third & fourth semesters.

17.2 After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of UG programmes constituted by the Vice-Chancellor. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee of the Academic Council constituted by the Chancellor for scrutiny. The minutes of the Standing Sub Committee along with the results are to be placed before the Vice-Chancellor for approval. After getting the approval of the Vice-Chancellor, the results will be published by the Controller of Examination/ Registrar.

17.3 If a candidate fails to secure a pass in a course due to not satisfying the minimum requirement in the end semester examination, he/she shall register and re-appear for the end semester examination during the following semester. However, the sessional marks secured by the candidate will be retained for all such attempts.

17.4 If a candidate fails to secure a pass in a course due to insufficient sessional marks though meeting the minimum requirements of the end semester examination, and wishes to improve on his/her sessional marks, he/she will have to register for the particular course and attend the course with permission of the HOD concerned and Director(Academic) with a copy marked to the Registrar. The sessional and external marks obtained by the candidate in this case will replace the earlier result.

17.5 A candidate can apply for the revaluation of his/her end semester examination answer paper in a theory course within 2 weeks from the declaration of the results, on payment of a prescribed fee through proper application to the Registrar/ Controller of Examinations through the Head of the Department. The Registrar/ Controller of Examination will arrange for the revaluation and

the results will be

intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

18. Grade Card

18.1 After results are declared, grade sheet will be issued to each student which will contain the following details:

(i) Program and branch for which the student has enrolled.

(ii) Semester of registration.

(iii) List of courses registered during the semester and the grade scored.

(iv) Semester Grade Point Average (GPA)

(v) Cumulative Grade Point Average (CGPA).

19. Class/Division

19.1 Classification is based on CGPA and is as follows:

CGPA $\geq$ 8.0: **First Class with distinction**

6.5 $\leq$ CGPA < 8.0 : **First Class**

5.0 $\leq$ CGPA < 6.5 : **Second Class.**

19.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance within the minimum duration of the programme.

(ii) The award of 'First Class' is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses **within 10 semesters.**

(iii) The period of authorized discontinuation of the programme (vide clause 11.1) will

not be counted for the purpose of the above classification.

20. Transfer of credits

20.1. Within the broad framework of these regulations, the Academic Council, based on the recommendation of the transfer of credits committee so consulted by the Chancellor may permit students to earn part of the credit requirement in other approved institutions of repute and status in the country or abroad.

20.2 The Academic Council may also approve admission of lateral entry (who hold a diploma in Engineering/ technology) candidates with advance credit based on the recommendation of the transfer of credits committee on a case to case basis.

21. Eligibility for the award of B.Tech. Degree

21.1. A student will be declared to be eligible for the award of the B.Tech. Degree if he/she has

i) registered and successfully acquired the credits for the core courses;

ii) successfully acquired the credits in the different categories as specified in the curriculum corresponding to the discipline (branch) of his/her study within the stipulated time;

iii) has no dues to all sections of the Institute including Hostels, and

iv) has no disciplinary action pending against him/her.

The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

22. Change of Branch

22.1 If the number of students in any branch of B.Tech. class as on the last instructional day of the First Semester is less than the sanctioned strength, then the vacancies in the said branches can be filled by transferring students from other branches. All such transfers will be allowed on the basis of merit of the students. The decision of the Chancellor shall be final while considering such requests.

22.2 All students who have successfully completed the first semester of the course will be eligible for consideration for change of branch subject to the availability of vacancies.

23. Power to modify

23.1. Notwithstanding all that has been stated above, the Academic Council shall modify any of the above regulations from time to time subject to approval by the Board of Management.

DEPARTMENT OF BIOTECHNOLOGY

Foundation course Semester I

Sl. No	Course Code	Course Title	L	T	P	C	TCH
Theory							
1.	FC 1101	Communication English-I	7	4	0	5	11
2.	FC 1102	Matrix Algebra & Differential Calculus	3	1	0	4	4
3.	FC 1103 / FC 1104	Fundamentals of Physics / Chemistry *	2	0	0	2	2
4.	FC 1105	Fundamentals of Computing	2	0	0	2	2
Practical							
5.	FCL 1101	English Language Laboratory I	0	0	3	1	3
6.	FCL 1102 / FCL1103	Introduction to Physical Sciences Laboratory *	0	0	3	1	3
7	FCL 1104	Fundamentals of Computer Laboratory	0	0	3	1	3
			Total			**16**	**28**

Semester II

Sl. No	Course Code	Course Title	L	T	P	C	TCH
Theory							
1.	FC 1106	Communication English-II	7	4	0	5	11
2.	FC 1107	Integral Calculus, Differential Equations & Trigonometry	3	1	0	4	4
3.	FC 1103 / FC 1104	Fundamentals of Physics / Chemistry *	2	0	0	2	2
4.	FC 1108	Introduction to Engineering Graphics	3	1	0	3	4
Practical							
5.	FCL 1105	English Language Laboratory II	0	0	3	1	3
6.	FCL 1102 / FCL1103	Introduction to Physical Sciences Laboratory *	0	0	3	1	3
7.	FCL 1106	Basic Workshop	0	0	3	1	3
Total						**17**	**30**

Note: * Depending upon the number of batches, it will be alternated between semesters 1 & 2

Regular Course
Semester I

Sl. No	Course Code	Course Title (Semester 1)	L	T	P	C	TCH
Theory							
1.	EL 2101	Technical English	3	0	0	3	3
2.	MA 2101	Engineering Mathematics-I	3	1	0	4	4
3.	PH 2001/ CY 2001	Engineering Physics / Engineering Chemistry *	3	0	0	3	3
4.	ME 2101	Engineering Graphics	1	0	3	3	4
5.	CS 2101	Computer Programming	3	0	0	3	3
Practical							
6.	CS 2131	Computer Programming Laboratory	0	0	3	2	3
7.	GE 2131	Engineering Practices Laboratory-I	0	0	3	2	3
8.	EL 2131	Communication Skills Laboratory I	0	0	3	2	3
9.	PH 2031/ CY 2031	Physics Laboratory / Chemistry Laboratory *	1	0	3	3	4
		Total				25	30

Semester II

Sl. No	Course Code	Course Title (Semester 2)	L	T	P	C	TCH
Theory							
1.	MA2201	Engineering Mathematics-II	3	1	0	4	4
2.	PH 2001/ CY 2001	Engineering Physics / Engineering Chemistry *	3	0	0	3	3
3.	CH2202	Instrumental Analysis for Engineers	3	0	0	3	3
4.	BT1101	Biochemistry- I	3	1	0	4	4
5.	BT1201	Cell biology	3	0	0	3	3
Practical							
6.	PH 2031/ CY 2031	Physics Laboratory / Chemistry Laboratory *	1	0	3	3	4
7.	GE2231	Engineering Practices Laboratory-II	0	0	3	2	3
8.	CH2232	Technical Analysis Lab	0	0	3	2	3
9	EL 2231	Communication Skills Laboratory II	2	0	2	3	4
		Total				**27**	**34**

Semester III

Sl. No	Course Code	Course Title(Semester 3)	L	T	P	C	TCH
Theory							
1.	MA2301	Engineering Mathematics III	3	1	0	4	4
2.	CH2301	Unit Operation	3	1	0	4	4
3.	BT1203	Microbiology	3	0	0	3	3
4.	BT1202	Bioorganic chemistry	3	0	0	3	3
5.	CH2302	Chemical Process Calculation	3	1	0	4	4
Practical							
6.							
7.	BT1252	**Bio organic chemistry lab**	0	0	3	1	**1**
8.	CH2332	Unit Operations Lab	0	0	3	2	3
9.	BT1251	Biochemistry Lab	0	0	3	1	**1**
		Total				**22**	**23**

Semester IV

Sl. No	Course Code	Course Title(Semester 4)	L	T	P	C	TCH
Theory							
1.	BT1251	Basic Industrial Biotechnology	3	0	0	3	3
2.	CY2002	Environmental Science and Engineering	3	0	0	3	3
3.	CH2403	Chemical Engg Thermodynamics	3	1	0	4	4
4.	BT1255	Molecular Biology	4	0	0	3	4
5.	CH2405	Chemical Reaction Engg	3	1	0	4	4
Practical							
6.	CH2431	Chemical Reaction Engg lab	0	0	3	2	3
7.	BT1253	Microbiology lab	0	0	4	2	2
8.	CH2433	Computer programming lab in Chemical Engg	0	0	3	2	3
9.	CH2434	Project	0	0	6	4	6
		Total				**27**	**32**

Total Credits after four semesters: 107

Semester V

Sl. No	Course Code	Course Title(Semester 5)	L	T	P	C	TCH
Theory							
1.	BT1304	Genetic Engineering	2	1	0	3	3
2.	BT1303	Bioinformatics	4	0	0	4	4
3.	BT1301	Enzyme Engg. & Technology	3	0	0	3	3
4.	BT1302	Biochemistry II	4	0	0	4	4
5.	BT1303	Bioprocess Principles	3	0	0	3	3
Practical							
6.	BT1351	Molecular Biology Lab	0	0	4	2	2
7.	BT1352	Bioprocess Lab-I	0	0	4	2	2
8.	EL2431	Communication skills and personality development	**2**	**0**	**2**	**3**	**3**
		Total				**24**	**24**

Semester VI

Sl. No	Course Code	Course Title(Semester 6)	L	T	P	C	TCH
Theory							
1.	MA1214	Probability and statistics	3	1	0	4	4
2.	CH1303	Mass Transfer – I	3	1	0	4	4
3.	BT1304	Bioprocess Engineering	4	0	0	4	4
4.	BT1305	Protein Engineering	3	0	0	3	3
5.	BT1421	Plant biotechnology	3	0	0	3	3
6.	BT1420	Environmental biotechnology	3	0	0	3	3
Practical							
7.	CH2631	Mass Transfer Lab	0	0	3	2	3
8	BT1354	Bioprocess lab - II	0	0	6	2	2
9	CH2634	Industrial Training	0	0	0	2	0
		Total				**25**	**26**

Semester VII

Sl. No	Course Code	Course Title(Semester 7)	L	T	P	C	TCH
Theory							
1	BT1401	Downstream processing	3	1	0	4	4
2		Bio separation technology	3	0	0	3	3
3	BT1402	Immunology	3	1	0	4	4
4	BT1424	Principles of food processing	3	0	0	3	3
5	BT1435	Bioprocess Economics & Plant Design	3	0	0	3	3
6.	BT----	Elective - -I	3	0	0	3	3
Practical							
7.	CH2731	Analytical Techniques in Biotechnology	0	0	4	2	2
8.	BT1452	Downstream processing lab	0	0	4	2	2
		Total				**24**	**24**

Semester VIII

Sl. No	Course Code	Course Title(Semester 8)	L	T	P	C	TCH
Theory							
1.	MG2002	Total Quality Management	3	0	0	3	3
2.	GE1401	Professional ethics and human values	4	0	0	4	4
3.	BT----	Elective-II	3	0	0	3	3
Practical							
4.	CH2831	Project Work & Viva-voce			24	6	24
		Total				**16**	**34**

TOTAL CREDITS = 203

List of Electives

List of Electives

List of Electives

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
Elective - I							
1.	BT1422	Bio Conjugate Technology	3	0	0	3	3
2.	BT1423	Animal Biotechnology	3	0	0	3	3
3.	BT1433	Genomics and Proteomics	3	0	0	3	3
4.	BT1426	Biophysics	3	0	0	3	3
5	BT1427	Cancer Biology	3	0	0	3	3
Elective - II							
1	BT1428	Biopharmaceutical Technology	3	0	0	3	3
2	BT1429	Immunotechnology	3	0	0	3	3
3	BT1430	Biological Spectroscopy	3	0	0	3	3
4	BT1431	Molecular Modeling & Drug Design	3	0	0	3	3
5	BT1432	Metabolic Engineering	3	0	0	3	3

SEMESTER - I

EL 2101 Technical English

L T P C
3 0 0 3

Goal

The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their workplace or living space; to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

Objectives

The course should enable the students to:

- Widen the capacity of the learners to listen to English language at the basic level and understand its meaning.
- Enable learners to communicate in an intelligible English accent and pronunciation.
- Assist the learners in reading and grasping a passage in English.
- Learn the art of writing simple English with correct spelling, grammar and punctuation.
- Cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

Outcome

The students should be able to:

- Have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
- Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
- Read, comprehend and answer questions based on literary, scientific and technological texts.
- Write instructions, recommendations, checklists, process-description, letter-writing and report writing.
- Have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection

processes.

Unit I: Listening Skill **9**

Topics: Listening to the sounds, silent letters & stress in English words & sentences - Listening to conversation & telephonic conversation -- Listening for general meaning & specific information -- Listening for positive & negative comments - Listening to technical topics - Listening to prose & poetry reading -- Listening exercises. Embedded language learning: Sentence definition -- Spelling & punctuation -- Imperative form -

Sequencing of sentences -- Gerunds -- Infinitives -- 'Wh-'questions.

Unit II: Speaking Skill **9**

Topics: Self-introduction - Expressing personal opinion - Dialogue - Conversation - Simple oral interactions-- Speaking on a topic -- Expressing views for & against -- Speaking on personal topics like hobbies, topics of interest, present & past experiences, future plans - Participating in group discussions, role plays, debates, presentations, power-point presentations & job-interviews.

Embedded language learning: Adverbs -Adjectives - Comparative and Numerical adjectives – Nouns & compound nouns -- Prefixes and suffixes.

Unit III: Reading Skill **9**

Topics: Reading anecdotes, short stories, poems, parts of a novel, notices, message, time tables, advertisements, leaflets, itinerary, content page - Reading pie chart & bar chart -- Skimming and scanning -- Reading for contextual meaning - Scanning for specific information -- Reading newspaper & magazine articles - Critical reading -- Reading-comprehension exercises.

Embedded language learning: Tenses - Active and passive voice -- Impersonal passive -- Words and their function -- Different grammatical forms of the same word.

Unit IV: Writing Skill **9**

Topics: Writing emails, notes, messages, memos, notices, agendas, advertisements, leaflets, brochures, instructions, recommendations & checklists -- Writing paragraphs -- Comparisons & contrasts - Process description of Flow charts - Interpretation of Bar charts & Pie charts - Writing the minutes of a meeting -- Report writing -- Industrial accident reports -- Letter-writing -- Letter to the editors - Letter inviting & accepting or declining

the invitation - Placing orders - Complaints – Letter requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letters of application for a job, enclosing a CV or Resume - Covering letter. Embedded language learning: Correction of errors - Subject-verb Concord -- Articles - Prepositions -- Direct and indirect speech.

Unit V: Thinking Skill **9**

Topics: Eliciting & imparting the knowledge of English using thinking blocks - Developing thinking skills along with critical interpretation side by side with the acquisition of English -- Decoding diagrams & pictorial representations into English words, expressions, idioms and proverbs. Embedded language learning: General vocabulary -- Using expressions of cause and effect -- Comparison & contrast -- If-conditionals -- Expressions of purpose and means.

Reference Books

1. Norman Whitby. Business Benchmark: Pre-Intermediate to Intermediate - BEC Preliminary. New Delhi: Cambridge University Press, 2008 (Latest South Asian edition).
2. Norman Whitby. Business Benchmark: Pre-Intermediate to Intermediate - Preliminary-Personal Study Book. New Delhi: Cambridge University Press, 2008 (Latest South Asian edition).
3. Cambridge BEC Preliminary: Self-study Edition - Practice Tests. New Delhi: Cambridge University Press, 2008 or latest South Asian edition.
4. Devaki Reddy & Shreesh Chaudhary. Technical English. New Delhi: Macmillan, 2009.
5. Rutherford, Andrea J. Basic Communication Skills for Technology. 2nd edition. New Delhi: Pearson Education, 2006.

MA 2101 ENGINEERING MATHEMATICS I

L T P C
3 1 0 4

Goal

To create the awareness and comprehensive knowledge in engineering mathematics.

Objectives

The course should enable the students to:

- Find the inverse of the matrix by using Cayley Hamilton Theorem and Diagonalisation of matrix using transformation.
- Understand the Evolutes and Envelope of the curve.
- Learn the solutions of second order linear differential equations of standard types and Legendre's linear differential equation.
- Learn partial differentiations involving two and three variables and expansions of functions using Taylor series.
- Learn the expansions of trigonometric, hyperbolic functions and their relations..

Outcome

The students should be able to:

- Identify Eigen value problems from practical areas and obtain its solutions and using transformation diagonalising the matrix which would render Eigen values.
- Find out effectively the geometrical aspects of curvature and appreciates mathematical skills in constructing evolutes and envelopes in mechanics and engineering drawing.
- Recognize and to model mathematically and solving, the differential equations arising in science and engineering.
- Understand and model the practical problems and solve it using maxima and minima as elegant applications of partial differentiation.
- Acquire skills in using trigonometric and hyperbolic and inverse hyperbolic functions.

UNIT I MATRICES 12

Review: Basic concepts of matrices-addition, subtraction, multiplication of matrices - adjoint -inverse - solving cubic equations.Characteristic equation - Properties of Eigen values - Eigen values and Eigen vectors – Cayley Hamilton theorem (without proof) - Verification and inverse using Cayley Hamilton theorem. Diagonalisation of matrices - Orthogonal matrices - Quadratic form - Reduction of symmetric matrices to a Canonical form using orthogonal transformation - Nature of quadratic form.

UNIT II DIFFERENTIAL CALCULUS 12

Review: Basic concepts of differentiation - function of function, product and quotient rules. Methods of differentiation of functions - Cartesian form - Parametric form - Curvature - Radius of curvature - Centre of curvature - Circle of curvature. Evolutes of parabola, circle, ellipse, hyperbola and cycloid - Envelope.

III ORDINARY DIFFERENTIAL EQUATIONS 12

Review: Definition, formation and solutions of differential equations.

Second order differential equations with constant coefficients - Particular integrals - , eaxCosbx, eaxSinbx. Euler's homogeneous linear differential equations - Legendre's linear differential equation - Variation of parameters.

UNIT IV PARTIAL DIFFERENTIATION 12

Partial differentiation - differentiation involving two and three variables - Total differentiation -Simple problems. Jacobian - verification of properties of Jacobians - Simple problems. Taylor's series - Maxima and minima of functions of two and three variables.

UNIT V TRIGONOMETRY 12

Review: Basic results in trigonometry and complex numbers - De Moivre's theorem.

Expansions of sinn , cosn , tann where n is a positive integer. Expansions of in terms of sines and cosines of multiples of where m and n are positive integers. Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers - Separation of complex functions into real and imaginary parts - Simple problems.

Note: Questions need not be asked from review part.

TOTAL: 60

TEXT BOOKS

1. Erwin Kreyzig, A Text book of Engineering Mathematics, John Wiley, 1999.
2. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.
3. Chandrasekaran A, A Text book of Engineering Mathematics I, Dhanam Publications, Chennai, 2010.

REFERENCES

1. Venkataraman M.K, Engineering Mathematics, Volume I, The National Publishing Company, Chennai, 1985.
2. Kandaswamy P, Thilagavathy K and Gunavath K, Engineering Mathematics, Volume I & II, S.Chand and Company, New Delhi, 2005.
3. Bali N.P, Narayana Iyengar. N.Ch., Engineering Mathematics, Laxmi Publications Pvt. Ltd, New Delhi, 2003
4. Veerarajan T, Engineering Mathematics (for first year), Fourth Edition,Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.

PH2001 ENGINEERING PHYSICS

L T P C
3 0 0 3

Goal

To impart fundamental knowledge in various fields of Physics and its applications.

Objectives

The course should enable the students to:

- Develop strong fundamentals of properties and behaviour of the materials
- enhance theoretical and modern technological aspects in acoustics and ultrasonics.
- enable the students to correlate the theoretical principles with application oriented study of optics.
- provide a strong foundation in the understanding of solids and materials testing.
- Enrich the knowledge of students in modern engineering materials.

Outcome

The students should be able to:

- Understand the properties and behaviour of materials.
- Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonics and be able to employ it as an engineering tool.
- Understand the concept, working and application of lasers and fiber optics.
- Know the fundamentals of crystal physics and non destructive testing methods.
- Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER 9

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - characteristics of musical sound - intensity - loudness - Weber

Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation

time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriction and Piezoelectric methods - properties - applications of ultrasonics with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS 9

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

UNIT IV CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING 9

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS 9

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis -Properties and applications.

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - uses of superconductors.

TOTAL : 45

TEXT BOOKS:

1. Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpat rai publications (P) Ltd., New Delhi 2010.

2. P.Mani, "Engineering Physics", Vol-I, Dhanam Publications, Chennai 2011.
3. Rajendran V. an Marikani A., "Applied Physics for engineers" , 3rd edition, Tata Mc Graw -Hill publishing company Ltd., New Delhi,2003.

REFERENCES:

1. Uma Mukherji, Engineering Physics , Narosa publishing house, New Delhi, 2003.
2. Arumugam M., Engineering Physics , Anuradha agencies, 2007.
3. Palanisamy P.K., Engineering Physics, SciTech Publications, Chennai 2007.
4. Arthur Beiser, Concepts of Modern Physics, Tata Mc Graw -Hill Publications, 2007.
5. P.Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley India, 2007.

CY 2001 Chemistry

L T P C
3 0 0 3

Goal

To impart basic principles of chemistry for engineers.

Objectives

The course should enable the students to

- Make the students conversant with the basics of

(a) Water technology and (b) Polymer science

- Provide knowledge on the requirements and properties of a few important engineering materials.
- Educate the students on the fundamentals of corrosion and its control.
- Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
- Create awareness among the present generation about the various conventional energy sources.

Outcome

The students should be able to

- Gain basic knowledge in water analysis and suitable water treatment method.
- Get an idea on the type of polymers to be used in engineering applications.

- Get awareness about new materials
- Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
- Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
- Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I: WATER TECHNOLOGY AND POLYMER CHEMISTRY 9

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis. Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys - Definition, Examples.

UNIT II: ENGINEERING MATERIALS 9

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications.-Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives - Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III: ELECTROCHEMISTRY AND CORROSION 9

Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) - Constituents of Paints and varnish.

UNIT IV: CHEMICAL THERMODYNAMICS 9

Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy -

heat capacity - work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics - entropy change - phase transformations and entropy change - problems - Work Function & Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.

UNIT V: FUELS AND ENERGY SOURCES 9

Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas - Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell - Secondary Cell - Nickel Cadmium Battery - Fuel Cells - Hydrogen -Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy - Light water nuclear power plant.

Total : 45

Text Books

1. S. S. Dara, Text Book of Engineering Chemistry, S. Chand & Company Ltd., New Delhi, 2003
2. Murthy, Agarwal & Naidu, Text Book of Engineering Chemistry, BSP, 2003.
3. S.Sumathi, Engineering Chemistry, Dhanam Publications, 2008.
4. S.Sumathi and P.S.Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

References

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004
3. A. Gowarikar, Text Book of Polymer Science, 2002
4. Kuriacose & Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004
5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

ME 2101 ENGINEERING GRAPHICS

L T P C
1 0 3 3

Goal

To develop graphical skills for communicating concepts, ideas and designs of engineering products and to give exposure to national standards relating to technical drawings.

Objectives

The course should enable the students to

- Introduce drawing standards and use of drawing instruments.
- Introduce first angle projection.
- Practice of engineering hand sketching and introduce to computer aided drafting
- Familiarize the students with different type of projections.
- Introduce the process of design from sketching to parametric 3D CAD and 2D orthographic drawings to BIS

Outcome

The students should be able to

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically
- Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact

Note: Only first angle projection is to be followed

BASICS OF ENGINEERING GRAPHICS 2

Importance of graphics Use of drawing instruments - BIS conventions and specifications - drawing sheet sizes, layout and folding - lettering - Dimensioning-Geometrical constructions - Scales. Construction of curves like ellipse, parabola, cycloids and involutes.

UNIT I PROJECTION OF POINTS, LINES AND SURFACES 15

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projection - Naming views as per BIS - First angle projection. Projection of points. Projection of straight lines located in first quadrant using rotating line(using method only). Projection of plane surfaces like polygonal lamina and circular lamina. Drawing views when the surface of the lamina is inclined to one reference plane.

UNIT II PROJECTION OF SOLIDS 10

Projections of simple solids like prism, pyramid, cylinder and cone - Drawing views when the axis of the solid is inclined to one reference plane. Introduction to 'section of solids'.

UNIT III DEVELOPMENT OF SURFACES 10

Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

UNIT IV ORTHOGRAPHIC PROJECTIONS 10

Orthographic projections - Conversion to orthographic views from given pictorial views of objects, including dimensioning. Free hand sketching of Orthographic views from Pictorial views.

UNIT V PICTORIAL PROJECTIONS 10

Isometric projection - Isometric scale - Isometric views of simple solids like prisms, pyramids, cylinders and cones. Introduction to perspective Projections.

COMPUTER AIDED DRAFTING (Demonstration Only) 3

Introduction to computer aided drafting and dimensioning using appropriate software.

2D drawing commands: Zoom, Picture editing commands, Dimensioning, Isometric drawing, Iso-Planes and 3D drafting. Plotting of drawing. Practice includes drawing the projection of lines and solids. Prepare isometric view of simple solids like prisms, pyramids, cylinders and cones.

TOTAL : 60

TEXT BOOKS:

1. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd.,New Delhi, 2010.
2. Warren J. Luzadder and Jon. M.Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2003.

REFERENCES

1. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, Anand-3001, 2007.
2. Thomas E. French, Charles J.Vierck and Robert J.Foster, Engineering Drawing and Graphic Technology, McGraw-Hill Book company 13th Edition.1987.
3. IS 9609 - 1983 Lettering on Technical Drawings.
4. IS 10714 - 1983 General Principles of Presentation of Technical Drawings.
5. IS 11669 - 1986 General Principles of Dimensioning of Technical Drawings.

CS2101 COMPUTER PROGRAMMING

L T P C
3 0 0 3

Goal

To introduce computers and programming and to produce an awareness of the power of computational techniques that are currently used by engineers and scientists and to develop programming skills to a level such that problems of reasonable complexity can be tackled successfully.

Objectives

The course should enable the students to:

- Learn the major components of a Computer system.
- Learn the problem solving techniques.
- Develop skills in programming using C language.

Outcomes

The student should be able to:

- Understand the interaction between different components of Computer system and number system.
- Devise computational strategies for developing applications.
- Develop applications (Simple to Complex) using C programming language.

UNIT - I COMPUTER FUNDAMENTALS 9

Introduction - Evolution of Computers - Generations of Computer - Classification of Computers - Application of Computers - Components of a Computer System - Hardware - Software - Starting a Computer (Booting) - Number Systems.

UNIT- II COMPUTER PROGRMMING AND LANGUAGES 9

Introduction - Problem-Solving Techniques: Algorithms, Flowchart, Pseudocode - Program Control Structures - Programming Paradigms - Programming languages - Generations of Programming Languages - Language Translators - Features of a Good Programming Languages.

UNIT - III PROGRAMMING WITH C 9

Introduction to C - The C Declaration - Operators and Expressions - Input and Output in C - Decision Statements - Loop Control Statements.

UNIT- IV FUNCTIONS, ARRAYS AND STRINGS 9

Functions - Storage Class - Arrays - Working with strings and standard functions.

UNIT - V POINTERS, STRUCTURES AND UNION 9

Pointers - Dynamic Memory allocation - Structure and Union - Files.

TEXT BOOK:

1. ITL Education Solution Limited, Ashok Kamthane, "Computer Programming", Pearson Education Inc 2007 (Unit: I to V).

REFERNCES:

1. Byron S. Gottfried, "Programming with C", Second Edition, Tata McGraw Hill 2006.
2. Yashvant Kanetkar, "Let us C", Eighth edition, BPP publication 2007.
3. Stephen G.Kochan, "Programming in C - A Complete introduction to the C programming language" , Pearson Education, 2008.
4. T.JeyaPoovan, "Computer Programming Theory and Practice", Vikas Pub, New Delhi.

CS2131 COMPUTER PROGRAMMING LABORATORY

(Common to all branches)

L T P C
0 0 3 2

Goal

To provide an awareness to develop the programming skills using computer languages.

Objectives

The course should enable the students to:

- To gain knowledge about Microsoft office, Spread Sheet.
- To learn a programming concept in C.

Outcome

The students should be able to

- Use MS Word to create document, table, text formatting and Mail merge options.
- Use Excel for small calculations using formula editor, creating different types of charts and including pictures etc,
- Write and execute the C programs for small applications.

LIST OF EXPERIMENTS: a) Word Processing 15

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet 15

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document **c) Programming in C :**
7. To write a C program to prepare the electricity bill.
8. Functions:

   (a) Call by value (b) Call by reference.
10. To write a C program to print the Fibonacci series for the given number.
11. To write a C program to find the factorial of number using recursion.
12. To write a C program to implement the basic arithmetic operations using Switch Case statement.
13. To write a C program to check whether the given number is an Armstrong number.
14. To write a C program to check whether the given string is a Palindrome.
15. To write a C program to create students details using Structures.
16. To write a C program to demonstrate the Command Line Arguments.
17. To write a C program to implement the Random Access in Files.
18. To write C programs to solve some of the Engineering applications

GE 2131 ENGINEERING PRACTICE LABORATORY - I
(Common to all branches)

L T P C
0 0 3 2

Goal

To provide the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

Objectives

The course should enable the students to

- Relate theory and practice of basic Civil and Mechanical Engineering
- Learn concepts of welding and machining practice
- Learn concepts of plumbing and carpentry practice

Outcomes

The students should be able to

- Indentify and use of tools, Types of joints used in welding, carpentry and plumbing operations.
- Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.
- Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.

List of Experiments

I. MECHANICAL ENGINEERING PRACTICE 15

1. Welding

   Arc welding: Butt joints, Tee and lap joints.

1. Basic Machining

   Facing, turning, threading and drilling practices using lathe and drilling operation with vertical drilling machine.

3. Machine assembly practice Study of centrifugal pump

4. Study on

a. Smithy operations - Productions of hexagonal headed bolt.

b. Foundry operations - Mould preparation for gear and step cone pulley.

II. CIVIL ENGINEERING 12

1. Basic pipe connection using valves, couplings, unions, reducers, elbows in household fitting.
2. Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.
3. Wood work: Sawing, Planning and making common joints.

4. Study of joints in door panels, wooden furniture.

EL2131 COMMUNICATION SKILLS LABORATORY 1

L T P C
0 0 3 2

Goal

The goal of the programme is to provide a practical input towards nurturing accomplished learners who can function effectively in the English language skills.

Objectives

The course should enable the students to

- Extend the ability of the learners to be able to listen to English and comprehend its message.
- Enable the learners to have a functional knowledge of spoken English.
- Assist the learners to read and grasp the meaning of technical and non-technical passages in English.
- Help the learners develop the art of writing without mistakes.
- Expand the thinking capability of the learners so that they would learn how to view things from a different angle.

Outcome

The students should be able to

- Listen to and evaluate English without difficulty and comprehend its message.
- Develope a functional knowledge of spoken English so as to use it in the institution and at job interviews.
- Read and comprehend the meaning of technical and non-technical passages in English.
- Develope the art of writing so as to put down their thoughts and feelings in words.
- Think independently and contribute creative ideas.

Unit I: Listening Skill

Topics: Listening to conversations and interviews of famous personalities in various fields -- Listening practice related to the TV-- Talk shows - News - Educative programmes -- Watching films for critical comments - Listening for specific information - Listening for summarizing information - Listening to monologues for taking notes - Listening to answer

multiple-choice questions.

Unit II: Speaking Skill

Topics: Self-introduction -- Group discussion - Persuading and negotiating strategies - Practice in dialogues -- Presentations based on short stories / poems -- Speaking on personal thoughts and feelings -- academic topics - News reading - Acting as a compere -- Speaking about case studies on problems and solutions - Extempore speeches.

Unit III: Reading Skill

Topics: Reading anecdotes to predict the content - Reading for interpretation -- Suggested reading - - Short stories and poems -- Critical reading - Reading for information transfer - Reading newspaper and magazine articles for critical commentary - Reading brochures, advertisements, pamphlets for improved presentation.

Unit IV: Writing Skill

Topics: At the beginning of the semester, the students will be informed of a mini dissertation of 1000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

Unit V: Thinking Skill

Topics: Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms and proverbs - Inculcating interest in English using thinking blocks. Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading

Reference Books

1. Raman, Meenakshi, and Sangeetha Sharma. Technical Communication: English Skills for Engineers. 2nd edition. New Delhi: Oxford University Press, 2010.
2. Riordian, Daniel. Technical Communication. New Delhi. Cengage Learning, 2009

Websites for learning English

1. British: Learn English - British Council (Listen & Watch) - <http://learnenglish. british council. org/>
2. American: Randall's ESL Cyber Listening Lab - <http://www.esl-lab.com/>
3. Intercultural: English Listening Lesson Library Online http://www.elllo.org/

PH 2031 PHYSICS LABORATORY
(COMMON TO ALL BRANCHES)

L T P C
1 0 3 3

List of Experiments

1. Torsional Pendulum - Determination of rigidity modulus of the material of a wire.
2. Non Uniform Bending - Determination of Young's Modulus.
3. Viscosity -Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.
4. Lee's Disc - Determination of thermal conductivity of a bad conductor.
5. Air Wedge - Determination of thickness of a thin wire.
6. Spectrometer - Refractive index of a prism.
7. Semiconductor laser - Determination of wavelength of Laser using Grating.

REFERENCES:

1. P.Mani, Engineering Physics Practicals, Dhanam Publications, Chennai, 2005.

CY 2031 - Chemistry laboratory

L T P C
1 0 3 3

List of Experiments

1. Estimation of Commercial soda by acid-base titration
2. Determination of Percentage of nickel in an alloy
3. Determination of Temporary, permanent and total hardness of water by EDTA method
4. Determination of Chloride content in a water sample
5. Potentiometric Estimation of iron
6. Conductometric Titration of a strong acid with a strong base
7. Conductometric Titration of mixture of acids.
8. Determination of Degree of polymerization of a polymer by Viscometry

References:

1. J.Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantative Chemical Analysis, 6th Edition, Pearson Education, 2004.
2. C. W. Garland, J. W. Nibler, D. P. Shoemaker, Experiments in Physical Chemistry, 8th ed.," McGraw-Hill, New York, 2009.
3. S. Sumathi, Engineering Chemistry Practicals, Dhanam Publications, 2011.

SEMESTER-II

MA2201 ENGINEERING MATHEMATICS II

L T P C
3 1 0 4

Goal

To create the awareness and comprehensive knowledge in engineering mathematics.

Objectives

The course should enable the students to:

- Understand the evaluation of the double and triple integrals in Cartesian and polar forms.
- Know the basics of Vector calculus.
- Know Cauchy - Riemann equations, Milne - Thomson method and Conformal mapping
- Grasp the concept of Cauchy's integral formula, Cauchy's residue theorem and contour integration.
- Know Laplace transform and inverse Laplace transform and their properties.

Outcome

The students should be able to:

- Find area as double integrals and volume as triple integrals in engineering applications.
- Evaluate the gradient, divergence, curl, line, surface and volume integrals along with the verification of classical theorems involving them.
- Applies analytic functions and their interesting properties in science and engineering.
- Evaluate the basics of complex integration and the concept of contour integration which is important for evaluation of certain integrals encountered in practice.
- Have a sound knowledge of Laplace transform and its properties and their applications in solving initial and boundary value problems.

UNIT I MULTIPLE INTEGRALS 12

Review: Basic concepts of integration - Standard results - Substitution methods - Integration by parts - Simple problems.

Double integrals: Cartesian and polar co-ordinates - Change of variables - simple problems - Area as a double integral. Triple integrals: Cartesian co ordinates - Volume as a triple

integral - simple problems.

UNIT II VECTOR CALCULUS 12

Review: Definition - vector, scalar - basic concepts of vector algebra - dot and cross products-properties. Gradient, Divergence and Curl - Unit normal vector, Directional derivative - angle between surfaces- Irrotational and solenoidal vector fields. Verification and evaluation of Green's theorem - Gauss divergence theorem and Stoke's theorem. Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds.

UNIT III ANALYTIC FUNCTIONS 12

Review: Basic results in complex numbers - Cartesian and polar forms - Demoivre's theorem.

Functions of a complex variable - Analytic function - Necessary and sufficient conditions (without proof) - Cauchy - Riemann equations - Properties of analytic function - Harmonic function - Harmonic conjugate - Construction of Analytic functions by Milne - Thomson method. Conformal mapping: $w = z + a$, az, $1/z$ and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Statement and application of Cauchy's integral theorem and Integral formula - Evaluation of integrals using the above theorems - Taylor and Laurent series expansions -Singularities - Classification. Residues - Cauchy's residue theorem (without proof) - Contour integration over unit circle and semicircular contours (excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM 12

Laplace transform - Conditions of existence - Transform of elementary functions - properties - Transforms of derivatives and integrals - Derivatives and integrals of transforms - Initial and final value theorems - Transforms of unit step function and impulse function - Transform of periodic functions. Inverse Laplace transform - Convolution theorem - Solution of linear ODE of second order with constant coefficients.

TOTAL: 60

Note: Questions need not be asked from review part.

TEXT BOOKS

1. Venkatraman M.K, Mathematics, Volume - II, National Publishing Company, Chennai, 1985.
2. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher,

Delhi, 2004.

3. Chandrasekaran A, Engineering Mathematics, Volume - II, Dhanam Publication, 2008.

REFERENCE:

1. Kandasamy P, Engineering Mathematics Volume II, S. Chand & Co., New Delhi, 1987.
2. Grewal B.S, Engineering Maths - II, Sultan Chand, New Delhi, 1993.
3. Bali N.P, Manish Goyal, Text book of Engineering Mathematics, 3rd Edition, Lakshmi Publications, 2003.

CH2201 INTRODUCTION TO CHEMICAL ENGINEERING

4 Credits

Goal

Provide an overview of chemical engineering and its role in the chemical process industry

Objectives

The course should enable the students to

- Understand the difference between chemistry and chemical engineering and the role of chemical engineering in the process industry.
- Understand the various aspects of chemical engineering such as unit operations and unit processes.
- Learn the basic laws such as conservation of mass and energy and understand its importance in the basic material and energy balance calculations.
- Know the dimensional analysis along with various methods of performing dimensional analysis.
- Learn the importance and aspects of safety and various methods of systematic analysis of safety aspects.

Outcomes

The students should be able to

- Identify the role of chemical engineer in a process industry.
- Appreciate the scope of engineering in a chemical industry in comparison with that of other engineering disciplines.
- Carry out mass and energy balances for a given chemical process.
- Perform the dimensional analysis and empirical calculations for simple physical systems.
- Carry out the preliminary analysis of the various aspects of safety of any chemical process.

UNIT I: ROLE OF CHEMICAL ENGINEERS IN EVERY DAY LIFE 8

Chemistry, Chemical engineering and Chemical technology, Role of Chemical Engineers in Petroleum Refining, Coal gasification, Electronics, Bio-chemical and Environmental engineering.

UNIT II: HISTORY OF CHEMICAL ENGINEERING AND UNIT OPERATIONS 8

History of Chemical Engineering and Chemical Technology, Scope of Chemical Engineering, Concept of different Unit processes and Unit operations.

UNIT III: CONSERVATION LAWS AND APPLICATION 9

Laws of Conservation of mass and energy, steady and Unsteady process, General conservation equation for open systems, Conservation of mass in waste water treatment.

UNIT IV: SCALE UP AND DIMENSIONAL ANALYSIS 10

Principle of Dimensional Analysis, pi-theorem, Dimensionless groups, Use of dimensional analysis for Scale-up studies, Geometric, Dynamic and Kinematic Similarity.

UNIT V: SAFETY AND EMPIRICAL CORRELATIONS 10

Engineering aspects of Industrial Safety, Storage of Chemicals - Pool fire, BLEVE, VCE, MSDS of a compound, Need for semi empirical approach in Chemical Engineering- Case Studies.

Total No. of Periods: 45

TEXT BOOK:

1. Introduction to Chemical Engineering by S.K.Ghosal, S.K.Sanyal, S.Datta.

REFERENCE BOOKS:

1. McCabe, W.L., Smith, J. C. and Harriot, P. "Unit operations in Chemical Engineering", McGraw Hill.
2. Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", Tata McGraw Hill.
3. Safety in Chemical process industries,O.P.Kharbanda.

CH2202 INSTRUMENTAL ANALYSIS FOR ENGINEERS

3 Credits

Goal

To introduce important instruments used in Analytical Chemistry and their working principle and applications

Objectives

The course should enable the students to

- Understand the basic concepts of electromagnetic radiation and classification of various instrumental methods
- Learn molecular spectroscopy
- Understand the concept of atomic spectroscopy and chromatography
- Learn Moseley's law understand the concept of X-Ray Detectors
- Learn thermogravimetry, thermograms, and related instruments

Outcomes

The students should be able to

- Identify the suitable instrumental method of analysis based on the physical properties and bond structure
- Interpret and analyze the data from vibrational, rotational characteristics of molecules
- Apply the atomic spectroscopy to detect metal ions and chromatography tools to separate molecules
- Interpret the data obtained from X-Ray analysis
- Analyze thermograms of various compounds and predict melting points

UNIT I INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS 9

ELECTROMAGNETIC RADIATION: Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, absorbance and transmittance and their relationship, Permitted energy levels for the electrons of an atom and simple molecules, Classification of instrumental methods based on physical properties.

QUANTITATIVE SPECTROSCOPY: Beer-Lambert's Law, Limitations, Deviations (Real, Chemical, Instrumental). Nesslerimetry, Duboscq colourimetry, Estimation of inorganic ions such as Fe, Ni and estimation of Nitrite using Beer-Lambert's Law.

UNIT II MOLECULAR SPECTROSCOPY 9

Various electronic transitions in organic and inorganic compounds effected by UV, Visible

and infra red radiations, Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Woodward-Fischer rules for the calculation of absorption maxima (dienes and carbonyl compounds), Effects of auxochromes and effects of conjugation on the absorption maxima, Instrumentation for UV, VISIBLE and IR spectroscopies (Source, Optical parts and Detectors), Multicomponent analysis, Photometric titration (Experimental setup and various types of titrations), Applications of UV, VISIBLE AND IR spectroscopies.

UNIT III ATOMIC SPECTROSCOPY AND CHROMATOGRAPHIC METHODS 9

Atomic absorption spectrophotometry: Principle, Instrumentation and Applications, Various interferences observed in AAS (Chemical radiation and excitation).

Classification of chromatographic methods, Column, Thin layer, Paper, Gas, High Performance Liquid Chromatographical methods (Principle, mode of separation and Technique). Separation of organic compounds by column and Thin layer, mixture of Cu, Co and Ni by Paper, separation of amino acids by paper, estimation of organic compounds by GC and HPLC.

UNIT IV ELECTROMETRIC METHODS OF ANALYSIS 9

Introduction to electrometric methods, difference between redox and acid-base reactions, types of cells,schematic representation of cells, single electrode potential, laboratory reference electrodes (Standard hydrogen, saturated calomel, Ag - AgCI and inert electrodes), ion-selective electrodes. Potentiometry: Nernst equation, experimental set-up and measurement of pH; Conductometry - Measurement of conductance, experimental set-up and various titrations (strong and weak acid/ base).

UNIT V XRD ANALYSIS AND THERMAL METHODS 9

Introduction, Mosley's law, Different emission and diffraction methods, various X-ray detectors

Thermogravimetry: Instrumentation, factors affecting the shapes of thermograms, applications, thermograms of some important compounds ($CuSO_4$, $5H_2O$, $CaC_2O_4.2H_2O$ etc). Differential thermal analysis : Principle, Instrumentation and applications, differences between DSC and DTA. Applications of DSC (Inorganic and Polymer samples)

Total No of periods: 45

Text Book

1. Willard, H.H., Merritt. I.I., Dean J.a., and Settle, F.A., " Instrumental methods of analysis ", Sixth edition, CBS publishers, 1986.

References:

1. Parikh V.M., " Absorption spectroscopy of organic molecules ", Addison - Wesley Publishing Company, 1974.
2. Skoog D.A. and West D.M., " Fundamentals of Analytical Chemistry ", Saunders-college Publishing, 1982.
3. Banwell, G.C., " Fundamentals of molecular spectroscopy ", TMH, 1992.
4. Vogel A.I., " Quantitative Inorganic analysis ", V.Edition.
5 Day R.A., Underwood A.L., " Qualitative Inorganic analysis ", (A.I.Vogel), V.Edition, Prentice-Hall of India (P) Ltd., New Delhi, 1991.
6. Sharma, B.K., " Instrumental Methods of Analysis ", Goel publishing House, 1995.

BT1101 BIOCHEMISTRY – I 3 1 0 4

Goal

To impart knowledge on the basic principles of bio-chemistry.

Objectives

The course should enable the students to be

- Conversant with structures and properties of Carbohydrates.
- Educate the students on the fundamentals of the structure, properties and reactions of proteins and amino acids
- Give a sound knowledge about the composition, structure and functions of nucleic acids.
- Educate the students about the structure and properties of fats, lipids and enzymes.
- To understand nutrition aspects and metabolic regulation.
-

Outcome

The students should be able to

- Gain basic knowledge about carbohydrates.
- Get an idea about various proteins and amino acids.
- Have an in-depth knowledge about of nucleic acids
- Get good background knowledge about fats, lipids and enzymes.
- Get exposure on nutrition aspects and metabolic regulation.

UNIT I INTRODUCTION TO BIOMOLECULES 9

Overview - Basic principles of Organic Chemistry, Types of Biomolecules, Chemical nature, Biological role, Biological buffers, Water and its importance in Biochemistry.

UNIT II STRUCTURES & PROPERTIES OF CARBOHYDRATES, PROTEINS 9

Carbohydrates (Mono, Di, Oligo)- forms of Isomerism, Physiological importance, Polysaccharides - Starch- glycogen- Cellulose and their derivatives- Chitin- Peptidoglycons- Glycoaminoglycons-Glycoconjugates, Test for Carbohydrates.Classification of Amino acids and Proteins, Structure of Proteins- Primary- Secondary- Tertiary and Quaternary - Myoglobin & Hemoglobin, Test for Proteins.

UNIT III STRUCTURES & PROPERTIES OF LIPIDS, NUCLEIC ACIDS 9

Lipid - Classification (Fatty acids, Glycerolipids, Phospholipids, Glycolipids, Sphingolipids, Steroids) - Physiological importance, Significance of Cholesterol, Nucleic Acids - Structure of Purines - Pyrimidines - Nucleosides - Nucleotides - Ribonucleic acids - Deoxyribonucleic acids - Nucleoprotein complexes, Synthetic Nucleotide analogs, Functions of Nucleotides - Carrier of Chemical energy of cell- Enzyme Cofactor - Regulatory Molecules

UNIT IV NUTRITION & METABOLISM 9

Nutrition, Digestion and absorption of Carbohydrates - Lipids - Proteins - Vitamins - Minerals, Vitamins - Biomedical importance - Classifications - Deficiency diseases, Introduction to Biocatalysis by Enzymes and Pathways, Introduction to Biosynthesis and Breakdown of Carbohydrates- Lipids- Proteins and Nucleic Acids

UNIT V INTERMEDIARY METABOLISM & BIOENERGETICS 9

TCA cycle - Glycolysis - Glyconeogenesis - Pentose phosphate shunt - Urea cycle - Interconnection of Pathways - Metabolic regulations. High energy compounds - Electronegative Potential of compounds, Respiratory Chains- ATP cycle-Calculation of ATP production during Glycolysis and TCA cycle, Regulation of levels of High energy compounds and reducing equivalents inside the cell.

TOTAL PERIODS: 45

Text Book

1.Lehninger's Principles of Biochemistry by David L. Nelson and Michael M. Cox, Macmillan Worth publisher.

2.Lubert Stryer, Biochemistry, 4th Edition, WH. Freeman and co., 2000.

3.Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell, V.W., Harper's Biochemistry

Prentice Hall International.

4.Voet and Voet, Biochemistry 2nd Edition, John Wiley and Sons Inc., 1995

5.B.S. Bahl., Arun Bahl., Advanced Organic Chemistry 1st Edition, S. Chand & Co. Ltd., 2000.

BT1201 CELL BIOLOGY 3 0 0 3

Goal

The course aims to develop skills of the students in the area of Cell Biology and Cell Signalling pathways.

Objectives

The course should enable the students to be

- Understand the basic concept of cell structure, organelles and cellular functions
- To study about transportations through cell membrane
- To focus on different receptors and model of signalling
- Learn about the various about cell signal transduction pathways
- To introduce the concept of cell culture
-

Outcome

The students should be able to

- Gain basic knowledge about different types of cells and organelles found therein.
- Distinguish the different modes of cellular signaling and signal amplification
- Have extensive knowledge about cell signaling pathways
- Have a thorough knowledge about the various signalling moieties and be able to appreciate their role.
- Be well versed with cell culture techniques.

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 9

Eukaryotic and prokaryotic cells, principles of membrane organisation, membrane proteins, cytoskeletal proteins, types of cell division, mitosis & meiosis, extra cellular matrix, cell cycle and molecules that control cell cycle.

UNIT II TRANSPORT ACROSS CELL MEMBRANES 9

Passive & active transport, permeases, sodium potassium pump, Ca2+ ATPase pumps, lysosomal and vacuolar membrane ATP dependent proton pumps, co transport symport, antiport, transport into prokaryotic cells, endocytosis and exocytosis. Entry of viruses and toxins into cells.

UNIT III RECEPTORS AND MODELS OF EXTRA CELLULAR SIGNALLING 9

Cytosolic, nuclear and membrane bound receptors, examples of receptors, autocrine, paracrine and endocrine models of action, quantitation and characterisation of receptors.

UNIT IV SIGNAL TRANSDUCTION 9

Signal amplification, different models of signal amplifications, cyclic amp, role of inositol phosphates as messengers, biosynthesis of inositol tri phosphates, cyclic GMP and g proteins, role in signal transduction, calcium ion flux and its role in cell signaling, current models of signal amplification, phosphorylation of protein kinases, regulation of protein kinases, serine –threonine kinases, tumor necrosis factor receptor families.

UNIT V CELL CULTURE 9

Techniques for the propagation of eukaryotic and prokaryotic cells. Cell line, generation of cell lines, maintenance of stock cells, characterization of cells, immunochemistry, morphological analysis techniques, in cell culture, ex-plant cultures primary cultures, contamination, differentiation, three dimensional cultures, role of matrix in cell growth.

TOTAL PERIODS: 45

Text Books

1. Darnell J, Lodish H, Baltimore D, “Molecular Cell Biology”, W.H.Freeman;
2. Kimball T.W., “Cell Biology”, Wesley Publishers;

References

1. De Robertis & De Robertis, “Cell Biology”.
2. James D.Watson, “Molecular Biology of the Cell”
3. Robert de Levie, " Principles of Quantitative Chemical Analysis ", I Edition, Tata McGraw Hill, 1998.
4. Rouessac, F., " Chemical Analysis-Modern instrumental methods and techniques ", Wiley-Publishers 1999.

GE 2231 - ENGINEERING PRACTICES LABORATORY II

L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Electrical Engineering

1. Wiring for a tube light.
2. Wiring for a lamp and fan.
3. Staircase wiring.
4. Study of (i) Iron box and (ii) Fan with Regulator.

2. Electronics Engineering

1. Study of Electronic components and Equipments.
2. Characteristics of PN junction diode & measurement of Ripple factor or half wave and full wave rectifier.
3. Applications of OP-AMP - Inverter, Adder and Subtractor.
4. Study and verification of Logic Gates.

Total = 30

Text Book:

1. T. Jeyapoovan, M.Saravanapandian and S. Pranitha, "Engineering Practices Lab Manual", 3rd Edition 2006, Vikas Publishing house (P) Ltd., New Delhi.

CH2333 TECHNICAL ANALYSIS LAB

Credit 2

Goal

To learn analytical techniques in determining contaminants/pollutants in water and various analysis methods

Objectives

The course should enable the students to

- Understand the basic concepts of determination of chemical constituents of a material
- Learn spectroscopy and simple characterization tools
- Understand the importance of contaminants and pollutants determination

Outcomes

The students should be able to

- Identify the constituents and chemical composition of a given mixture
- Interpret and analyze the data from spectroscopy and simple characterization tools
- To identify and formulate approaches to any sample analysis in a lab or in an industry

List of Experiments

1. Analysis of water

Determination of temporary hardness
Determination of permanent hardness

2. Determination of chlorine demand in water - Estimation of residual chlorine in water by Volumetric method
3. Cement Analysis (3 experiments)

Estimation of silica content

Estimation of calcium oxide content

Estimation of mixed oxide content

4. Fertilizer Analysis - Estimation of Nitrogen in Urea by Kjeldals method
5. Determination of Sulfur in coal by Turbidity method
6. Preparation of standard curve(Absorbance vs. concentration) of a standard protein by folin's Method using visual Spectrophotometer
7. Determination of Ferrous/Copper ions by colorimeter method
8. Determination of CO in a combustion process by IR method
9. Analysis of gaseous mixture using TCD/FID
10. Separation of proteins by Paper Chromatography
11. Determination of molecular weight by UV spectrophotometer
12. Calibration and analysis of an organic mixture(benzene&toluene) by a refractometer
13. Determination of any optically active substance in the presence of non-active species by a polarimeter

TOTAL: 45hrs

List of Equipments

1. Polarimeter
2. Paper Chromatography Kit

3. UV Spectrophotometer
4. Colorimeter
5. Turbidimetry equipment
6. Visual Spectrophotometer

EL 2231 COMMUNICATION SKILLS LABORATORY 2

L T P C
2 0 2 3

Goal

The goal of the programme is to provide an advanced practical input towards moulding student-achievers who can use the English language with ease.

Objectives

The course should enable the students to

1. Extend the power of the learners to listen to English at an advanced level and comment on it.
2. Guide the learners to speak English at the formal and informal levels.
3. Enable learners to read and grasp the in-depth meaning of technical and non-technical passages in English.
4. Help the learners develop the art of writing at the formal and informal levels.
5. To expand the thinking capability of the learners so that they would learn how to be original in their thoughts.

Outcome

The students should be able to

1. Listenand understand English at an advanced level and interpret its meaning.
2. Develop English at the formal and informal levels and thus gained the confidence to use it without fear.
3. Read and grasp the in-depth meaning of technical and non-technical passages in English.
4. Develope the art of formal and informal writing.
5. The learners will be able to think independently and creatively and also verbalize their thoughts fearlessly.

Unit I: Listening Skill

Topics: Listening to telephonic conversations -- Listening to native British speakers -- Listening to native American speakers -- Listening to intercultural communication -- Listening to answer questions as one-liners and paragraphs -- Listening practice to identify ideas, situations and people -- Listening to group discussions -- Listening to films of short duration.

Unit II: Speaking Skill

Topics: Interview skills - People skills - Job interview - Body language and communication -- How to develop fluency -- Public speaking -- Speaking exercises involving the use of stress and intonation - Speaking on academic topics - Brain storming & discussion - Speaking about case studies on problems and solutions - Extempore speeches - Debating for and against an issue - Mini presentations - Generating talks and discussions based on audiovisual aids.

Unit III: Reading Skill

Topics: Reading exercises for grammatical accuracy and correction of errors -- Reading comprehension exercises with critical and analytical questions based on context - Evaluation of contexts - Reading of memos, letters, notices and minutes for reading editing and proof reading -- Extensive reading of parts of relevant novels after giving the gist of the same.

Unit IV: Writing Skill

Topics: At the beginning of the semester, the students will be informed of a mini dissertation of 2000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

Unit V: Thinking Skill

Topics: Practice in preparing thinking blocks to decode pictorial representations into English words, expressions, idioms and proverbs - Eliciting the knowledge of English using thinking blocks -- Picture rereading -- Finding meaning in the meaningless - Interpreting landscapes, simple modern art and verbal and non-verbal communication.

Reference Books

1. Ibbotson, Mark. Cambridge English for Engineering. New Delhi: Cambridge University

Press, 2009.

2. Smith-Worthington Jefferson. Technical Writing for Success. New Delhi. Cengage Learning, 2007.

Websites for learning English

1. British: Learn English - British Council (Business English) - <http://learnenglish. british council.org/>
2. BBC Learning English (General and Business English) - <http://www.bbc.co.uk/worldservice/ learningenglish/>
3. Intercultural: English Listening Lesson Library Online <http://www.elllo.org/>

SEMESTER III

MA 2301 ENGINEERING MATHEMATICS III (Common to all branches)

L T P C
3 1 0 4

Goal

To develop the skills of the students in the areas of boundary value problems and transform techniques

Objectives

The course should enable the students to

- Develop the skills of the students in the areas of boundary value problems and transform techniques.
- Gain a knowledge in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory.
- Serve as a prerequisite for post graduate and specialized studies and research.

Outcome

The students should be able to

- Formulate certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
- Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results
- Have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair, and specialization on Fourier transform pair, their properties, the possible special cases with attention to their applications.
- Have learnt the basics of Z - transform in its applicability to discretely varying functions gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order partial differential equations - Lagrange's

linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 12

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range sine series - Half range cosine series - Complex form of Fourier Series - Parseval's identify - Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 12

Classification of second order linear partial differential equations - Solutions of one dimensional wave equation - One dimensional heat equation - Steady state solution of two-dimensional heat equation (Insulated edges excluded) - Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem (without proof) - Fourier transform pair - Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem.

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform - Elementary properties - Inverse Z - transform - Convolution theorem - Formation of difference equations - Solution of difference equations using Z - transform.

TOTAL HOURS= 60

Text Book

1. Grewal, B.S., Higher Engineering Mathematics, 39th Edition , Khanna Publishers, Delhi, 2007.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., Engineering Mathematics Volume II", S. Chand & Company ltd., New Delhi, 4th edition 2009.
3. Wylie C. Ray and Barrett Louis, C., Advanced Engineering Mathematics, Sixth Edition, McGraw-Hill, Inc., New York, 1995.

References

1. Andrews, L.A., and Shivamoggi B.K., Integral Transforms for Engineers and Applied Mathematicians, Macmillen, New York, 2007.
2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., Advanced Mathematics for Engineering Students, Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
3. Churchill, R.V. and Brown, J.W., Fourier Series and Boundary Value Problems, Fourth

Edition, McGraw-Hill Book Co., Singapore, 1987.

CH2301 UNIT OPERATION

Credits 4

Goal

To study various processing techniques in a process industry

Objectives

The course should enable the students to

- Study the characteristics of solids and their behavior under external forces, size analysis
- Learn size reduction and the laws related to energy calculations in size reduction, and different equipment for size reduction
- Understand the various methods of mechanical separation of mixtures such as screening, gravity settling, thickening
- Study the theory of filtration and types of filters
- Learn the working principle of mixing and agitation equipment and the design correlations
- Study various equipment used for storage and conveying of various types of solids

Outcomes

The students should be able to

- Carry out the stress analysis calculations for various forces on a body
- Select the right type of equipment for size reduction and calculate the energy requirements and the efficiency of equipment
- Carry out the design calculations for mechanical separation equipment
- Design the filtration equipment
- Perform design calculations for mixers, and agitators
- Identify the right type of storage facility, and conveyors for the given solid material

UNIT I PARTICLE CHARACTERISTICS AND SIZE ANALYSIS 7

General characteristics of solids, their behaviour under different external forces, agglomeration, techniques for size analysis

UNIT II SIZE REDUCTION 7

Laws of size reduction, classification of equipment, methods of size reduction, disintegration,

preparation of colloids

UNIT III MECHANICAL SEPARATIONS 9

Screening and Screening equipment, effectiveness of screens, gravity settling, sedimentation, thickening, centrifugal separation, impingement methods, industrial dust removing equipment with special reference to electrostatic and magnetic separators, heavy media separations, floatation.

UNIT IV FILTRATION 8

Theory of filtration, Batch and continuous filters, centrifuges, membrane and ultra filtration

UNIT V MIXING AND AGITATION 7

Equipment for blending and kneading, dispersion, power for agitation, correlations

UNIT VI STORAGE AND CONVEYING OF SOLIDS 7

Conveyors, elevators, pneumatic conveying, Different methods for storage of solids.

TOTAL PERIODS: 45

Text Book

McCabe,W.L, Smith J.C ., " Unit Operations in Chemical Engineering ", McGraw-Hill, Fourth Edition,1984.

References

Coulson, J.M., Richardson, J.F., " Chemical Engineering ", Volume 2, Third Edition, Pergamon Press, 1977.

BT1203 MICROBIOLOGY 3 0 0 3

Goal

The course aims to introduce microbiology fundamentals such that students are able to identify microorganisms and also use the knowledge meaningfully in industrial applications.

Objectives

The course should enable the students to

- Decipher the roles and characteristics of various microorganisms
- To get requisite knowledge about the basic concept of replication in microorganisms
- To evaluate explicitly the Nutritional requirement of microorganisms
- Get insight into the physical and chemical control of microorganisms.
- Know in depth about the various metabolites and their applications

Outcome

The students should be able to

- Clearly distinguish various microorganisms and know their nomenclature
- Thoroughly know the mechanism of replication in microorganisms
- Decide about the various media used for bacterial culture
- control microorganisms using antibiotics
- employ microorganisms for pollution abatement and various other industrial application

UNIT I INTRODUCTION 6

Basic of microbial existence; history of microbiology, classification and nomenclature of microorganism, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

UNIT II MICROBES-STRUCTURE AND MULTIPLICATION 12

Structural organization and multiplication of bacteria, viruses, algae and fungi with a special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophage.

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM 12

Nutritional requirements of bacteria and different media used for bacterial culture; growth curve and different methods to quantitate bacterial growth, aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT – IV CONTROL OF MICROORGANISMS 6

Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents, mode of action and resistance to antibiotics; clinically important microorganisms.

UNIT - V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY 9

Primary metabolites; secondary metabolites and their applications; preservation of food; production of penicillin, alcohol, Vitamins(B2,C & E only); biogas; bioremediation; leaching

of ores by microorganisms; bio-fertilizers and bio-pesticides; microorganisms and pollution control; biosensors

TOTAL PERIODS: 45

Text books

1. Talaron K, Talaron A, Casita, Pelczar And Reid. Foundations In Microbiology, W.C.Brown Publishers, 1993.
2. Pelczar MJ, Chan ECS and Krein NR, Microbiology, Tata McGraw-Hill Edition, New Delhi, India.
3. Prescott LM, Harley JP, Klein DA, Microbiology, 3rd Edition, Wm. C. Brown Publishers, 1996.

BT1202 BIOORGANIC CHEMISTRY 3 0 0 3

Goal

The course aims to develop skills of Students in the area of Organic Chemistry and its applications in Biology.

Objectives

The course should enable the students to

- Learn the basics of organic chemistry
- Know importance of Stereochemistry of enzymatic reactions
- Understand the working of enzymes
- Learn kinetics of protein folding
- Study nucleation condensation and protein folding pathways

Outcome

The students should be able to

- Acquire basics of organic chemistry and various catalytic reactions
- Thoroughly know the mechanism of Stereospecific enzymatic reactions
- Analyze the various types of enzymes and know their uses
- Evaluate and appreciate protein folding kinetics

- Scrutinize the protein folding optimization processes

UNIT I CONCEPTS IN ORGANIC CHEMISTRY 9

Stereochemistry – R,S notation – re-si faces – e,z isomerism- conformers- ethane – cyclopean - reactivates- mechanisms of sn1 sn2 reactions, e1 e2 reactions – ester formation and hydrolysis, reaction rates - hammond's postulate – h/d effects. Catalysis – general acid – base and covalent catalysis.

UNIT II STEREOCHEMISTRY OF ENZYMATIC REACTIONS 9

Stereospecific enzymatic reactions – fumarase catalysed reactions – NAD dependent oxidation and reduction reactions - Stereochemistry of nucleophilic reactions – chiral methyl group – chiral phosphate.

UNIT III CASE STUDIES OF ENZYME STRUCTURE AND MECHANISM 9

The dehydrogenases – the proteases – ribonucleases – lysozyme- stability of proteins – stability – activity tradeoff.

UNIT IV KINETICS OF PROTEIN FOLDING 9

Basic methods – two state kinetics – multistate kinetics – transition states in protein folding – 1h/2h exchange methods – folding of peptides.

UNIT V FOLDING PATHWAYS & ENERGY LANDSCAPES 9

Folding of ci2 – nucleation condensation mechanism – folding of barnase – time resolution – insights from theory – optimization of folding rates – molecular chaperones.

TOTAL PERIODS: 45

References

1. Structure And Mechanism In Protein Science: A Guide To Enzyme Catalysis and Protein Folding; A. R. Fersht, W.H. Freeman, 1999.
2. Bioorganic Chemistry; H. Dugas, Springer Verlag, 1999.

CH2302 CHEMICAL PROCESS CALCULATION

4 Credits

Goal

To teach the students the material and energy balance calculations for various chemical processes

Objectives

The course should enable the students to

- Learn various units and dimensions relevant to chemical engineering
- Understand the ideal and non-ideal behavior of gases, gas laws
- Learn the basics of material balance in steady-state and unsteady state conditions for various processes
- Learn the basics of humidity and use the humidity charts
- Learn the basics of thermo physics and thermo chemistry calculations

Outcomes

The students should be able to

- Express various properties in different systems of units and convert them from one system of units to another system
- Apply gas law calculations to real life problems
- To carry out material balance calculations for various unit operations
- Perform drying and condensation calculations
- Perform energy balance calculations for various processes in chemical engineering

UNIT I UNITS AND DIMENSIONS 9

Basic and derived units, use of model units in calculations, Methods of expression, compositions of mixture and solutions.

UNIT II GAS CALCULATIONS 9

Ideal and real gas laws - Gas constant - calculations of pressure, volume and temperature using ideal gas law. Use of partial pressure and pure component volume in gas calculations, applications of real gas relationship in gas calculation

UNIT III MATERIAL BALANCE 9

Stoichiometric principles, Degrees of Freedom Analysis, Application of material balance to unit operations like distillation, evaporation, crystallisation, drying etc., - Material balance with chemical reaction - Limiting and excess reactants - recycle -bypass and purging - Unsteady state material balances.

UNIT IV HUMIDITY AND SATURATION 9

Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity - Use of humidity in condensation and drying - Humidity chart, dew point

UNIT V THERMO PHYSICS & THERMOCHEMISTRY 9

Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat

calculations, problems involving sensible heat and latent heats, evaluation of enthalpy. Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction - Energy balance for systems with and without chemical reaction. - Unsteady state energy balances.

TOTAL PERIODS: 45

TEXT BOOKS:

1. Bhatt, B.L., VORA, S.M., "Stoichiomentry ", Tata McGraw-Hill, 2008.
2. Hougen, O.A., Watson, K.M and Ragatz, R.A., " Chemical Process Principles Part-I ", John Wiley and Asia Publishing, 1970.

REFERENCES:

1. Himmelblau, D.M., "Basic Principles and Calculations in Chemical Engineering ", Fourth Edition, Prentice Hall Inc.,1982.
2. Whitwell, J.C., Tone, R.K. "Conservation of Mass and Energy ", McGraw-Hill, 1973.
3. Process Calculation for Chemical Engineering, Second Revised Edition, Chemical Engineering Education Development Centre, I.I.T., Madras, 1981.

BT1252 BIO ORGANIC CHEMISTRY LAB 0 0 3 1

Goal

To carry out experiments in the area of Bio Organic Chemistry.

Objectives

The course should enable the students to

- Evaluate the importance of cellular extraction
- Understand the concepts of Soxhlet Extraction
- Identify the best method for isolation of lycopene
- Understand the concept behind TLC analysis
-

Outcomes

The students should be able to

- To extract materials that are used in Pharma & Biotech industries
- Apply and appreciate the importance of Soxhlet Extraction
- Identify the best possible separating method for isolation of lycopene
- Undertake TLC analysis of given extracts

List of Experiments

1. Single Cell Extraction
2. Soxhlet Extraction (Ginger, pepper, cotton, tannings, polyphenols,etc.)
3. Isolation of lycopene from tomato paste.
4. TLC of all extracts to be taken.

TOTAL PERIODS: 45

REFERENCE

1. Fummis B.S., Hannaford A.J., Smith P.W.G., "Text Book of Practical Organic Chemistry", Longman Edition, 1995.

CH2332 UNIT OPERATIONS LAB

1 Credit

Goal

To expose the students to the practical experience of handling various equipment that are used in process industry.

Objectives

The course should enable the students to

- Learn the operation of drying
- operate size reduction equipment such as Jaw Crusher and Ball Mill
- Carry out the mass separation operations such as Distillation, Extraction, Leaching, and absorption
- Understand the concept of pressure drop across the fixed bed, and the transition of fixed bed to fluidized bed

Outcomes

The students should be able to

- Generate the drying curve for the given wet material

- Determine the energy requirement for size reduction of the solid material
- Determine the size of distillation, extraction leaching, and absorption equipment
- Determine the minimum fluid velocity to for the required to operate the bed

List of Experiments

1. Drying
2. Simple Distillation
3. Size reduction (or) Screening
4. Leaching
5. Extraction
6. Packed Bed Absorber
7. Fluidized Bed
8. Jaw Crusher
9. Ball Mill
10. Heat Exchanger

List of Equipment

1. Dryer
2. Simple Distillation Set-up
3. Ball Mill
4. Leacing Equipm,ent
5. Extraction Equipment
6. Packed Bed
7. Jaw Crusher
8. Heat Exchanger

BT1251 BIOCHEMISTRY LAB 0 0 3 1

Goal

To carry out experiments in the area of basic Biochemistry.

Objectives

The course should enable the students to

- Understand the importance of biochemical measurement units
- Be acquainted with the concepts of Buffers
- Identify the best method for Quantitation of carbohydrates, amino-acids and lipids
- Understand the concept behind nucleic acid analysis
- Have an understanding about various Enzymatic assays

Outcomes

The students should be able to

- To extract materials that are used in Pharma & Biotech industries
- Apply and appreciate the importance of Soxhlet Extraction
- Identify the best possible separating method for isolation of lycopene
- Undertake TLC analysis of given extracts
- Evaluate Enzymatic assay of phosphatase

Experiments Undertaken

1. General guidelines for working in biochemistry lab (theory)
2. Units of volume, weight, density and concentration measurements and their range in biological measurements.
3. Demonstration of proper use of volume and weight measurement devices.
4. Accuracy, precision, sensitivity and specificity (theory)
5. Preparation of buffer –titration of a weak acid and a weak base.
6. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.
7. Quantitative method for amino acid estimation using ninhydrin – distinguishing amino from imino acid.
8. Protein estimation by Biuret and Lowry's methods.
9. Protein estimation by Bradford and spectroscopic methods.
10. Extraction of lipids and analysis by TLC.
11. Estimation of nucleic acids by absorbance at 260 nm and hyperchromic effect (demo).
12. Enzymatic assay: phosphatase from potato.
13. Enzymatic assay: estimation of glucose by TGO method after hydrolysis of starch with acid and specificity of the enzymatic method.

TOTAL PERIODS: 45

List of Equipment

1. pH meter 2
2. Colorimeter 3
3. Water bath (Dry bath 40°C - 120°C preferred) 3

4. Balance (500 g – 0.1 g) 1
5. Balance (0.1 mg) 1
6. Table top Centrifuge Remi R-24 1
7. Microfuge 2
8. Micropipettes 20 µl - 200 µl; 1 µl – 20 µl 33
9. Oven 1
10. UV – vis spectrometer 1
11. Vortexer 4
12. Magnetic Stirrer 2
13. Fume hood 1
14. Bunsen Burner 4
15. Microplate Reader (vis-range) (300-700 nm) 1

SEMESTER IV

BT1251 BASIC INDUSTRIAL BIOTECHNOLOGY 3 0 0 3

Goal

To introduce the students to a much applied area of basic industrial biotechnology.

Objectives

The course should enable the students to

- Know the relevance of industrial bioprocess principles
- Study about the production of some commercially important primary metabolites
- Learn production processes for various secondary metabolites
- Acquire knowledge about the various methods involved in Production of industrial enzymes
- Learn about recombinant proteins and their application

Outcome

The students should be able to

- Appreciate the various industrial bioprocesses
- Identify commercially important primary metabolites and their usage
- Evaluate thoroughly the manufacturing processes of various secondary metabolites
- Assess the various methods for producing industrially relevant enzymes
- Identify the recombinant proteins used for therapeutic and diagnostic application

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS 7

A historical overview of industrial fermentation process – traditional and modern biotechnology. A brief survey of organisms, processes, products relating to modern biotechnology. Process flow sheeting – block diagrams, pictorial representation.

UNIT II PRODUCTION OF PRIMARY METABOLITES 10

A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid, acetic acid etc.,); amino acids (glutamic acid, phenyalanine, aspartic acid etc.,) and alcohols (ethanol, butanol etc.,)

UNIT III PRODUCTION OF SECONDARY METABOLITES 10

Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin etc.), aminoglycosides (streptomycin etc.,)

macrolides (erythromycin), vitamins and steroids.

UNIT IV PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS 8

Production of industrial enzymes such as proteases, amylases, lipases, cellulases etc., Production of biopesticides, biofertilisers, biopreservatives (Nisin), cheese, biopolymers (xanthan gum, PHB etc.,), single cell protein.

UNIT V PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS 10

Production of recombinant proteins having therapeutic and diagnostic applications, production of vaccines. Production of monoclonal antibodies. Products of plant and animal cell culture.

TOTAL PERIODS: 45

Text Books

1. Casida Jr, L.E., "Industrial Microbiology", New Age International (P) Ltd.
2. Presscott, Dunn, "Industrial Microbiology", Agrobios (India).

References

1. Wulf Cruger and Anneliese Crueger, "Biotechnology: A Textbook of Industrial Microbiology", Panima Publishing Corporation.
2. Murrey Moo & Young, "Comprehensive Biotechnology", Pergamon.

CY2002 ENVIRONMENTAL SCIENCE AND ENGINEERING

3 Credits

Goal

To make the students aware of the impact of development on the environment and ways to mitigate the ill effects.

Objectives

The course should enable the students to

Give an overview of exploitation of various natural resources and its impact on the environment

- Understand the ecosystem and biodiversity
- Understand the pollution of air, water, soil and its effect on environment, and study the methods to reduce the pollution
- Study the impact of population growth on environment, and the human health

Outcomes

The students should be able to

- Identify the various human activities adversely affecting the natural resources and the balance ecosystem
- Analyze the various aspects of ecosystems and suggest ways to protect them
- Carry out detailed study of pollution of given locality and suggest steps to mitigate pollution
- Analyze and manage human healthcare problems due to population growth

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance - need for public awareness - forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems - mineral resources: use effects on forests and tribal people - water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies - food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies - land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification - role of an individual in conservation of natural resources - equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets - river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - introduction to biodiversity - definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - biodiversity at global, national and local levels - India as a mega-diversity nation - hot-spots of biodiversity - threats to biodiversity: habitat loss,

poaching of wildlife, man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 8

Definition - causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - solid waste management: causes, effects and control measures of urban and industrial wastes - role of an individual in prevention of pollution - pollution case studies - disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site - urban / rural / industrial / agricultural

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development - urban problems related to energy - water conservation, rain water harvesting, watershed management - resettlement and rehabilitation of people; its problems and concerns, case studies - environmental ethics: issues and possible solutions - climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. - wasteland reclamation - consumerism and waste products - environment production act - air (prevention and control of pollution) act - water (prevention and control of pollution) act - wildlife protection act - forest conservation act - issues involved in enforcement of environmental legislation - public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS - women and child welfare - role of information technology in environment and human health - case studies.

TOTAL : 45hrs

TEXT BOOKS

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., "Environmental Science", Wadsworth Publishing Co.

REFERENCES

1. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.

2. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell Science.

3. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno-Science Publications.

4. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.

5. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.

6. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.

CH2402 CHEMICAL ENGINEERING THERMODYNAMICS

4 Credits

Goal

Teach the thermodynamic concepts and emphasize the role of thermodynamics in various chemical engineering operations

Objectives

The course should enable the student to

- Understand the basic terminologies used in thermodynamics
- Learn various thermodynamic formulations such as Maxwell's equations in relating various properties of thermodynamic systems
- Study the equations of state for real gases to determine their PVT behavior
- Study thermodynamic aspects of compression in single-stage and multi-stage
- Study the equilibrium relationships between different phases under different circumstances.

Outcomes

The students should be able to

- Clearly identify the thermodynamic system and its interaction with its surroundings
- Calculate the energy requirements to carry out certain thermodynamic transformations

- Estimate the various properties of thermodynamic systems involving real gases
- Calculate the energy requirement for compression
- Carry out calculations related phase equilibrium

UNIT I BASIC CONCEPTS **9**

The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule. The first law and internal energy, statements of first law for the non-flow and flow systems, enthalpy and heat capacity limitations of the first law. Statements of the second law of thermodynamics, available and unavailable energies, the entropy function, applications of the second law.

UNIT II THERMODYNAMIC FORMULATIONS **9**

Measurable quantities, basic energy relations, maxwell relations, thermodynamic formulations to calculate enthalpy, internal energy and entropy as function of pressure and temperature, other formulations involving Cp and Cv, complex thermodynamic formulations, thermodynamic properties of an ideal gas, entropy change in reversible and irreversible process

UNIT III THERMODYNAMIC PROPERTIES OF REAL GASES **9**

The PVT behavior of fluids, laws of corresponding states and equation of states approaches to the PVT relationships of non ideal gas problems, compressiblity factors, generalized equations of state, property estimation via generalised equation of state , fugacity and fugacity coefficients of real gases.

UNIT IV COMPRESSION OF FLUIDS **8**

Thermodynamic aspects of compression process, classification of compression processes, basic equation for change of state of gases, the work expression for different situations, the effect of clearance volume, multistage compression, convergent divergent flow, Ejectors.

UNIT V PHASE EQUILIBRIA **10**

Criteria for equilibrium between phases in multi component non-reacting systems in terms of chemical potential and fugacity, application of phase rule, vapour-liquid equilibrium, phase diagrams for homogeneous systems and for systems with a miscibility gap, effect of temperature and pressure on azeotrope composition, liquid-liquid equilibrium, ternary liquid-liquid equilibrium.

TOTAL PERIODS : 45

Text Book

1. Smith, J.M., Van Ness, H.C., " Introduction to Chemical Engineering Thermodynamics ", Kogakushai 1976.

References:

1. Hougen, O.A., Watson, K.M., and Ragatz, R.A., "Chemical Process Principles Part II, Thermodynamics ", John Wiley 1970.
2. Dodge, B.F., " Chemical Engineering Thermodynamics ", McGraw-Hill, 1960.
3. Sandler, S.I., " Chemical and Engineering Thermodynamics 2nd edn. ", Wiley, 1989.
4. Kyle, B.G., " Chemical and Process Thermodynamics 2nd edn. ", Prentice Hall of India Pvt.Ltd., 1990.

BT1255 MOLECULAR BIOLOGY 4 0 0 4

Goal

To introduce the students to the fundamentals concepts of molecular biology and gene regulation.

Objectives

The course should enable the students to

- Know the importance of Mendelian genetics
- Study about the nucleic acids and how DNA replicates
- Acquire knowledge about transcription process
- Learn about translation mechanism
- Study how gene regulation and repair mechanism is undertaken

Outcome

The students should be able to

- Appreciate the genetic machinery at play in life
- Identify the importance of DNA, RNA and how they replicate
- Evaluate how transcription occurs in the cell
- Assess the translation mechanism and its relevance in Biotechnology
- Ascertain gene regulation and repair mechanism in both prokaryotes and eukaryotes

UNIT I CLASSICAL GENETICS 05

Mendelian genetics, linkage, crossing over, classical experiments – Hershey and chase;

Avery McLeod & McCarty. Bacterial conjugation, transduction and transformation.

UNIT II STRUCTURE OF NUCLEIC ACIDS AND DNA REPLICATION 15

Conformation of DNA and RNA; replication in prokaryotes, D-loop and rolling circle mode of replication, replication of linear viral DNA. Organisation of eukaryotic chromosome – cot value, replication of telomeres in eukaryotes.

UNIT III TRANSCRIPTION 08

In prokaryotes and eukaryotes, features of promoters and enhancers, transcription factors, nuclear RNA splicing, ribozyme.

UNIT IV TRANSLATION 10

Elucidation of genetic code, mechanism, codon usage, suppressor mutation.

UNIT V REGULATION OF GENE EXPRESSION 07

phage life cycle, mutation and λLac and trp operon, repair of DNA

TOTAL PERIODS: 45

Text Books

1. David Friefelder, Molecular Biology, Narosa Publ. House. 1999
2. Benjamin Lewin, Gene VII, Oxford University Press. 2000

References

1. Watson JD, Hopkins WH, Roberts JW, Steitz JA, Weiner AM, Molecular Biology of the Gene. 1987.

CH2404 CHEMICAL REACTION ENGINEERING

4 Credits

Goal

To impart the basic understanding of Reaction engineering and the knowledge to choose the correct reactor system for the given reaction.

Objectives

The course should enable the student

- Learn the reaction kinetics and its calculation in the context of batch reaction.
- Study the design calculations for the flow reactors such as CSTR and PFR
- Learn the reaction kinetics involving multiple reactions in series and parallel
- Study the effects of temperature and pressure on the reaction kinetics
- Study the non-ideal conditions and the residence time distributions in flow reactions systems using various techniques such as E Curve, F Curve, and C Curve

Outcomes

The student should be able to

- Analyze the batch reactor systems
- Perform design calculations of CSTR and PFR
- Calculate the reaction conversions involving multiple reactions
- Determine the reaction conversions under non-isothermal conditions and the best reaction conditions to optimize the reaction
- Analyze the residence time distribution in a given flow reactor system.

UNIT I BATCH REACTORS **9**

Introduction and over view of the subject, kinetics of homogeneous reactions, non elementary reactions, Collision theory and Transition - state theory, volume Arrhenius relation, various methods of analysis of batch reactor data (including variable volume and variable pressure data). Isothermal batch reactor design.

UNIT II HOMOGENEOUS FLOW REACTORS **9**

Design equation for plug flow reactor (PFR) and continuous stirred tank reactor (CSTR), data analysis in flow reactors, Design of PFR, CSTR, cascade of CSTR's and combination for PFR and CSTR.

UNIT III MULTIPLE REACTIONS **9**

Design for multiple reactions, parallel reactions, series reactions (Omit reversible and series - parallel reaction).

UNIT IV TEMPERATURE AND PRESSURE EFFECTS **9**

Non - Isothermal design: Energy balance equations for batch, PFR and CSTR under non-isothermal conditions, Equilibrium conversion under adiabatic conditions, Design of the homogeneous reactors under adiabatic conditions.

UNIT V NON-IDEAL FLOW **9**

Residence time distribution curves E, F and C; Interpretation of the response data for the "Dispersion" and "Tanks - in series" Models (omit multi parameter models).

TOTAL:45

Text Book

1. Scott Fogler," Elements of Chemical Reaction Engineering" 2nd Edition Eastern Economy Edition

References

1. S. D. Dawande, Principles of Reaction Engineering,Central Techno Publications
2. Smith J. M., Chemical Engineering Kinetics, MGH, 2nd Edition
3. Levenspiel. O., Chemical Engineering, Wiley Eastern Ltd., 3rd Edition

Froment and Bischoff, Chemical Reactor Analysis and Design, Wiley

CH2431 CHEMICAL REACTION ENGINEERING LAB

2 Credits

Goal

Lab session to complement the theory portion of Chemical Reaction Engineering course

Objectives

The course should enable the students to

- Understand various reactor systems
- Importance of residence time and holding time
- Monitoring the rate of reactions in series/parallel arrangement of reactors
-

Outcomes

The students should be able to

- Determine the rate coefficients for multitude of reactor systems
- Interpret and analyze the data from reaction systems
- Identify the best possible arrangement of reactors vis-à-vis series/parallel/ or mixed types reactor systems

List of Experiments

1. Kinetic studies in a batch reactor

a) To determine the reaction conversion in saponification reaction

b) To determine the time taken for a specific conversion percentage for 2nd order kinetics

2. Kinetics a plug flow reactor
3. Kinetics in a PFR followed by a CSTR

4. RTD in a PFR
5. RTD in a packed bed
   RTD in CSTRs in series

List of Equipments

1. Batch Reactor with stirrer
2. Plug Flow Reactor (PFR)
3. CSTR
4. CSTRs in series
5. Combined PFR and CSTR

BT1253 MICROBIOLOGY LAB 0 0 4 2

Goal

The course aims to develop the student's skills in the preparation, identification and quantification of microorganisms.

Objectives

The course should enable the students to

- highlight the Laboratory safety and sterilization aspects
- Evaluate the various methods involved in identification of microorganisms
- Culturing and identifying microorganisms by various stains
- Know importance of microorganisms from different sources
- Learn kinetics of Antibiotic sensitivity assay
- evaluate Growth curve and the various parameters that may influence it

Outcome

The students should be able to

- identify the importance of Laboratory safety and sterilization aspects and also comply with it
- Easily identify common microorganisms
- Culture and identify microorganisms by using various stains
- Identify usefulness of microorganisms from different environmental sources
- Apply Antibiotic sensitivity assay to evaluate lethality
- Appraise the Growth curve of microbes and the parameters that may significantly influence

it

List of Experiments

1. Laboratory safety and sterilization techniques
2. Microscopic methods in the identification of microorganisms
3. Preparation of culture media – nutrient broth and nutrient agar
4. Culturing of microorganisms – in broth and in plates (pour plates, streak plates, isolation and preservation of bacterial cultures)
5. Staining techniques – grams' and differential
6. Quantitation of microorganisms.
7. Effect of disinfectants on microbial flora
8. Isolation and identification of microorganisms from different sources – soil, water and milk
9. Antibiotic sensitivity assay
10. Growth curve – observation and growth characteristics of bacteria and yeast.
11. Effect of different parameters on bacterial growth (ph, temperature & UV irradiation)

TOTAL PERIODS: 45

CH2433 COMPUTER PROGRAMMING LAB IN CHEMICAL ENGINEERING

2 Credits

Goal

To understand and write programs using commonly available software packages to do elementary calculations in Chemical Engineering

Objectives

The course should enable the students to

- Learn the basics of spreadsheet
- program (MS-EXCEL), and formulae to carry out various calculations
- Study the statistical functions available in MS-EXCEL
- Solve the interpolation, integration and differentiation problems

Outcomes

The students should be able to

- Perform various chemical process calculations using MS-EXCEL
- Set-up the statistical analysis in EXCEL to handle large amount of data
- Solve chemical engineering problems using mathematical solvers available in MS-EXCEL

List of Experiments

The following calculations need to be carried out using a spreadsheet program such as MS-EXCEL

1. Calculations of Density, Molecular weight, Mole and Percentage Composition of mixtures
2. Data Fitting and Regression Analysis
3. Statistical Analysis of Data
4. Numerical Interpolation
5. Numerical Integration
6. Numerical Differentiation

List of Equipment

1. Computers with Windows OS and MS-Office Programs

CH2434 PROJECT WORK

2 Credits

Goal

To do mini project to appreciate the concepts learned upto fourth semester

SEMESTER V

BT1304 GENETIC ENGINEERING 2 1 0 3

Goal

To impart basic knowledge in Genetic Engineering

Objectives

The course should enable the students to

- Fundamental knowledge of Biotechnology related to genetics
- To learn recombinant technology
- To learn about various genetic libraries
- To study about sequencing tools in Genetic Engineering
- To study about Human Genome project

Outcomes

The students should be able to

- Have a thorough knowledge of the use of Genetic Engineering as a tool in Biotechnology
- Have a thorough know-how of recombination events and vectors used therein
- Evaluate the difference between a genomic library and cDNA library
- Employability of Genetic Engineering tools such as PCR, RT-PCR, Inverse PCR, Nested PCR, Genome sequencing
- Application of Recombinant DNA technology in the post Human Genome era

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY 4

Role of genes within cells, genetic elements that control gene expression, restriction and modifying enzymes, safety guidelines of recombinant DNA research.

UNIT II CREATION OF RECOMBINANT MOLECULES 10

Restriction mapping, design of linkers and adaptors. Characteristics of plasmid and phage vectors, prokaryotic and eukaryotic expression vectors. Insect, Yeast and Mammalian vectors.

UNIT III CONSTRUCTION OF LIBRARIES 15

Construction of cDNA and genomic libraries. Screening of libraries with DNA probes and

with antisera.

UNIT IV POLYMERASE CHAIN REACTION 10

Inverse PCR, Nested PCR, Taqman assay, Molecular beacons, RACE PCR, RAPD, site directed mutagenesis, methods of nucleic acid sequencing- Sangers method, (Kunkel's Method).

UNIT V APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY 6

Cloning in plants, Ti plasmid, and transgenic and knockout animals.

TOTAL PERIODS: 45

Text Book

1. Old RW, Primrose SB, "Principles of Gene Manipulation, An Introduction To Genetic Engineering", Blackwell Science Publications, 1993.
2. Ansubel FM, Brent R, Kingston RE, Moore DD, "Current Protocols In Molecular Biology", Greene Publishing Associates, NY, 1988.

References

1. Berger Sl, Kimmer AR, "Methods In Enzymology", Vol. 152, Academic Press, 1987.

BT1303 BIOINFORMATICS 4 0 0 4

Goal

Aims at providing an elementary knowledge of bio informatics and its application

Objectives

The course should enable the students to

- Have fundamental knowledge about scope of Bioinformatics and the various search engines
- Database management and their use
- Introduction to sequence alignment and programming
- initiate Phylogenetic Tree analysis
- understand micro array data analysis

Outcomes

The students should be able to

- use search engines and design search algorithms
- Know how to use Biological Databases
- Distinguish between local and global alignment
- evaluate Phylogenetic Tree analysis
- evaluate micro array data analysis

UNIT I INTRODUCTION 9

Basic UNIX commands – telnet – ftp – protocols – hardware – topology -search engines – search algorithms.

UNIT II DATABASES 9

Data management – data life cycle – database technology – interfaces and implementation – biological databases and their uses

UNIT III PATTERN MATCHING & MACHINE LEANING9

Pairwise sequence alignment – local vs. global alignment – multiple sequence alignment – dot matrix analysis – substitution matrices – dynamic programming – bayesian methods – tools – BLAST – FASTA-Primer design- machine learning – neural networks – statistical methods – Hidden Markov models.

UNIT IV PHYLOGENY 9

Introduction; mutations; irrelevant mutations; controls; mutations as a measure of time; distances; reconstruction; distances between species; estimating time intervals from distances.

UNIT V ADVANCED TOPICS IN BIOINFORMATICS 9

Biomolecular and cellular computing – micro array analysis – systems biology.

TOTAL PERIODS: 45

Text Books

1. B. Bergeron, Bioinformatics Computing, PHI, 2002.
2. Westhead, D.R., Parish, J.H., Twyman, R.M., Instant Notes In Bioinformatics, BIOS Scientific Publishers, 2000.

Reference

1. C. Gibas & P. Jambeck, Developing Bioinformatics Skills, O'Reilly, 1999.

ENZYME ENGG. & TECHNOLOGY 3003

Goal

Aims at providing an elementary knowledge as well as theoretical concepts of enzymes and their application

Objectives

The course should enable the students to

- understand the different types of enzymes and their applications
- Have fundamental knowledge about enzyme catalysis, apoenzymes and metalloenzymes
- Distinguish between free and immobilised enzyme kinetics
- understand various Methods of production, Extraction and purification of enzymes
- Have technical know about instrumental techniques employed in enzymatic analysis

Outcomes

The students should be able to

- Understand the different types of enzymes and their applications
- Have fundamental knowledge about enzyme catalysis, apoenzymes and metalloenzymes
- Distinguish between free and immobilised enzyme kinetics
- understand various Methods of production, Extraction and purification of enzymes
- Have technical know about instrumental techniques employed in enzymatic analysis

UNIT 1 INTRODUCTION TO ENZYMES 8

Classification of enzymes, specificity of enzyme action – monomeric and oligomeric enzymes,-Factors modifying enzyme activity, biotechnological applications of enzymes and applications of enzymes in various industries.

UNIT 2 CHEMICAL NATURE OF ENZYME CATALYSTS 9

Structural Components of Enzymes – Structure, apoenzymes, prosthetic group, cofactors, Mechanisms of reactions catalysed by enzymes – Metal activated enzymes – metalloenzymes –involvement of co enzymes.

UNIT 3 FREE AND IMMOBILISED ENZYME KINETICS 10

Classification of enzymes, Kinetics of single substrate reactions, turnover number, Enzyme Inhibition, presteady state kinetics, Kinetics of multi-substrate reactions, Allosteric enzymes – The Monad – Changeux – Wyman model (MCW) and The Koshland – Nemethy – Filmer (KNF) model, Temperature and pH effects on enzyme activity. Methods of

immobilization of enzymes, Kinetics of immobilized enzymes – Effects of external mass transfer and intra – particle diffusion.

UNIT4 EXTRACTION AND PURIFICATION OF ENZYMES 9

Methods of production of enzymes, Extraction of Enzymes –soluble enzymes – membrane bound enzymes – Nature of extraction medium – purification of enzyme – criteria of purity– Determination of molecular weight of enzymes.

UNIT 5 INSTRUMENTAL TECHNIQUES IN ENZYMATIC ANALYSIS 9

Principles – Manometry – Spectrophotometry – Spectrofluorimetry – Electrochemical methods – Enthalpimetry – Radio chemical methods – Automation in enzymatic analysis.

TOTAL PERIODS: 45

Text Books

1. Enzymes by Trevor palmer
2. Enzymes by Robert A. Copeland, 2nd edition.
3.Biochemical Engineeringby Harwey W. Blanch and Douglas S. Clark

BT1302 BIOCHEMISTRY-II 4 0 0 4

Goal

Aims at providing an elementary knowledge in Biochemistry, with special emphasis on metabolizing - amino acids, nucleic acids, polysaccharide and lipids.

Objectives

The course should enable the students to

- Understand the Metabolic pathway of amino acids
- To impart knowledge about Protein transport and its degradation
- Study about metabolism of nucleic acids, polysaccharides and lipids
- Have fundamental knowledge about structural proteins and cytoskeleton
- To evaluate the kinetics of transport across Biomembranes

Outcomes

The students should be able to

- Be thorough about the Metabolic pathway of amino acids
- To appreciate the complex mechanism of Protein transport and its degradation
- Acquire requisite skills to appreciate the complex metabolism of nucleic acids, polysaccharides and lipids
- Eavaluate the role of cytoskeleton and structural proteins in maintaining cell integrity
- Understand the kinetics of transport across Biomembranes

UNIT I METABOLISM OF AMINO ACIDS 15

Metabolic pathways with examples-Biosynthesis of Gly,Ser and Cys-Essential amino-acids-Biosynthesis of aromatic acids-Important molecules derived from amino-acids (auxins, serotonin and polyamines).

UNIT II PROTEIN TRANSPORT AND DEGRADATION 5

Protein targeting, signal sequence, secretion; Folding, Chaperons and targeting of organelle proteins, Protein degradation, receptor-mediated endocytosis, turnover.

UNIT III METABOLISM OF NUCLEIC ACIDS, POLYSACCHARIDES AND LIPIDS 10

Biosynthesis of nucleotides- Degradation of nucleic acid by nucleases- Biosynthesis and degradation of starch - Biosynthesis and degradation of Lipids(phospholipids)-Cholesterol biosynthesis and regulation-Growth hormones.

UNIT IV STRUCTURAL PROTEINS AND CYTOSKELETON 5

Contractile proteins, Actin, myosin, actin polymerization, acto-myosin complexes, mechanism of myosin ATPase activity, excitation- contraction coupling and relaxation, microtubules, microfilaments and their role in organelle movements

UNIT V BIOMEMBRANE, TRANSPORT AND ELECTRICAL CONDUCTIVITY

10

Biomembranes-Active and passive Transport – Biomembrane agonists and antagonists as drugs-Ion channel defects (Cystic Fibrosis).

TOTAL PERIODS: 45

Text Books

1. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M Cox, Macmillan Worth Publisher
2. Lubert Stryer, Biochemistry, 4th Edition, WH Freeman & Co., 2000.

References

1. Voet and Voet, Biochemistry, 2nd Edition, John Wiley & Sons Inc., 1995.
2. Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell. V.W., Harper's Biochemistry, Prentice Hall International.
3. Creighton. T.E., Proteins, Structure and Molecular Properties, 2nd Edition, W.H. Freeman and Co., 1993.
4. Salway, J.G., Metabolism at a Glance, 2nd Edition, Blackwell Science Ltd., 2000.

BT1303 BIOPROCESS PRINCIPLES 3 0 0 3

Goal

To develop skills of the students in the area of Bio process Technology with emphasis on Bioprocess principles.

Objectives

The course should enable the students to

- To examine the history of fermentation industry and parameters to be monitored and controlled in fermentation process
- To evaluate the kinetics and thermodynamics of enzymatic process
- To impart knowledge about the principles of sterilization design
- To study the stoichiometry and energetics of cell growth and product formation
- To evaluate the kinetics and mechanism of microbial growth

Outcomes

The students should be able to

- Appreciate the history of fermentation industry
- Have fundamental knowledge about enzyme kinetics and thermodynamics of enzymatic reactions
- Be thorough with the principles of sterilization techniques
- Evaluate the stoichiometry of cell growth and product formation
- Understand various kinetics models for microbial growth

UNIT I OVERVIEW OF FERMENTATION PROCESSES 6

Overview of fermentation industry, general requirements of fermentation processes, basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

UNIT II RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS 8

Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods

UNIT III STERILIZATION TECHNIQUES 6

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous.

UNIT IV METABOLIC STOICHIOMETRY AND ENERGETICS 12

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION 13

Modes of operation - batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - leudeking-piret models, substrate and product inhibition on cell growth and product formation.

TOTAL PERIODS: 45

Text Books

1. Pauline Doran, “Bioprocess Engineering Calculation”, Blackwell Scientific Publications.
2. Shule and Kargi, “Bioprocess Engineering”, Prentice Hall, 1992.

References

1. Bailey and Ollis, “Biochemical Engineering Fundamentals”, McGraw-Hill (2nd Ed.), 1986.
2. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, “Principles of Fermentation Technology”, Science & Technology Books.
3. Harvey W. Blanch, Douglas S. Clark, “Biochemical Engineering”, Marcel Dekker, Inc.

BT1351 MOLECULAR BIOLOGY LAB 0 0 4 2

Goal

To develop the skills of student's by providing hands on practical training in Molecular Biology.

Objectives

The course should enable the students to

- Isolate plasmid DNA, genomic DNA and RNA
- Understand principle behind Gel Electrophoresis and restriction digestion of DNA
- Know how to prepare Competent Cells
- Comprehend how to undertake selection for recombinants
- Grasp what Phage titration is

List of Experiments

1. Isolation of bacterial DNA
2. Isolation of plant cell and animal cell genomic DNA
3. Agarose gel electrophoresis
4. Restriction enzyme digestion
5. Transformation and screening for recombinants
6. Agarose gel electrophoresis
7. Restriction enzyme digestion
8. Competent cells preparation
9. Blue and white colony selection for recombinants
10. Phage Titration

TOTAL PERIODS: 45

Reference Book

Sambrook et al "Molecular Cloning-A laboratory Manual"

BT1352 BIOPROCESS LAB - I 0 0 4 2

Goal

The course imparts skill development to students in the field of enzyme isolation, its assay,

enzyme kinetics and microbial fermentation.

Objectives

The students will be able to

- Culture bacteria and yeast
- Develop their practical skills in enzyme isolation and purification
- Evaluate enzyme kinetics and inhibition kinetics
- Carry out enzyme immobilized reaction and microbial culture

List of Experiments

1. Growth of bacteria – estimation of biomass, calculation of specific growth rate, yield coefficient
2. Growth of yeast – estimation of biomass, calculation of specific growth rate, yield coefficient
3. Medium optimization – plackett burman design
4. Medium optimization – response surface methodology
5. Enzyme kinetics – Michelis Menton parameters
6. Enzyme activity – effect of temperature and ph
7. Enzyme inhibition kinetics
8. Enzyme immobilization – gel entrapment
9. Enzyme immobilization – cross linking
10. Bioreactor Operations.

EL 2431 COMMUNICATION SKILLS & PERSONALITY DEVELOPMENT

L T P C 2 0 2 3

Goal

The goal of the programme is to provide the learners with the methods and materials required for becoming accomplished personalities through the medium of English.

Objectives

The course is expected to enable students to:

1. Be aware of self-knowledge by exposure to soft skills, values, behaviour, attitudes, temperamental changes, and a positive attitude to life.
2. Learn personality traits and undergo personality tests to determine their own personality characteristics and the scope for improvement.
3. Cultivate the art of speaking fluently making use of proper gestures, tone and voice

modulation, adding humour to the speech.

4. Figure out the need to work in teams, adorn or accept team leadership, and make use of body language to enhance team spirit.
5. Be familiar with the art of managing self, people, work and time, keeping in mind problems like time-wasters and stress-builders.

Outcome

On completion of the course, the students will be able to:

1. Apply the knowledge gained to improve upon their values, behaviour, attitude, and develop the soft skills required for home, workplace and the society.
2. Employ the concept of personality traits and build up an accomplished personality that would be pleasing to people around so as to influence them positively.
3. Develop a personal style and communicate fearlessly and effectively in a convincing manner so as to impress listeners or the audience.
4. Participate in presentations, group discussions, debates and mock interviews making good use of language skills and interpersonal relationships.
5. Comprehend stress-management tips to overcome stress-prone habits and develop a career plan with personal, familial and societal goals for success.

UNIT I **12**

Values and attitudes - Value-formation - Values & education - Terminal & Instrumental values - Civic responsibilities - The power of Personal/ Cultural/ Social valves -- Behaviour and attitudes -- Features of attitudes - Developing positive attitude - Overcoming negative attitude -- People skills - Soft skills as per the Work Force Profile - The four temperaments - Sanguine - Choleric - Melancholic - Phlegmatic -- Tests for Personal Chemistry.

UNIT II **12**

What is personality development? - Types of personalities as per (i) Heredity (ii) Environment (iii) Situation - the 16 personality factors - MBTI Tests - Personality types - Increasing self-awareness: Assessing one's locus of control, Machiavellianism, self-esteem, self-monitoring, risk-taking, Type A, Type B personality elements - Intellectual and physical abilities for jobs -- Personality tests.

UNIT III **12**

Developing the art of speaking - How to get rid of stage fright? - Enhancing fluency - Modulating voice

- Enunciation - Positive and negative gestures - Preparation - How to begin? - How to convince the listeners? - How to wind up the speech? - Adding humour and illustration -

Developing one's own style

- Types of style - How to influence the audience? - How to become an effective speaker? -- Tests for effective speaking.

UNIT IV **12**

Team work - Team building - Team leadership -- How to face an interview? -- How to participate in a group discussion? - How to argue for or against in a debate? - Body language - Non-verbal communication - Personal appearance - Facial expression - Posture - Gestures - eye contact - Etiquette - Voluntary and involuntary body language - Gender implications -- Tests.

UNIT V **12**

Managing self, people, work, situations - Time-management - Secrets of time-management - Time-wasters - Stress -- Kinds of stress - Spotting stress - Stress-builders - Stress - management tips - Stress-prone habits -- Goals - Career planning - Interpersonal interaction - Interpersonal relationships -- Tests.

References:

1. Burlington, V.T. Group Interaction in High Risk Environments. Ashgate Publication, 2004.
2. Fisher, Kimball. Leading Self-directed Work Terms: A Guide to Developing New Team Leadership Skills. New York, NY: McGraw Hill, 2000.
3. Ted W. Engstrom and R. Alec Mackenzie. Managing Your Time: Practical Guidelines on the Effective Use of Time. 2008.
4. Burnard, Philip. Training Games for Interpersonal Skills. McGraw Hill, Inc., New York, 1992.
5. Greenwich, Carolyn. The Fun Factor, McGraw Hill, Inc., New York, 1997.

- **Study material will be prepared by the Department of Languages.**
- **Tests suggested will be prepared by a senior faculty of the department.**
- **Movies will be screened to discuss and debate on the topics introduced in each unit.**

SEMESTER VI

MA 1214 PROBABILITY AND STATISTICS 3 1 0 4

Goal

The Scope of this course aims at providing requisite skills to apply the statistical tools in Engineering problems.

Objectives

The course is expected to enable students to:

- Have a fundamental knowledge of the Probability and Random Variables
- Learn the concepts of Standard distribution
- Understand the applications of Two-Dimensional Random Variables
- Comprehend the need for Testing of Hypothesis
- Understand the concept of Analysis of variance in various experimental set ups

Outcome

On completion of the course, the students will be able to:

- Acquire skills in handling Probability and Random Variables
- Undertake Standard distributions of given data
- Evaluate Co-variance, Correlation and Regression analysis of given data
- Apply normal, T, Chi-square and F distribution Tests to given biological data
- Estimate Analysis of variance of the given data

UNIT – I: Probability and Random Variables 9

Axioms of Probability – Conditional Probability – Total Probability – Baye's Theorem – Random variable – Probability mass function – Probability Density functions – Properties – Moments – Moment generating functions and their properties.

UNIT – II: Standard distributions 9

Binomial, Poisson , Geometric, Negative binomial, Uniform, Exponential, Gamma, Weibull and normal distributions and their properties – Functions of Random Variables.

UNIT – III: Two-Dimensional Random Variables 9

Joint distribution – Marginal and conditional distribution - Co-variance – Correlation and Regression – Transformation of Random Variables – Central Limit Theorem.

UNIT – IV: Testing of Hypothesis 9

Sampling distributions – Testing of Hypothesis for mean, Variance, Proportions and

differences using normal, t, Chi-square and F distribution – Tests for Independence of attributes and goodness of fit.

UNIT – V: Designs of Experiments **9**

Analysis of variance one way classification CRD – Two way classification RBD – Latin square.

TOTAL PERIODS: 45

Text Books

1. Kandasamy, "Probability and Statistics", S. Chand & Co, Latest Edition
2. Sivaramakrishna Dass, "Probability and Statistics, Viji Academy, Latest Edition.

Reference Books

1. M.B.K. Murthy, "Probability and Statistics", V.R.B., Publishers, Latest Edition.
2. T. Veerarajan "Probability and Statistics", Tata McGraw Hill, New Delhi, Latest Edition.

CH2602 MASS TRANSFER - 1

4 Credits

Goal

To make the students understand the mechanisms of Mass Transfer in unit operations

Objectives

The course should enable the students to

- Learn the basics of diffusion and the empirical laws that govern diffusion
- Understand the analogies between momentum, mass and heat transfer, the concept and importance of mass transfer coefficient
- Understand the basics of humidification, construction and use of psychrometric charts
- Understand the mass transfer mechanism in the drying operation
- Understand the mechanism of mass transfer and crystal growth in crystallization of solids from a solution

Outcomes

The students should be able to

- Perform preliminary calculations related to diffusion and to appreciate mass and

molar flux

- Calculate the mass transfer coefficient for a given system
- Design humidification equipment
- Perform drying calculations for the design of driers
- Carry out calculations related to design of crystallizer

UNIT-I DIFFUSION **9**

Molecular and Eddy diffusion, Fick's Law, Measurement and calculation of diffusivity, Diffusion in Multi-component gaseous mixtures, Diffusion in solids and its applications, Steady state diffusion under stagnant and laminar flow conditions.

UNIT-II MASS TRANSFER CO-EFFICIENT **9**

Concept of mass transfer co-efficient, Mass transfer under laminar and turbulent flow, Theories of mass transfer and their applications, Boundary layer, Correlation of mass transfer co-efficient, Analogies between momentum, heat and mass transfer, Interphase and overall mass transfer co-efficient in binary and Multi-component systems, jd factor.

UNIT-III HUMIDIFICATION **9**

Basic concepts, psychrometric charts, Methods of humidification and de-humidification, Design calculation, Cooling Towers principle and operation, equipments.

UNIT-IV DRYING **9**

Theory and mechanism of drying, Drying characteristics, Design and performance of Batch and Continuous Drying, Estimation of Drying rates, equipments.

UNIT-V CRYSTALLIZATION **9**

Theory of Crystallization, Factors governing nucleation and crystal growth, Growth coefficient, Applications, Batch and Continuous crystallizers, Industrial Crystallizer.

TOTAL PERIODS: 45

TEXT BOOK:

1. Treybal, R.E, Mass Transfer Operations - McGraw Hill.

REFERENCE BOOKS:

1. McCabe and Smith, Unit Operations of Chemical Engineering, McGraw Hill.
2. J.M. Coulson and J.F. Richardson, Chemical Engineering Vol - II, Pergamon Press.
3. T.K. Sherwood, R.L. Pigford and C.R. Wilke, Mass Transfer, McGraw Hill.

BT1304 BIOPROCESS ENGINEERING 4 0 0 4

Goal

This course aims to develop the skills of the students in the area of Bioprocess Engineering.

Objectives

The course should enable the students to

- Understand in depth about Stirred tank reactor
- Study about various other reactors
- Comprehend Bioreactor scale up
- Know the fundamentals of modelling and simulations of bio process
- Examine the various Designs of enzyme reactors

Outcomes

The students should be able to

- Appreciate the use of Stirred tank reactor
- Have thorough knowledge about the other reactors
- Be aware of design concepts in Bioreactor processes scale up
- Evaluate the stoichiometry of cell growth and product formation
- Understand various kinetic models of enzyme bioreactors

UNIT I ANALYSIS OF STR 8

Stirred tank reactor - non-ideality, RTD and stability analysis, tanks in series and dispersion models – application to design of continuous sterilizer.

UNIT II ANALYSIS OF OTHER CONFIGURATIONS 8

Packed bed reactor, airlift reactor, fluidized bed reactor bubble column reactors – non-ideality, RTD and stability analysis.

UNIT III BIOREACTOR SCALE – UP 9

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors - microbial oxygen demands; methods for the determination of mass transfer coefficients; mass transfer correlations. Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed.

UNIT IV MODELLING AND SIMULATION OF BIOPROCESSES 12

Study of structured models for analysis of various bioprocess – compartmental models, models

of cellular energetics and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch, fed batch, steady and transient culture metabolism.

UNIT V BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS 8

Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions; formulation of dimensionless groups and calculation of effectiveness factors. Design of immobilized enzyme reactors – packed bed, fluidized bed and membrane reactors.

TOTAL PERIODS: 45

Text Books

1. Anton Moser, "Bioprocess Technology", Kinetics and Reactors", Springer Verlag.
2. James E. Bailey & David F. Ollis, "Biochemical Engineering Fundamentals", McGraw-Hill.

References

1. James M. Lee, "Biochemical Engineering", PHI, USA.
2. Atkinson, "Handbook of Bioreactors",
3. Harvey W. Blanch, Douglas S. Clark, "Biochemical Engineering", Marcel Decker Inc.

BT1305 PROTEIN ENGINEERING 3 0 0 3

Goal

The course imparts advanced knowledge on proteins through a detailed study of protein structure, its characteristics property and significance in biological systems.

Objectives

The course should enable the students to

- Understand how proteins are made and the various bonds involved therein
- Learn in depth about amino acids
- Study about protein architecture – Primary, Secondary, Tertiary and Quaternary structure
- Comprehend about DNA-binding proteins, transcription factors, Immunoglobulins and Enzymes
- Know the fundamentals of bio processes involved in producing recombinant protein

Outcomes

The students should be able to

- Enumerate how proteins attain their stable structure
- Cognizant about all amino acids and their properties
- Aware of protein architecture - Primary, Secondary, Tertiary or Quaternary structure
- Specify the numerous DNA-binding proteins, transcription factors and the role they play in gene expression
- Be thorough about the underlying principles involved in making recombinant proteins

UNIT I BONDS AND ENERGIES IN PROTEIN MAKEUP 5

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure.

UNIT II AMINO ACIDS AND THEIR CHARACTERISTICS 5

Amino acids (the students should be thorough with three and single letter codes) and their molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups) and peptide synthesis.

UNIT III PROTEIN ARCHITECTURE 12

Primary structure: peptide mapping, peptide sequencing - automated Edman method & mass-spec. High-throughput protein sequencing setup Secondary structure: Alpha, beta and loop structures and methods to determine, Super-secondary structure: Alpha-turn-alpha, beta-turn-beta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and down & TIM barrel structures nucleotide binding folds, prediction of substrate binding sites. Tertiary structure: Domains, folding, denaturation and renaturation, overview of methods to determine 3D structures, Quaternary structure: Modular nature, formation of complexes.

UNIT IV STRUCTURE-FUNCTION RELATIONSHIP 15

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins: General characteristics, Trans-membrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes: Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate-assisted catalysis other commercial applications.

UNIT V PROTEIN ENGINEERING **8**

Advantages and purpose, overview of methods, underlying principles with specific examples: thermal stability T4-lysozyme, recombinant insulin to reduce aggregation and inactivation, de novo protein design.

TOTAL PERIODS: 45

Text Books

1. Voet D. and Voet G., "Biochemistry", Third Edn. John Wiley and Sons, 2001
2. Branden C. and Tooze J., "Introduction to Protein Structured, Second Edition", Garland Publishing, NY, USA, 1999

References

1. Creighton T.E., " Proteins", Freeman WH, Second Edition, 1993
2. Moody P.C.E. and Wilkinson A.J. "Protein Engineering", IRL Press, Oxford, UK, 1990.

BT1421 PLANT BIOTECHNOLOGY 3 0 0 3

Goal

To develop the skills of the students in the area of Plant Biotechnology.

Objectives

The course should enable the students to

- Understand in depth about the role of DNA in plant cells
- Learn in depth about chloroplast and mitochondria
- Study about Nitrogen Fixation in legumes
- Comprehend about Ti plasmid pathogenesis and Viral Vectors
- Know the fundamentals of transgenesis

Outcomes

The students should be able to

- Distinguish between transcription and translation
- Ascertain what organelles such as chloroplast and mitochondria do within a cell
- Appreciate the process of Nitrogen Fixation and what benefit it has to the N cycle

- Utilise the *Agrobacterium* and other Viral Vectors for gene delivery
- Do tissue culture and raise transgenic plants also

UNIT I ORGANIZATION OF GENETIC MATERIAL 9

Genetic material of plant cells – nucleosome structure and its biological significance; junk and repeat sequences; outline of transcription and translation.

UNIT II CHLOROPLAST & MITOCHONDRIA 9

Structure, function and genetic material; rubisco synthesis and assembly, coordination, regulation and transport of proteins. Mitochondria: Genome, cytoplasmic male sterility and import of proteins.

UNIT III NITROGEN FIXATION 9

Nitrogenase activity, nod genes, nif genes, bacteroids.

UNIT IV AGROBACTERIUM & VIRAL VECTORS 9

Pathogenesis, crown gall disease, genes involved in the pathogenesis, Ti plasmid – t-DNA, importance in genetic engineering. Viral Vectors: Gemini virus, cauliflower mosaic virus, viral vectors and its benefits.

UNIT V APPLICATION OF PLANT BIOTECHNOLOGY 9

Outline of plant tissue culture, transgenic plants, herbicide and pest resistant plants, molecular pharming, theraputic products.

TOTAL PERIODS: 45

Text Books

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, Narosa Publications. 1995.
2. Singh BD. Text Book of Biotechnology, Kalyani Publishers. 1998

References

1. Heldt HW. Plant Biochemistry & Molecular Biology, Oxford University Press. 1997.
2. Ignacimuthu .S, Applied Plant Biotechnology, Tata McGraw-Hill. 1996.

BT1420 ENVIRONMENTAL BIOTECHNOLOGY 3 0 0 3

Goal

The course imparts knowledge about microorganisms present in the environment and how to utilise them for pollution abatement.

Objectives

The course should enable the students to

- Learn the fundamentals of microorganisms
- Know about how degradation of Xenobiotic compounds can be initiated by microbes
- Study about waste water treatment using conventional methods as well as microbes
- Comprehend about treating industrial waste as well as solid waste using microbes
- Know the fundamentals of bioremediation

Outcomes

The students should be able to

- Have thorough knowledge about microorganisms
- Enumerate on the degradation of Xenobiotic compounds by microbes
- Treat waste water using microorganisms
- Be familiar with the conventional industrial waste and Solid waste treatment technologies
- Utilise bioremediation as an appropriate technology for environmental clean-up

UNIT I FUNDAMENTALS OF MICRO-ORGANISMS 9

Microbial flora of soil, growth, ecological adaptations, interactions among soil microorganisms, biogeochemical role of soil microorganisms.

UNIT II DEGRADATION OF XENOBIOTIC COMPOUNDS 9

Simple aromatics, chlorinated polyaromatic petroleum products, pesticides and surfactants.

UNIT III INDUSTRIAL WASTE WATER MANAGEMENT 9

Waste water characteristics, biological waste water treatment, unit operations, design and modeling of activated – sludge process, mathematics modeling of anaerobics – digested dynamics.

UNIT IV TREATMENT OF INDUSTRIAL WASTES 9

Dairy, pulp, dye, leather and pharamaceuticals, solid waste management.

UNIT V BIOREMEDIATION 9

Latest elements, developments pertaining to environmental biotechnology.

TOTAL PERIODS: 45

Text Books

1. Stanir R.Y., Ingraham.J.L., Wheelis.M.L., Painter R.R., general Microbiology, McMillan Publications, 1989.
2. Foster C.F., john Ware D.A., environmental Biotechnology, Ellis Honwood Ltd., 1987.

Reference

1. Karnely D., Chakrbarty.K., Omen G.S., biotechnology and Biodegradation, Advances in Applied Biotechnology Series, Vol, Gulf Publications Co., London, 1989.

CH2631 MASS TRANSFER LAB

2 Credits

Goal

To carry out experiments in determining various mass transfer parameters

Objectives

The course should enable the students to

- Importance of separation process
- Apply the concepts of mass transfer operations introduced in the theory component
- Identify the best tools for separating mixtures

Outcomes

The students should be able to

- To determine the Diffusion coefficients of simple gases and liquids
- Appreciate the importance of separating mixtures in an economical way
- Identify the Best possible separating method with the given parameters

List of Experiments

1. Measurement of Diffusion coefficient
2. Simple distillation
3. Steam distillation
4. Leaching
5. Packed bed distillation column
6. Determination of thermal conductivity of metal bar using Fourier's equation

List of Equipment

1. Diffusion Experiment Set-up
2. Simple Distillation Set-up
3. Steam Distillation Device
4. Leaching Equipment
5. Packed Bed Distillation Column Set-up
6. Thermal conductivity metal bar with measuring devices

BT1354 BIOPROCESS LAB II 0 0 6 2

Goal

The course imparts skills to students in the field of Bioreactors and how to use them for practical applications.

Objectives

The course should enable the students to

- Learn the fundamentals of Batch cultivation
- Acquire the fundamentals of how to Estimate kla
- Know about Residence time distribution
- Study about heat transfer coefficient and its significance
- Comprehend what Enzyme Decay is

Outcomes

The students should be able to

- Undertake Batch cultivation
- Have thorough knowledge about how to Estimate kla
- Comprehensively Enumerate on the Residence time distribution
- Be familiar with estimating heat transfer coefficient
- Estimate Enzyme Decay of a given reaction

List of Experiments

1. Batch cultivation, estimation of kla – dynamic gassing method, exhaust gas analysis – carbon balancing, gas balancing.
2. Estimation of kla – sulphite oxidation method
3. Estimation of kla – power correlation method
4. Residence time distribution
5. Estimation of overall heat transfer coefficient
6. Enzyme Decay (Reactivity with time)

TOTAL PERIODS: 45

CH2634 INDUSTRIAL TRAINING

2 Credits

Goal

To do mini project in an industry to appreciate the concepts learned up to sixth semester.

SEMESTER VII

BT1401 DOWNSTREAM PROCESSING 3 1 0 4

Goal

The course imparts knowledge to students in the field of downstream processing involving products isolation, purification and final formulation.

Objectives

The course should enable the students to

- Learn the fundamentals of downstream processing and how cell can be disrupted
- Study about Unit operations for solid-liquid separation
- Be familiar with the conventional methods of products isolation
- Well versed with various methods of product purification
- Know the fundamentals of in final product formulation

Outcomes

The students should be able to

- Have thorough knowledge about cell disruption and subsequent downstream processing
- Be thorough with Unit operations for solid-liquid separation
- Reckon how products isolation is done
- Be familiar with the conventional methods of products isolation
- Gauge final product formulation

UNIT I DOWNSTREAM PROCESSING 9

Introduction to downstream processing principles characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pretreatment and stabilisation of bioproducts.

UNIT II PHYSICAL METHODS OF SEPERATION 9

Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III ISOLATION OF PRODUCTS 9

Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

UNIT IV PRODUCT PURIFICATION **9**

Chromatography – principles, instruments and practice, adsorption, reverse phase, ion-exchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques.

UNIT V FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS **9**

Crystallization, drying and lyophilization in final product formulation.

TOTAL PERIODS: 45

Text Books

1. P.A. Belter, E.L. Cussler And Wei-Houhu – Bioseparations – Downstream Processing For Biotechnology, Wiley Interscience Pub. (1988).
2. R.O. Jenkins, (Ed.) – Product Recovery In Bioprocess Technology – Biotechnology By Open Learning Series, Butterworth-Heinemann (1992).

References

1. J.C. Janson And L. Ryden, (Ed.) – Protein Purification – Principles, High Resolution Methods And Applications, VCH Pub. 1989.
2. R.K. Scopes – Protein Purification – Principles And Practice, Narosa Pub. (1994).

BT **BIOSEPARATION TECHNOLOGY** **3 0 0 3**

Goal

The course provides an opportunity to understand the importance of the Bioseparation process, economics and process design criteria for various classes of bio products.

Objectives

The course should enable the students to

- Learn the fundamentals of Bioseparation process in biotechnological context
- Study about how cell can be disrupted
- Be familiar with the conventional methods of products isolation- filtration, precipitation and extraction
- Well versed with various methods of product purification- chromatography and electrophoresis
- Know the fundamentals product crystallisation and drying

Outcomes

The students should be able to

- Have thorough knowledge about cell disruption and subsequent downstream processing
- Be thorough with Unit operations for solid-liquid separation
- Reckon how products isolation is done
- Be familiar with the conventional methods of products isolation
- Gauge final product formulation

UNIT 1 INTRODUCTION TO BIOSEPARATION PROCESS 9

Role and importance of Bioseparation process in biotechnological processes. Problems and requirements of bioproduct purification. Cost- cutting strategies Characteristics of biological mixtures – Process of Classification of Bioproducts -Biological activity Analysis of purity-Process economics-Capital and operating cost analysis

UNIT 2 CELL DISRUPTION AND SEDIMENTATION 9

Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

UNIT 3 FILTRATION, PRECIPITATION AND EXTRACTION 9

Membrane based separations micro and ultra filtration theory, design and configuration of membrane separation equipment, applications, precipitation methods (with salts, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction),in situ product removal.

UNIT 4 CHROMATOGRAPHY AND ELECTROPHORESIS 9

Adsorptive chromatographic separation processes, gel permeation chromatography, all electrophoresis techniques including capillary electrophoresis, hybrid separation technologies-membrane chromatography, electro chromatography. –HPLC

UNIT 5 PRODUCT CRYSTALLISATION AND DRYING 9

Crystallisation.-Principles-Nucleation-Crystal growth-Kinetics-Batch crystallizers-Process crystallizers of proteins-Scale-up and design- Drying –Principles-Water in biological solids-Heat and mass transfer-Dryer description and operation-Vacuum shelf and rotary dryer-Freeze dryer-Spray dryer-Scale-up and design-spreadsheet and simulators.

TOTAL PERIODS: 45

Text Books

1. Roger G Harrison et al "Bioseparation Science and Engineering" Oxford University Press, 2003

2. Belter PA and Cussler E, "Bioseparations", Wiley 1985

Reference Books

1. Wankat P.C, "Rate controlled separations", Elsevier, 1990

2.Asenjo J.M., "Separation processes in Biotechnology" Marcel Dekker Inc. 1993.

BT1402 IMMUNOLOGY 3 1 0 4

Goal

The course introduces the students to the field of immunology- a mechanisms by which a human body interacts with a pathogenic microbe and finally eliminates it.

Objectives

The course should enable the students to

- Learn the fundamentals of immune system
- Know about how cellular responses occur in cells
- Study about immune responses to infections, immunosuppression and Immunodeficiencies
- Ascertain genetics of transplantation
- Know the fundamentals of autoimmune disorders and diagnosis.

Outcomes

The students should be able to

- Have thorough knowledge about immune system
- Enumerate on the various cellular responses occurring within the cells
- Fathom how human body responds to infections, immunosuppression and Immuno-deficiencies
- Be familiar with transplantation and the pro and cons of it
- How to diagnose Autoimmune disorders

UNIT I INTRODUCTION **9**

Cells of immune system; innate and acquired immunity; primary and secondary lymphoid organs; antigens: chemical and molecular nature; haptens; adjuvants; types of immune responses; theory of clonal selection.

UNIT II CELLULAR RESPONSES **10**

Development, maturation, activation and differentiation of T-cells and B-cells; TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions; monoclonal antibodies: principles and applications; antigen presenting cells; major histocompatibility complex; antigen processing and presentation; regulation of T-cell and B-cell responses.

UNIT III INFECTION AND IMMUNITY **11**

Injury and inflammation; immune responses to infections: immunity to viruses, bacteria, fungi and parasites; cytokines; complement; immunosuppression, tolerance; allergy and hypersensitivity; AIDS and Immunodeficiencies; resistance and immunisation; Vaccines.

UNIT IV TRANSPLANTATION AND TUMOR IMMUNOLOGY **9**

Transplantation: genetics of transplantation; laws of transplantation;; tumor immunology.

UNIT V AUTOIMMUNITY **6**

Autoimmunity, Autoimmune disorders and diagnosis.

TOTAL PERIODS: 45

Text Books

1. Roitt I, Male, Brostoff. Immunology, Mosby Publ., 2002.
2. Kuby J, Immunology, WH Freeman & Co., 2000.
3.

Reference

1. Ashim K. Chakravarthy, Immunology, Tata McGraw-Hill, 1998.

CH2754 PRINCIPLES OF FOOD PROCESSING **3**
Credits

Goal

To make the students aware of role of chemical engineering in the food processing industry

Objectives

The course should enable the students to

- Learn the characteristics and functions of constituents of food
- Understand the intentional and unintentional additives and their roles in the food processing
- Understand the use of various microorganisms in food processing and preservation
- Study various ways in which food can be spoiled and the diseases caused by spoiled food
- Learn the important techniques employed in food preservation

Outcomes

The students should be able to

- Figure out the relationship between the food constituents and their energy levels
- Determine the pros and cons of various food additives
- Analyze the process of food processing and preservation using appropriate microorganism
- Suggest steps to prevent food spoilage
- Employ the correct method of food preservation to improve the shelf life of food products

UNIT I FOOD AND ENERGY 9

Constituents of food - carbohydrates, lipids, proteins, water, vitamins and minerals, dietary sources, role and functional properties in food, contribution to organoleptic and textural characteristics.

UNIT II FOOD ADDITIVES 9

Classification, intentional and non-intentional additives, functional role in food processing and preservation; food colourants - natural and artificial; food flavours; enzymes as food processing aids.

UNIT III MICROORGANISMS ASSOCIATED WITH FOOD 9

Bacteria, yeasts and molds - sources, types and species of importance in food processing and preservation; fermented foods and food chemicals, single cell protein.

UNIT IV FOOD BORNE DISEASES 9

Classification - food infections - bacterial and other types; food intoxications and poisonings - bacterial and non-bacterial; food spoilage - factors responsible for spoilage, spoilage of vegetable, fruit, meat, poultry, beverage and other food products.

UNIT V FOOD PRESERVATION 9

Principles involved in the use of sterilization, pasteurization and blanching, thermal death curves of microorganisms, canning; frozen storage-freezing characteristics of foods, microbial activity at low temperatures, factors affecting quality of foods in frozen storage;

irradiation preservation of foods.

TOTAL PERIODS: 45

Text Books

1. T.P. Coultate - Food - The Chemistry Of Its Components, 2nd Edn. Royal Society, London, 1992.
2. B. Sivasanker - Food Processing And Preservation, Prentice-Hall Of India Pvt. Ltd. New Delhi 2002.

References

1. W.C. Frazier And D.C. Westhoff - Food Microbiology, 4th Ed., McGraw-Hill Book Co., New York 1988.
2. J.M. Jay - Modern Food Microbiology, CBS Pub. New Delhi, 1987

BT1435 BIOPROCESS ECONOMICS AND PLANT DESIGN 3 0 0 3

Goal

The course introduces the students to Business organizations, project design and development, Economics of plant Design and Quality control requirements.

Objectives

The course should enable the students to

- Learn the fundamentals of Bio Process Economics and Management Principles
- Know about how to choose a Project, design and develop it further
- Study about cost estimation, profitability and accounting in a project
- Ascertain how to undertake Optimum design Strategy
- Know about good manufacturing practices and Quality Control measures

Outcomes

The students should be able to

- Have thorough knowledge about Bio Process Economics and Management Principles
- Design a Project and develop it further
- Fathom how to undertake cost estimation, profitability and accounting in a project
- Be familiar with optimization of design strategy
- How to diagnose Autoimmune disorders

UNIT I PROCESS ECONOMICS AND BUSINESS ORGANIZATIONS 10

Definition of Bio Process, Bio Process Economics, Importance of various M-inputs-Globalization concept-Competition by Dumping-It's effect on Plant size-Status of India with adjoining ASEAN countries (Singapore, Malaysia, Indonesia etc)-Project profile concept-details; Structure and Types of Organizations; Simple Management Principles.

UNIT II PROJECT DESIGN AND DEVELOPMENT 10

Choosing a Project, Market Survey, Importance of Techno-Economic-Viability Studies, Sourcing of Processes, Process alternatives, Fixing most economic processes, Technology-Scanning, Plant Location Principles, Plant Lay out, Process Flow sheets, Preparation of Budgetory investment and production costs.

UNIT III COST ESTIMATION, PROFITABILITY AND ACCOUNTING 10

Capital investment, Concept of time-Value of money, Source Sink concept of Profitability, Capital Costs, Depreciation, Estimation of Capital costs, Manufacturing Costs, Working Capital; Profitablity Standards, Project profitability evaluation, Alternative investments and Replacements; Annual reports, Balance Sheets, Performance Analysis.

UNIT IV PROCESS OPTIMIZATION TECHNIQUES 6

Optimum design-Design Strategy, Economic-Balance, Different unit-Operations with Single and Multiple Variables.

UNIT V QUALITY AND QUALITY CONTROL 9

Current good manufacturing practices. Concepts of Quality Control in 20th century; Elements of quality control envisaged by ISI since 1947; Emergence of Statistical Process Control (SPC), Simple SPC concept details, Fundamental Concepts of ISO 9000 Quality System and the various requirements for ISO certification.

TOTAL PERIODS: 45

Text Books

1. Peters M.S., Klaus D. Plant Design and Economics for Chemical Engineers. McGraw-Hill International Edition, Chemical Engineering series, 1991.

2. Senapathy R. Text Book of Principles of Management and Industrial Psychology. Lakshmi Publications, 2001.

Reference

1. Rudd and Watson. Strategy for Process Engineering, Wiley Publications.1987.

Elective - -I

Please follow the list of electives given at the last

BT1451 ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY 0 0 4 2

(Demonstrations & Seminar)

Goal

The course imparts requisite skills to students in the field of basic biotechnology.

Objectives

The course should enable the students to

- Learn about the various types of centrifugation
- Know about various methods of Chromatography
- Study about SDS PAGE
- Comprehend about different Immunological techniques
- Cognizant about RFLP & DNA sequencing
- Familiar with operating a pilot fermentor

Outcomes

The students should be able to

- Have thorough knowledge about centrifugation
- Enumerate on the various methods of Chromatography
- Be familiar with the conventional SDS PAGE
- Utilise ELISA and monoclonal antibodies as Immunological detection techniques
- Undertake Electroporation of Cells
- Use RFLP and DNA fingerprinting techniques to identify complexity in genome
- Successfully run a Fermentor

List of Experiments

1. Principles of Various types of centrifugation
2. Principles of Chromatography: TLC Paper & Silica, Column –Silica and Alumina, HPLC
3. Principles of SDS PAGE
4. Principles of Immunological techniques – ELISA, Cell identification using monoclonal

antibodies & PCR FACS.
5. Principles of electroporation, RFLP & DNA sequencing.
6. Running of a pilot fermentor.

TOTAL PERIODS: 45

Reference

1. Readings in Scientific American, W.H. Freeman, 1985-1993.

BT1452 DOWNSTREAM PROCESSING LAB 0 0 4 2

Goal

The course imparts hands on training in downstream processing, through simple experiments.

Objectives

The course should enable the students to

- Learn the fundamentals of centrifugation, microfiltration
- Know about how cells can be disrupted
- Study about ultrafiltration separation techniques
- Understand how aqueous two phase extraction of biological is done
- Learn about affinity chromatography, ion exchange chromatography, gel filtration chromatography
- Know the fundamentals of Product polishing

Outcomes

The students should be able to

- Have thorough knowledge about centrifugation, microfiltration
- Disrupt cells easily for further processing
- Comprehend and employ ultrafiltration separation techniques
- Be familiar with the aqueous two phase extraction of biological entities
- Undertake various chromatography techniques with ease- affinity, ion exchange and gel filtration chromatography
- Utilise Product polishing methods for getting final product

List of Experiments

1. Solid liquid separation – centrifugation, microfiltration
2. Cell disruption techniques – ultrasonication, French pressure cell
3. Cell disruption techniques – dyno mill – batch and continuous
4. Precipitation – ammonium sulphite precipitation
5. Ultra filtration separation
6. Aqueous two phase extraction of biologicals
7. High resolution purification – affinity chromatography
8. High resolution purification – ion exchange chromatography
9. Product polishing – gel filtration chromatography
10. Product polishing – spray drying, freeze drying

SEMESTER VIII

MG2002 TOTAL QUALITY MANAGEMENT 3 Credits

Goal

To teach the importance of quality in industry and various methods and tools of quality management

Objectives

The course should enable the students to

- Understand the basics of quality and its management
- Learn various principles aimed at maintaining TQM (Total Quality Management)
- Understand the concept of Statistics and its usefulness in different process control techniques
- Study and understand different tools used in quality control
- Understand the various aspects of ISO

Outcomes

The students should be able to

- Acquire basics of quality and various methods involved in it
- Achieve the quality targets using various Total Quality Management principles
- Use statistical process control techniques to achieve the set quality goals
- Use various Quality Control Tools aimed at improves quality
- Execute the implementation of ISO in the organization

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership - Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES 9

Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement - Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership - Partnering,

sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals - Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS 9

Benchmarking - Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) - House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) - Concept, Improvement Needs, FMEA - Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System - Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 - Concept, Requirements and Benefits.

TOTAL PERIODS: 45

Text Book

1. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).

2. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, 1999. (Indian reprint 2002).

References

1. Feigenbaum.A.V. "Total Quality Management, McGraw Hill, 1991.

2. Oakland.J.S. "Total Quality Management Butterworth - Hcinemann Ltd., Oxford. 1989.

3. Narayana V. and Sreenivasan, N.S. Quality Management - Concepts and Tasks, New Age International 1996.

4. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.

GE1401 PROFESSIONAL ETHICS & HUMAN VALUES 4 0 0 4

(Common to all branches)

Goal

To create awareness on Engineering ethics and Human Values along with instilling Moral and Social Values.

Objectives

The course should enable the students to

- Understand the basics of Morals, Values and Ethics
- Learn various Engineering Ethics principles
- Understand the codes of ethics especially when engineers have to be responsible experimenters
- Study and understand assessment of safety and risk
- Understand the various aspects of Intellectual Property Rights and associated global issues

Outcomes

The students should be able to

- Inculcate right moral values
- Employ the learnt Engineering Ethics principles in daily life
- Implement the codes of ethics in social milieu
- Execute the professional rights and duties
- Abide by the code of Ethics in Global environment especially with respect to Multinational corporations

UNIT I HUMAN VALUE 10

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and

religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 8

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

TOTAL PERIODS: 45

Text Books

1. Mike Martin and Roland Schinzinger, “Ethics in engineering”, McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

References

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.

CH2831 PROJECT & VIVA-VOCE 6 Credits

Goal

To apply the concepts studied over four years and to do a project to improve critical thinking and to analyze industry problems

ELECTIVES COURSES

Elective– I

BT1422 BIOCONJUGATE TECHNOLOGY 3 0 0 3

Goal

The course introduces the students to Bio conjugate technology and its industrial applications.

Objectives

The course should enable the students to

- Learn how to modify Amino Acids, Proteins, sugars and nucleic acids
- Know about Amine reactive chemical reactions
- Ascertain how the bioconjugate reagents function
- Study about enzyme conjugation to DNA
- Comprehend about Immunogen conjugates, liposome conjugates and derivatives

Outcomes

The students should be able to

- Have thorough knowledge about how to modify Amino Acids, Proteins, sugars and nucleic acids
- Design Amine reactive chemical reactions and various other chemical reactions
- Fathom how to undertake bioconjugate reagents function
- Be familiar with enzyme conjugation to DNA
- Familiarise with use of Immunogen conjugates, liposome conjugates and derivatives

UNIT I FUNCTIONAL TARGETS 9

Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates – modification of nucleic acids and oligonucleotides.

UNIT II CHEMISTRY OF ACIVE GROUPS 9

Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photoreactive chemical reactions.

UNIT III BIOCONJUGATE REAGENTS 9

Zero length cross linkers – Homobifunctional cross linkers – Heterobifunctional cross linkers – Trifunctional cross linkers – Cleavable reagent systems – tags and probes.

UNIT IV ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION 9

Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleic acids – biotin labeling of DNA- enzyme conjugation to DNA – Fluorescent of DNA.

UNIT V BIOCONJUGATE APLICATIONS 9

Preparation of Hapten-carrier Immunogen conjugates - antibody modification and conjugation – immunotoxin conjugation techniques – liposome conjugated and derivatives-Colloidal – gold-labeled proteins – modification with synthetic polymers.

TOTAL PERIODS: 45

Text Book

1. Bioconjugate Techniques, G.T. Hermanson, Academic Press, 1999.

BT1423 ANIMAL BIOTECHNOLOGY 3 0 0 3

Goal

The course introduces the students to area of animal biotechnology and its applications.

Objectives

The course should enable the students to

- Learn the basic animal tissue culture techniques
- Know about various Bacterial and viral diseases that affect animals and their diagnosis
- Ascertain the various therapeutic approaches for treating animal diseases
- Study about micromanipulation technology
- Comprehend about strategies towards the production of transgenic animals

Outcomes

The students should be able to

- Have thorough knowledge about basic animal tissue culture techniques
- Be able to diagnose various Bacterial and viral diseases that affect animals
- Design therapeutic approaches for treating animal diseases
- Fathom how to undertake micromanipulation technology and breeding of farm animals
- Be familiar with various strategies towards making transgenic animals

UNIT I ANIMAL CELL CULTURE 12

Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures-suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures.

UNIT II ANIMAL DISEASES AND THEIR DIAGNOSIS 10

Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, in-situ hybridization; northern and southern blotting; RFLP.

UNIT III THERAPY OF ANIMAL DISEASES 12

Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their applications in animal infections; gene therapy for animal diseases.

UNIT IV MICROMANIPULATION OF EMBRYO'S 6

What is micromanipulation technology; equipments used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ

cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals.

UNIT V TRANSGENIC ANIMALS 5

Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals.

TOTAL PERIODS: 45

Text Books

1. Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002
2. Ramadass P, Meera Rani S. Text Book Of Animal Biotechnology. Akshara Printers, 1997.

Reference

1. Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press, 2000

BT1433 GENOMICS AND PROTEOMICS 3 0 0 3

Goal

This course offers advanced level training on gene expression and gene therapy by covering topics such as genome mapping and proteomic techniques.

Objectives

The course should familiarize and expose the students to

- Learn the basic animal tissue culture techniques
- Know about basic Principles of gene expression and physical mapping
- Concepts of functional genomics
- Comprehend the proteomic techniques
- Understand the protein-protein interactions

Outcomes

The students should be able to

- Apply the basic animal tissue culture techniques in lab

- Grasp the Principles of gene expression and physical mapping and be able to apply them
- Follow up the concepts of functional genomics in application oriented scenario
- Use the proteomic techniques such as SDS gels
- Acknowledge the importance of Post translational modification and protein-protein interactions

UNIT I OVERVIEW OF GENOMES OF BACTERIA, ARCHAE AND EUKARYOTA 9

Organisation of genes, coding non-coding chromosomes and high order structures, genomes relatedness.

UNIT II PHYSICAL MAPPING TECHNIQUES 9

Top down and bottom up approach; linking and jumping of clones; genome sequencing; placing small fragments on map; STS assembly; gap closure; pooling strategies; cytogenetic mapping techniques.

UNIT III FUNCTIONAL GENOMICS 9

Gene finding; annotation; ORF and functional prediction; Substractive DNA library screening; differential display and representational difference analysis; SAGE; TOGA.

UNIT IV PROTEOMICS TECHNIQUES 9

Protein level estimation; Edman protein microsequencing; protein cleavage; 2 D gel electrophoresis; metabolic labeling; detection of proteins on SDS gels; pattern analysis; Mass spectrometry- principles of MALDI-TOF; Tandem MS-MS; Peptide mass fingerprinting.

UNIT V PROTEIN PROFILING 9

Post translational modification; protein-protein interactions; glycoprotein analysis; phosphoprotein analysis.

TOTAL PERIODS: 45

TEXT BOOKS

1. Cantor and Smith, Genomics. John Wiley & Sons, 1999.
2. Pennington and Dunn, Proteomics, BIOS Scientific Publishers, 2001

REFERENCES

1. Liebler, Introduction to Proteomics, Humana Press, 2002
2. Hunt and Livesey, Functional Genomics, Oxford University press, 2000
3. Primrose and Twyman, principles of genome analysis and genomics, Blacwell Publishing Co., 2003.

BT1426 BIOPHYSICS 3 0 0 3

Goal

This course offers the theories and concepts of biophysics of biomolecules.

Objectives

The course should familiarize and expose the students to

- Learn the biological structures and the bonds present therein
- Know about structure and properties of DNA
- Comprehend the different conformation of proteins
- Study the techniques of cellular ion transport and models
- Understand the energetics and dynamics of biological systems

Outcomes

The students should be able to

- Ascertain the biological structures and the bonds present therein
- Grasp the structure and properties of a, b and z forms of DNA
- Follow up the concepts of Ramachandran plots in application oriented scenario
- Establish how transport occurs across ion channels
- Acknowledge the various concepts in thermodynamics

UNIT I MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS 9

Intramolecular bonds – covalent – ionic and hydrogen bonds – biological structures - general features – water structure – hydration – interficial phenomena and membranes – self-assembly and molecular strucutre of membranes.

UNIT II CONFORMATION OF NUCLEIC ACIDS 9

Primary strucutre – the bases – sugars and the phosphodiester bonds- double helical structure – the a, b and z forms – properties of circular DNA– topolgy – polymorphism and flexibility of DNA – strucutre of ribonucleic acids – hydration of nucleic acids.

UNIT III CONFORMATION OF PROTEINS 9

Conformation of the peptide bond – secondary structures – ramachandran plots – use of potential functions – tertiary structure – folding – hydration of proteins – hydropathy index.

UNIT IV CELLULAR PERMEABILITY AND ION – TRANSPORT 9

Ionic conductivity – transport across ion channels – mechanism - ion pumps- proton transfer – nerve conduction – techniques of studying ion transport and models.

UNIT V ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS 9

Concepts in thermodynamics – force and motion – entropy and stability – analyses of fluxes – diffusion potential – basic properties of fluids and biomaterials – laminar and turbulent flows.

TOTAL PERIODS: 45

Text Books

1. Biophysics; R. Glaser, Springer Verlag, 2000.
2. Biophysics: Molecules In Motion; R. Duane. Academic Press, 1999.

BT1427 CANCER BIOLOGY 3 0 0 3

Goal

To make the students comprehend the basic concepts of cancer biology, various stages in carcinogenesis, molecular cell biology of cancer, cancer metastasis, and cancer therapy.

Objectives

The course should familiarize and expose the students to

- Learn the fundamentals of cancer biology
- Know about how carcinogenesis occurs
- Comprehend the principles of molecular cell biology of cancer especially with respect to the Oncogenes
- Study how cancer metastasis occurs
- Gain knowledge of the recent advances in cancer detection and therapy

Outcomes

The students should be able to

- Ascertain the different forms of cancer and also learn about cancer diagnosis
- Grasp the structure and properties of a, b and z forms of DNA
- Have a thorough understanding of the principles of physical and chemical carcinogenesis

- Establish how Oncogenes get activated
- Have a comprehensive understanding of cancers detection and treatment methods such as chemotherapy, radiation therapy etc

UNIT I FUNDAMENTALS OF CANCER BIOLOGY **9**

Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.

UNIT II PRINCIPLES OF CARCINOGENESIS **12**

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

UNIT III PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER **9**

Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes, retroviruses and oncogenes, detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation. Telomerases.

UNIT IV PRINCIPLES OF CANCER METASTASIS **9**

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNIT V NEW MOLECULES FOR CANCER THERAPY **6**

Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.

TOTAL PERIODS: 45

Text Books

1. Maly B.W.J, “Virology A Practical Approach”, IRLl Press, Oxford, 1987.
2. Dunmock N.J And Primrose S.B., “Introduction to Modern Virology”, Blackwell Scientific Publications, Oxford, 1988.

Reference

1. “An Introduction Top Cellular And Molecular Biology of Cancer”, j Oxford Medical Publications, 1991.

Elective II

BT1428 BIOPHARMACEUTICAL TECHNOLOGY 3 0 0 3

Goal

The students would have comprehensive understanding about drug manufacture, drug action and drug metabolism.

Objectives

The course should familiarize and expose the students to

- Learn the fundamentals of Indian Pharmaceutical industry
- Know about drug action, metabolism and pharmacokinetics
- Comprehend the principles of drug manufacture, reaction processes and applications
- Study how drugs are manufactured and also the quality management aspects
- Gain knowledge of the various biopharmaceuticals available to consumers

Outcomes

The students should be able to

- Know the Indian Pharmaceutical industry and regulatory aspects involved therein
- Grasp the structure and properties of a, b and z forms of DNA
- Have a thorough understanding of the principles of physical and chemical carcinogenesis
- Study how tablets and capsules are prepared and also the quality management scenario
- Have a comprehensive understanding of various biopharmaceutical products and their use

UNIT I INTRODUCTION 7

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects.

UNIT II DRUG ACTION, METABOLISM AND PHARMACOKINETICS 9

Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; pharmaco kinetics.

UNIT III MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS 7

Types of reaction process and special requirements for bulk drug manufacture.

UNIT IV PRINCIPLES OF DRUG MANUFACTURE 15

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oval liquids – vegetable drugs – topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; gmp.

UNIT V BIOPHARMACEUTICALS 7

Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biologicals.

TOTAL PERIODS: 45

Text Books

1. Gareth Thomas. Medicinal Chemistry. An introduction. John Wiley. 2000.
2. Katzung B.G. Basic and Clinical Pharmacology, Prentice Hall of Intl. 1995.

BT1429 IMMUNOTECHNOLOGY 3 0 0 3

Goal

The students would have comprehensive understanding about Immunotechnology and the current trends therein.

Objectives

The course should familiarize and expose the students to

- Learn about the various types of antigens and adjuvants
- Know about Monoclonal and polyclonal antibodies, ELISA, RIA
- Comprehend the principles of cell mediated immunity
- Study immuno cytochemistry, immuno fluoresecence, immuno enzymatic assays
- Gain knowledge about various immuno therapies with genetically engineered antibodies
- Focus on the recent trends in Immunology of infectious diseases

Outcomes

The students should be able to

- Decipher the various types of antigens and adjuvants and also their mode of action

- Have a thorough knowledge about Monoclonal and polyclonal antibodies, ELISA, RIA
- Understand the principles of cell mediated immunity
- Undertake immuno fluoresecence, immuno enzymatic and immunopathological assays
- Have a comprehensive understanding of various immuno therapies with genetically engineered antibodies

UNIT I ANTIGENS 3

Types of antigens, their structure, preparation of antigens for raising antibodies, handling of animals, adjuvants and their mode of action.

UNIT II ANTIBODIES & IMMUNODIAGNOSIS 9

Monoclonal and polyclonal antibodies – their production and characterization, western blot analysis, immuno electrophoresis, SDS-PAGE, purification and synthesis of antigens, ELISA-principle and applications, radio immuno assay (RIA) principles and applications, non isotopic methods of detection of antigens-enhanced chem. iluminescence assay.

UNIT III ASSESSMENT OF CELL MEDIATED IMMUNITY 12

Identification of lymphocytes and their subsets in blood. T cell activation parameters, estimation of cytokines, macrophages activation, macrophage activation, macrophage microbicidal assays, in-vitro experimentation-application of the above technology to understand the pathogenesis of infectious diseases.

UNIT IV IMMUNOPATHOLOGY 6

Preparation of storage of tissues, identification of various cell types and antigens in tissues, isolation and characterization of cell types from inflammatory sites and infected tissues, functional studies on isolated cels, immuno cytochemistry – immuno fluoresecence, immuno enzymatic and immuno ferrtin techniques, immuno electron microscopy.

UNIT V MOLECULAR IMMUNOLOGY 9

Preparation of vaccines, application of recombinant DNA technology for the study of the immune system, production of antidiotypic antibodies, catalytic antibodies, application of PCR technology to produce antibodies and other immunological reagents, immuno therapy with genetically engineered antibodies.

UNIT VI CURRENT TOPICS IN IMMUNOLOGY 6

Trends in Immunology of infectious diseases and tumours, topics as identified from time to time.

TOTAL PERIODS: 45

Text Books

1. Talwar G.P., and Gupta S.K., "A hand book of practical and clinical immunology", Vol. 1 & 2, CBS Publications, 1992.
2. Weir D.M., Practical Immunology, Blackwell Scientific Publications, Oxford, 1990.

Reference

1. Austin J.M. and Wood K.J., Principle of cellular and molecular immunology, Oxford university press, Oxford, 1993.

BT1430 BIOLOGICAL SPECTROSCOPY 3 0 0 3

Goal

The students would have comprehensive understanding about various Biological spectroscopic methods and the current trends therein.

Objectives

The course should enable the students to

- Learn about optical rotations and circular dichroism
- Know about NMR and magnetic resonance imaging
- Comprehend the principles of mass spectrometry
- Study Scattering and diffraction by x- rays
- Gain knowledge about SEM, TEM, AFM

Outcomes

The students should be able to

- Decipher how optical rotations and circular dichroism occurs in nucleic acids and proteins
- Understand the principles of NMR and magnetic resonance imaging
- Have a thorough knowledge about mass analyzers and ion detectors
- Understand how to measure diffraction pattern of crystals
- Have a comprehensive understanding of combinatorial chemistry and high throughput screening methods

UNIT I OPTICAL ROTATORY DISPERSION 5

Polarized light – optical rotation – circular dichroism – circular dichroism of nucleic acids and proteins.

UNIT II NUCLEAR MAGNETIC RESONANCE 10

Chemical shifts – spin – spin coupling – relaxation mechanisms – nuclear overhauser effect – multidimensional nmr spectroscopy – detemination of macromolecular structure by NMR – magnetic resonance imaging.

UNIT III MASS SPECTROMETRY 10

Ion sources sample introduction – mass analyzers and ion detectors – biomolecule mass sepctrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IV X-RAY DIFFRACTION 10

Scattering by x- rays – diffraction by a crystal – measuring diffraction pattern – bragg reflection – unit cell – phase problem – anomalous diffraction – detemination of crystal structure – electron and neutron diffraction.

UNIT V SPECIAL TOPICS AND APPLICATIONS 10

Electron microscopy – transmission and scanning electron microscopy – scanning tunneling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

TOTAL PERIODS: 45

Text Books

1. Campbell I.D and Dwek R.A., "Biological Spectroscopy", Benjamin Cummins and Company, 1986.
2. Atkins P.W., "Physical Chemistry", Oxford IV Edition, 1990.

BT1431 MOLECULAR MODELING & DRUG DESIGN 3 0 0 3

Goal

The students would have comprehensive understanding about Classical mechanics, Statistical mechanics, Quantum mechanics and its applications.

Objectives

The course should enable the students to

- Get introduced to classical mechanics concepts
- Have an understanding about statistical mechanics
- Comprehend the principles of quantum mechanics
- Study about Gromos, Gromacs, Amber & Dock
- Gain knowledge about Model chemiststrix

Outcomes

The students should be able to

- Decipher classical mechanics concepts
- Understand the principles of statistical mechanics
- Have a thorough knowledge about quantum mechanics
- Understand how to apply Gromos, Gromacs, Amber & Dock
- Apply the concepts learnt in Model chemiststrix

UNIT I INTRODUCTION TO CLASSICAL MECHANICS 9

Newtons laws of motion – time intervals- algorithms

UNIT II INTRODUCTION TO STATISTICAL MECHANICS 9

Boltzman's Equation – Ensembles – Distribution law for non-interacting molecules – Statistical mechanics of fluids.

UNIT III QUANTUM MECHANICS 9

Photoelectric effect – De Broglies hypothesis – Uncertainty principle – Schrodingers time independent equation – particle in a one -dimensional box.

UNIT IV GROMOS, GROMACS, AMBER & DOCK 9

Energy minization, application of Fourier transformer – force fields – principal components analysis – RMSD calculation – applications – dynamics of a molecule – concepts of parallezing work.

UNIT V GAUSSIAN98 9

Methods – Basic sets – Model chemiststrix – inputs – outputs – uses.

TOTAL PERIODS: 45

Text Books

1. Statistical Mechanics; D. McQuarrie, Narosa, 1999.
2. Quantum Mechanics; D. McQuarrie, Narosa, 1999.

Reference

1. GROMOS Handbook.

BT1432 METABOLIC ENGINEERING 3 0 0 3

Goal

The students would have comprehensive understanding about Classical mechanics, Statistical mechanics, Quantum mechanics and its applications.

Objectives

The course should enable the students to

- Get introduced to feedback regulation concepts
- Have an understanding about primary metabolites
- Comprehend the principles of Secondary Metabolites
- Study about factors important to bioconversions
- Gain knowledge about how to Regulate Enzyme Production

Outcomes

The students should be able to

- Decipher feedback regulation concepts
- Understand primary metabolites and feedback regulation
- Have a thorough knowledge about Secondary Metabolites
- Understand about bioconversions and its advantages
- Evaluate and Regulate Enzyme Production

UNIT I INTRODUCTION 9

Induction-Jacob Monod Model, catabolite regulation, glucose effect, camp deficiency, feedback regulation, regulation in branched pathways, differential regulation by

isoenzymes, concerted feedback regulation, cumulative feedback regulation, amino acid regulation of RNA synthesis, energy charge, permeability control passive diffusion, facilitated diffusion, active transport group transportation.

UNIT II SYNTHESIS OF PRIMARY METABOLITES 9

Alteration of feedback regulation, limiting accumulation of end products, feedback, resistant mutants, alteration of permeability.

UNIT III SECONDARY METABOLITES 9

Biosynthesis of Secondary Metabolites: Precursor effects, prophophase, idiophase relationships, enzyme induction, feedback regulation, catabolite regulation by passng control of secondary metabolism, producers of secondary metabolites.

UNIT IV BIOCONVERSIONS 9

Bioconversions: Advantages of Bioconversions, specificity, yields, factors important to bioconversions, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or sequential bioconversions, conversion of insoluble substances.

UNIT V REGULATION OF ENZYME PRODUCTION 9

Regulation of Enzyme Production: Strain selection, improving fermentation, recognizing growth cycle peak, induction, feedback repression, catabolite repression, mutants resistant to repression, gene dosage.

TOTAL PERIODS: 45

References

1. Wang D. I. C., Cooney C. L., Demain A. L., Dunnil P., Humphrey A. E., Lilly M. D., Fermentation and Enzyme Technology, John Wiles and Sons., 1980.
2. Stanbury P. F. and Whitaker A., Principles of Fermentation Technology, Pergamon Press, 1984.
3. Zubay G., Biochemistry, Macmillan Publishers, 1989.