ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

23

BIO-TECHNOLOGY

For

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2013-14)

(I - IV Years Syllabus)

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

ACADEMIC REGULATIONS R13 FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2013-14 and onwards

1. **Award of B. Tech. Degree**

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

1.1 The candidate shall pursue a course of study for not less than four academic years and not more than eight academic years.

1.2 After eight academic years of course of study, the candidate is permitted to write the examinations for two more years.

1.3 The candidate shall register for 224 credits and secure 216 credits with compulsory subjects as listed in Table-1.

Table 1: Compulsory Subjects

Serial Number	Subject Particulars
1	All practical subjects
2	Industry oriented mini project
3	Comprehensive Viva-Voce
4	Seminar
5	Project work

2 The students, who fail to fulfill all the academic requirements for the award of the degree within ten academic years from the year of their admission, shall forfeit their seats in B. Tech. course.

3 Courses of study

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

Branch Code	Branch
01	Civil Engineering
02	Electrical and Electronics Engineering
03	Mechanical Engineering
04	Electronics and Communication Engineering
05	Computer Science and Engineering
08	Chemical Engineering
10	Electronics and Instrumentation Engineering

11	Bio-Medical Engineering
12	Information Technology
14	Mechanical Engineering (Mechatronics)
17	Electronics and Telematics Engineering
18	Metallurgy and Material Technology
19	Electronics and Computer Engineering
20	Mechanical Engineering (Production)
21	Aeronautical Engineering
22	Instrumentation and Control Engineering
23	Biotechnology
24	Automobile Engineering
25	Mining Engineering
26	Mining Machinery
27	Petroleum Engineering
28	Civil and Environmental Engineering
29	Mechanical Engineering (Nano Technology)
30	Agricultural Engineering
31	Computer Science & Technology

4 Credits

	I Year		Semester	
	Periods / Week	**Credits**	**Periods / Week**	**Credits**
Theory	03+1/03	06	04	04
	02	04	—	—
Practical	03	04	03	02
Drawing	02+03	06	03 06	02 04
Mini Project	—	—	—	02
Comprehensive Viva Voce	—	—	—	02
Seminar	—	—	6	02
Project	—	--	15	10

5 Distribution and Weightage of Marks

5.1 The performance of a student in each semester or I year shall be evaluated subject-wise for a maximum of 100 marks for a theory and 75 marks for a practical subject. In addition, industry-oriented mini-project, seminar and project work shall be evaluated for 50, 50 and 200 marks, respectively.

5.2 For theory subjects the distribution shall be 25 marks for Internal Evaluation and 75 marks for the End-Examination.

5.3 For theory subjects, during a semester there shall be 2 mid-term examinations. Each mid- term examination consists of one objective paper, one essay paper and one assignment. The objective paper and the essay paper shall be for 10 marks each with a total duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for essay paper). The Objective paper is set with 20 bits of multiple choice, fill-in the blanks and matching type of questions for a total of 10 marks. The essay paper shall contain 4 full questions (one from each unit) out of which, the student has to answer 2 questions, each carrying 5 marks. While the first mid-term examination shall be conducted on 1 to 2.5 units of the syllabus, the second mid-term examination shall be conducted on 2.5 to 5 units. Five (5) marks are allocated for Assignments (as specified by the subject teacher concerned). The first Assignment should be submitted before the conduct of the first mid-examination, and the second Assignment should be submitted before the conduct of the second mid-examination. The total marks secured by the student in each mid-term examination are evaluated for 25 marks, and the average of the two mid-term examinations shall be taken as the final marks secured by each candidate. However, in the I year, there shall be 3 mid term examinations, each for 25 marks, along with 3 assignments in a similar pattern as above (1st mid shall be from Unit-I, 2nd mid shall be 2 &3 Units and 3rd mid shall be 4 & 5 Units) and the average marks of the examinations secured (each evaluated for a total of 25 marks) in each subject shall be considered to be final marks for the internals/sessionals. If any candidate is absent from any subject of a mid-term examination, an on-line test will be conducted for him by the University.

The details of the Question Paper pattern without deviating from the R13 regulations as notified in the website is as follows:

- ***The End semesters Examination will be conducted for 75 marks which consists of two parts viz. i). Part-A for 25 marks, ii). Part –B for 50 marks.***
- ***Part-A is compulsory question which consists of ten sub-questions. The first five sub-questions are from each unit and carries 2 marks each. The next five sub-questions***

are one from each unit and carries 3 marks each.

- ***Part-B consists of five Questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question)***

5.4 For practical subjects there shall be a continuous evaluation during a semester for 25 sessional marks and 50 end semester examination marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. The end semester examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the clusters of colleges which are decided by the examination branch of the University.

5.5 For the subject having design and/or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and Estimation, the distribution shall be 25 marks for internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for end semester examination. There shall be two internal tests in a Semester and the average of the two shall be considered for the award of marks for internal tests. However, in the I year class, there shall be three tests and the average will be taken into consideration.

5.6 There shall be an industry-oriented Mini-Project, in collaboration with an industry of their specialization, to be taken up during the vacation after III year II Semester examination. However, the mini-project and its report shall be evaluated along with the project work in IV year II Semester. The industry oriented mini-project shall be submitted in a report form and presented before the committee. It shall be evaluated for 50 marks. The committee consists of an external examiner, head of the department, the supervisor of the mini-project and a senior faculty member of the department. There shall be no internal marks for industry-oriented mini-project.

5.7 There shall be a seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit it to the department. It shall be evaluated by the departmental committee consisting of head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for the seminar.

5.8 There shall be a Comprehensive Viva-Voce in IV year II semester.

The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is intended to assess the student's understanding of the subjects he studied during the B. Tech. course of study. The Comprehensive Viva-Voce is evaluated for 100 marks by the Committee. There are no internal marks for the Comprehensive Viva-Voce.

5.9 Out of a total of 200 marks for the project work, 50 marks shall be allotted for Internal Evaluation and 150 marks for the End Semester Examination (Viva Voce). The End Semester Examination of the project work shall be conducted by the same committee as appointed for the industry-oriented mini-project. In addition, the project supervisor shall also be included in the committee. The topics for industry oriented mini project, seminar and project work shall be different from one another. The evaluation of project work shall be made at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project.

5.10 The Laboratory marks and the sessional marks awarded by the College are subject to scrutiny and scaling by the University wherever necessary. In such cases, the sessional and laboratory marks awarded by the College will be referred to a Committee. The Committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective institutions as per the University rules and produced before the Committees of the University as and when asked for.

6 Attendance Requirements

6.1 A student is eligible to write the University examinations only if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

6.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or I year may be granted by the College Academic Committee

6.3 Shortage of Attendance below 65% in aggregate shall not be condoned.

6.4 A student who is short of attendance in semester / I year may seek re-admission into that semester/I year when offered within 4 weeks from the date of the commencement of class work.

6.5 Students whose shortage of attendance is not condoned in any semester/I year are not eligible to write their end semester examination of that class and their registration stands cancelled.

6.6 A stipulated fee shall be payable towards condonation of shortage of attendance.

6.7 A student will be promoted to the next semester if he satisfies the attendance requirement of the present semester/I year, as applicable, including the days of attendance in sports, games, NCC and NSS activities.

6.8 If any candidate fulfills the attendance requirement in the present semester or I year, he shall not be eligible for readmission into the same class.

7 Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.6.

7.1 A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/ practical design/drawing subject/project and secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the mid-term and end semester exams.

7.2 A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement.

7.3 A student will not be promoted from II year to III year unless he fulfils the academic requirement of 34 credits up to II year I semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

7.4 A student shall be promoted from III year to IV year only if he fulfils the academic requirements of 56 credits up to III year I semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

7.5 A student shall register and put up minimum attendance in all 224 credits and earn 216 credits. Marks obtained in the best 216 credits shall be considered for the calculation of percentage of marks.

7.6 Students who fail to earn 216 credits as indicated in the course structure within ten academic years (8 years of study + 2 years additionally for appearing for exams only) from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled.

8 Course pattern

8.1 The entire course of study is for four academic years. I year shall be on yearly pattern and II, III and IV years on semester pattern.

8.2 A student, eligible to appear for the end examination in a subject, but absent from it or has failed in the end semester examination, may

write the exam in that subject during the period of supplementary exams.

8.3 When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the next semester/year. However, the academic regulations under which he was first admitted, shall continues to be applicable to him.

9 Award of Class

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

Class Awarded	% of marks to be secured	
First Class with Distinction	70% and above	**From the aggregate marks secured from 216 Credits.**
First Class	Below 70 but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

The marks obtained in internal evaluation and end semester / I year examination shall be shown separately in the memorandum of marks.

10 Minimum Instruction Days

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

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

12 There shall be no transfer from one college/stream to another within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Hyderabad.

13 WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the university or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

14. **TRANSITORY REGULATIONS**

14.1 Discontinued, detained, or failed candidates are eligible for readmission as and when next offered.

14.2 After the revision of the regulations, the students of the previous batches will be given two chances for passing in their failed subjects, one supplementary and the other regular. If the students cannot

clear the subjects in the given two chances, they shall be given equivalent subjects as per the revised regulations which they have to pass in order to obtain the required number of credits.

14.3 In case of transferred students from other Universities, the credits shall be transferred to JNTUH as per the academic regulations and course structure of the JNTUH.

15. General

15.1 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

15.2 The academic regulation should be read as a whole for the purpose of any interpretation.

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

15.4 The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

15.5 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/Institutions, have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the candidates have not studied at the earlier Institution on their own without the right to sessional marks. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JNTUH, the candidates have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.

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Academic Regulations R13 For B.Tech. (Lateral Entry Scheme)

Applicable for the students admitted into II year B. Tech. (LES) from the Academic Year 2013-14 and onwards

1 **Eligibility for award of B. Tech. Degree (LES)**

I. The LES candidates shall pursue a course of study for not less than three academic years and not more than six academic years.

II. They shall be permitted to write the examinations for two more years after six academic years of course work.

2. The candidate shall register for 168 credits and secure 160 credits from II to IV year B.Tech. Program (LES) for the award of B.Tech. degree with compulsory subjects as listed in Table-1.

Table 1: Compulsory Subjects

Serial Number	Subject Particulars
1	All practical subjects
2	Industry oriented mini project
3	Comprehensive Viva-Voce
4	Seminar
5	Project work

3. The students, who fail to fulfil the requirement for the award of the degree in 8 consecutive academic years (6 years of study + 2 years additionally for appearing exams only) from the year of admission, shall forfeit their seats.

4. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

5. **Promotion Rule**

A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

A student shall be promoted from III year to IV year only if he fulfils the academic requirements of 34 credits up to III year I semester from all the examinations, whether or not the candidate takes the examinations.

6. **Award of Class**

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

Class Awarded	% of marks to be secured	
First Class with Distinction	70% and above	**From the aggregate marks secured from 216 Credits.**
First Class	Below 70 but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

The marks obtained in the internal evaluation and the end semester examination shall be shown separately in the marks memorandum.

7. All the other regulations as applicable to **B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)**.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

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

2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is

	any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work

		and shall not be permitted for the remaining examinations of the subjects of that semester/ year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/ year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/ year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical

12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

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

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B. TECH. BIO-TECHNOLOGY

I YEAR

Code	Subject	L	T/P/D	C
A10001	English	2	-	4
A10002	Mathematics – I	3	1	6
A12301	Fundamentals of Biology	3	-	6
A10004	Engineering Physics	3	-	6
A10005	Engineering Chemistry	3	-	6
A10501	Computer Programming	3	-	6
A10301	Engineering Drawing	2	3	6
A10581	Computer Programming Lab.	-	3	4
A10081	Engineering Physics & Engineering Chemistry Lab.	-	3	4
A10083	English Language Communication Skills Lab.	-	3	4
A10082	IT Workshop / Engineering Workshop	-	3	4
	Total	**19**	**16**	**56**

II YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A30013	Biochemistry	4	-	4
A30201	Basic Electrical and Electronic Engineering	4	-	4
A32303	Cell Biology	4	-	4
A30006	Mathematics –II	4	-	4
A32302	Biofluid Mechanics	4	-	4
A32304	Microbiology	4	-	4
A32381	Biochemistry Lab	-	3	2
A32382	Cell Biology and Microbiology Lab	-	3	2
	Total	**24**	**6**	**28**

II YEAR II SEMESTER

Code	Subject	L	T/P/D	C
A42306	Heat Transfer Operations	4	-	4
A42308	Molecular Biology & Genetics	4	-	4
A42309	Thermodynamics for Biotechnologists	4	-	4
A40009	Environmental Studies	4	-	4
A42305	Analytical Methods in Biotechnology	4	-	4
A42307	Immunology	4	-	4
A42383	Analytical Methods in biotechnology Lab	-	3	2
A42384	Immunology Lab	-	3	2
	Total	**24**	**6**	**28**

III YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A52313	Mass Transfer Operations	4	-	4
A50806	Biochemical Reaction Engineering	4	-	4
A52312	Genetic Engineering	4	-	4
A52310	Bio Ethics, Bio Safety and Intellectual Property Rights	4	-	4
A52311	Enzyme Engineering	4	-	4
A50010	Managerial Economics and Financial Analysis	4	-	4
A52385	Molecular Biology and Genetic Engineering Lab	-	3	2
A50086	Advanced Communication Skills Lab	-	3	2
	Total	**24**	**6**	**28**

III YEAR II SEMESTER

Code	Subject	L	T/P/D	C
A62317	Plant Biotechnology	4	-	4
A62314	Bioprocess Engineering	4	-	4
A60809	Instrumentation and Process Control	4	-	4
A60008	Probability and Statistics	4	-	4
	ELECTIVE –I			
A62316	Industrial and Environmental Biotechnology	4	-	4
A62315	Computational Biology			
A60506	Computer Organization			
	Open Elective			
A60018	Human Values and Professional Ethics	4	-	4
A60117	Disaster Management			
A60017	Intellectual Property Rights			
A62387	Plant Biotechnology Lab	-	3	2
A62386	Bioprocess Engineering Lab	-	3	2
	Total	**24**	**6**	**28**

IV YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A72319	Bioinformatics	4	-	4
A72328	Transport Phenomena in Bioprocess	4	-	4
A72323	Downstream Processing	4	-	4
A72318	Animal Biotechnology	4	-	4
	ELECTIVE –II			
A72322	Crop improvement			
A72327	Structural Biology			
A72321	Cancer Biology			
A70527	Artificial Neural Networks	4	-	4
	ELECTIVE –III			
A72326	Molecular Pathogenesis			
A72320	Biopharmaceuticals			
A72324	Introduction to Biomaterials	4	-	4
A72388	Bioinformatics Lab	-	3	2
A72389	Downstream Processing Lab	-	3	2
	Total	**24**	**6**	**28**

IV YEAR II SEMESTER

Code	Subject	L	T/P/D	C
A82329	Bioprocess Optimization and Plant Design	4	-	4
	ELECTIVE –IV			
A82331	Food Biotechnology	4	-	4
A82333	Nanobiotechnology			
	ELECTIVE-V			
A82330	Clinical Trials & Regulatory Affairs	4	-	4
A82332	Metabolic Engineering			
A80087	Industry Oriented Mini Project	-	-	2
A80089	Seminar	-	6	2
A80088	Project Work	-	15	10
A80090	Comprehensive viva	-	-	2
	Total	**12**	**21**	**28**

Note: All End Examinations (Theory and Practical) are of three hours duration.
T-Tutorial L – Theory P – Practical D-Drawing C – Credits

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I Year B.Tech. Biotech	**L**	**T/P/D**	**C**
	2	**-/-/-**	**4**

(A10001) ENGLISH

Introduction:

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

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

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

Objectives:

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

SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation.
2. To equip students with necessary training in listening so that they

can comprehend the speech of people of different backgrounds and regions.

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

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

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: **Skills Annexe -Functional English for Success)**
- Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

- Skimming the text
- Understanding the gist of an argument
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Understanding discourse features
- Scanning
- Recognizing coherence/sequencing of sentences

NOTE : The students will be trained in reading skills using the prescribed text for detailed study.

They will be examined in reading and answering questions using 'unseen' passages which may be taken from authentic texts, such as magazines/ newspaper articles.

Writing Skills :

Objectives

To develop an awareness in the students about writing as an exact and formal skill.

To equip them with the components of different forms of writing, beginning with the lower order ones.

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Note Making
- Formal and informal letter writing
- Describing graphs using expressions of comparison

TEXTBOOKS PRESCRIBED:

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

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

For Non-detailed study

1. **Second text book "Epitome of Wisdom",** Published by Maruthi Publications, Guntur
   - The course content and study material is divided into Five Units.

Unit –I:

1. Chapter entitled **'Wit and Humour**' from **'Skills Annexe'** -Functional English for Success, Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'Mokshagundam Visvesvaraya'** from **"Epitome of Wisdom**", Published by Maruthi Publications, Hyderabad.

L- Listening For Sounds, Stress and Intonation

S- Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations)

R- Reading for Subject/ Theme

W- Writing Paragraphs

G- Types of Nouns and Pronouns

V- Homonyms, homophones synonyms, antonyms

Unit –II

1. Chapter entitled **"Cyber Age"** from **"Skills Annexe -Functional English for Success"** Published by Orient Black Swan, Hyderabad.
2. Chapter entitled **'Three Days To See'** from **"Epitome of Wisdom"**, Published by Maruthi Publications, Hyderabad.

L – Listening for themes and facts

S – Apologizing, interrupting, requesting and making polite conversation

R- for theme and gist

W- Describing people, places, objects, events

G- Verb forms

V- noun, verb, adjective and adverb

Unit –III

1. Chapter entitled **'Risk Management'** from **"Skills Annexe - Functional English for Success"** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'Leela's Friend'** by R.K. Narayan from **"Epitome of Wisdom"**, Published by Maruthi Publications, Hyderabad

L – for main points and sub-points for note taking

S – giving instructions and directions; Speaking of hypothetical situations

R – reading for details

W – note-making, information transfer, punctuation

G – present tense

V – synonyms and antonyms

Unit –IV

1. Chapter entitled **'Human Values and Professional Ethics'** from **"Skills Annexe -Functional English for Success"** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'The Last Leaf'** from **"Epitome of Wisdom"**, Published by Maruthi Publications, Hyderabad

L - Listening for specific details and information

S- narrating, expressing opinions and telephone interactions

R - Reading for specific details and information

W- Writing formal letters and CVs

G- Past and future tenses

V- Vocabulary - idioms and Phrasal verbs

Unit –V

1. Chapter entitled **'Sports and Health'** from **"Skills Annexe - Functional English for Success"** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'The Convocation Speech'** by N.R. Narayanmurthy' from **"Epitome of Wisdom"**, Published by Maruthi Publications, Hyderabad

L- Critical Listening and Listening for speaker's tone/ attitude

S- Group discussion and Making presentations

R- Critical reading, reading for reference

W- Project proposals; Technical reports, Project Reports and Research Papers

G- Adjectives, prepositions and concord

V- Collocations and Technical vocabulary

Using words appropriately

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

REFERENCES :

1. Contemporary English Grammar Structures and Composition by David Green, MacMillan Publishers, New Delhi. 2010.
2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.
3. English Grammar Practice, Raj N Bakshi, Orient Longman.
4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.
5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson
6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
8. Technical Communication, Meenakshi Raman, Oxford University Press
9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education
10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.

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

Outcomes:

- Usage of English Language, written and spoken.
- Enrichment of comprehension and fluency
- Gaining confidence in using language in verbal situations.

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(A10002) MATHEMATICS -I

Objectives: To learn

- The types of Matrices and their properties.
- Concept of rank of a matrix and applying the concept of rank to know the consistency of linear equations and to find all possible solutions, if exist.
- The concept of eigenvalues and eigenvectors of a matrix is to reduce a quadratic form into a canonical form through a linear transformation.
- The mean value theorems and to understand the concepts geometrically.
- The functions of several variables and optimization of these functions.
- The evaluation of improper integrals, Beta and Gamma functions.
- Multiple integration and its applications.
- Methods of solving the differential equations of 1st and higher order
- The applications of the differential equations to Newton's law of cooling, Natural growth and decay, Bending of beams etc.
- The definition of integral transforms and Laplace Transform.
- Properties of Laplace transform.
- Inverse Laplace Transform.
- Convolution theorem.
- Solution of Differential equations using Laplace transform.

UNIT-I

Theory of Matrices: Real matrices – Symmetric, skew – symmetric, orthogonal. Complex matrices: Hermitian, Skew-Hermitian and Unitary Matrices. Idempotent matrix, Elementary row and column transformations-Elementary matrix, Finding rank of a matrix by reducing to Echelon and normal forms. Finding the inverse of a non-singular square matrix using row/ column transformations (Gauss- Jordan method). Consistency of system of linear equations (homogeneous and non- homogeneous) using the rank of a matrix. Solving m x n and n x n linear system of equations by Gauss elimination.

Cayley-Hamilton Theorem (without proof) – Verification. Finding inverse of

a matrix and powers of a matrix by Cayley-Hamilton theorem, Linear dependence and Independence of Vectors. Linear Transformation – Orthogonal Transformation. Eigen values and eigen vectors of a matrix. Properties of eigen values and eigen vectors of real and complex matrices. Finding linearly independent eigen vectors of a matrix when the eigen values of the matrix are repeated.

Diagonalization of matrix – Quadratic forms up to three variables. Rank – Positive definite, negative definite, semi definite, index, signature of quadratic forms. Reduction of a quadratic form to canonical form.

UNIT – II

Differential calculus methods: Rolle's Mean value Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – (all theorems without proof but with geometrical interpretations), verification of the Theorems and testing the applicability of these theorem to the given function.

Functions of several variables: Functional dependence- Jacobian- Maxima and Minima of functions of two variables without constraints and with constraints-Method of Lagrange multipliers.

UNIT – III

Improper integration, Multiple integration & applications: Gamma and Beta Functions –Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions

Multiple integrals – double and triple integrals – change of order of integration-change of variables (polar, cylindrical and spherical) Finding the area of a region using double integration and volume of a region using triple integration.

UNIT – IV

Differential equations and applications : Overview of differential equations-exact, linear and Bernoulli (NOT TO BE EXAMINED). Applications of first order differential equations – Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories.

Linear differential equations of second and higher order with constant coefficients, Non-homogeneous term of the type type $f(X) = e^{ax}$, Sin ax, Cos ax, and x, eV(x), xV(x), method of variation of parameters. Applications to bending of beams, Electrical circuits and simple harmonic motion.

UNIT – V

Laplace transform and its applications to Ordinary differential equations Definition of Integral transform, Domain of the function and Kernel for the Laplace transforms. Existence of Laplace transform. Laplace transform of standard functions, first shifting Theorem, Laplace transform of functions

when they are multiplied or divided by “t”. Laplace transforms of derivatives and integrals of functions. – Unit step function – second shifting theorem – Dirac’s delta function, Periodic function – Inverse Laplace transform by Partial fractions(Heaviside method) Inverse Laplace transforms of functions when they are multiplied or divided by ”s”, Inverse Laplace Transforms of derivatives and integrals of functions, Convolution theorem –- Solving ordinary differential equations by Laplace transforms.

TEXT BOOKS:

1. Advanced engineering Mathematics by Kreyszig, John Wiley & Sons Publishers.
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.

REFERENCES:

1. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, 3rd edition, Narosa Publishing House, Delhi.
2. Engineering Mathematics – I by T.K. V. Iyengar, B. Krishna Gandhi & Others, S. Chand.
3. Engineering Mathematics – I by D. S. Chandrasekhar, Prison Books Pvt. Ltd.
4. Engineering Mathematics – I by G. Shanker Rao & Others I.K. International Publications.
5. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, CRC Press Taylor & Francis Group.
6. Mathematics for Engineers and Scientists, Alan Jeffrey, 6th Edi, 2013, Chapman & Hall/ CRC
7. Advanced Engineering Mathematics, Michael Greenberg, Second Edition, Pearson Education.

Outcome:

- After learning the contents of this Unit the student is able to write the matrix representation of a set of linear equations and to analyze solutions of system of equations.
- The student will be able to understand the methods of differential calculus to optimize single and multivariable functions.
- The student is able to evaluate the multiple integrals and can apply the concepts to find the Areas, Volumes, Moment of Inertia etc., of regions on a plane or in space.

- The student is able to identify the type of differential equation and uses the right method to solve the differential equation. Also able to apply the theory of differential equations to the real world problems.
- The student is able to solve certain differential equations using Laplace Transform. Also able to transform functions on time domain to frequency domain using Laplace transforms.

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(A12301) FUNDAMENTALS OF BIOLOGY

Objectives: The objective of the course is to introduce the students with basics of biological system both at the cellular, biochemical and molecular level and provide an understanding of its applications in various fields such as prokaryotic and eukaryotic biodiversity, plant, animal and molecular biology.

UNIT I:

Introduction To Microorganisms

Diversity in biological systems, Cell biology and cell structure, Difference between Prokaryotes & Eukaryotes. Kingdom systems. Five-kingdom classification, General characters, Brief account on Ecology, Morphology, Nutrition, Locomotion and Reproduction, useful and harmful effects of Bacteria, Viruses, Algae, Fungi and Protozoans.

UNIT II:

Plant Biology

Plant Biology: Concepts of Growth, Meristems. Development of different plant organs; Plant growth regulators; Photosynthesis : Plant & Bacterial photosynthesis; oxygenic and anoxygenic photosynthesis; chlorophyll as trapper of solar energy, photosynthetic reaction centres, Hill reaction, PS I & PS II, Photophosphorylation - cyclic & non-cyclic; Dark reaction & CO_2 fixation. Economic Importance of Plants.

UNIT III:

Animal Biology

Introduction of body as a whole, Cells and Tissue Organization, Electrolytes and Body fluids. Physiology: Digestive system, Circulatory systems & Blood, Respiratory system and Endocrine system, Neuromuscular system, Sensory systems - hearing, taste, smell and visual receptors.

UNIT IV:

Basic Molecular Biology

Genetics: DNA as genetic material, Structure of DNA, DNA replication, Transcription, Translation, Genes to proteins to protein function, Gene expression and regulation, Recombinant DNA technology.

UNIT V :

Applications of Biotechnology

Drugs and Chemicals from Plants & Animals, Definition and importance (in

general) of Biofuels, Biofertilizers, Biopesticides, Bioindicators and Biosensors, Microbial Enzymes, Single Cell Protein (SCP), Monoclonal Antibodies, Introduction to Transgenic Plants & Animals.

TEXT BOOKS:

1. Introduction to biology and biotechnology, second edition, K.Vaitaidyanath, K. Pratap Reddy, and K.Satya Prasad, BS Publications.

REFERENCES:

1. H.G. Rehen and G.Reed, biotechnology Volume I & 2.
2. Basic Biotechnology, Second Edition, by Colin Ratledge and Bjorm Kristiansen, Cambridge University Press.
3. Anatomy and Physiology In Health and Disease,K. J.W. Wilison and A. Waugh, Churchill & Livingston.
4. Plant Physiology F.B Salisbury & C.W. Ross 4th edition Thomson Wadsworth.
5. Dr. C.C. Chatterjee, Human Physiology (11th Edition) Vol I and II, Medical Allied Agency, Kolkata, 1987.

Outcomes: At the end of the course, the student must be able to understand the fundamentals of biology, biological diversity and their applications in agriculture and medical biotechnology.

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(A10004) ENGINEERING PHYSICS

Objectives:

It gives

- to the students basic understanding of bonding in solids, crystal structures and techniques to characterize crystals.
- to understand the behavior of electron in a solid and thereby one can determine the conductivity and specific heat values of the solids.
- to study applications in Engineering like memory devices, transformer core and Electromagnetic machinery.
- to help the student to design powerful light sources for various Engineering Applications and also enable them to develop communication systems using Fiber Technology.
- to understand the working of Electronic devices, how to design acoustic proof halls and understand the behavior of the materials at Nano scale.

UNIT-I

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

X-ray Diffraction & Defects in Crystals: Bragg's Law, X-Ray diffraction methods: Laue Method, Powder Method**:** Point Defects: Vacancies, Substitutional, Interstitial, Frenkel and Schottky Defects, line defects (Qualitative) & Burger's Vector.

UNIT-II

Principles of Quantum Mechanics: Waves and Particles, de Broglie Hypothesis , Matter Waves, Davisson and Germer' Experiment, Heisenberg's Uncertainty Principle, Schrödinger's Time Independent Wave Equation - Physical Significance of the Wave Function – Infinite square well potential, extension to three dimensions

Elements of Statistical Mechanics & Electron theory of Solids: Phase space, Ensembles, Micro Canonical , Canonical and Grand Canonical Ensembles **-** Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics (Qualitative Treatment), Concept of Electron Gas, , Density of States, Fermi

Energy- Electron in a periodic Potential, Bloch Theorem, Kronig-Penny Model (Qualitative Treatment), E-K curve, Origin of Energy Band Formation in Solids, Concept of Effective Mass of an Electron, Classification of Materials into Conductors, Semi Conductors & Insulators.

UNIT-III

Dielectric Properties: Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector, Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities: Ionic and Electronic - Internal Fields in Solids, Clausius - Mossotti Equation, Piezo - electricity and Ferro- electricity.

Magnetic Properties & Superconducting Properties: Permeability, Field Intensity, Magnetic Field Induction, Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Domain Theory of Ferro Magnetism on the basis of Hysteresis Curve, Soft and Hard Magnetic Materials, Properties of Anti-Ferro and Ferri Magnetic Materials and their Applications, Superconductivity, Meissner Effect, Effect of Magnetic field, Type-I & Type-II Superconductors, Applications of Superconductors.

UNIT-IV

Optics: Interference-Interference in thin films (Reflected light), Newton rings experiment- Fraunhofer diffraction due to single slit, N-slits, Diffraction grating experiment , Double refraction-construction and working of Nicol's Prism.

Lasers & Fiber Optics: Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Einstein's Coefficients and Relation between them, Population Inversion, Lasing Action, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers- Principle of Optical Fiber, Construction of fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Types of Optical Fibers: Step Index and Graded Index Fibers, Attenuation in Optical Fibers, Application of Optical Fiber in communication systems.

UNIT-V:

Semiconductor Physics: Fermi Level in Intrinsic and Extrinsic Semiconductors, Calculation of carrier concentration in Intrinsic &, Extrinsic Semiconductors, Direct and Indirect Band gap semiconductors, Hall Effect-Formation of PN Junction, Open Circuit PN Junction, Energy Diagram of PN Diode, Diode Equation, I-V Characteristics of PN Junction diode, Solar cell, LED & Photo Diodes. Acoustics of Buildings & Acoustic Quieting: Reverberation and Time of Reverberation, Sabine's Formula for Reverberation Time, Measurement of Absorption Coefficient of a Material, factors affecting the Architectural Acoustics and their Remedies.

Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume

Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Top-down Fabrication: Chemical Vapour Deposition, Characterization by TEM.

TEXT BOOKS:

1. Engineering Physics,K. Malik, A. K. Singh, Tata Mc Graw Hill Book Publishers.
2. Engineering Physics, V. Rajendran, Tata Mc Graw Hill Book Publishers.

REFERENCES:

1. Fundamentals of Physics, David Halliday, Robert Resnick, Jearl Walker by John Wiley & Sons.
2. Sears and Zemansky's University Physics (10th Edition) by Hugh D. Young Roger A. Freedman, T. R. Sandin, A. Lewis FordAddison-Wesley Publishers.
3. Applied Physics for Engineers – P. Madhusudana Rao (Academic Publishing company, 2013).
4. Solid State Physics – M. Armugam (Anuradha Publications).
5. Modern Physics – R. Murugeshan & K. Siva Prasath – S. Chand & Co. (for Statistical Mechanics).
6. A Text Book of Engg Physics – M. N. Avadhanulu & P. G. Khsirsagar– S. Chand & Co. (for acoustics).
7. Modern Physics by K. Vijaya Kumar, S. Chandralingam: S. Chand & Co.Ltd.
8. Nanotechnology – M.Ratner & D. Ratner (Pearson Ed.).
9. Introduction to Solid State Physics – C. Kittel (Wiley Eastern).
10. Solid State Physics – A.J. Dekker (Macmillan).
11. Applied Physics – Mani Naidu Pearson Education.

Outcomes:

- The student would be able to learn the fundamental concepts on behavior of crystalline solids.
- The knowledge on Fundamentals of Quantum Mechanics, Statistical Mechanics enables the student to apply to various systems like Communications Solar Cells, Photo Cells and so on.
- Design, Characterization and study of properties of materials help the student to prepare new materials for various Engineering applications.
- This course also helps the student exposed to non-destructive testing methods.
- Finally, Engineering Physics Course helps the student to develop problem solving skills and analytical skills.

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(A10005) ENGINEERING CHEMISTRY

Objective:

An engineer is as someone who uses scientific, natural and physical principles to design something of use for people or other living creatures. Much of what any engineer does involves chemistry because everything in our environment has a molecular make up. Engineering requires the concepts of applied chemistry and the more chemistry an engineer understands, the more beneficial it is. In the future, global problems and issues will require an in-depth understanding of chemistry to have a global solution. This syllabus aims at bridging the concepts and theory of chemistry with examples from fields of practical application, thus reinforcing the connection between science and engineering. It deals with the basic principles of various branches of chemistry which are fundamental tools necessary for an accomplished engineer.

UNIT I:

Electrochemistry & Corrosion: Electro Chemistry – Conductance - Specific, Equivalent and Molar conductance and their Units; Applications of Conductance (Conductometric titrations). **EMF:** Galvanic Cells, types of Electrodes – (Calomel, Quinhydrone and glass electrodes); Nernst equation and its applications ; concept of concentration cells, electro chemical series, Potentiometric titrations, determination of P^H using glass electrode-Numerical problems.

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

Corrosion and its control: Causes and effects of corrosion; Theories of corrosion – Chemical & Electrochemical corrosion; Types of corrosion (Galvanic, Water line, Pitting and Intergranular); Factors affecting rate of corrosion – Nature of metal and Nature of Enviornment – Corrosion control methods – Cathodic protection (sacrificial anodic and impressed current). Surface coatings: Metallic coatings & methods of application of metallic coatings - hot dipping (galvanization & tinning), Cementation, cladding, electroplating (copper plating) Electroless plating (Ni plating) - Organic coatings – Paints - constituents and their functions.

UNIT II:

Engineering Materials: Polymers: Types of Polymerization (Chain & Step growth).**Plastics:** Thermoplastic & Thermo setting resins; Compounding &

fabrication of plastics (Compression and injection moulding).Preparation, properties, engineering applications of PVC, Teflon and Bakelite.

Fibers- Charcterstics of fibers – preparation, properties and uses of Nylon – 6,6 and Dacron – Fiber Reinforced Plastics (FRP) – applications. **Rubbers** – Natural rubber and its vulcanization. Elastomers – Buna-s, Butyl rubber and Thiokol rubber.

Conducting polymers: Polyacetylene, Polyaniline, Mechanism of Conduction, doping; applications of Conducting polymers. **Bio-degradable Polymers**- preparation and Applications of Poly vinyl acetate and Poly lactic acid - **Cement:** composition of Portland cement, setting & hardening of cement (reactions), **Lubricants:** Classification with examples- Characterstics of a good lubricant & mechanism of lubrication (thick film, thin film and extreme pressure) – properties of lubricants: viscosity, Cloud point, flash and fire points. **Refractories:** Classification, characteristics of a good refractory and applications.

Nanomaterials: Introduction, preparation by sol-gel & chemical vapour deposition methods. Applications of nanomaterials.

UNIT III:

Water and its Treatment: Hardness of Water: Causes of hardness, expression of hardness – units – types of hardness, estimation of temporary & permanent hardness of water by EDTA method - numerical problems. Boiler troubles – Scale & sludges, Priming and foaming, caustic enbrittlement and boiler corrosion; Treatment of boiler feed water – Internal treatment (Phosphate, Colloidal and calgon conditioning) – External treatment – Lime Soda process, Zeolite process and ion exchange process. Numerical Problems. **Potable Water**- Its Specifications – Steps involved in treatment of potable water – Disinfection of water by chlorination and ozonisation. Reverse osmosis & its significance.

Unit – IV :

Fuels & Combustion: Fuels – Classification – soild fuels : coal – analysis of coal - proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining – cracking – types – fixed bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol, Bergius and Fischer-Tropsch's process: Gaseous fuels - constituents, characteristics and applications of natural gas, LPG and CNG. Analysis of flue gas by Orsat's apparatus – Numerical Problems.

Combustion – Definition, Calorific value of fuel – HCV , LCV; Determination of calorific value by Junker's gas calorimeter – theoretical calculation of Calorific value by Dulong's formula – Numerical problems on combustion.

UNIT V:

Phase Rule & Surface Chemistry : **Phase Rule:** Definition of terms: Phase,

component, degree of freedom, phase rule equation. Phase diagrams – one component system- water system. Two component system Lead- Silver, cooling curves, heat treatment based on iron-carbon phase diagram - hardening, annealing and normalization.

Surface Chemistry: **Adsorption –** Types of Adsorption, Isotherms – Freundlich and Langmuir adsorption isotherm, applications of adsorption; **Colloids**: Classification of Colloids; Electrical & optical properties, micelles, applications of colloids in industry.

TEXT BOOKS:

1. Engineering Chemistry by R.P. Mani,K.N. Mishra, B. Rama Devi / CENGAGE learning.
2. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).

REFERENCE BOOKS

1. Engineering Chemistry by B. Siva Shankar Mc.Graw Hill Publishing Company Limited, New Delhi (2006).
2. Engineering Chemistry J.C. Kuriacase & J. Rajaram, Tata McGraw Hills Publishing Company Limited, New Delhi (2004).
3. Text Book of Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co Publishers, New Delhi (2006).
4. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.

Outcome:

- Students will demonstrate a depth of knowledge and apply the methods of inquiry in a discipline of their choosing, and they will demonstrate a breadth of knowledge across their choice of varied disciplines.
- Students will demonstrate the ability to access and interpret information, respond and adapt to changing situations, make complex decisions, solve problems, and evaluate actions.
- Students will demonstrate awareness and understanding of the skills necessary to live and work in a diverse engineering world.

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(A10501) COMPUTER PROGRAMMING

Objectives:

- To understand the various steps in Program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs.
- To learn to write programs (using structured programming approach) in C to solve problems.
- To introduce the students to basic data structures such as lists, stacks and queues.
- To make the student understand simple sorting and searching methods.

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Program Development.

Introduction to the C Language – Background, C Programs, Identifiers, Types, Variables, Constants, Input / Output, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements- Selection Statements (making decisions) – if and switch statements, Repetition statements (loops)-while, for, do-while statements, Loop examples, other statements related to looping – break, continue, goto, Simple C Program examples.

UNIT - II

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

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

UNIT - III

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications-Arrays and Pointers, Pointer Arithmetic and arrays, Passing an array to a function,

memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

UNIT - IV

Enumerated, Structure, and Union Types– The Type Definition (typedef), Enumerated types, Structures –Declaration, initialization, accessing structures, operations on structures, Complex structures, structures and functions, Passing structures through pointers, self referential structures, unions, bit fields, C programming examples, command –line arguments.

Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling),Positioning functions, C program examples.

UNIT – V

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

Lists- Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Push and Pop Operations, Queues- Enqueue and Dequeue operations.

TEXT BOOKS:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.

REFERENCE BOOKS:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. C for All, S. Thamarai Selvi, R.Murugesan, Anuradha Publications.
3. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.
4. Programming in C, Ajay Mittal, Pearson.
5. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
6. Problem solving with C, M.T.Somasekhara, PHI
7. Programming with C, R.S.Bickar, Universities Press.
8. Computer Programming & Data Structures, E.Balagurusamy, 4th edition, TMH.

9. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
10. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI.
11. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press.

Outcomes:

- Demonstrate the basic knowledge of computer hardware and software.
- Ability to apply solving and logical skills to programming in C language and also in other languages.

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I Year B.Tech. Biotech.	**L**	**T/P/D**	**C**
	2	**-/-/3**	**6**

(A10301) ENGINEERING DRAWING

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Drawing/ Graphics – Various Drawing Instruments – Conventions in Drawing – **Lettering practice** – BIS Conventions.

Curves: Constructions of Curves used in Engineering Practice:

a) Conic Sections including the Rectangular Hyperbola – General method only.

b) Cycloid, Epicycloid and Hypocycloid.

c) Involute.

Scales: Construction of different types of Scales, Plain, Diagonal, Vernier scale.

UNIT – II

Orthographic Projections in First Angle

Projection: Principles of Orthographic Projections – Conventions – First and Third Angle projections.

Projections of Points : including Points in all four quadrants.

Projections of Lines : Parallel, perpendicular, inclined to one plane and inclined to both planes. True length and true angle of a line. Traces of a line.

Projections of Planes: Plane parallel, perpendicular and inclined to one reference plane. Plane inclined to both the reference planes.

UNIT – III

Projections of Solids: Projections of regular solids, cube, prisms, pyramids, tetrahedran, cylinder and cone, axis inclined to both planes.

Sections and Sectional Views: Right Regular Solids – Prism, Cylinder, Pyramid, Cone – use of Auxiliary views.

UNIT – IV

Development of Surfaces: Development of Surfaces of Right, Regular Solids – Prisms, Cylinder, Pyramids, Cone and their parts. frustum of solids.

Intersection of Solids:- Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT – V

Isometric Projections : Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Plane Figures, Simple and Compound

Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of parts with Spherical surface.

Transformation of Projections : Conversion of Isometric Views to Orthographic Views. Conversion of orthographic views to isometric views – simple objects.

Perspective Projections : Perspective View : Points, Lines and Plane Figures, Vanishing Point Methods (General Method only).

TEXT BOOKS

1. Engineering Drawing – Basant, Agrawal, TMH
2. Engineering Drawing, N.D. Bhatt

REFERENCES :

1. Engineering Graphics. P I Varghese Tata McGraw Hill Education Pvt. Ltd.
2. Engineering drawing – P.J. Shah .S.Chand Publishers.
3. Engineering Drawing- Johle/Tata Macgraw Hill Book Publishers.
4. Engineering Drawing – M.B. Shah and B.C. Rana, Pearson.
5 . Engineering Drawing by K.Venu Gopal & V.Prabu Raja New Age Publications.
6. Engineering Drawing by John. PHI Learning Publisher.

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I Year B.Tech. Biotech.	**L**	**T/P/D**	**C**
	-	**-/3/-**	**4**

(A10581) COMPUTER PROGRAMMING LAB

Objectives:

- To write programs in C to solve the problems.
- To implement linear data structures such as lists, stacks, queues.
- To implement simple searching and sorting methods.

Recommended Systems/Software Requirements:

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

Week I

a) Write a C program to find the sum of individual digits of a positive integer.

b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 2

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

Sum=$1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$

b) Write a C program to find the roots of a quadratic equation.

Week 3

a) The total distance travelled by vehicle in 't' seconds is given by distance s = $ut+1/2at^2$ where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec^2). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

b) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Week 4

a) Write C programs that use both recursive and non-recursive functions

i) To find the factorial of a given integer.

ii) To find the GCD (greatest common divisor) of two given integers.

Week 5

a) Write a C program to find the largest integer in a list of integers.

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices

ii) Multiplication of Two Matrices

Week 6

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

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n Characters from a given position in a given string.

b) Write a C program to determine if the given string is a palindrome or not

Week 7

a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.

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

Week 8

a) Write a C program to generate Pascal's triangle.

b) Write a C program to construct a pyramid of numbers.

Week 9

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

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

For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Print x, n, the sum

Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.

Week 10

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

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

Week 11

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

i) Reading a complex number

ii) Writing a complex number

iii) Addition of two complex numbers

iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 12

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

b) Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line.)

Week 13

a) Write a C program to display the contents of a file.

b) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

Week 14

a) Write a C program that uses non recursive function to search for a Key value in a given list of integers using Linear search.

b) Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers using Binary search.

Week 15

a) Write a C program that implements the Selection sort method to sort a given array of integers in ascending order.

b) Write a C program that implements the Bubble sort method to sort a given list of names in ascending order.

Week 16

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

i) Create a singly linked list of integer elements.

ii) Traverse, the above list and display the elements.

Week 17

Write a C program that implements stack (its operations) using a singly linked list to display a given list of integers in reverse order. Ex. input: 10 23 4 6 output: 6 4 23 10

Week 18

Write a C program that implements Queue (its operations) using a singly linked list to display a given list of integers in the same order. Ex. input: 10

23 4 6 output: 10 23 4 6

Week 19

Write a C program to implement the linear regression algorithm.

Week 20

Write a C program to implement the polynomial regression algorithm.

Week 21

Write a C program to implement the Lagrange interpolation.

Week 22

Write C program to implement the Newton- Gregory forward interpolation.

Week 23

Write a C program to implement Trapezoidal method.

Week 24

Write a C program to implement Simpson method.

TEXT BOOKS:

1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications.
2. Computer Programming in C, V. Rajaraman, PHI Publishers.
3. C Programming, E.Balagurusamy, 3rd edition, TMH Publishers.
4. C Programming, M.V.S.S.N.Prasad, ACME Learning Pvt. Ltd.
5. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand Publishers
6. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publishers.

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(A10081) ENGINEERING PHYSICS / ENGINEERING CHEMISTRY LAB

ENGINEERING PHYSICS LAB

(Any TEN experiments compulsory)

Objectives

This course on Physics lab is designed with 13 experiments in an academic year. It is common to all branches of Engineering in B.Tech Ist year.

The objective of the course is that the student will have exposure to various experimental skills which is very essential for an Engineering student.

The experiments are selected from various areas of Physics like Physical Optics, Lasers, Fiber Optics, Sound, Mechanics, Electricity & Magnetism and Basic Electronics.

Also the student is exposed to various tools like Screw gauge, Vernier Callipers, Physics Balance , Spectrometer and Microscope.

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

LABORATORY MANUAL:

1. Laboratory Manual of Engineering Physics by Dr.Y.Aparna & Dr.K.Venkateswara Rao (V.G.S Publishers)

Outcomes

The student is expected to learn from this laboratory course the concept of error and its analysis. It also allows the student to develop experimental skills to design new experiments in Engineering.

With the exposure to these experiments the student can compare the theory and correlate with experiment.

ENGINEERING CHEMISTRY LAB

List of Experiments (Any 12 of the following)

Titrimetry:

1. Estimation of ferrous iron by dichrometry.
2. Estimation of hardness of water by EDTA method.

Mineral analysis:

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

Instrumental Methods:

Colorimetry:

5. Determination of ferrous iron in cement by colorimetric method
6. Estimation of copper by colorimetric method.

Conductometry:

7. Conductometric titration of strong acid vs strong base.
8. Conductometric titration of mixture of acids vs strong base.

Potentiometry:

9. Titration of strong acid vs strong base by potentiometry.
10. Titration of weak acid vs strong base by potentiometry.

Physical properties:

11. Determination of viscosity of sample oil by redwood / oswald's viscometer.
12. Determination of Surface tension of lubricants.

Preparations:

13. Preparation of Aspirin
14. Preparation of Thiokol rubber

Adsorption:

15. Adsorption of acetic acid on charcoal.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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(A10083) ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

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

Objectives

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

Syllabus: English Language Communication Skills Lab shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

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

Exercise – I

CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

ICS Lab: Ice-Breaking activity and JAM session.

Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms.

Exercise – II

CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker – Weak Forms and Strong Forms - Consonant Clusters.

ICS Lab: Situational Dialogues – Role-Play- Expressions in Various Situations – Self-introduction and Introducing Others – Greetings – Apologies –

Requests – Social and Professional Etiquette - Telephone Etiquette.

Concord (Subject in agreement with verb) and Words often misspelt-confused/misused

Exercise - III

CALL Lab: Minimal Pairs- Word accent and Stress Shifts- Listening Comprehension.

ICS Lab: Descriptions- Narrations- Giving Directions and guidelines.

Sequence of Tenses, Question Tags and One word substitutes.

Exercise – IV

CALL Lab: Intonation and Common errors in Pronunciation.

ICS Lab: Extempore- Public Speaking

Active and Passive Voice, –Common Errors in English, Idioms and Phrases

Exercise – V

CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice

ICS Lab: Information Transfer- Oral Presentation Skills

Reading Comprehension and Job Application with Resume preparation.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

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

(i) P – IV Processor

a) Speed – 2.8 GHZ

b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

(ii) Headphones of High quality

2. Interactive Communication Skills (ICS) Lab :

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Books Suggested for English Language Lab Library (to be located within

the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. *A Handbook for English Language Laboratories.* New Delhi: Foundation
2. *Speaking English Effectively* 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
3. Sasi Kumar, V & Dhamija, P.V. *How to Prepare for Group Discussion and Interviews.* Tata McGraw Hill
4. Hancock, M. 2009. *English Pronunciation in Use. Intermediate.* Cambridge: CUP
5. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad.
6. Hewings, M. 2009. *English Pronunciation in Use. Advanced.* Cambridge: CUP
7. Marks, J. 2009. *English Pronunciation in Use. Elementary.* Cambridge: CUP
8. Nambiar, K.C. 2011. *Speaking Accurately. A Course in International Communication.* New Delhi : Foundation
9. Soundararaj, Francis. 2012. *Basics of Communication in English. New Delhi: Macmillan*
10. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
11. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.
12. **A textbook of English Phonetics for Indian Students** by T. Balasubramanian (Macmillan)
13. **Prescribed Lab Manual:** A Manual entitled "***English Language Communication Skills (ELCS) Lab Manual- cum- Work Book***", published by Cengage Learning India Pvt. Ltd, New Delhi. 2013

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Examination:

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 year-end Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s).

The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

Outcomes:

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

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I Year B.Tech. Biotech.	**L**	**T/P/D**	**C**
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(A10082) IT WORKSHOP / ENGINEERING WORKSHOP

Objectives:

The IT Workshop for engineers is a training lab course spread over 54 hours. The modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel and Power Point.

PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. **The students should work on working PC to disassemble and assemble to working condition and install Windows and Linux on the same PC. Students are suggested to work similar tasks in the Laptop scenario wherever possible.**

Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet. Usage of web browsers, email, newsgroups and discussion forums would be covered. In addition, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks would be introduced.

Productivity tools module would enable the students in crafting professional word documents, excel spread sheets and power point presentations using the Microsoft suite of office tools and LaTeX. (**Recommended to use Microsoft office 2007 in place of MS Office 2003)**

PC Hardware

Week 1 – Task 1 : Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Week 2 – Task 2 : Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Week 3 – Task 3 : Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Week 4 – Task 4 : Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Week 5 – Task 5: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva

Week 6 – Task 6 : Software Troubleshooting : Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

Internet & World Wide Web

Week 7 - Task 1 : **Orientation & Connectivity Boot Camp :** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Week 8 - Task 2 : Web Browsers, Surfing the Web : Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Week 9 - Task 3 : **Search Engines & Netiquette :** Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Week 10 - Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install antivirus software, configure their personal firewall and windows update on their computer. Then they need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

Week 11- Task 5: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list.

Productivity tools

LaTeX and Word

Week 12 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office 2007/ equivalent (FOSS) tool word: Importance of LaTeX and MS office 2007/ equivalent (FOSS) tool Word as word Processors, Details of the three tasks and features that would be covered in each, using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.

Task 1 : Using LaTeX and Word to create project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Week 13 - Task 2: Creating project abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Week 14 - Task 3 : Creating a Newsletter : Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel

Week 15 - Excel Orientation: The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the two tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

Week 16 - Task 2 : Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP, Sorting, Conditional formatting

LaTeX and MS/equivalent (FOSS) tool Power Point

Week 17 - Task1: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both LaTeX and Power point. Students will be given model power

point presentation which needs to be replicated (exactly how it's asked).

Week 18- Task 2: Second week helps students in making their presentations interactive. Topic covered during this week includes: Hyperlinks, Inserting – Images, Clip Art, Audio, Video, Objects, Tables and Charts

Week 19 - Task 3: Concentrating on the in and out of Microsoft power point and presentations in LaTeX. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides.

REFERENCE BOOKS:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. LaTeX Companion – Leslie Lamport, PHI/Pearson.
3. Introduction to Computers, Peter Norton, 6/e Mc Graw Hill Publishers.
4. Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education
5. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
7. PC Hardware and A+Handbook – Kate J. Chase PHI (Microsoft)

Outcomes:

- Apply knowledge for computer assembling and software installation.
- Ability how to solve the trouble shooting problems.
- Apply the tools for preparation of PPT, Documentation and budget sheet etc.

ENGINEERING WORKSHOP

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry
2. Fitting
3. Tin-Smithy and Development of jobs carried out and soldering.

4. Black Smithy
5. House-wiring
6. Foundry
7. Welding
8. Power tools in construction, wood working, electrical engineering and mechanical Engineering.

2. TRADES FOR DEMONSTRATION & EXPOSURE:

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

TEXT BOOK:

1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers.
2. Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition.

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II Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
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(A30013) BIOCHEMISTRY

Objectives: The major objective of this course is to provide exposure to students with the chemical nature of biomolecules both simple and complex and to impart an understanding of important metabolic pathways and their regulations.

UNIT-I

Fundamentals of Biochemistry:

Chemical foundations of Biology: Properties of water, pH & Buffers, The Handerson Hasselbalch equation, determination of pKa values, Physiological buffers. Covalent bond and non covalent bond interactions. Classes of organic compounds and functional groups – Basics of Stereochemistry of Biomolecules.

Bioenergetics; Redox potential, components in electron transport systems in mitochondria, respiratory chain. Oxidative phosphorylation - Energetics, High energy compounds.

UNIT II

Carbohydrates:

Classification of carbohydrates,properties and chemical reactions of carbohydrates,Industrially significant carbohydrates, Lectins,Glucose tolerance test,Glycolysis,Aerobic and anaerobic fate of Pyruvate, Gluconeogenesis,Pentose phosphate pathway

UNIT III

Proteins:

Amino acids and peptides - classification, chemical reactions and physical properties, non- natural aminoacids and their significance.

Proteins - classification and hierarchy in structure, Ramachandran map,Nitrogen cycle, Nitrogen balance, Reductive amination and transamination, Urea cycle;Production of aminoacids-Glutamate pathway,Shikimate pathway for the production of aminoacids.

Unit IV

Lipids:

Classification of lipids, Characterisation of Fats, Brief outlines of Fatty acid synthesis and breakdown, Significance of cholesterol and lipoproteins in Lipid profile analysis,Lipids as surfactants in industry.

UNIT V

Nucleic Acids:

Nucleic acids and their metabolism, Structure of purines and Pyrimidines,Brief outlines of Biosynthesis and Degradation.

TEXT BOOKS:

1. Lehninger A L,Nelson O.L,M.M.Cox,Principles of Biochemistry 3rd edition,2000CBS Publicatons.
2. L.Stryer ,JM.Berg ,JL Tymockzo Biochemistry 5th edition,WH Freeman & Co ,2002

REFERENCES:

1. Voet D,Voet J .G.Biochemistry,second Edition,John C wiley and Sons,1994
2. Campbell and Farell ,Biochemistry ,Brooks/cole CENGAGE learning, 2008
3. Fundamentals of Biochemistry JL.Jain S.chand Publishers.

Outcomes: After the completion of the course, the student will gain an understanding of the metabolic processes, their control and how the stoichiometry of metabolites influences the production of biotech products.

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	4	**-/-/-**	**4**

(A30201) BASIC ELECTRICAL AND ELECTRONIC ENGINEERING

Objectives: This course introduces the concepts of electrical DC and single phase and three phase AC circuits, basic law's of electricity, instruments to measure the electrical quantities, different methods to solve the electrical networks, construction operational features of energy conversion devices i.e. DC and AC machines, transformers. It also emphasizes on basics of electronics, semiconductor devices and their characteristics and operational features. It also focus on the digital electronic circuits.

UNIT I:

CIRCUITS: DC CIRCUITS: RLC concepts, Kirchhoff's laws, steady state solution of D.C circuits.

A.C CIRCUITS: Introduction to A.C circuits, RMA & Average values of wave forms, complex impedance and complex power, power factor, analysis of single phase A.C circuits.

3-PHASE CIRCUITS: Introduction of 3-phase circuits, power in 3- phase circuits, analysis of simple 3-phase balance circuits.

UNIT-II:

MEASUREMENTS & ELECTRICAL MACHINES : MEASUREMENTS: Moving coil and moving iron instruments (Ammeter and voltmeter). Dynamometer type watt meters and energy meters (Principles of operation and constructional details).

ELECTRICAL MACHINES: Principles of operation and characteristics of D C machines, Transformers (single phase and three phase) - Synchronous Machines - three Phase and single phase induction motors - (Principles of operation and constructional details).

UNIT -III:

SEMICONDUCTOR DEVICES & RECTIFIERS: Classification of solids based on energy hand theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - P-N junction - V I characteristic of PN junction diode - Zener diode - Zener diode characteristics - Half wave and full wave rectifiers - Voltage regulation, SCR, Diac, Triac, Characteristics and simple applications.

UNIT-IV:

TRANSISTORS: Bipolar junction transistor - CB, CE, CC - Configurations and characteristics – Biasing circuits - Field Effect Transistor - Configurations and characteristics - FET amplifier - UJT - characteristics and simple

applications - switching transistors - concept of feedback - negative feedback - application in temperature and motor speed control.

UNIT-V:

DIGITAL ELECTRONICS: Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra - Exclusive OR gate - Half and Full adders - flip flops - registers and counters - A/D, D/A conversion - Digital computer principle.

EEE: TEXT BOOKS:

1. Basic concepts of Electrical Engineering, PS Subramanyam, BS Publications.
2. Basic Electrical Engineering, S.N. Singh, PHI.

ECE: TEXT BOOKS:

1. Electronic Devices and Circuits, S.Salivahanan, N.Suresh Kumar, A.Vallavaraj,Tata McGraw-Hill companies..
2. Electronic Devices and Circuits, K. Lal Kishore,BS Publications.
3. Switching Theory and Logic Design, A. Anand Kumar, PHI.

EEE: REFERENCES:

1. Basic Electrical Engineering, Abhijit Chakrabarthi, Sudipta nath, Chandrakumar Chanda, Tata-McGraw-Hill.
2. Principles of Electrical Engineering, V.K Mehta, Rohit Mehta, S.Chand Publications.
3. Basic Electrical Engineering, T.K.Nagasarkar and M.S. Sukhija, Oxford University Press.
4. Fundamentals of Electrical Engineering, RajendraPrasad, PHI.
5. Basic Electrical Engineering by D.P.Kothari , I.J. Nagrath, McGraw-Hill.

ECE: REFERENCES:

1. Millman's Electronic Devices and Circuits,J. Millman, C.C.Halkias, and Satyabrata Jit, Tata McGraw-Hill companies.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky,PEI/PHI.
3. Introduction to Electronic Devices and Circuits, Rober T. Paynter,PE.
4. Integrated Electronics, J. Millman and Christos C. Halkias, Tata McGraw-Hill companies.
5. Electronic Devices and Circuits, Anil K. Maini, Varsha Agarwal,Wiley India Pvt. Ltd.
6. Digital Design – Morris Mano, PHI

Outcomes: After going through this course the student gets a thorough knowledge on basic electrical circuits, parameters, and operation of the transformers in the energy conversion process, electromechanical energy conversion, construction operation characteristics of DC and AC machines and the constructional features and operation of measuring instruments like voltmeter, ammeter, wattmeter etc...and different semiconductor devices, their voltage-current characteristics, operation of diodes, transistors, realization of various electronic circuits with the various semiconductor devices, and cathode ray oscilloscope and various digital electronic circuits, their analysis, operational features, applications, With which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

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	4	**-/-/-**	**4**

(A32303) CELL BIOLOGY

Objectives: The objective of the course is to familiarize the students with cell structure, function, multiplication, differentiation, inter and intracellular signaling and regulatory pathways.

UNIT I:

CELL STRUCTURE AND FUNCTION

Basic properties of cells; Cell theory; Cell complexity; Different classes of cells; Dimensions of cells; Size & shape of Prokaryotic & Eukaryotic cells; Chemistry of the cell; Importance of carbon and water; Plasma membrane-structure and function; Cytoplasm & Cytoskeleton; Microtubules, Microfilaments, Intermediate Filaments. Structure and functions of Nucleus, Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysosomes, Peroxisomes, Chloroplast & Mitochondria.

UNIT II:

INTRACELLULAR TRANSPORT SYSTEMS

Passive and Active Transport, Permeases, Na^+/K^+ Pump, ATPase pumps, Lysosomal & Vacuolar membrane, ATP dependent Proton Pumps, Co-Transport, Symport, Antiport, Transport into Prokaryotic Cells, Endocytosis and Exocytosis.

Post-Translational Modifications and Transport of Macromolecules:Protein glycosylation, and other modifications. Sorting & macromolecular traffic within cells. Polarization of cells & trafficking in polarized cells.

UNIT III:

CELL DIVISION AND DIFFERENTIATION

Overview of the Cell Cycle, Interphase, Mitosis, Meiosis and Cytokinesis. Animal Cell & Yeast Cell Division, Cell Cycle Control & Checkpoints.

General Characteristics of Cell Differentiation, Historical events in Cell differentiation, Cytoplasmic determinants, Nucleoplasmic Interactions; Stem Cell differentiation and its Biological Importance.

UNIT IV

RECEPTORS & SIGNAL TRANSDUCTION

Cytosolic, Nuclear & Membrane bound receptors, Examples and types of receptors; Chemo receptors of Bacteria (Attractants & Repellents), Concept of Secondary messengers, cAMP, cGMP, Protein Kinases, G Proteins, Steroid / Peptide hormone regulation, Tissue specific regulation.

UNIT V:

DISRUPTION OF CELLULAR PATHWAYS AND INTRODUCTION TO CANCER

Characteristics of cancer cells; Disruption in cell cycle; Disruption in cell signaling. Micro organisms and cancer. Telomere/telomerase and cancer.

TEXT BOOKS:

1) Cell & Molecular Biology by Gerald Karp (2nd Ed.) Wiley publishers.
2) The Cell by Cooper.

REFERENCES:

1) The World of the cell by Becker, Reece, Poenie (3rd edition) Benjamin Publishers.
2) Molecular Biology of the cell by Bruce Alberts.
3) Cell and Molecular biology – De Robertis and De Robertis Waverly Pvt. Ltd.
4) Molecular biology- Mohan P. Arora

Outcomes: After completion of the course students would be able to distinguish different cell organelles by structures and explain the mechanisms associated with them. They can identify the important check points of cell division and alteration leading to fatal consequences.

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(A30006) MATHEMATICS - II

Objectives:

- The objective is to find the relation between the variables x and y out of the given data (x,y).
- This unit also aims to find such relationships which exactly pass through data or approximately satisfy the data under the condition of least sum of squares of errors.
- The aim of numerical methods is to provide systematic methods for solving problems in a numerical form using the given initial data.
- This topic deals with methods to find roots of an equation and solving a differential equation.
- The numerical methods are important because finding an analytical procedure to solve an equation may not be always available.
- In the diverse fields like electrical circuits, electronic communication, mechanical vibration and structural engineering, periodic functions naturally occur and hence their properties are very much required.
- Indeed, any periodic and non-periodic function can be best analyzed in one way by Fourier series and transforms methods.
- The unit aims at forming a partial differential equation (PDE) for a function with many variables and their solution methods. Two important methods for first order PDE's are learnt. While separation of variables technique is learnt for typical second order PDE's such as Wave, Heat and Laplace equations.
- In many Engineering fields the physical quantities involved are vector-valued functions.
- Hence the unit aims at the basic properties of vector-valued functions and their applications to line integrals, surface integrals and volume integrals.

UNIT – I

Vector Calculus: Vector Calculus: Scalar point function and vector point function, Gradient- Divergence- Curl and their related properties. Solenoidal and irrotational vectors – finding the Potential function. Laplacian operator. Line integral – work done – Surface integrals -Volume integral. Green's

Theorem, Stoke's theorem and Gauss's Divergence Theorems (Statement & their Verification).

UNIT – II:

Fourier series and Fourier Transforms: Definition of periodic function. Fourier expansion of periodic functions in a given interval of length 2π . Determination of Fourier coefficients – Fourier series of even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

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

UNIT – III:

Interpolation and Curve fitting

Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations of symbols. Difference expressions – Differences of a polynomial-Newton's formulae for interpolation - Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

Curve fitting: Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares.

UNIT – IV : Numerical techniques

Solution of Algebraic and Transcendental Equations and Linear system of equations: Introduction – Graphical interpretation of solution of equations .The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method .

Solving system of non-homogeneous equations by L-U Decomposition method (Crout's Method). Jacobi's and Gauss-Seidel iteration methods.

UNIT – V

Numerical Integration and Numerical solutions of differential equations:

Numerical integration - Trapezoidal rule, Simpson's $1/3^{rd}$ and 3/8 Rule , Gauss-Legendre one point, two point and three point formulas.

Numerical solution of Ordinary Differential equations: Picard's Method of successive approximations. Solution by Taylor's series method – Single step methods-Euler's Method-Euler's modified method, Runge-Kutta (second and classical fourth order) Methods.

Boundary values & Eigen value problems: Shooting method, Finite difference method and solving eigen values problems, power method

TEXT BOOKS:

1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCES:

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi & Others, S. Chand.
2. Introductory Methods by Numerical Analysis by S.S. Sastry, PHI Learning Pvt. Ltd.
3. Mathematical Methods by G.Shankar Rao, I.K. International Publications, N.Delhi
4. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, 2013, CRC Press Taylor & Francis Group.
5. Mathematics for Engineers and Scientists, Alan Jeffrey, 6ht Edi, 2013, Chapman & Hall/ CRC
6. Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Person Education
7 Mathematics For Engineers By K.B.Datta And M.A S.Srinivas,Cengage Publications

Outcomes: From a given discrete data, one will be able to predict the value of the data at an intermediate point and by curve fitting, can find the most appropriate formula for a guessed relation of the data variables. This method of analysis data helps engineers to understand the system for better interpretation and decision making

- After studying this unit one will be able to find a root of a given equation and will be able to find a numerical solution for a given differential equation.
- Helps in describing the system by an ODE, if possible. Also, suggests to find the solution as a first approximation.
- One will be able to find the expansion of a given function by Fourier series and Fourier Transform of the function.
- Helps in phase transformation, Phase change and attenuation of coefficients in acoustics.
- After studying this unit, one will be able to find a corresponding Partial

Differential Equation for an unknown function with many independent variables and to find their solution.

- Most of the problems in physical and engineering applications, problems are highly non-linear and hence expressing them as PDEs'. Hence understanding the nature of the equation and finding a suitable solution is very much essential.
- After studying this unit, one will be able to evaluate multiple integrals (line, surface, volume integrals) and convert line integrals to area integrals and surface integrals to volume integrals.
- It is an essential requirement for an engineer to understand the behavior of the physical system.

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	4	**-/-/-**	**4**

(A32302) BIOFLUID MECHANICS

Objectives: This course is formulated to impart the knowledge of fluids, flow properties and their measurements with respect to process operations.

UNIT-I

Overview of Fluid Mechanics

Application of Engineering principles in bioprocess Industries-Introduction to unit operations and its application in Bioprocess Industries. Concept of units and dimensions, basic quantities and derived units in SI and American Engineering system, conversion of units. Concept of mass and force, various equations of state including ideal gas law to evaluate P.V.T data, their application in process calculations by solving basic numerical problems.

UNIT-II

Properties & Classification of Fluids

Fluid mechanics- Properties of fluids, fluid statics, energy balance in fluid flow through pipes and conduits, Bernoulli's equation and its application, calculation of power required for pumping fluids. Examples from bioprocessing systems. Rheology of fluids - Newton's law of viscosity. Concept of Newtonian and non - Newtonian fluids- Different types of non-Newtonian fluids with examples in bioprocessing. Measurement of viscosity using extrusion rheometer, plate and cone viscometer, coaxial cylinder viscometer.

UNIT-III

Flow Resistance & Pressure Drop

Flow through pipes, average velocity, flow regimes, Laminar and turbulent flow – characterization by Reynold's number, pressure drop due to skin friction and form friction, friction factor chart, Hagen -Poiseuille equation. Flow past immersed bodies: Definition of drag and drag coefficient. Friction in flow through beds of solids, derivation of friction factor equations and pressure drop expressions. Introduction of the concept of packed beds. Concept of terminal velocity.

UNIT-IV

Flow Measuring Devices

Flow measuring and monitoring systems- valves, bends, elbows, prevention of leaks, mechanical seals, stuffing box. Flow measuring devices-manometers, orifice meter, venture meter and rotameter.

UNIT-V

Pumps

Fluid transportation machinery: Different types of pumps, positive displacement pumps, reciprocating pumps, diaphragm pumps, peristaltic pumps. Calculation of pump horse power.

TEXT BOOKS:

1. Unit operations of chemical engineering, Mc Cabe, W.L, Smith J.C., and Harriot P., Mc-Graw Hill, 3rd Ed.
2. Unit Operations-1: K. A.Gavhane: Nirali Prakashan

REFERENCES:

1. Fluid mechanics and machinery, C. P. Kothandaraman and R. Rudramoorhy, New Age International Publishers, 3rd Ed (2012).
2. "Technical aspects of the rheological properties of microbial cultures", - Charles, M in Advances in Biochemical Engineering, Ghose, T.K., Fiechter, A and Blakebrough, N.(Eds), Spinger-Verlag, Berlin, pp. 1-62
3. Unit operation in Food processing, Earle, R.L. (1996) Pergamon Press, Oxford, PP. 212-282.
4. Introduction to Biochemical Engineering, D.G.Rao, Tata Mc Hill (2005)
5. Bio-process Engineering Principles, Pauline M.Doran. Academic press.

Outcomes: At the end students will know fluid properties, their behavioral characteristics and would be able to calculate pressure drop across the column .They will be able to measure the various fluid properties and handle fluid based equipments and reactors.

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II Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A32304) MICROBIOLOGY

Objectives: This course is formulated to provides an exposure to microbial diversity, their characteristics, classification, physiology and identification. It also enables them to understand host pathogen interaction and their microbial environment. It also introduces the students to pathogens and viruses.

UNIT I:

INTRODUCTION TO MICROBIOLOGY: Discovery of microorganisms; Theory of spontaneous generation, Germ theory of diseases; Major contribution and events in the field of Microbiology. Scope and relevance of microbiology.

Identification of Microorganisms - A general account. Microdiversity

UNIT II:

MAJOR GROUPS OF MICROORGANISMS AND GENERAL METHODS OF IDENTIFICATION: General characteristics of Bacteria, Archaea and Eubacteria. Diversity classification of Woese et al. Three domains of life. Five - kingdom system of Whittaker.

Classification systems - Phylogenetic, Phenetic, Taxonomic ranks, Major characteristics used in Taxonomy - Morphological, Physiological, ecological, Biochemical, Immunological, Genetic and Molecular.

Colony characteristics, staining techniques; Fixation, Principle dyes, simple staining, differential staining, spore staining, flageller staining.

Biochemical tests – Sugar fermentations, IMVIC tests, Catalase production etc.

UNIT III:

NUTRITION, CULTIVATION AND PRESERVATION OF MICROORGANISMS: Nutrition requirements of microorganisms; nutritional classes of microbes, Macro and micronutrients, their sources and physiological functions of nutrients. Growth factors and their functions in metabolism. Aerobic and anaerobic metabolism. Cultivation of microorganisms; Culture media, synthetic, complex media, solidifying agents, types of media -selective, differential and enrichment and enriched media, pure culture methods - spread plate, pour plate and streak plate, special techniques for cultivation of anaerobes.

Influence of environmental factors on growth – solutes, water activity, pH, temperature, oxyzen, osomotic pressure, radiation.

Preservation of Microganisms: working and primary stock cultures – agar slants, agar stabs, spore preparation, use of sterile soil, cryopreservation, lyophilisation, Application and limitations of various methods.

UNIT IV:

PATHOGENESITY: Definition of infection and disease, Normal Physiology versus pathology and disease, Normal Flora versus Pathogens, virulence and responsible factors colonization, Examples: Influenza, Toxin, Tuberculosis, Antimicrobials & mode of action: cell membrane, protein, nucleic acid.

UNIT V:

VIRUSES: Introduction to Viruses: Properties and Structure of Viruses; Animal Virology; Plant Virology; Viruses of Arthropods, bacteria and other lower organisms; classification of viruses (Bacterial, plant and animal with 1 example each); Applications of Virology in Biotech Industry,

Replication of viruses: Viral Replication-Bacterial, plant and animal with 1 example each (in case of animal viruses the teaching should include the examples of DNA and RNA viral replication and also of those that replicate in the cytoplasm and nucleus).

Identification, culture and assay of viruses: Identification and *in vitro* cultivation of viruses. Assay of viruses (Both bacterial and animal viruses)

TEXT BOOKS:

1. Microbiology, Pelczar M.J. Chan ECE and Krieg NR. Tata McGraw Hill.
2. General Microbiology. Roger Y stanier, Macmillan.

REFERENCES:

1. Biology of Micro organisma. BROCK, Prentice Hall, International Inc.
2. Introduction to Micro Biology a case History approach 3rd edition john. L. Ingraham, Catherine A lingraham, Thomson Publications.
3. General Microbiology. Hons. G.Schlege. Combridge university press.
4. General Microbiology. Prescott and Dunn Mc Graw Hill Publishers.
5. Introduction to microbiology – A case history approach 3rd edition – john L. ingram, Catherine A. Ingram Thomson Publishers.
6. Microbiology: A Human perspective 5th edition, Nestor, Anderson, Robertes

Outcomes: Student would be able to distinguish between bacteria by culture and staining methods. They understand the different mechanisms associated with pathogenecity, virus replication, quantification and identification. They will gain the ability to differentiate virus from bacteria and also correlate the differences between replication, quantification and identification methods.

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II Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A32381) BIOCHEMISTRY LAB

Objectives: This course is designed to impart basic practical knowledge of preparation of standard solutions and buffers, color reactions of biomolecules and their estimations, basic knowledge of chromatography and basics of biomolecular separation of mixtures.

1. Units, Volume & Weight measurements. Concentration units, pH Measurement. Preparation of buffers, Preparation of standard solutions: 0.1N Hcl, 2/3N H_2SO_4, 10mm Tris.
2. Qualitative tests for Carbohydrates, Aminoacids, Lipids
3. Qualitative estimation of Carbohydrates: DNS Method, Protein: Bradford/Lowry
4. Lipids: Saponification number, I_2 Value
5. Estimation of Purity of Nucleic Acids
6. Chromatography: Paper, TLC
7. Estimation of Nucleic Acids, Test for ribose and deoxyribose sugar.
8. Extraction of Caffeine from tea leaves.

REFERENCES:

1. Biotechnology Procedures and experiments Hand Book by S.Harisha, Infinity Science Press, 2008
2. Laboratory Manaual in Biochemistry by J.Jayaraman New age International Publications.
3. Principles & Techniques of Practical Biochemistry 5th edition. K. Wilson & J.Walker, Cambridge University Press, 2000.
4. Biochemical Methods by S.Sadasivam, A. Manickam, New Age International Publishers.

Outcomes: Students would be able to distinguish between different biomolecules such as carbohydrates, proteins, lipids by identification and estimation techniques.

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II Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A32382) CELL BIOLOGY AND MICROBIOLOGY LAB

Objectives: This course aims to provide students an exposure to the identification of different cell types and their morphology, media preparation, propagation of microbial cultures, isolation of pure cultures of microbes from mixed cultures of samples and their biochemical identification. The knowledge of growth of inoculated cultures in different fermentation modes will also be imparted.

Outcomes: After completion of the course students will gain expertise to distinguish various cell types by morphology, media supplements, identification techniques during fermentation, which will be useful in the biotech based industries. They will also develop ability to purify / isolate pure culture from mixed population and correlate with growth pattern.

1. Identification of Animal, Plant & Bacterial cells.
2. Micrometry.
3. Differential centrifugation and isolation of Chloroplast & Mitochondria.
4. Sterilization techniques (lecture/demonstrations)
5. Preparation of culture media (a) Broth (b) Solid media
6. Culture of microorganisms: (a) Broth (b) Pure culture techniques: Streak plate, pour plate, spread plate.
7. Isolation and preservation of bacterial cultures.
8. Identification of microorganisms (a) Staining techniques (b) Biochemical testing.
9. Antibiotic sensitivity test - Disc diffusion method, minimum inhibitory concentration.
10. Microbiological examination of water.
11. Biochemical tests
    IMVIC test
    Catalase test
    Coagulase test
    Gelatinase test
    Oxidase test.
12. Determination of Bacterial growth by turbidometry/colorimetry.
13. Factors affecting the bacterial growth – affect of temperature and pH.

REFERENCES:

1. Biotechnology Procedures and experiments Hand Book by S.Harisha, Infinity Science Press
2. Microbiological applications, Laboratory Manual in General Microbiology by Benson, Mc Graw Publications.
3. Laboratory manual in microbiology by P. Gunasekharan, Newage international Publishers.

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II Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A42306) HEAT TRANSFER OPERATIONS

Objectives: This course enables students to understand the concept of heat transfer using finite element methods for modeling steady state and transient problems in conduction, convection and radiation.

UNIT I:

Conductive Heat Transfer

Introduction to heat transfer, Various modes of Heat Transfer, Mechanism of Heat Transfer by conduction; Steady state Heat Transfer through slabs, through series of resistances and Heat Transfer through hollow cylinders, concept of log-mean radius, unsteady-state Heat Transfer, through uniformly long slabs, cylinders and spheres, extended surface heat transfer through fins etc.

Unit II:

Convective Heat Transfer

Introduction to Convective Heat Transfer, Natural convection & forced convection, application of dimensional analysis to Convective Heat Transfer Various correlations for evaluating Heat Transfer coefficient in agitated vessels, Packed beds, Jacketed vessels.

UNIT III:

Boiling & Condensation

Heat transfer to fluids with phase change- heat transfer from condensing vapors- Drop wise and Film wise condensation – Derivations and practical use of Nusselt equation. Boiling of saturated liquid- maximum heat flux and critical temperature drop, minimum flux and film boiling. Design concept of condensers.

UNIT IV:

Heat Transfer Equipment

Typical heat exchange, equipment & various types of heat exchangers- counter and parallel flows, energy balances, long-mean temperature difference and correction for mixed and cross flow – Rating of single and multiple heat exchangers – Description of extended surface heat exchangers.

UNIT V:

Special Applications

Single and Multiple effect evaporations and numerical problems on evaporators. Steam table, Steam economy, Steam capacity, evaporators

performance with various feeding viz, forward, backward and parallel. Applications of heat transfer in bioprocessing-batch and continuous sterilization.

TEXT BOOKS:

1. W.L. Mc Cabe and JC Smith, Unit Operations of Chemical Engineering, Mc Graw Hill, 5th edition.
2. Heat Transfer, K. A. Gavhane and Nirali Prakashan.

REFERENCE BOOKS:

1. BIOTOL Series: Transport phenomena in bioprocesses, Verlag
2. D.G.Rao, Introduction to Biochemical Engineering, Tata Mc Graw Hill, 2005.
3. P.M. Doran, Bioprocess Engineering Principles, Academic Press.

Outcomes: After completing this course student should be able to perform analysis including conduction, convection and radiation. Find experimental methods to validate the finance element analysis results.

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II Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A42308) MOLECULAR BIOLOGY AND GENETICS

Objectives: This course aims to introduce the students with structure of all the supramolecular assemblies and their synthesis in the cell. It also gives an understanding of the basics of heredity, genetic recombination, mutations and chromosomal abnormalities.

UNIT I:

STRUCTURE OF DNA AND ITS BIOSYNTHESIS

Structure of DNA, variation from Watson & Crick model, Structural Organization of DNA in eukaryotic chromosomes; Denaturation & melting curves. Enzymes involved in replication, step by step process. Models of DNA replication: semi conservative Mechanism of DNA replication in *E.coli* (bi- directional). Mitochondrial (D-loop), Viral DNA (Rolling circle), Single stranded- DNA phages (M13, 174), Eukaryotic telomeres and its replication.

UNIT II:

TRANSCRIPTION & TRANSLATION

m-RNA, r-RNA, t-RNA structures, Transcription apparatus and proteins involved in transcription. Prokaryotic & Eukaryotic transcription, processing of t-RNA, r-RNA, m- RNA splicing.

The genetic code and Wobble Hypothesis, Codon usage, Protein synthesis in Prokaryotes and Eukaryotes.

UNIT III:

PHYSICAL BASIS OF HEREDITY

Basic laws of inheritance mono-hybrid, dihybrid and tri-hybrid ratios, Modification of Mendel's ratios due to gene interaction. Multiple factors of inheritance. Genes and environment, identification of the genetic materials - classical experiments. Hershey Chase, Avery McLeod etc.

UNIT IV:

GENETIC RECOMBINATION IN BACTERIA

Discovery, Detection, Molecular mechanisms of transformation, transformation methods. Bacterial conjugation Sex factors in bacteria, F and HFr transfer, mechanism of transfer, Mechanism of recombination, Bacterial transduction: Transduction phenomena, Methods of transduction, cotransduction, Generalized, Specialized & Abortive transduction, Bacteriophages - lytic & lysogenic life cycle.

UNIT V:

CHROMOSOMAL ABERRATIONS MUTAGENESIS & EXTRA CHROMOSOMAL INHERITANCE

Special chromosomes, chromosome aberrations, origins, types and cytogenetic effects. Mutations, spontaneous, induced, lethal, mutagens their types and actions, classification of mutations, characters of mutations and applications. Site-directed mutagenesis and reverse genetics. DNA damage and repairs. Mutageniesity testing (Ames test)

Introduction to extra chromosomal inheritance, examples of extra chromosomal inheritance. Petite phenotypes in yeast. Uniparental inheritance in algae.

TEXT BOOKS:

1. Benjamin Lewin - Gene – VIII Edition.
2. Genetics by Strickberger

REFERENCES:

1. Molecular Biology, David Friefeldur, Norasa Publishing Home
2. Genetics by Strickberger.
3. Genetics by Griffith.
4. Molecular biotechnology principles and practices by Channarayappa, Universities Press.
5. Genetics, PS Verma and V K Agarwal. S. Chand & Company
6. Lodish, H., Berk A., Zipursky, S.L. Matsudaria, P. Baltimore, D. and Darnell, J.2000. Molecular Cell Biology, Media connected, W.H. Freeman and Company.

Outcomes: After completion of the course the students will be able to differentiate between components by structure. They also gain an understanding to differentiate between prokaryotic and eukaryotic transcription and translation.

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II Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A42309) THERMODYNAMICS FOR BIOTECHNOLOGISTS

Objectives: The major focus of this course is to make students understand the basic thermodynamics principles applied in biological field and to make them understand the feasibility and extent of bioreaction during bioprocessing of materials.

UNIT I:

INTRODUCTION AND FIRST LAW OF THERMODYNAMICS

The Scope of Thermodynamics, joule's experiments, Internal energy, Formulation of the first law of thermodynamics, Thermodynamic state and state functions, Enthalpy, The study state flow process, Equilibrium**,** The phase rule.

UNIT II:

SECOND LAW OF THERMODYNAMICS

The statement of second law, the heat engine, Carnot cycle for an ideal gas, Entropy, Entropy changes, Mathematical statement of second law.

UNIT III:

SYSTEMS OF VARIABLE COMPOSITION

IDEAL BEHAVIOR

Fundamental Property Relation, The potential as a critical of phase equilibrium, The ideal gas law Mixtures and ideal solutions, Raoult's law.

INON IDEAL BEHAVIOR

Partial properties, Fugacity and fugacity coefficient, Generalized correlations for the fugacity coefficient, excess Gibbs Energy, Activity coefficient from VLE Data.

Unit IV:

THERMODYNAMIC PROPERTIES OF FLUIDS

Estimation of thermodynamic properties using equations of state; Maxwell relationships and their applications; Calculation of flow processes based on actual property changes.

PHASE EQUILIBRIA

Criteria for phase equilibrium; Vapour-liquid equilibrium calculations for binary mixtures, Liquid -Liquid equilibrium and Solid-Liquid equilibrium

SOLUTION THERMODYNAMICS

Partial molar properties; concepts of chemical potential and fugacity, Ideal

and non ideal solutions; Gibbs Duhem equation; Excess properties of mixtures; Activity Coefficient - corm position models

UNIT V:

CHEMICAL REACTION EQUILIBRIA

Equilibrium criteria for homogeneous chemical reactions; Evaluation of equilibrium constant and effect of pressure and temperature on equilibrium constant; Calculation of equilibrium conversions and yields for single and multiple chemical reactions

TEXT BOOKS :

1. J M.Smith,H.C.Van Ness and M.M.Abbott. Introduction to Chemical Engineering Thermodynamics McGraw Hill
2. Chemical process principles by Hougen and Watson

REFERENCES:

1. Chemical Engineering Thermodynamics by Pradeep Ahuja, PHI Learning Private Limited, 2009.
2. M.D.Koretsky, Engineering and Chemical Thermodynamics, John Wiley and sons,2004

Outcomes: The students will come to know the principles of classical and statistical thermodynamics, the extent of chemical reaction possible and the existence of phase equilibrium. They will be able to calculate the enthalpy and entropy of a bioprocess, and possible preference of a reaction and process over parallel reactions and process.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A40009) ENVIRONMENTAL STUDIES

Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations.

UNIT-I :

Ecosystems : Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II:

Natural Resources : Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III:

Biodiversity and Biotic Resources : Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV:

Environmental Pollution and Control Technologies : Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and

characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT-V:

Environmental Policy, Legislation & EIA : Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

SUGGESTED TEXT BOOKS:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela .2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B.Botkin & Edward A.Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

Outcomes:

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which inturn helps in sustainable development.

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II Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A42305) ANALYTICAL METHODS IN BIOTECHNOLOGY

Objectives: The main objective of the course is to impart exposure to students join with the basic principles of analytical techniques and their applications in biotechnological research.

UNIT I:

INTRODUCTION

Electromagnetic Spectrum, Interaction of Electromagnetic radiation with matter and transition between molecular energy levels, Jablonski diagram, Types of molecular energies, classification of Instrumental methods.

Errors, precision and accuracy: Types of errors, Significant figures, Precision and accuracy, Methods of Expressing accuracy and Precsion, Confidence limits, Sensitivity and detection limit for instruments.

UNIT II:

MICROSCOPY

Bright field, Dark field, Fluorescent, Phase contrast, confocal microscopy, SEM & TEM Microscopy, Flow Cytometry.

UNIT III:

SPECTROSCOPY

Beer – Lambert's Law and apparent deviations, UV - VIS Spectrophotometer, Spectrofluorimeter, Principle and applications of Atomic absorption & Atomic emission spectroscopy.

UNIT IV:

METHODS OF STRUCTURAL DETERMINATION AND SEPARATION TECHNIQUES

X-ray Diffraction, optical Rotatory dispersion,Circular dichromism, NMR.

Hydrodynamic methods, Sedimentation, Centrifugation and Filtration, Electrophoresis of proteins and nucleic acids, 1D and 2D Gels, Types of Electrophoretic techniques (Capillary and Pulse field).

Basics of Chromatography:Paper, Column, TLC, GC, HPLC and GPC – Principles and applications, Capillary columns, the stationary liquid phase – Bonded phase – Sample injection – Solid samples, – detectors - first family detectors – second family detectors – detector scavenging – dual detection temperature programming – commercial gas chromatographs – qualitative analysis – simulated distillation, qualitative analysis. Solvent extraction and ion – exchange techniques.

UNIT V:

RADIOACTIVITY

Electroanalytical methods: Potentiometry, Polarography, voltametry and Amperometry, Types of Radioactivity,Units of Radioactivty,Types of Radioactive rays and their properties,Types of Radioactive decay,Detection and measurement of Radioactivity–GM counters,Scintillation counters,Applications of Radioisotopes

TEXT BOOKS:

1. Biophysical Chemistry Principles & Techniques by Upadhya & Upadhya 4th edition, Himalaya Publishing House, 2012.
2. Instrumental methods of chemical analysis – Gurudeep R.Chatwal 7 Sham K Anand, Himalaya Publishing house, ISBN

REFERENCES:

1. Hobert H Willard D. L. Merritt & J. R. J. A. Dean, Instrumental Methods of Analysis, CBS Publishers & Distributors.
2. Pranb kumar Banerjee,Introduction to Biophysics, S.chand Publications,2008.
3. Instrumental methods of chemical analysis-Gurudeep R.ChatwAL 7 Sham K.Anand,Himalaya Publishing house,ISBN.
4. Principles & Techniques of Practical Biochemistry 5th edition. K. Wilson & J.Walker, Cambridge University Press, 2000.

Outcomes: After completion of the course the student should be able to identify and demonstrate the technique to be used for a particular type of analysis.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A42307) IMMUNOLOGY

Objectives: The main objective of this course is to provide exposure to the students with the mechanisms associated with immune system and any abnormalities that could lead to disease development.

UNIT I:

The Immune System

Phylogeny; Innate and acquired immunity; Complements: Classical and alternate pathways; Function-opsonization, inflammation.

Haptens, Antigens and immunogens, their chemical nature; Properties influencing Antigenicity and immunogenicity,

UNIT II:

Cells and Organs Of The Immune System

Cells of innate immunity; Cells of adaptive immunity; Haematopoiesis and major cell lineages;.

Primary lymphoid organs (Thymus and Bone marrow); Secondary lymphoid organs (Spleen and Lymph node); Mucosal immune system.

UNIT III:

Humoral Immunity

B Cells and Ontogeny**:** Differentiation and maturation; Activation and effector function; Antibodies and their Applications**:** Immunoglobulins, structure, classes, sub classes; Isotypes, allotypes and idiotypes; Immunoglobulin functions; Generation of antibody diversity and class switching ; hybridomas and monoclonals, immunotoxicins, chimeric antibodies, abzymes; Antigen-antibody interactions. Antibody mediated Hypersensitivity reactions.

UNIT IV:

Cell Mediated Immunity

Ontogeny of T cells: differentiation, maturation, activation, effector function, regulation;T-cells subclasses and their functions; MHC and polymorphism and T cell diversity; Ag processing and presentation; Cell mediated hypersensitivity reactions, relevance & its significance

UNIT V:

Hypersensitivity, Transplantation, Autoimmunity and Tumors

Graft rejection types and mechanisms; prevention of graft rejection: immunosuppression by chemicals and biologicals; Autoimmunity:

experimental models and treatment; Tumor immunology: evasion of immunity, cancer immunotherapy.

TEXT BOOKS:

1) E. Roitt Essential Immunology, Vaccines conventional, subunit and recombinant, antidiotypic vaccine, Blackwell Scientific publications, Oxford.

2) Kuby Immunology, 5th Edition . Richard A Goldsby, Thomas J Kindt Barbara A Osborne. W H Freeman and Company.

REFERENCES:

1) Benjamin E and Leskowitz S, immunology A short Course. Wiley LISS NY, ELISA Immunological Techniques. DNA vaccines Immunotechnology.

2) Cellular Molecular Immunology. Abul Abbas and Litchman. 2003.

3) Esssential Immunology by Abhas & Liechmann.

4) Khan FH. The elements of Immunology. Pearson education. 2009.

Outcomes: Students will be able to distinguish between innate & acquired immunity, they will also be able to demonstrate and identify immune cells specific functions. They can correlate between immune/disease development.

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II Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A42383) ANALYTICAL METHODS IN BIOTECHNOLOGY LAB

Objectives: This lab curriculum is designed to train the students with different analytical techniques frequently used for biotechnological applications.

1. Demonstration of viable cells using phase contrast microscopy.
2. Verification of Lambert – Beers Law by UV – VIS spectrophotometer, scanning.
3. Estimation of different macromolecules by visible spectrophotometer.
4. Estimation of turbidity using UV-VIS spectrophotometer.
5. Emission spectra of Anthracene using Spectrofluorimeter.
6. Separation of different macromolecules by Paper, Thin layer, Column chromatography & HPLC(Demo in National Labs/Universities)
7. Membrane separation-dialysis, TFF.

REFERENCES:

1. Biotechnology Procedures and experiments Hand Book by S.Harisha, Infinity Science Press, 2008
2. F. Settle. Handbook of Instrumental Techniques for Analytical Chemistry, Prence Hall, 1997.
3. Laboratory Manual in Biochemistry – J.Jayaraman
4. Basic Separation techniques in Biochemistry

Outcome: After completion of the course students will gain expertise to use instruments viz. microscopes, spectrophotometer and will be skilled to use chromatographic and separation techniques used in biotechnology labs.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A42384) IMMUNOLOGY LAB

Objectives: This practical course is designed to impart training to students with immunological techniques such as Blood typing / grouping, ELISA and Immunofluoresence etc.

1. Agglutination: Haemagglutination & Blood typing / grouping.
2. Flocculation : VDRL
3. Immunoprecipitation
   a) Ouchterlony's immuno diffusion technique.
   b) Counter current immuno electrophoresis.
4. Enzyme linked immunosorbant assay(ELISA)
5. Immunoglobulins purification.
6. Differential (Identification of cell types) & Total leukocyte counts of blood
7. Isolation & Viability determination of Lymphocytes from peripheral blood.
8. Lymphocyte proliferation with mitogen
9. Identification of cell types by receptors – Immunofluoresence.
10. Assessment of Polyclonal antibodies.

REFERENCES:

1. Benjamin E and Leskowitz S, immunology A short Course. Wiley LISS NY, ELISA Immunological Techniques. DNA vaccines Immunotechnology.

Outcomes: After completion of the course students will be able to demonstrate their expertise and skills in the area of immunology which can be used in lab diagnostics.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A52313) MASS TRANSFER OPERATIONS

Objectives: The major objective of this course is to educate the students' with mass transfer operations involved in various bioprocesses and to design mass transfer equipments.

UNIT I:

INTRODUCTION TO MASS TRANSFER AND DIFFUSION

Introduction to Mass Transfer Operations; Fick's Law of Diffusion, Gas diffusion and Liquid diffusion (one component transferring to non-transferring component and equimolar counter diffusion.) Diffusivity estimation (Stefan's experiment); concepts of permeability, distribution of gas and liquid components through solid, diffusion of biological solutes in liquids, diffusion in biological gels.

UNIT II:

INTERFACE MASS TRANSFER AND MASS TRANSFER COEFFICIENT

Interface mass transfer with special reference to gas absorption, oxygen mass transfer and parameter affecting oxygen mass transfer, convective mass transfer, Evolution of mass transfer coefficient, Use of various dimensionless numbers and equations involved.

UNIT III:

GAS LIQUID OPERATIONS

Absorption: Definition, Solubility of gases in liquids, single stage (one component transferring) operation. Distillation: VLE, single stage equilibrium distillation, simple distillation and steam distillation operation; continuous distillation (McCabe Thiele method only).

UNIT IV:

LIQUID – LIQUID AND SOLID-LIQUID OPERATIONS

Liquid-Liquid extraction: LLE, types of equilibrium system, Single stage extraction, Multi stage cross and counter current operations. Solid liquid operation: Leaching, SLE, Single stage leaching. Adsorption: Physical adsorption, Chemisorption, Adsorption hysterisis, Adsorption isotherm, Single stage operation, Fixed bed adsorption.

UNIT V:

SPECIAL APPLICATIONS

Application of various mass transfer operations in bioprocessing namely; Oxygen mass transfer in production of penicilin**,** Drying of baker's yeast,

Extraction of penicillin using butyl acetate, Crystallization of citric acid, Distillation of alcohol from fermentation broth, Absorption of ammonia in water, etc,.

TEXT BOOKS:

1. Robert E. Treybal, Mass Transfer Operations III Edition, Mc. Graw Hill International**.**
2. Christi J. Geankoplis, Transport process & Unit operations, Ill ed., Prentice Hall India Pvt. Ltd.

REFERENCES:

1. Unit operations of chemical engineering,Mc Cabe, W.L, Smith J.C., and Harriot P., Mc-Graw Hill,
2. Judson Kind: Separation Processes, II Edition, Mc Graw Hill Chemical Engineering series.
3. Philip A. Schweitzer, Handbook of separation Techniques for chemical Engineering, III Edition, Mc. Graw Hill.
4. Philip C. Wankat Rate, Controlled separations, Chapman and Hall,
5. P.M.Doran Bioprocess Engineering Principles, Academic Press

Outcomes: At the end of the course students will gain an understanding of various mass transfer mechanisms and its applications in different bioprocesses.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A50806) BIOCHEMICAL REACTION ENGINEERING

Objectives: The curriculum aims to help the students to understand chemical reactions and their kinetics, It also enables them to gain an in depth knowledge of the design equation of reactors.

UNIT I:

MATERIAL BALANCES

Law of conservation of mass, generalized mass balance equation, Simplified form, Procedure for material balance calculations, material balance with recycle, bypass and purge streams with and without chemical reactions, Electron balances, biomass yield, Stoichiometry of chemical reactions, maximum possible yield. Unsteady state material balance equations.

UNIT II:

ENERGY BALANCES

Basic energy concepts, intensive and extensive properties, enthalpy and it's calculation procedure, general energy balance equation, energy changes, non reactive process, procedure for energy balance with and without reactions, energy changes due to reaction, Heat of reaction for system with biomass production. Energy balance equations for unsteady state process.

UNIT- III:

KINETICS OF HOMOGENEOUS REACTIONS

Classification of reactions, single and multiple reactions, kinetics of elementary and non elementary reactions, order of reaction, rate constants, testing of reaction kinetics models, Arrehenius's law, temperature dependence of reaction rate, Activation energy, transition state theory and collision theory. Searching for reaction mechanism. Interpretation of batch reactor data, constant volume and variable volume, integral and differential methods of analysis.

UNIT IV:

REACTOR DESIGN

Ideal reactor, space time and space velocity, reactor design for single reaction, steady state mixed and plug flow reactor, multiple reactor system, same and different types reactors in series, Autocatalytic reactions. Reactor design for multiple reactions, successive irreversible first and higher order reaction, heat of reaction, equilibrium constants, progression of optimum temperature. Adiabatic and nonadiabatic reactions, exothermic reactions, multiple reactions.

UNIT V:

NON-IDEALITY OF REACTOR

Non-ideal flow conditions: The residence time distribution (RTD). State of aggregation of the flowing stream. Earliness of mixing, Role of RTD, State of aggregation and earliness of mixing in determining reactor behavior. Exit age distribution of fluid, Experimental methods for finding E – pulse, step experiments, Relationship between F and E curves. The convolution integral, Conversion in non-ideal flow reactors,

TEXT BOOKS:

1. Octave Levenspiel, Chemical Reaction Engineering, John Wiley & Sons publication.
2. Foggler, Elements of Chemical Reaction Engineering

REFERENCES:

1. K. A. Gavhane, Chemical Reaction Engineering-I, Nirali Prakashan, (2011)

Outcomes: Students will be able to understand various types of reactions, ideal and non ideal behavior of reactors and will be skilled to develop the design equations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A52312) GENETIC ENGINEERING

Objectives: The main objective of the course is to create awareness of the principles and procedures involved in genetic engineering and gene manipulations, expression of cloned gene and applications of r-DNA technology.

UNIT I:

Gene Regulation and Expression

Prokaryotes: *Lac, ara* and *trp* operons, sigma switch; **Eukaryotes:** Repetitive DNA, gene arrangement, gene amplification, switch, non-switch; Regulatory elements- repressors, activators, promoters, enhancers.

UNIT II:

Vectors for gene transfer: plasmids & transposons

Plasmids: Definition, and types/classification, Host restriction in transfer; Transposons: Definition and types including retrotransposons, mechanism of transposition & excision, applications; Others: phagemids and cosmids.

UNIT III:

DNA Technology

Manipulation of DNA

Construction of prototype vector PBR^{322}; Enzymes in genetic engineering; Cloning strategies: sticky and blunt end cloning, T/A cloning, addition of linkers and adapters.

Vérification of Manipulated DNA

Size of plasmid: gel retardation; Restriction mapping, DNA methylation; sequencing.

UNIT – IV:

Expression and Detection

Methods of gene transfer: chemical and electrical; Expression in *E. coli,* yeast, insect cells, mammalian cells; Detection of gene (southern), mRNA (Northern) and protein (Western); Dot & slot blot; Genomic and cDNA library construction and application.

UNIT V:

Applications of r-DNA Technology

Gene cloning in medicine (Insulin, Blood clotting factor VIII); Overview of transgenic and Knock-out plants and animals; Introduction to Gene therapy

(*Ex vivo* & *In vivo*), case study of ADA.

Molecular markers

RFLP, RAPD, AFLP; 16s r-RNA typing; Micro array and Gene chip; Applications in disease profile.

PCR and its application

Principles of PCR; Primer design; PCR methodology; Reverse transcription PCR; Multiplex PCR; Identification of PCR product; Application of PCR.

TEXT BOOKS:

1) Old RW, Primrose SB, principles of Gene manipulation, An introduction to Genetic engineering, Blackwell Scientific Publications,

2) T.A. Brown, Gene Cloning.

REFERENCES:

1) Ansubel FM., Brent A, Kingston AE, Moore DO, Current protocols in Molecular Biology, Greene Publishing Associates, NY.

2) Berger SL, Kimmer AR, Methods in Enzymology, Vol 152, Academic Press.

Outcomes: Student would be able to identify appropriate vectors for gene cloning, assess the cloned products and demonstrate the manipulation methods for improvement of gene function.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A52310) BIO ETHICS, BIO SAFETY AND INTELLECTUAL PROPERTY RIGHTS

Objectives: This course aims to provide an exposure to the issues and regulations involved in bioethics and biosafety. It also provides an understanding of regulatory affairs and IPR.

UNIT I:

BIOETHICS

Introduction to Bioethics. Social and ethical issues in Biotechnology, The principles of bioethics, autonomy, human rights, privacy justice. Ethics related to use of experimental animals. ICMR guide lines.

UNIT II:

BIOSAFETY CONCEPTS AND ISSUES

Definition of Biosafety. Biosafety for human health and environment. Biosafety in laboratory institutions, laboratory associated infections, Assessment of biological hazards and level of biosafety. Prudent biosafety practical in laboratory.

BIOSAFETY REGULATIONS:

Use of genetically modified organisms and their release to the environment. Special procedures for r-DNA based products. International dimensions in Biosafety, catagena protocol on biosafety, bioterrorism. Biotechnology and Food safety. Case study- Bt Cotton, Bt Brinjal.

UNIT III:

REGULATORY AFFAIRS

Regulatory requirements and guidelines for regulatory affairs- Indian context for drugs and Biologics. GLP. GMP, understanding of drugs and cosmetics act.

UNIT IV:

INTELLECTUAL PROPERTY RIGHTS

Intellectual property rights, and Intellectual property protection, patents and methods of application of patents, case study on patents (Basmati rice, turmeric, neem).

Trade Secrets, copyrights, Trade Marks, legal implications, farmers rights, plant breeder's rights, TRIPS, International and regional agreements, Compulsory Licensing.

Patent search, Patent drafting & patent cooperation treaty for filling patents.

UNIT V:

International and National conventions on biotechnology and related areas. Establishment of WIPO. Mission activities ,General Agreement on trade and tariff (GATT) – Fundamental principles and their impact on developed countries.

TEXT BOOKS:

1. Singh K. Intellectual Property Rights on Biotechnology, BCll, New Delhi.
2. Protection of industrial property rights - P Das and Gokul Das

REFERENCES:

1. V. Sree Krishna. Bioethics and Biosafety in Biotechnology. New Age International Publications. (2007).
2. Original laws published by Govt of India.
3. Intellectual property Today : vol Nos May 2001 (www.iptoday.com).
4. Thomas JA; Fuch RL (2002) Biotechnology and safety Assessment (3rd) Academic press.

Outcomes: After the completion of the course the student will gain an understanding of ethical issues involved, concepts of biosafety, biosafety regulations, regulatory affairs and IPR. They will also gain skills of Patent drafting and filing.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A52311) ENZYME ENGINEERING

Objectives: This course aims to impart knowledge regarding enzyme, catalysis, kinetics, characteristics, and immobilization behavior.

Unit I:

Enzymes

Brief History: Definition; Classification with examples from each class; Functions of Enzymes; Sources of Enzymes; Whole cells vs isolated enzymes. Enzyme isolation, purification, immobilization and assay methods. Application of enzymes in industrial, medical, pharmaceutical and food sectors.

Unit II:

Structure of Enzyme and catalysis

Basic Unit; Amino acids; Natural and non-natural amino acids; physico-chemical properties of amino acids e.g. P^{ka}- chemical properties of amino acids, Methods of identification of amino acids. Specific and general acid-base catalysis; covalent catalysis; Factors affecting the mechanism of enzyme catalysis, and factors affecting enzyme activity viz., pH, Temperature, Fluid forces, chemical agents and radiation.

Unit III:

Enzyme Kinetics, Enzyme Inhibition

Kinetics of single substrate reaction – Michelis-Menton equation; Brigg's-Halder eqation, Kinetics for reversible reaction. The turnover number, Evaluation of kinetic parameters. Kinetics of multiple – substrate kinetics. Various types of enzyme inhibition, Substrate and product inhibition, Mechanism of action of chymotrypsin, Glyceraldehyde 3-phosphate dehydrogenase, Isoenzyme, Carboxy peptidase etc.

Unit IV:

Presteady–state Kinetics

Rapid mixing methods, Determination of number of active sites – the initial "Burst" kinetics of chymotrypsin, relaxation techniques, enzyme kinetics at limiting conditions.

Unit V:

Enzyme Immobilization Kinetics

Internal and external mass transfer effects in immobilized enzyme reactions, Intra-particle diffusion and reaction, Interaction between mass transfer and

biochemical reaction. Concept of Thiele – modulus and effectiveness factor, Biot number.

TEXT BOOKS:

1. Biochemical Engineering . H.W. Blanch and D.S. Clark, Marcel – Dekker New York.
2. Biochemical Engineering. J.M.Lee, Prentice- Hall, New Jersey.

REFERENCES :

1. Biochemical Engineering Fundaments. Bailey and Ollis. Second Edition, McGraw-Hill International Edition.
2. Bioprocess Engineering. Shuler and Kargi. Prentice Hall India.
3. Chemical Reaction Engineering, Octave Levenspiel, Second Edition, John Wiley & Sons publication.
4. Introduction to Biochemical Engineering, D.G. Rao. (2005), TMH, New Delhi.

Outcomes: After taking this course students will be able to monitor and predict the progress of enzyme catalytic reactions. They will know its structure and characteristics. They will be able to determine the number of active sites, specific activity, types of reaction. They also will be able to determine whether the enzyme catalytic process is under mass transfer limitation when immobilized.

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III Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A50010) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Objectives:

To enable the student to understand and appreciate, with a practical insight, the importance of certain basic issues governing the business operations namely: demand and supply, production function, cost analysis, markets, forms of business organisations, capital budgeting and financial accounting and financial analysis.

Unit I:

Introduction & Demand Analysis

Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. *Elasticity of Demand*: Definition, Types, Measurement and Significance of Elasticity of Demand. *Demand Forecasting,* Factors governing demand forecasting, methods of demand forecasting.

Unit II:

Production & Cost Analysis

Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. *Cost Analysis***:** Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

Unit III:

Markets & New Economic Environment

Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. *Pricing*: Objectives and Policies of Pricing. Methods of Pricing. *Business:* Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, *New Economic Environment*: Changing Business Environment in Post-liberalization scenario.

Unit IV:

Capital Budgeting

Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget. Capital Budgeting: features of capital

budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems).

Unit V:

Introduction to Financial Accounting & Financial Analysis

Accounting concepts and Conventions - Introduction IFRS - Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis***:** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

TEXT BOOKS:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
3. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012.

REFERENCES:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2012
4. Domnick Salvatore: Managerial Economics in a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting—A Managerial Perspective, Pearson, 2012.
6. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Shailaja & Usha : MEFA, University Press, 2012.
10. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
11. Vijay Kumar & Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
12. J. V. Prabhakar Rao & P.V. Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

Outcomes:

At the end of the course, the student will

a) understand the market dynamics namely, demand and supply, demand forecasting , elasticity of demand and supply, pricing methods and pricing in different market structures.

b) Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis

c) Develop an understanding of

d) Analyse how capital budgeting decisions are carried out

e) Understand the framework for both manual and computerised accounting process

f) Know how to analyse and interpret the financial statements through ratio analysis.

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III Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A52385) MOLECULAR BIOLOGY AND GENETIC ENGINEERING LAB

Objectives: This course aims to give hands-on knowledge on basic techniques associated with extraction, purification and manipulation of DNA.

1. Isolation of Plant and Bacterial Genomic DNA and Plasmid DNA.
2. Agarose Gel Electrophoresis & Isolation and visualization of plasmid on Agarose gel.
3. Restriction digestion.
4. Demonstration of Chemical mutagenesis.
5. Restriction mapping and ligation.
6. Transformation, screening for recombinants.
7. Polyacrylamide Gel Electrophoresis.
8. Blotting Techniques.
9. Expression of Beta – galactosidase and assay.
10. Cloning of DNA into plasmid vector.

REFERENCES:

1. Biotechnology Procedures and experiments Hand Book by S.Harisha, Infinity Science Press, 2008
2. Current protocols in Molecular Biology by Maniatis.
3. Molecular Biology Principles and Practices by Dr. Priyanka Siwach, Dr. Namita Singh, Laxmi Publications Pvt. Ltd.

REFERENCES:

1. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
2. DNA Cloning: a Practical Approach, .M. Glover and B.D. Hames, IRL Press, Oxford.
3. Methods in Enzymology vol. 152, Guide to Molecular Cloning Techniques, S.L. Berger and A.R. Kimmel, Academic Press, Inc. San Diego.

Outcomes: After completion of the course students can demonsrate gene cloning, gene manipulations which can be utilized for developing biotech products.

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	-	**-/3/-**	**2**

(A50086) ADVANCED COMMUNICATION SKILLS (ACS) LAB

Introduction

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

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

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

Objectives:

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

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

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1. Activities on Fundamentals of Inter-personal Communication and

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

2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

Minimum Requirement:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate acoustics.**
- **Round Tables with movable chairs**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ**
- **T. V, a digital stereo & Camcorder**
- **Headphones of High quality**

Prescribed Lab Manual: A book titled ***A Course Book of Advanced Communication Skills (ACS) Lab*** published by Universities Press,

Hyderabad.

Suggested Software:

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

- **Oxford Advanced Learner's Compass**, 7th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed**
  - **Positive Thinking**
  - **Interviewing Skills**
  - **Telephone Skills**
  - **Time Management**

Books Recommended:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
4. Business and Professional Communication: Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
5. The Basics of Communication: A Relational Perspective. Steve Duck & David T. McMahan. Sage South Asia Edition. Sage Publications. 2012.
6. English Vocabulary in Use series, Cambridge University Press 2008.
7. Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
8. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
9. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
10. Handbook for Technical Writing by David A McMurrey & Joanne

Buckely CENGAGE Learning 2008.

11. Job Hunting by Colm Downes, Cambridge University Press 2008.
12. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
13. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.
14. Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/ Cambridge University Press.
15. International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

***Advanced Communication Skills Lab Practicals**:*

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

Mini Project: As a part of Internal Evaluation

1. Seminar/ Professional Presentation

2. A Report on the same has to be prepared and presented.

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

Outcomes

- Accomplishment of sound vocabulary and its proper use contextually.
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

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	4	**-/-/-**	**4**

(A62317) PLANT BIOTECHNOLOGY

Objectives: The objective of this course is to familiarize students with the concepts of plant tissue culture and its applications. It also gives them an exposure to transgenic crops for yield enhancement and use of plants as bioreactors.

UNIT I:

TISSUE CULTURE AND ITS APPLICATIONS-I

Introduction to cells and tissue culture, concept of totipotency, laboratory requirements and general techniques. Tissue culture media, constituents and preparation. Initiation of aseptic culture.

Suspension culture, somatic embryogenesis, organogenesis, Micro propagation (clonal propagation)

Haploid production ands its application & limitations.

UNIT II:

TISSUE CULTURE AND ITS APPLICATIONS-II

Protoplast isolation, culture & regeneration**,** short term & long term germplasm conservation, somaclonal variations.

Production of chemicals and other important compounds from plants. Strategies for enhancing the product yield. Bioreactor models for commercialization of product.

UNIT III:

TRANSFORMATION TECHNOLOGY

Agrobacterium mediated transformation, chemical methods, direct gene transfer methods: electroporation, microinjection and particle bombardment. Basic concept and essential steps of the genetic transformation process.

Transgensis: Production of transgenic plants for biotic (insect resistance, disease resistance, Virus resistance, Herbicide resistance), Abiotic stress tolerance (Drought, temperature, salt).

UNIT IV:

MOLECULAR MARKERS

Introduction to Conventional Plant Breeding; Concept of molecular DNA markers – RFLP, RAPD, AFLP, SNPs, SSRs, SSCPs and their role in crop improvement.

UNIT V:

MOLECULAR FARMING AND APPLICATIONS

Plant biotechnology applications for production of industrial enzymes and therapeutic proteins, antigens, antibodies etc,.

TEXT BOOKS:

1. Bhojwani, S.S. and Rajdan, Plant Tissue Culture: Theory and Practice. 2004
2. Plant Biotechnology Methods in Tissue Culture and Gene Transfer by R.Keshavachandran, KV Peter, MS Swaminathan, University Press, 2009

REFERENCES:

1. Crispeels, M.J. and Sadava, D.E., Plants, Genes and Crop Biotechnology, Jones and Bartlett Publishers (2nd Edition), 2003.
2. Bhowjwani, S.S., Plant Tissue Culture: Application and Limitations. Amsterdam,
3. Bernard R. Glick and John E. Thompson, Methods in Plant Molecular Biology and Biotechnology, CRC Press,
4. John Hammond, Peter McGarvey, Vidadi Yusibov, Plant Biotechnology: New Products and Applications, Springer Verlag,
5. Plant Molecular Biotechnology by S.Mahesh, New Age International Publishers, 2008.

Outcomes: After completion of the course students will gain knowledge of *in vitro* manipulations for micropropagation and transgenic plant production.They will develop skills to generate plants with novel traits.

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(A62314) BIOPROCESS ENGINEERING

Objectives: The major objective of this course is to impart in students the skills to operate bioprocesses for production of various Bio-products

UNIT I:

INTRODUCTION TO BIOPROCESSES

An overview of traditional and modern applications of biotechnology industry, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets. General requirements of fermentation processes, an overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry, solid-state and submerged fermentation, applications, whole cell immobilization.

UNIT II:

MEDIA DESIGN AND STERILIZATION

Medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation for optimal growth and product formation, examples of simple and complex media, design and usage of various commercial media for industrial fermentations. **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. Optimization of medium. **Sterilization:** Basic principles of sterilization, media sterilization, kinetics of thermal death of cells & spores, design of batch and continuous sterilization, sterilization of air and filter design. Other methods of sterilization viz., radiation and chemical sterilization.

UNIT III:

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

Phases of cell growth in batch cultures, Simple unstructured kinetic models for microbial growth, Monod model, Growth of filamentous organisms. Growth associated (primary) and non - growth associated (secondary) product formation Kinetics. Leudeking-Piret models, substrate and product inhibition on cell growth and product formation. Introduction to Structured Models for growth and product formation.

Unit- IV:

BIOREACTOR OPERATION

Design equation for enzyme reactors, Batch growth of microorganisms, Design equation of plug flow reactor, Design of CSTR with washout concept; Stirred tank reactor with recycle of biomass; Continuous tank fermenters in series without and with recycle of biomass; Estimation of kinetic parameters. Multiphase Bioreactors: Different types of reactors: Air lift reactors, Multipurpose tower reactors, Liquid impelled loop reactor, Pumped tower loop reactor, Fluidized-bed reactor, Packed-bed reactor, Bubble-column reactors, Airlift reactors.

Unit- V:

MASS TRANSFER IN BIOREACTOR

Role of diffusion in bioprocessing, Convective mass transfer, Liquid-solid mass transfer, Liquid – liquid mass transfer, Gas-liquid mass transfer. Factors affecting cellular oxygen demand, Oxygen transfer in fermenters. Methodology of oxygen transfer from gas bubble to cell. Measuring dissolved oxygen concentrations, Mass transfer correlations, Measurement of K a by various methods viz., sulphite oxidation method, dynamic gassing out and oxygen balance methods, Scale-up and scale-down of bioreactors.

TEXT BOOKS:

1. Biochemical Engineering . H.W. Blanch and D.S. Clark, Marcel – Dekker New york .
2. Biochemical Engineering Fundaments. Bailey and Ollis, McGraw-Hill International Edition.

REFERENCES :

1. M.L.Shuler and F. kargi Bioprocess engineering, Prentice Hall of India.
2. .T Panda, Bioreacors, Analysis and Design, Tata McGraw (2011)
3. P.M. Doran, Biochemical process principles, Academic Press.
4. D.G. Rao, Introduction to Biochemical Engineering, Tata McGraw-Hill, 2005.
5. Biochemical Engineering by Mukesh Doble and Sathyanarayana N. Gummadi, PHI Learning private limited, 2009.
6. Biochemical Engineering, second edition by Syed Traveer Ahmed Inamdar, PHI Learning, 2009.

Outcomes: After completion of the course the students will be able to operate, design and optimize the production medium, they will gain the ability to handle bioreactors to carry out fermentation process involving various types of cells.

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(A60809) INSTRUMENTATION AND PROCESS CONTROL

Objectives: This course aims to impart knowledge of instruments used in the measurement processes, their working principles, characteristics and behavior during the process. This is also to develop the concept of control system during bioprocessing of materials.

Unit –I:

BASICS OF INSTRUMENTATION

Elements of instruments, static and dynamic characteristics, basic concepts of response of first order type instruments, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer, static accuracy and response of thermometers. Thermo electricity: Industrial thermocouples, thermocouple wires, thermo couple wells. Composition analysis, spectroscopic analysis by absorption, emission, mass and color measurement spectrometers, gas analysis by thermal conductivity, analysis of moisture, gas chromatography, refractometer.

Unit-II:

MEASURING DEVICES

Head, density and specific gravity, direct measurement of liquid level, pressure measurement in open vessels, level measurements in pressure vessels. Pressure vacuum and head: liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, measurement of absolute pressure, measuring pressure in corrosive liquids. Head flow meters, area flow meters, open channel meters, viscosity meters, quantity meters, viscosity measurements. Recording instruments, indicating and signaling instruments.

UNIT-III:

SENSORS AND TRANSDUCERS

Biosensors: Types, Transducers in biosensors- calorimetric, optical, potentiometric / amplometric, conductometric/ resistometric, piezoelectric, semi conductor, mechanical and molecular electromics based, molecular wires and switches, development of molecular arrays as memory stores, design of a biomolecular photomic computers- information processing.

Unit- IV:

PROCESS DYNAMICS

Introduction. Dynamics of First order system, Dynamics of higher order systems, Transfer Function, Transient response to step, ramp, pulse, impulse,

sinusoidal forcing function, physical examples of first order systems, liquid level, mixing process, concept of time constant, Response of Second order system to step. Transportation lag control systems, Pade approximation, pole-zero response. Servo and Regulatory control problems.

Unit- V:

CONTROL SYSTEM

Development of Block diagram, Controllers and final control elements, Ideal transfer functions of operational, PI, PD and PID Controllers. Controller tuning, Frequency response analysis, Internal model control, Cascade and feed-forward control, control system for multivariable process. Reduction of physical control system to block diagram. Closed loop transfer functions for servo regulator problems. Overall Transfer function for multi loop control system. Stability and control system by Routh's stability criterion. Frequency response: Bode diagram, First order, first order system in series, second order system and for controllers and transportation lag. Bode stability criterion. Gain margin and phase margin.

TEXT BOOKS:

1. Industrial instrumentation by Donald P.Eckman, Wiley eastern,
2. Donald R. Coughanowr, Process Systems Analysis and Control, McGraw-Hill.

REFERENCES:

1. KR Rogers, M. Mascion, Biosensors for analytical monitoring EP & biosensors year
2. Principles of industrial instrumentation by Patra Nabis, TMH.
3. Chemical Process Control Stephanoupoulis, G., Prentice Hall, New Delhi.

Outcomes: After completion of the course the students will get acquainted to the working principles of various instruments, They will understand inherent dynamics of the process and the various effects on the final outcome. They will have knowledge on stability of the process and control the same.

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	4	**-/-/-**	**4**

(A60008) PROBABILITY AND STATISTICS

Objectives: To learn

- Understand a random variable that describes randomness or an uncertainty in certain realistic situation. It can be of either discrete or continuous type.
- In the discrete case, study of the binomial and the Poisson random variables and the Normal random variable for the continuous case predominantly describe important probability distributions. Important statistical properties for these random variables provide very good insight and are essential for industrial applications.
- Most of the random situations are described as functions of many single random variables. In this unit, the objective is to learn functions of many random variables through joint distributions.
- The types of sampling, Sampling distribution of means ,Sampling distribution of variance,Estimations of statistical parameters, Testing of hypothesis of few unknown statistical parameters.
- The mechanism of queuing system ,The characteristics of queue,The mean arrival and service rates.
- The expected queue length, The waiting line.
- The random processes, The classification of random processes, Markov chain, Classification of states.
- Stochastic matrix (transition probability matrix),Limiting probabilities, Applications of Markov chains.

UNIT-I:

Single Random variables and probability distributions

Random variables – Discrete and continuous. Probability distributions, mass function/ density function of a probability distribution . Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.

Binomial, Poisson & normal distributions and their properties. Moment generating functions of the above three distributions, and hence finding the mean and variance.

UNIT-II:

Multiple Random variables, Correlation & Regression

Joint probability distributions- Joint probability mass / density function,

Marginal probability mass / density functions, Covariance of two random variables, Correlation -Coefficient of correlation, The rank correlation.

Regression- Regression Coefficient, The lines of regression and multiple correlation & regression.

UNIT-III:

Sampling Distributions and Testing of Hypothesis

Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and varience, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of varience.

Parameter estimations – likelihood estimate, interval estimations.

Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, Level of significance. One sided test, two sided test,

Large sample tests:

(i) Test of Equality of means of two samples equality of sample mean and population mean (cases of known varience & unknown varience, equal and unequal variances)

(ii) Tests of significance of difference between sample S.D and population S.D.

(iii) Tests of significance difference between sample proportion and population proportion&difference between two sample proportions.

Small sample tests:

Student t-distribution,its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples

Snedecor's F- distribution and it's properties. Test of equality of two population variences

Chi-square distribution , it's properties, Chi-square test of goodness of fit

UNIT-IV:

Queuing Theory

Structure of a queuing system, Operating Characteristics of queuing system, Transient and steady states, Terminology of Queuing systems, Arrival and service processes- Pure Birth-Death process Deterministic queuing models-M/M/1 Model of infinite queue, M/M/1 model of finite queue .

UNIT-V:

Stochastic processes

Introduction to Stochastic Processes –Classification of Random processes,

Methods of description of random processes, Stationary and non-stationary random process, Average values of single random process and two or more random processes. Markov process, Markov chain, classification of states – Examples of Markov Chains, Stochastic Matrix.

TEXT BOOKS:

1) Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers

2) Probability and Statistics for Engineers and Scientists by Sheldon M.Ross, Academic Press

3) Operations Research by S.D. Sarma,

REFERENCE BOOKS:

1. Mathematics for Engineers by K.B.Datta and M.A S.Srinivas,Cengage Publications

2. Probability and Statistics by T.K.V.Iyengar & B.Krishna Gandhi Et

3. Fundamentals of Mathematical Statistics by S C Gupta and V.K.Kapoor

4. Probability and Statistics for Engineers and Scientists by Jay l.Devore.

Outcomes:

- Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variable involved in the probability models. It is quite useful for all branches of engineering.
- The student would be able to calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations .It is Mainly useful for non-circuit branches of engineering.
- The students would be able to find the expected queue length, the ideal time, the traffic intensity and the waiting time. These are very useful tools in many engineering and data management problems in the industry. It is useful for all branches of engineering.
- The student would able to understand about the random process, Markov process and Markov chains which are essentially models of many time dependent processes such as signals in communications, time series analysis, queuing systems. The student would be able to find the limiting probabilities and the probabilities in n^{th} state. It is quite useful for all branches of engineering

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(A62316) INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY

(Elective I)

Objectives: The main objective of this course is to familiarize students to microbes & microbial processes, including fermentation and optimization, covering all areas of industrial microbiology. It also imparts an understanding of pollution of environment and various remediation techniques.

Unit- I:

Primary and Secondary metabolites

Organic acids (Citric & Lactic acid); Amino acids (Glutamic acid & Phenyl alanine); Alcohols (Ethanol & Butanol).

Secondary metabolites

Antibiotics (Beta lactams, Cephalosporins, Streptomycin & Erythromycin); Vitamin B_{12}; Overview of steroids (no description of process).

Unit-II:

Enzymes and Recombinant Proteins

Proteases; Lipases; Cellulases; Other commercially important enzymes for food & pharma.

Insulin; Interleukin (IL-2); Interferon (IFN-Gamma); Recombinant vaccines (Hepatitis).

Unit- III:

Water pollution and biological treatment of wastewater

Domestic and Industrial wastewater characteristics; Biological process for wastewater treatment; Aerobic system and anaerobic system; Domestic wastewater treatment schemes.

Unit- IV:

Bioremediation and Hazardous Waste Management

Overview & definition of Bioremediation; Strategies of Bioremediation; Types of Bioremediation: *Insitu* & *Exsitu*; Applications of Bioremediation; A case study for bioremediation of Heavy metals like Mercury; Constrains and priorities of Bioremediation.

Hazardous Waste Management: Hazardous Waste Characteristics; Sources and types; Biotechnological applications for hazardous waste management.

Unit- V:

Novel Biotechnological Applications for environmental management

Biofuels; Biopolymers; Biofertilizers; Biopesticides; Biofilms; Bioleaching.

TEXT BOOKS:

1. Biotechnology, 5th edition by John E. Smith. Cambridge low price editions.
2. Basic Industrial Biotechnology by S.M.Reddy, S.Ram Reddy, G.Narendra Babu, New Age International Publishers, 2012

REFERENCES:

1. Microbiology: - Prescott and Dunn.
2. Microbial biotechnology: Glazer, A.N. and Nikaido, H. W.H. Freeman &Company, New York.
3. Industrial Microbiology:- A. H. Patel.. Stanier R. Y., Ingram J.L., Wheelis M.L., Painter R.R., General
4. Foster C.F., John Ware D.A., Environmental Biotechnology, Ellis Horwood Ltd.,
5. Karrely D., Chakrabarty K., Omen G.S., Biotechnology and Biodegradation,
6. Bioremediation engineering; design and application, John. T. cookson,Jr. Mc Graw Hill, Inc.

Outcomes: After completion of the course the students will be able to differentiate between various fermentation processes and correlate process variables with product yields. They can also distinguish between different pollutants and identify the appropriate waste treatment to the relevant problem.

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	4	**-/-/-**	**4**

(A62315) COMPUTATIONAL BIOLOGY

(Elective I)

Objectives: This course aims to provide an understanding of functional genomics , comparative genomics, proteomics and its application in phylogenetic analysis and drug designing . It also aims to investigate molecular biology problems from computational perspective.

UNIT I:

INTRODUCTION TO COMPUTATIONAL BIOLOGY

Introduction to active areas of research in Computational Molecular Biology, Functional Genomics, Comparative Genomics, Dynamic Programming, Graphical representation of biochemical systems, S-systems equations, steady state analysis, Model refinements

UNIT II:

GENOMICS

DNA Sequence assembly and gene identification. Homology based gene prediction. Gene expression profiling, Identification of SNPs, SNP arrays, Role of SNP in Pharmacogenomics, other applications. Methods of studying gene expression, EST approach, Human Genome Project.

Micro Arrays

Understanding microarray data, normalizing microarray data, detecting differential gene expression correlation of gene expression data to biological processes and computational analysis tools.

UNIT III:

PROTEOMICS

Protein identification, structure and function determination. Structure comparison methods. Prediction of secondary structure from sequence.

Protein homology modeling, Protein threading. Protein ab initio structure prediction. Protein design emphasis on structural Bioinformatics.

UNIT IV:

TAXONOMY AND PHYLOGENY

Basic concepts in systematics, taxonomy and phylogeny; Nature of data used in taxonomy and phylogeny; Molecular evolution, Definition and description of Phylogenetic trees and types of trees, Dendograms and its interpretation

UNIT-V:

DRUG DESIGN

Drug discovery process, Role of Bioinformatics in drug design, Target identification and validation, lead optimization and validation.

TEXT BOOKS:

1. Jonathan Pevsner. Bioinformatics and Functional Genomics. A Jhon Wiely & Sons, Inc., Publication
2. E.O.Voit Computational Analysis of Biochemical systems, Cambridge University Press 2000.

REFERENCES:

1. Introduction to computational biology, An Evalutionary Approach by Bernhard Haubold and Thomas Wiehe. Spinger India publications. India (2006).
2. Moody P C E and A J Wilkinson. Protein Engineering. IRL Press.
3. Creighton T E, Proteins. Freeman W H. Second edition.
4. Journal BIOINFORMATICS (Oxford University).
5. BRANDOND TOOZE – Proteomics
6. David W Mount. Bioinformatics- Sequence and genome analysis. CSHL Press.

Outcomes: At the end the students will be able to gain an in depth knowledge of genomics and proteomics. They will be able to utilize this knowledge for gene identification, in pharma sector and other areas. They will also gain expertise in using bioinformatics tools for drug design.

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(A60506) COMPUTER ORGANIZATION

(Elective-I)

Objectives:

- To understand basic components of computers.
- To explore the I/O organizations in depth.
- To explore the memory organization.
- To understand the basic chip design and organization of 8086 with assembly language programming.

UNIT-I:

Basic Computer Organization

Functions of CPU, I/O Units, Memory: Instruction: Instruction Formats- One address, two addresses, zero addresses and three addresses and comparison; addressing modes with numeric examples: Program Control-Status bit conditions, conditional branch instructions, Program Interrupts: Types of Interrupts.

UNIT-II:

Input-Output Organizations

I/O Interface, I/O Bus and Interface modules: I/O Vs memory Bus, Isolated Vs Memory-Mapped I/O, Asynchronous data Transfer- Strobe Control, Hand Shaking: Asynchronous Serial transfer- Asynchronous Communication interface, Modes of transfer- Programmed I/O, Interrupt Initiated I/O,DMA; DMA Controller, DMA Transfer, IOP-CPU-IOP Communication , Intel 8089 IOP.

UNIT-III:

Memory Organizations

Memory hierarchy, Main Memory, RAM, ROM Chips, Memory Address Map, Memory Connection to CPU, associate memory , Cache Memory, Data Cache, Instruction cache, Miss and Hit ratio, Access time, associative, set associative, mapping , waiting into cache, Introduction to virtual memory.

UNIT-IV:

8086 CPU Pin Diagram

Special functions of general purpose registers, Segment register, concept of pipelining, 8086 Flag register, Addressing modes of 8086.

UNIT-V:

8086-Instruction formats

Assembly Language Programs involving branch & Call instructions, sorting, evaluation of arithmetic expressions.

TEXT BOOKS:

1) Computer system Architecture: Morris Mano (UNIT-1,2,3)
2) Advanced Micro Processor and Peripherals- Hall/ A K Ray(UNIT-4,5)

REFERENCE BOOKS:

1) Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI
2) Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson
3) Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int. Edition.
4) Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition Elsevier
5) Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication.

Outcomes:

After this course students understand in a better way the I/O and memory organization in depth. They should be in a position to write assembly language programs for various applications.

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(A60018) HUMAN VALUES AND PROFESSONAL ETHICS

(Open Elective)

Objectives : This introductory course input is intended

a. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

b. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.

c. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Unit I:

Course Introduction

Need, Basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit II:

Understanding Harmony in the Human Being

Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit III:

Understanding Harmony in the Family and Society

Harmony in Human - Human Relationship : Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; **Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.** Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

Unit IV:

Understanding Harmony in the Nature and Existence

Whole existence as Co-existence : Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

Unit V:

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order,

b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,

c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b) At the level of society: as mutually enriching institutions and

organizations

TEXT BOOKS

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. KV Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications,3rd Edition.

REFERENCE BOOKS

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
5. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
6. A.N. Tripathy, 2003, Human Values, New Age International Publishers.
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethichs (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story

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(A60117) DISASTER MANAGEMENT

(Open Elective)

Unit-I:

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Unit –II:

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards –

Unit –III:

Endogenous Hazards - Volcanic Eruption – Earthquakes – Landslides - Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - - Earthquake Hazards in India - - Human adjustment, perception & mitigation of earthquake.

Unit –IV:

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters

Infrequent events: Cyclones – Lightning – Hailstorms

Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes, distribution human adjustment, perception & mitigation) Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation) Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures- Extra Palnetary Hazards/ Disasters- Man induced Hazards / Disasters- Physical hazards/ Disasters-Soil Erosion

Soil Erosion:— Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion

Chemical hazards/ disasters:— Release of toxic chemicals, nuclear explosion- Sedimentation processes Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation

Biological hazards/ disasters:- Population Explosion.

Unit –V:

Emerging approaches in Disaster Management- Three Stages

1. Pre- disaster stage (preparedness)
2. Emergency Stage
3. Post Disaster stage-Rehabilitation

TEXT BOOKS:

1. Disaster Mitigation: Experiences And Reflections by Pardeep Sahni
2. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning

REFERENCES

1. R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi,1990
2. Savinder Singh Environmental Geography, Prayag Pustak Bhawan, 1997
3. Kates,B.I & White, G.F The Environment as Hazards, oxford, New York, 1978
4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000
5. H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994
7. Dr. Satender , Disaster Management t in Hills, Concept Publishing Co., New Delhi, 2003
8. A.S. Arya Action Plan for Earthquake,Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994
9. R.K. Bhandani An overview on Natural & Man made Disaster & their Reduction,CSIR, New Delhi
10. M.C. Gupta Manuals on Natural Disaster Management in India, National Centre for Disaster Management,IIPA, New Delhi, 2001

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(A60017) INTELLECTUAL PROPERTY RIGHTS

(Open Elective)

UNIT – I

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

UNIT – II

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

UNIT – III

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

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

UNIT – IV

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

Unfair competition : Misappropriation right of publicity, False advertising.

UNIT – V

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

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

TEXT BOOKS & REFERENCES:

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

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	-	**-/3/-**	**2**

(A62387) PLANT BIOTECHNOLOGY LAB

Objectives: This practical syllabi is designed to impart hands on expertise to students in different areas of *in vitro* plant cell culture and genetic transformation techniques.

1. Preparation of Media
2. Surface sterilization
3. Callus induction
4. Organ culture
5. Protoplast isolation, culture and Cytological examination
6. *Agrobacterium* mediated gene transfer, selection of transformants, reporter gene (GUS) assays.

REFERENCES:

1. Biotechnology Procedures and experiments Hand Book by S.Harisha, Infinity Science Press, 2008
2. Plant Biotechnology: Practical Manual, C.C.Giri & Archana Giri, IK International, 2007.

Outcomes: After completion of the course students will be skilled to use their expertise for *in vitro* manipulations for its application in agriculture and molecular farming.

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III Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A62386) BIOPROCESS ENGINEERING LAB

Objectives: This Practical curriculum is designed to impart training to students in handling of enzymes, microbes, media design and bioreactors.

1. ENZYME ISOLATION AND ASSAY OF ENZYME ACTIVITY

Extraction of commercially important enzymes from natural source Development of enzyme assay under assay conditions; quantification of enzyme activity and specific activity.

2. ENZYME KINETICS

Estimation of Michaelis-Menten parameters, Effect of pH and temperature on enzyme activity, Kinetics of inhibition and estimation of inhibition constant with specific example.

3. IMMOBILIZED ENZYME REACTIONS

Techniques of enzyme immobilization - matrix entrapment, ionic and cross linking; column packing; analysis of mass transfer effects on kinetics of immobilized enzyme reactions; bioconversion studies with immobilized - enzyme packed – bed reactors.

4. MICROBIAL CULTURE STUDIES:

Growth of microorganisms, estimation of Monod's parameters. Thermal Cell death kinetics; estimation of thermal death constant

5. SCREENING OF PROCESS VARIABLES

Optimization of process parameters by Plackett-Burman design and CCD techniques,

6. BIOREACTOR STUDIES

Batch, fed-batch, and continuous flow reactor analysis and residence time distribution.

7. DETERMINATION OF MASS TRANSFER COEFFICIENT IN BIOREACTOR

Determination of oxygen mass transfer coefficient (k_La), specific oxygen consumption rate and C* by dynamic method in a bioreactor.

Outcomes: At the end the students will be able to study enzyme kinetics, handle bioreactors, design media and optimize process parameters.

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(A72319) BIOINFORMATICS

Objectives: This course provides an introduction to biological data analysis using compilation methods. It also provides knowledge on various types of Databases and different tools/softwares which can be used in the biological systems.

Unit I:

Introduction to Bioinformatics

Need of Computers in Biotechnology; History, Scope & Applications of Bioinformatics, Elementary commands and protocols, ftp, telnet, http.

Unit-II:

Data Bases

Primary Data Base Information:

Introduction to Biological databases, Organization and management of databases. Searching and retrieval of information from the World Wide Web. Structure databases - PDB (Protein Data Bank), Molecular Modeling Databases (MMDB). Primary Databases NCBL, EMBL, DDBJ.

Secondary Data Base:Introduction to Secondary Databases Organization and management of databases Swissprot, PIR, KEGG.

Biochemical Data Bases: Introduction to BioChemical databases-organization and Management of databases. KEGG, EXGESCY, BRENDA, ERGO.

Unit III :

Sequencing Alignment and Scoring Matrices

Aligment-Local, Global alignment, pair wise and multiple sequence alignments, Concept of gap penalty and e-value, Alignment algorithms, Dynamic programming in sequence alignment: Neddleman-Wunsch Aligorithm and Smith-Waterman Algorithm, Amino acid substitution Matrices (PAM, BLOSUM). Sequence similarity search with database: BLAST and FASTA.

Unit IV:

Homology and Phylogenetic analysis

Introduction to Homology, Levels of protein structures, Homology modeling of proteins (sequence to structure), Cn3D, RasMol and SPDbV in homology modeling-case studies.

Introduction to phylogenetics, Methods of Phylogenetic analysis, Role of

multiple sequence alignment algorithms in Phylogenetic analysis, Automated Tools for Phylogenetic Analysis, Construction of phylogenetic tree.

Unit V:

Special Topics in Bioinformatics

DNA mapping and sequencing, Map alignment, Large scale sequencing methods: Shotgun and Sanger method. cDNA sequencing; Genome Mapping, Map assembly, Comparative Sequence analysis.

TEXT BOOKS:

1. Bioinformatics. David Mount, 2000. CSH Publications
2. Essential Bioinformatics by Jin Xiong, Cambridge University Press, 2011.

REFERENCES:

1. Bioinformatics: Methods and Applications: Geneomics & Proteomics and Drug Discovery by S.C.Rastogi, Namitha Mendiratta, Parag Rastogi, Prentice –Hall of India Private Limited, 2006
2. Genomics and Proteomics-Functional and Computational aspects. Springer Publications. Editior-Sandor Suhai.
3. Bioinformatics- Methods and Protocols-Human Press. Stephen Misener, Stephen A. Krawetz.
4. Bioinformatics – Principles and Applications – Harshawardhan P.Bal TATA MEGRAW HILL.
5. Bioinformatics Basics. Applications in Biological Science and Medicine by Hooman H. Rashidi and Lukas K.Buehler CAC Press 2000.
6. Bioinformatics – A Practical guide to the Analysis of Genes and Proteins – Andreas D.Baxevanis, B.F. Francis Ouellette. 3rd Edition, 2005, John Wiley & Sons, Inc.

Outcomes: At the end students get familiarized with existing tools and resources for computational analysis of biological data. They develop an awareness of problems which arise in the modeling & analysis of living system.

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	4	**-/-/-**	**4**

(A72328) TRANSPORT PHENOMENA IN BIOPROCESSES

Objectives: This course is designed to provide an understanding of different transport processes that occur during processing of materials and ensure proper distribution of mass and energy throughout the system.

Unit I:

Basics of Transfer Operation

Mechanism of Momentum Transport: Newton's Law of Viscosity, Non-Newtonian fluids, theory of viscosity of liquids, time dependant viscosity, viscosity measurement (cone-and-plate viscometer, coaxial cylinder rotary viscometer, impeller viscometer), use of viscometers with biological reaction fluids, rheological properties of fermentation broth, factors affecting broth viscocity (cell concentration, cell morphology, osmotic pressure, product and substrate concentration), Velocity distribution in laminar flow and turbulent flow

Unit II:

Momentum Transport

Equation of change for isothermal system (equation of continuity, equation of motion, equation of mechanical energy), Navier-Stoke's equation, Euler Equation and their application, Stream function and potential function and their applications. Creeping flow and irrotational flow, boundary layer theory. Interphase transport in isothermal systems (friction factors for flow in tubes and in packed columns) mixing, mixing mechanism, power requirements in ungassed Newtonian and Non Newtonian fluids, gassed fluids, interaction between cell and turbulent Eddies, skin friction, form friction, operating conditions for turbulent shear damage. Macroscopic Balances- mass, momentum and mechanical energy balances.

Unit III:

Energy Transport

Thermal conductivity and the mechanisms of energy transport- measurement of thermal conductivity, Fourier's law, steady state conduction, analogy between heat and momentum transfer. Steady and unsteady state heat transfer, Natural and forced convection, Dimensionless numbers in heat transfer. Calculation of heat transfer coefficient, Overall heat transfer coefficient. Non-isothermal heat transfer, Temperature distribution with more than one independent variables- heating in a semi infinite and finite slab, temperature distribution in turbulent flow- reference to stirred tank reactor, relationship between heat transfer, cell concentrations and stirring conditions

Unit IV:

Mass Transport

Diffusivity, theory of diffusion, analogy between mass, heat and momentum transfer, role of diffusion in bioprocessing, film theory, concentration distribution with more than one independent variable- unsteady diffusion, boundary layer theory, concentration distribution in turbulent flow- Corrsin equation. Definition of binary mass transfer coefficients, transfer coefficients at high mass transfer rates- boundary layer theory, penetration theory. Convective mass transfer, Liquid -solid mass transfer, liquid-liquid mass transfer, gas-liquid mass transfer

Unit V:

Oxygen Transport in Bioprocesses

Oxygen uptake in cell cultures, Factors affecting cellular oxygen demand, oxygen transfer from gas bubbles to aerobic culture, oxygen transfer in fermentors- bubbles, factors affecting oxygen transport- sparging, stirring, medium properties, antifoam agents, temperature, mass transfer correlations, measurements of $k_L a$ - oxygen balance method, dynamic method. Mixing and impeller design.

Note: In all units relevant basic numerical problems should be practiced

TEXT BOOKS:

1. R.B.Bird, W.E.Stewart, E.N.Lightfoot, Transport Phenomena, John wiley and sons, Singapore ,

2 P.M.Doran, Bioprocess Principles, Academic Press,

REFERENCES:

1. M.L.Shuler and F. Kargi, Bioprocess Engineering: Basic concepts, 2nd edition, Prentice Hall of India, 2003

2. Harvey W. Blanch, Douglas S. Clark Biochemical Engineering, Marcecel, Dekker, 2007.

Outcomes: After completion of the course the students will be able to understand the flow problems, different flow characteristics, laminar and turbulent flow, energy distribution, and will gain ability to calculate enthalpy change under mass flow characteristics.

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	4	**-/-/-**	**4**

(A72323) DOWNSTREAM PROCESSING

Objectives: This course is formulated to teach various methods of product separation, isolation and purification.

UNIT I:

OVERVIEW OF BIOSEPARATION AND ITS IMPORTANCE

Role and importance of downstream processing in bioprocess industries; problems and requirements of bioproduct purification. Economics of downstream processing in Biotechnology, cost-cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, low value products and low volume, high value products): Physico-chemical basis of bio-separation processes.

UNIT-II:

PRIMARY SEPARATION AND RECOVERY PROCESS

Cell disruption methods for intracellular products: Bead mill, homogenizer, chemical and enzymatic methods, ultrasonographic method. Removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

UNIT-III:

PRODUCT ISOLATION AND ENRICHMENT

Precipitation and sedimentation methods (with salts, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction), Extraction: co-current and counter-current extraction, Chemisorption, Adsorption, Sigle stage absorption, Fixed bed adsorption, Absorption isotherm, Langmuir and Friendlich isotherm, Absorption hysteresis, Break-through curve. Aqueous-two-phase extraction.

UNIT IV:

PRODUCT PURIFICATION

Chromatographic separation, HPLC, FPLC, GC, TLC, Ion-exchange chromatography, gel permeation chromatography, affinity chromatography, chromatofocusing electrophoresis separations, tangential cross flow filtration, membrane filtration, micro and ultrafiltration, holofibre separation, reverse osmosis, membrane separation theory and design. Other separation processes: dialysis, electrodialysis, pervoporation, electrophoresis methods of bioseparations. Recent development in product Isolation (for ex. one step purification, reverse micro cellular extraction on line membrane separation). In-situ product removal, integrated bioprocessing

UNIT V:

CRYSTALLIZATION AND DRYING

Crystallization, theory and principles, various crystallization equipment. **Drying**: Theory and principles of drying, definition of various terms, Drying kinetics, Drying rate terms, Mechanism of batch drying - constant rate and falling rate periods evaluation and diffusivity coefficient; various drying operations, drying equipment, criteria for selection of dryers.

TEXT BOOKS:

1. Wankat PC. Rate controlled separations, Elsevier.
2. Belter PA and Cussler E. Bioseparations, Wiley.

REFERENCES:

1. Product Recovery in Bioprocess Technology, BIOTOL.' Series, VCH.
2. Asenjo J.M. Separation processes in Biotechnology, Marcel Dekkere Inc
3. M.R.Ladisch, Bioseparation engineering: Principles, Practice and Economics, Wiley Interscience.

Outcomes: After completion of this course the students will be skilled in choosing a process of separation for a particular product, they will know how to design the relevant equipment, calculate the yield, and degree of purification.

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	4	**-/-/-**	**4**

(A72318) ANIMAL BIOTECHNOLOGY

Objectives: This course is designed to impart students an understanding of primary cell culture and methods of converting them to long term established cultures. They will be exposed to all the requirements and equipments needed for animal cell culture, stem cell technology, organ culture, tissue engineering.

Unit I:

Introduction

Primary and established cells; Equipments & Instrumentation; Characterization of cultured cells: Cell duplication time – examples of slow & rapid growers; Parameters of growth and their measurement; Measurement of viability and toxicity; Introduction to apoptosis and necrosis.

Unit II:

Media & Supplements

Balanced salt solutions and simple growth medium; Physical, chemical and metabolic functions of media constituents; Role of CO_2; Role of serum & supplements.

Unit III:

Basic mammalian cell culture techniques

Disaggregation of tissue and primary cells – enzymatic and non-enzymatic; Maintenance of cell culture- suspension and adherent; Cell separation based on cell density and phenotypic markers.

Higher order cultures

Organ and histotypic cultures; Three dimensional cultures; Mixed cell cultures – eg., study of immune response; Skin grafts.

Unit IV:

Application of Animal cell cultures

Study of biological process- eg., polarized and non-polarized cells; Production of vaccines; Biologicals and therapeutics (monoclonal antibody and recombinant protein).

Unit V:

Tissue Engineering & Stem Cells

Cloning; Micromanipulation; Synchronization; Transformation. Stem cells

Definition; Types – pleuripotent v/s totipotent; Embryonic, adult and fetal;

Role of stem cells in tissue engineering; Applications of stem cells.

TEXT BOOKS:

1. Culture of Animal Cells, (3rd Edition), F1. Ian Froshney. Wiley-Liss.
2. Animal Cell Culture – Practical Approach, Ed. John R.W. Masters, OXFORD.

REFERENCES:

1. Cell Culture Lab Fax. Eds. M. Butler & M. Dawson, Bios Scientific Publications Ltd., Oxford.
2. Animal Cell Culture Techniques. Ed. Martin Clynes, Springer.
3. Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods. Ed. Jenni P. Mather and David Barnes. Academic Press.
4. Cell Growth and Division: A Practical Approach. Ed. R. Basega, IRL Press.

Outcomes: After completion of the course students will achieve the expertise to demonstrate the methods for development of primary cell culture. They will develop awareness in interlinking of different fields for the development of biological organs.

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(A72322) CROP IMPROVEMENT

(Elective-II)

Objectives: Students get familiarized with tissue culture and transformation techniques for improvement of crop productivity and quality. To learn different molecular markers for molecular breeding and MAS.

Unit I:

Plant Breeding and Crop Improvement

Conventional Plant Breeding strategies, Hybridization, Inbred lines, Pure lines, Heterosis.

Unit II:

Molecular Markers for Crop Imrovement

RAPD, RFLP, AFLP, SSRs, SSCP, SCAR. QTLs: Marker assisted selection, construction of molecular maps, map based cloning.

Unit III:

Gene Cloning

Discovery, Cloning of Plant genes, Probe based screening, Genomic and proteomic approaches.

Unit IV:

Transgenic Crops I

Secondary Metabolites, Increase in Productivity by manipulation of photosynthesis, Nitrogen fixation, Nutrient uptake efficiency, Post harvest technology.

Unit V:

Transgenic Crops II

Transgenic plants for quality improvement for lipids & Carbohydrate content, Plantibodies, Edible Vaccines, Therapeutic Proteins.

TEXT BOOKS:

1. Biochemistry & Moleuclar Biology of Plants (Buchanan, B.B. Gruissem, W. and Jones, R.L. eds.) 2000.
2. Molecular Plant Breeding, Yunbi Xu, CABI Publishers, 2010.

REFERENCES:

1. Bernard R. Glick and John E. Thompson, Methods in Plant Molecular Biology and Biotechnology, CRC Press,

2. John Hammond, Peter McGarvey, Vidadi Yusibov, Plant Biotechnology: New Products and Applications, Springer Verlag,

3. Plant Molecular Biotechnology by S.Mahesh, New Age International Publishers, 2008.

Outcomes: Students would be able to do transformation of crop plants to increase crop productivity. Students will also gain the ability to apply molecular markers for MAS in breeding.

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	4	**-/-/-**	**4**

(A72327) STRUCTURAL BIOLOGY

(Elective-II)

Objectives: This course aims to familiarize students to the importance of structure of biomolecules with respective functions. They further understand the impact of interaction of biomoleucles such as protein-protein interaction, protein-nucleic acid interaction, receptor-ligand interaction on biological functions.

UNIT I:

MACROMOLECULAR STRUCTURE AND INTERMOLECULAR FORCES

Macromolecular Structure: Levels of structure in biomolecules, size and shape, Molecular chirality and Structural transitions.

Forces that determine Protein and Nucleic acid structure, basic problems. Polypeptide chains; geometric, potential energy calculations, observed values for rotation angles, hydrogen bonding, hydrophobic interactions and structure of water molecule; ionic interactions, disulphide bonds.

UNIT II

STRUCTURE OF NUCLEIC ACIDS

Nucleic acids; general characteristics of nucleic acid structure, geometric, glycosidic bond rotational isomers, backbone rotational isomers and ribose puckering forces stabilizing ordered forms, base pairing, base stacking; tertiary structure of nucleic acids.

UNIT-III

PROTEIN FOLDING AND STRUCTURE

Protein folding**:** Types of proteins and interactions that govern protein folding, protein structure, The protein globule and hydrophic interactions, organized folds, folding mechanisms, membrane proteins, helix-coil transitions.

Prediction of protein structure; Sequence-structure relationships (fundamentals of bioinformatics: sequence homology),

UNIT IV:

BIOMOLECULAR INTERACTIONS & KINETICS

Molecular recognition, supramolecular interactions, Functional importance of protein-protein and protein-nucleic acid interactions. Specific and non-specific DNA-protein complexes.

Biochemical Kinetics studies, uni-molecular reactions, simple bimolecular multiple intermediates, steady state kinetics, catalytic efficiency relaxation

spectrometry, ribonuclease as an example.

UNIT V:

EXPERIMENTAL METHODS

Size and shape of micro molecules: photons, chromophores, transition dipole moments, absorbance, and concentration. Methods of direct visualization of macromolecules as hydrodynamic particles - macromolecular diffusion, ultra centrifugation, viscometry.

TEXT BOOKS:

1) Introduction to Protein Architecture: The Structural Biology of Protein by A.M. Lesk, Oxford University press (2001).

2) Vijayan. M. Yathindra. N. and Kolaskar A.S. Perspectives in structural Biology. Indian Academy of Sciences.

REFERENCES:

1. Introduction to Protein Structure, by Branden and Tooze

2. Tinoco, I., Jr., Sauer, K., Wang, J. C., & Puglisi, J. D. (2001) Physical Chemistry: Principles and Applications in Biological Sciences, 4th ed. Prentice Hall.

3. Discovering Genomics, Proteomics and Bioinformatics by A. Malcolm Campbell, Laurie J.Heyer, 2nd Edition, Pearson Publications, 2008.

Outcomes: Students would be able to generate and study the importance of structure of biomoleules using x-ray diffraction and related techniques. They could assess the changes of the structure and its effect on the biological function. They will gain the ability to distinguish between the type of interaction and its impact on biological system.

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IV Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A72321) CANCER BIOLOGY

(Elective-II)

Objectives: This course aims to familiarize the students with an understanding of the molecular mechanisms of cancer, its development by factors such as physical, chemical, diet and retroviruses etc., .The effect of mutations involving anti and pro apoptotic genes and defects in DNA repair mechanisms along with strategies for cancer treatment are a part of the objectives.

UNIT I:

FUNDAMENTALS OF CANCER BIOLOGY

Regulation of Cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, Different forms of cancer – Classification: Epidemiology of cancer.

UNIT II:

PRINCIPLES OF CARCINOGENESIS

Principles of Physical Carcinogenesis, X - Ray radiation, UV - mechanism of radiation Carcinogenesis; Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Diet & Cancer.

UNIT III:

MOLECULAR CELL BIOLOGY OF CANCER

Oncogenes, Identification of Oncogenes, Viruses and Cancer, Detection of Oncogenes, Growth Factor and Growth Factor receptors that are Oncogenes. Oncogenes / Proto Oncogene activity. Growth factors related to transformations. Signal transduction and aberrant cell growth.

Principles of cancer metastasis: Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement Membrane disruption, Three-step theory of Invasion, Proteinases and tumour cell invasion.

UNIT IV:

DETECTION OF CANCER

Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

UNIT V:

TUMOR SUPPRESSION AND CANCER THERAPY

Tumor suppressor genes, modulation of cell cycle in cancer.

Different forms of therapy, Chemotherapy- new molecules, radiation Therapy, and Immunotherapy: advantages and limitations.

TEXT BOOKS:

1. L.M. Franks, N.M. Teich. An Introduction to Cellular and Molecular Biology of Cancer, New Edition, Oxford Medical publications.
2. Raymond. W. Ruddon, Oxford University press.

REFERENCES:

1. Dunmock N.J and Primrose.S.B., Introduction to modern Virology, Blackwel.

Outcomes: After completion of the course the student will be able to understand the cellular and molecular basis of cancer, its treatment and development of new drugs.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A70527) ARTIFICIAL NEURAL NETWORKS

(Elective-II)

UNIT- I

Introduction - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process – Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

UNIT- II

BACK PROPAGATION: back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT- III

SINGLE LAYER PERCEPTRONS: Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perceptron – convergence theorem, Relation between perceptron and Bayes classifier for a Gaussian Environment

Multilayer Perceptron – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection.

UNIT- IV

SELF ORGANIZATION MAPS: Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification.

UNIT- V

NEURO DYNAMICS: Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors as a recurrent network paradigm

Hopfield Models – Hopfield models, computer experiment

TEXT BOOK:

1. Neural networks: A comprehensive foundation/ Simon Hhaykin/ PHI.

REFERENCES:

1. Artificial neural networks/ B.Vegnanarayana/PHI
2. Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003
3. Neural networks/ James A Freeman David M S kapura/ Pearson education/2004
4. Introduction to Artificial Neural Systems/Jacek M. Zurada/JAICO Publishing House Ed. 2006.

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IV Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A72326) MOLECULAR PATHOGENESIS

(Elective-III)

Objectives: This course is designed to provide students an understanding of pathogenesis of a disease, a consequence of whole organism Vs a molecules of the microbe and its effect on disease development. They will get awareness about resistance, susceptibility and disease epidemiology outcomes of different populations.

UNIT I:

INTRODUCTION

Introduction to pathogenesis, components of microbial pathogenicity. Population genetics of Microbial pathogenesis, methods to detect genetic diversity and structure in natural population, epidemiology.

UNIT II:

HOST DEFENCES

Host defense against pathogens, clinical importance of understanding host defense, components of the host surface defences systems like skin, mucosa, eye, mouth, respiratory tract.

Components of the systemic defense like the tissues and blood.

Modulation of immune response by Pathogens

UNIT III

HOST- PATHOGEN INTERACTION

Virulence and virulence factors, colonising virulence factors, virulence factors damaging the host tissues, virulence genes and regulation of the virulence genes.

Experimental methods to study host-pathogen interaction, selecting the pathogen model, measurement of virulence, identification of potential virulence factors, Viral Pathogenesis.

UNIT IV:

PARADIGMS OF PATHOGENESIS:

Diphtheria disease by colonisation; Disease without colonisation, *Clostridium botulinum* and *Staphylococcus aureus;* Intestinal infections, *Shigella* and *E.coli* infections; *Vibrio cholera, Salmonella* infections; fungal infections.

UNIT V:

FUTURE CHALLENGES

Gastric and duodenal ulcers - are they due to infections? Lyme disease and Syphilis - unsolved mystery. Legionnaires disease-aftermath of comforts.Tuberculosis and other mycobacterial infections reemerging with vengeance. Rheumatic fever and glomerulo nephritis - still a question to be solved, HIV & AIDS, Malaria.

TEXT BOOK:

1) Iglewski B.H. and Clark V.L. Molecular basis of Bacterial pathogenesis, Academic press,

REFERENCES:

1. General Microbiology. Prescott and Dunn Mc Graw Hill Publishers.

2. Biology of Micro organisma. BROCK, Prentice Hall, International Inc.

Outcomes: Students could distinguish between the molecules with the pathogen which could cause disease or induced protection of the host. They get awareness why certain population are resistant vs susceptible based on their genetic background and the methods to resist epidemiology of a disease.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A72320) BIOPHARMACEUTICALS

(Elective-III)

Objectives: This course enables students to understand the difference between pharmaceuticals vs biopharmaceuticals, importance of properties of drugs, dose and absorbance rates in hosts (Pharmacokinetics). It also provides an in depth understanding of some biopharmaceuticals which are presently in use.

UNIT I:

INTRODUCTION TO PHARMACEUTICALS

History & Definition of Drugs. Sources of Drugs - Plant, Animals, Microbes and Minerals. Different dosage forms. Routes of drug administration; Biotech drugs in Development, Recent FDA Approvals

UNIT II:

DRUG DISCOVERY AND DRUG DESIGN

Drug Research based on Computers and Biotechnology, Antibodies in Rational Drug Designing, Classes of Therapeutic Targets in the Living Cell, Drug Development in Past and Role of Biotechnology Today, Drug Designing Softwares (AUTODOCK, ARGUSLAB etc.,)

UNIT III:

PHARMACOKINETICS

Pharmacokinetics- Drug absorption, factors that affect the absorption of drugs, Distribution of drugs, Biotransformation of drugs, Bioavailability of drugs and drug metabolism, Pharmacogenomics.

UNIT IV:

BIOPHARMACEUTICAL PRODUCTS

Production of Therapeutic Proteins, Blood Products, Monoclonal Antibodies, Hormone Therapy, Role of Biopharmaceuticals in treatment of various health disorders

UNIT V:

TRANSGENICS & GENE THERAPY

Transgenic Production of Biopharmaceuticals: Animals of Interest for Transgenesis, Challenges & Issues,Advantages, Transgenic Plants for Production, Human Gene Therapy: Examples; Ethics; Gene transfer with Viral & Non-viral Vectors.

TEXT BOOK:

1. Biopharmaceuticals by S.N.Jogdand, Himalaya Publishing House.

REFERENCES:

1. Biopharmaceuticals: Biochemistry & Biotechnology, Gary Walsh , John Wiley & Sons Ltd.
2. Remington's Pharmaceutical sciences, (Mark Publications & Company eston PA) year .
3. Theory & Practice of Industrial Pharmacy, Leon Lachman, Lea & Febiger .

Outcomes: At the end the students will be able to distinguish between pharma vs biopharma. They will be skilled to assess the properties of drugs & biopharma products and their outcome as a potential molecules.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A72324) INTRODUCTION TO BIOMATERIALS

(Elective-III)

Objectives: This course is designed with an objective to provide an understanding of the basic properties required for a material to be biocompatible. They will be imparted awareness in testing & quality assessment of the biomaterials. They will get exposure to latest nano biomaterials and their application for human use.

Unit I.

Introduction

Structure and function of human body: chemical, cellular, tissue, organ and system level.

Biocompatibility of synthetic materials and implants.

Unit II.

Basics of Biomaterials

Characteristics of biomaterials,

Classification of biomaterials,

Impact of biomaterials.

Unit III.

Biomaterials for human use

Metallic biomaterials as implants,

Bioceramics and ceramic biomaterials,

Polymeric biomaterials – classification, natural and synthetic materials; biomedical applications,

Composite biomaterials – classification, biological responses to composite biomaterials, biomedical applications.

Unit IV.

Quality and Testing of Biomaterials

Degradation,

Corrosion,

Deformation,

Fracture,

Brittle to ductile transition,

Fatigue,

Tribology.

Unit V.

Nanobiomaterials

Definition and classes of nanobiomaterials

Polymeric, ceramic and composite nanobiomaterials

Scaffolding, tissue engineering (including stem cells), growth factor delivery with nanobiomaterials

TEXT BOOKS:

1. Biomaterials: A Nano Approach by Sreeram Ramakrishna, Murgan Ramalingam, T.S.Sampath Kumar, Winston.O.Soboyejo, CRC Press
2. D. Byrom, Biomaterials –novel materials from biological sources, Stockton press, New York.

REFERENCE:

1. A. Steinbuechel – Biopolymers.

Outcomes: At the end students will be able to differentiate whether a material has the compatibility with biological system to be used for applications. They will be able to assess the quality of biomaterials, design and generate new biomaterials or modify existing material for enhancement of biocompatibility.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A72388) BIOINFORMATICS LAB

Objectives: This course aims to impart in students fundamental knowledge of various biological data bases and tools which can be used for analysis using compilation methods.

1) Information retrieval from Databases
2) FASTA & BLAST
3) Sequence Alignments:
   a) Pairwise sequence Alignment (EMBOSS)
   b) Multiple sequence Alignment (Clustal W)
4) Primer Designing Tools
5) Protein visualization tools (RASMOL, SPDBV)

REFERENCES:

1. Bioinformatics – A Practical guide to the Analysis of Genes and Proteins – Andreas D.Baxevanis, B.F. Francis Ouellette. 3rd Edition, 2005, John Wiley & Sons, Inc.

Outcomes: Students gain an expertise with existing tools and resources for computational analysis of biological data. They develop an awareness of problems which arise in the modeling & analysis of living system.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A72389) DOWNSTREAM PROCESSING LAB

Objectives: The lab curriculum is formulated to train students on various methods of product separation, isolation, purification and formulation.

1. Cell disruption techniques:

Bead mill, ultrasonication, chemical and enzymatic method, high pressure cell disrupter

2. Separation of soluble from insolubles: Filtration, sedimentation, centrifugation,

3. Product Isolation: Product enrichment operations, precipitation, ultra filtration, Aqueous two-phase extraction,

4. Product purification: Preparative liquid chromatographic techniques (HPLC), GC, Affinity chromatography, Ion-exchange chromatography, TLC, Gel electrophoresis, Ultra filtration, membrane based filtration.

5. Drying and Crystallization:

Product crystallization, Freeze drying, Flash drying.

6. Demonstration of few equipments

1. Tangential flow filtration unit
2. Ultra filtration membrane
3. Chromatographic apparatus
4. Chromatographic columns
5. UV-Vis spectrophotometer
6. HPLC
7. GC
8. FPLC
9. Lyophilizer

REFERENCES:

1. Product Recovery in Bioprocess Technology, BIOTOL.' Series, VCH.
2. Asenjo J.M. Separation processes in Biotechnology, Marcel Dekkere Inc

Outcomes: The students will be skilled to select a process of separation for a particular product, use the relevant equipment, calculate the yield, and degree of purification for industrial applications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A82329) BIOPROCESS OPTIMIZATION AND PLANT DESIGN

Objectives: This course aims to inculcate the knowledge of process economics and optimization using various statistical and non statistical approaches.

Unit I:

Basic Concepts

Overview of experimental design in biological process, understanding of variables in biological processes. Introduction to optimization of bioprocesses.

Unit II:

Optimization Approaches

Statistical and numerical optimization, fundamental theory. First order and second order designs, differences in approaches, general response surface analysis. Statistical experimental procedures for Placket – Burman designs; Method of Ridge analysis, Nelder – Mead simplex method; Optimization of multi – response biological systems. **Non statistical approach:** Self directing optimization, case-studies with simple response and multi-response analysis.

Unit III:

General Design Consideration

Technical feasibility survey, process development, principles of equipment design and specification. Project consideration: Marketability of product, availability of technology, raw materials, equipment, human resources, land and utilizations. Other consideration: Site characteristics, waste disposal, government regulation and other legal restriction, community factors and other factors affecting investment.

Unit IV:

Design of Heat Exchangers

Evaluation of heat load for any fermentation process, design of heat exchanger using energy balance equation. Application of optimization techniques in the design of a heat exchanger in terms of heat transfer area, temperature differences, cost and project economics.

Unit V:

Design of Bioreactors

Bioreactor: Application of mass and energy balances in the design, evaluation of size and related features of the fermenter. Application of optimization techniques in the design of fermenter in terms of size, cost and project

economics**.**

TEXT BOOKS:

1. B. Volesky and J. Votrubla. Modeling optimization of fermentation process. Elsevier, Amsterdam.
2. Peters and Timmerhaus. Plant design and economics and for chemical engineers. Mc Graw-Hill. 4th Edition.

REFERENCES:

1. Rudd and Watson. Strategy of process engineering. Wiley.
2. D.C. Montgomery. Design and Analysis of Experiments. 5th edition. Wiley India (P) Ltd., New Delhi.

Outcomes: The students will be able to design the experiments and optimize the processes, will be able to calculate the optimum conditions for best production. The students will know how the product cost can be minimized.

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IV Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A82331) FOOD BIOTECHNOLOGY

(Elective-IV)

Objectives: This course structure is envisaged to impart thorough knowledge and understanding of food related technical knowhow and problem for processecing, preservation quality control and food borne disease etc.

Unit I:

Introduction To Food Processing

Biotechnology in relation to the food industry, nutritive value of food, and microorganisms associated with food, its sources and behavior in foods.

Unit II:

Food Preservation

Bioprocessing of meat, fisheries, vegetables, dairy products, enzymes and chemicals used in food processing, Biochemical engineering for flavor and food production, cryopreservation, irradiated foods.

Unit III:

Fermented Food Products & Quality control

Dairy products, non-beverage plant products, beverages and related products of baking.

Quality control, case studies on Biotechnology in the evolution of food quality.

Unit IV:

Food Spoilage & Food Borne Diseases

Food -borne infections & intoxications.

Unit V:

Food Microbiology

Utilization of microorganisms in food Industry, Single cell protein, Neutraceuticals etc., Natural and artificial sweeteners and their role in controlling diseases and deficiencies.

TEXT BOOKS:

1. Roger A., Gordan B., and John T., Food Biotechnology.
2. Essentials of Food process Engineering. Chandra Gopala Rao. BS Publications. (2006).

REFERENCES:

1. George J.B., Basic Food Microbiology, CBS Publishers Distributors.

2. James M .J. Modern Food Microbiology, CBS Publishers & Distributors.
3. Lindsay, Willis Biotechnology, Challenges for the flavor and food Industries, Elsevier Applied Science.
4. Fundamentals of Food Engineering. D.G Rao. Prentice-Hall of India 2010.

Outcomes: At the end of the study the students will be competent to differentiate between food biotechnology benefits and types of microorganisms associated with food processing, preservation strategies and quality control.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A82333) NANO BIOTECHNOLOGY

(Elective-IV)

Objectives: The objective of this course is to provide exposure to the students to biological nano structures with their characterization and applications in Drug delivery, diagnostics, Imaging and development of sensors.

Unit I:

Introduction to Nanobiotechnology

Nanobiotechnology versus bionanotechnology

Nanoscale effects in biosystems, scope and future prospects.

Nanostructures: core/shell nanoparticles – classification – organic/inorganic, polymeric

Unit II:

Fabrication and Characterization of Nanostructures

Fabrication methods: self assembly, lithography, e-beam lithography, sol-gel process.

Characterization tools: AFM, STM, SEM, TEM, electron microscopy

Unit III:

Drug delivery and Biomedical engineering

Targeting cancer cells using PLGA nanoparticles, nanoengineered capsules for sustained drug delivery.

Core/shell nanoparticles in tissue engineering (organic, inorganic, polymeric)

Unit IV:

Nanobiocompunds

DNA polynode, RNA topoisomerase, biopolymers, procollagen, protein-magnetic materials.

Smart materials: Nanoscale biostructures, heterogenous nanostructures.

Unit V:

Applications of nanobiotechnology

Bioimaging, cell labeling, drugs-photodynamic therapy, molecular motors.

TEXT BOOKS:

1. Ratner and Ratner, Nanotechnology- a gentle introduction to the next big idea, Pearson education, 2007.

2. T. Pradeep, NANO: The Essentials, understanding Nanoscience & Nanotechnology, Mc Graw – Hill Education. (2010).

REFERENCES:

1. Harising nalwa, encyclopedia of Nanoscience and technology , scientic America
2. L.E.Foster, nanotechnology-science, innovation and opportunity, pearson education inc, 2007

Outcomes: After completion students will gain competence to distinguish between different types of nanostructures in biology. They gain awareness about changes in properties at nano level along with its applications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A82330) CLINICAL TRIALS AND REGULATORY AFFAIRS

(Elective-V)

Objectives: This course is designed with an aim to impart understanding of the best practices adopted for clinical trials. They get acquainted to the regulatory bodies with in India and at the global level.

UNIT-I:

INTRODUCTION

Licensing authorities-roles and responsibilities,ICH GCP,FDA, EU Clinical Trial; Directive, Data Protection Act & Regulations relating to electronic; signatures,Declaration of Helsinki 2000 amendment and financial disclosure; Regulation of drug preparation and Law, guidelines and codes of practice.

packaging,EMEA,European directives and MRECs,Ethics committees – history; structure regulation impact of ICH GCP recent development with regard to INDIA; / USA / EU Clinical Trial directive

UNIT II:

ETHICAL ISSUES

Ethics in all aspects of health care; Historical cases; Negligence , informed consent, mental competence; Up – to – date cases: cloning, human embryos and IVF; Shared responsibilities for decisions and understanding of risk.

UNIT III:

REGULATORY REQUIREMENTS

Definitions of GCP, auditing , monitoring and inspection; GCP auditing requirements from a regulatory perspective; GCP compliance and audit certificates; GCP auditor training; GCP audit team structure and SOPs; GCP audit planning; GCP audit conduct; Reporting GCP audit findings; Follow – up to GCP audit reports.

Roles and responsibilities in clinical research according to ICH GCP; Sponsor; Monitor; Investigator; IRB / IEC; Essential documentation. The INDIAN / USA / EU Directives on GCP in Clinical Trials: Purpose: How will the introduction affect clinical research; Extracts from the guidance documents. Possible sanctions for non- compliance (a) Legal and regulatory (b) Commercial and (c) Professional.

Regulations in clinical research; The purpose of audits; Types of audits; Preparing for audits; In company

On site; The audit process; Typical audit finding; What are they; Resolution;

How can they be avoided.

UNIT IV:

REGULATORY AFFAIRS

History of regulatory affairs; Main concepts QSE; Sources of information; Regulatory affairs for studies in human subjects;;What data is needed; Current and future European requirements and procedures; US perspective; Recognizing why clinical research has to meet the needs of regulatory Affairs.

Regulatory submissions for new products; What data is needed?; Requirements for gaining approval; US perspective; Regulatiion and control of marketing and sales of medical products; Regulations Codes of practice; Promotional materials.

UNIT V:

RECENT DEVELOPMENTS

Latest developments in ICH; Purpose; Implications; Guidance notes; Inspections. INDIAN / USA / EU Ethics approval system: Overview; Recent developments. Current issues in Clinical research: Confidentiality issues; Medicines for human use (clinical trials) regulations 2003: Other relevant issues

TEXT BOOKS:

1. Good Clinical Practices ,Central Drugs Standard Control Organisation, Govt. of India
2. Fundamentals of clinical trials. Third Edition. Lawrence M. Friendman, Curt D. Furberg, David L. DeMets. Springer International Edition. (2009).

REFERENCES:

1. International Clinical Trial, Volume 1 &2 Dominique P.Brunier and Gerhardt Nahler, Interpharm Press, Denver, Colorado.
2. Code of Federal Regulation by USFDA – Download.
3. ICH-GCP Guidelines – Download.
4. Biosafety issues related to genetically modified organism , Biotech Consortium India Limited, New Delhi.

Outcomes: At the end students would get awareness about factors which are important in GCP. They will also get knowledge of the guidelines followed in India and at the International level for GCP.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A82332) METABOLIC ENGINEERING

(Elective-V)

Objectives: The aim of the course is to give students an exposure to cellular metabolism, its regulation, metabolic flux , metabolic pathway modeling and its applications.

UNIT I :

INTRODUCTION

An Introduction to Metabolic Engineering, Overview of cellular metabolism. Models for cellular reactions, induction – Jacob Monod model and its regulation, Differential regulation by isoenzymes, Feed back regulation.

UNIT II :

BIOSYNTHESIS OF PRIMARY METABOLITES AND SECONDARY METABOLITES

Amino acid synthesis pathways and its regulation at enzyme level and whole cell level, Alteration of feed back regulation, Limiting accumulation of endproducts.

Regulation of secondary metabolite pathways, precursor effects, prophase, idiophase relationship, Catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites, applications of secondary metabolites.

UNIT III :

REGULATION OF ENZYME PRODUCTION

Strain selection, Genetic improvement of strains. Metabolic pathway, manipulations to improve fermentation, Feed back repression, Catabolite Repression, optimization and control of metabolic activities. The modification of existing - or the introduction of entirely new - metabolic pathways

UNIT IV :

METABOLIC FLUX

Integration of anabolism and catabolism, metabolic flux distribution analysis of bioprocess, material balance, kinetic types, equilibrium reaction. Experimental determination method of flux distribution, Metabolic flux analysis and its applications.

UNIT V :

METABOLIC ENGINEERING WITH BIOINFORMATICS AND APPLICATIONS

Metabolic pathway modeling, Analysis of metabolic control and the structure.metabolic networks, Metabolic pathway synthesis algorithms,

Application in pharmaceuticals, chemical bioprocess, food technology, agriculture, environmental bioremediation and biomass conversion.

TEXT BOOKS:

1. Wang.D.I.C Cooney C.L., Demain A.L., Dunnil.P. Humphrey A.E. Lilly M.D.,Fermentation and Enzyme Technology, John Wiley and sons.
2. Stanbury P.F., and Whitaker A., Principles of Fermentation Technology, Pergamon Press.

REFERENCES :

Zubay G., Biochemistry, Macmillan Publishers.

http://ocw.osaka-u.ac.jp/contents/19/ME040512.pdf For unit VI & VII

http://ocw.osaka-u.ac.jp/contents/19/ME040421.pdf For unit VI

http://ocw.osaka-u.ac.jp/contents/19/ME040526.pdf For unit VII

http://ocw.osaka-u.ac.jp/contents/19/ME040602.pdf For unit VI & VII

http://www.bioinfo.de/isb/gcb01/poster/hurlebaus.html

Outcomes: After completion of the course students will be able to understand and differentiate between various metabolic routes and their regulation. Students will be able to apply their knowledge for it's practical applications in different areas.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	-	**-/-/-**	**2**

(A80087) INDUSTRY ORIENTED MINI PROJECT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	-	**-/6/-**	**2**

(A80089) SEMINAR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	-	**-/15/-**	**10**

(A80088) PROJECT WORK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	-	**-/-/-**	**2**

(A80090) COMPREHENSIVE VIVA