ACHARYA NAGARJUNA UNIVERSITY

NAGARJUNA NAGAR – 522 510
ANDHRAPRADESH, INDIA

Scheme of Instruction, Examination and detailed Syllabi of

BIOTECHNOLOGY

4-Year B.Tech Degree Course
(Semester System)

w.e.f. 2011-2012

ACHARYA NAGARJUNA UNIVERSITY: NAGARJUNA NAGAR

REVISED REGULATIONS FOR

FOUR - YEAR B.TECH. DEGREE COURSE

(CREDIT BASED SYSTEM)

(Effective for the batch of students admitted into first year B.Tech. from the academic year 2011-2012).

1.0. MINIMUM QUALIFICATIONS FOR ADMISSION:

A candidate seeking admission into First Year of B.Tech. Degree Course should have passed either Intermediate examination conducted by the Board of Intermediate Education, Andhra Pradesh with Mathematics, Physics, and Chemistry as optional subjects (or any equivalent examination recognized by the Acharya Nagarjuna University) or Diploma in Engineering in the relevant branch conducted by the State Board of Technical Education & Training of Andhra Pradesh (or equivalent Diploma recognized by Acharya Nagarjuna University).

The selection is based on the rank secured by the candidate at the EAMCET / ECET (FDH) examination conducted by A.P. State Council of Higher Education.

The candidate shall also satisfy any other eligibility requirements stipulated by the University and / or the Government of Andhra Pradesh from time to time.

2.0. BRANCHES OF STUDY:

2.1. The B.Tech. Course is offered in the following branches of study at one or more of the affiliated colleges:

1 Biotechnology
2 Chemical Engineering
3 Civil Engineering
4 Computer Science & Engineering
5 Electrical & Electronics Engineering
6 Electronics & Communication Engineering
7 Electronics & Instrumentation Engineering
8 Information Technology
9 Mechanical Engineering

2.2 The first year of study is common to all branches of Engineering except for Chemical Engineering and Biotechnology.

2.3 In addition to the core electives, an open elective (non departmental elective) is to be offered in the first semester of fourth year by all branches of B.Tech. courses.

3.0. DURATION OF THE COURSE AND MEDIUM OF INSTRUCTION:

3.1 The duration of the course is four academic years consisting of two semesters in each academic year where as annual pattern is followed for first year. The medium of instruction and examination is English.

3.2 The duration of the course for the students (Diploma Holders) admitted under lateral entry into II B.Tech. is three academic years consisting of two semesters in each academic year. The medium of instruction and examination is English.

4.0. MINIMUM INSTRUCTION DAYS:

The first year shall consist of a minimum number of 180 instruction days and each semester of 2nd, 3rd and 4th years shall consist of 90 days of instruction excluding the days allotted for tests, examinations and preparation holidays.

5.0 EVALUATION:

The performance of the students in each year/ semester shall be evaluated subject wise

5.1. The distribution of marks between sessional work (based on internal assessment) and University Examination will be as follows:

Nature of the subject	Sessional Marks	University Exam. Marks
Theory subjects	30	70
Design and / or Drawing	30	70
Practicals	**30**	**70**
Project work	50	**150 (**Viva voce)

5.2. In the First Year, there shall be three Mid Term Examinations and three Assignment Tests in theory subjects, conducted at approximate equal intervals in the academic year. Assignment questions shall be given at least one week in advance and the students shall answer the question(s) specified by the concerned teacher just before the commencement of the Assignment Test. A maximum of 18 Sessional marks (75% approx) shall be awarded based on the best two performances out of the three Mid Term Exams and a maximum of 7 (25% approx) marks for the best two Assignment Tests out of the three Assignment Tests conducted.

For Drawing subject (Engineering Graphics), 7 marks shall be awarded based on day-to-day class work and the remaining 18 marks based on the best two performances in the three Mid Term Exams. No separate Assignment Tests will be held for this subject.

The remaining 5 marks out of the 30 marks earmarked for the internal sessional marks are allotted for attendance in the respective theory and drawing subjects in a graded manner as indicated in ***clause* 7.2** from I year to IV year.

In each of the Semesters of 2^{nd}, 3^{rd} and 4^{th} years, there shall be two Mid Term examinations and two Assignment Tests in every theory subject. The Sessional marks for the midterm examinations shall be awarded giving a weightage of 14 marks out of 18 marks (75% approx) to that midterm examination in which the student scores more marks and the remaining 4 marks (25% approx.) for other midterm examination in which the student scores less marks. Similarly a weightage of 5 marks (75% approx) out of 7 marks earmarked for assignment tests shall be given for the assignment in which the student scores more marks and remaining 2 marks (25% approx) shall be given for the assignment test in which the student scores less marks.

For Drawing subjects, there shall be only two Mid Term examinations in each semester with no Assignment Tests. In case of such subjects a maximum of seven marks shall be given for day-to-day class work and the remaining maximum 18 marks shall be awarded to the Mid Term examinations taking into account the performance of both the Mid Term examinations giving weightage of 14 marks for the Mid Term Examination in which the student scores more marks and the remaining 4 marks for the other midterm examination. A weightage of 5 marks will be given in the total sessional marks of 30 for attendance in all theory and drawing subjects as indicated in ***clause* 7.2.**

5.3. The evaluation for Laboratory class work consists of weightage of **20** marks for day to day laboratory work including record work and 10 marks for internal laboratory examination including Viva-voce examination.

In the case of Project work, the sessional marks shall be awarded based on the weekly progress and based on the performance in a minimum of two Seminars and the Project Report submitted at the end of the semester. The allotment of sessional marks for Seminars and for day-to-day class work shall be **20 and 30.**

NOTE : A student who is absent for any Assignment / Mid Term Exam, for any reason whatsoever, shall be deemed to have scored zero marks in that Test / Exam and no make-up test / Exam shall be conducted.

5.4. A student who could not secure a minimum of 50% aggregate sessional marks is not eligible to appear for the year-end / semester-end University examination and shall have to repeat that year/ semester.

6.0. LABORATORY / PRACTICAL CLASSES:

In any year/semester, a minimum of 90 percent experiments / exercises specified in the syllabi for laboratory course shall be conducted by the students, who shall complete these in all respects and get the Record certified by the concerned Head of the Department for the student to be eligible to face the University Examination in that Practical subject.

7.0. ATTENDANCE REGULATIONS:

7.1 Regular course of study means a minimum average attendance of 75% in all the subjects computed by totaling the number of hours / periods of lectures, design and / or drawing, practicals and project work as the case may be, held in every subject as the denominator and the total number of hours / periods actually attended by the student in all the subjects, as the numerator.

7.2 A Weightage in sessional marks upto a maximum of 5 marks out of 30 marks in each theory subject shall be given for those students who put in a minimum of 75% attendance in the respective theory in a graded manner as indicated below:

Attendance of 75% and above but less than 80%	- 1 mark
Attendance of 80% and above but less than 85%	- 2 marks
Attendance of 85% and above but less than 90%	- 3 marks
Attendance of 90% and above	- 5 marks

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

7.4 A student who could not satisfy the minimum attendance requirements, as given above, in any year / semester, is not eligible to appear for the year end or semester end examinations and shall have to repeat that year/semester.

8.0 DETENTION:

A student, who fails to satisfy either the minimum attendance requirements as stipulated in *Clause-7*, or the requirement of minimum aggregate sessional marks as stipulated in *Clause 5*, shall be detained. Such a student shall have to repeat the same year / semester as the case may be subsequently and satisfy the above requirements afresh to become eligible to appear for the year-end / semester-end University examination.

9.0. UNIVERSITY EXAMINATION:

9.1. For each theory, design and/or drawing subject, there shall be a comprehensive University Examination of three hours duration at the end of First year / each Semester of 2nd, 3rd and 4th years, except where stated otherwise in the detailed Scheme of Instruction.

Question paper setting shall be entrusted to external examiners from the panels approved by the respective Boards of Studies.

9.2. For each Practical subject, the University examination shall be conducted by one internal and one external examiner appointed by the Principal of the concerned college and the University respectively, the duration being that approved in the detailed Schemes of Instruction & Examination.

9.3 Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner to be appointed by the University.

10.0 AWARD OF CREDITS

Credits are awarded for each Theory/Practical Subjects. Each theory subject is awarded 4 credits and each practical subject is awarded 2 credits. Project work is awarded 10 credits. However for some important theory subjects more than 4 credits may be awarded by individual boards. The total number of credits for all the four years put together should be in the range of 218-224 for any branch.

10.1 AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1	≥85%	S	10.0
2	75%-84%	A	9.0
3	65%-74%	B	8.0
4	55%-64%	C	7.0
5	45%-54%	D	6.0
6	40%-44%	E	5.0
7	≤39%	F(Fail)	0.0
8	The grade 'W' represents withdrawal/absent (subsequently changed into pass or E toS or F grade in the same semester)	W	0.0

10.2 A Student securing 'F' grade in any subject there by securing 0 grade points has to reappear and secure at least 'E' grade at the subsequent examinations in that subject.

10.3 After Ist year/each semester, Grade sheet will be issued which will contain the following details:

- **The list of subjects for the 1st year/each semester and corresponding credits and Grades obtained**
- **The Grade Point Average(GPA) for the 1st year/ each semester and**
- **The Cumulative Grade Point Average(CGPA) of all subjects put together up to that semester from first year onwards**

GPA is calculated based on the fallowing formula:

$$\frac{\text{Sum of [No.Credits X Grade Points]}}{\text{Sum of Credits}}$$

CGPA will be calculated in a similar manner, considering all the subjects enrolled from first year onwards.

11.0 CONDITIONS FOR PROMOTION

11.1. A student shall be eligible for promotion to II B.Tech. Course if he / she satisfies the minimum requirements of attendance and sessional marks as stipulated in Clauses 5 and 7, irrespective of the number of backlog subjects in I B.Tech.

11.2. A student shall be eligible for promotion to III B.Tech. Course if he / she **secures a minimum of 70% of the total number of credits from one regular and one supplementary examinations of I B.Tech.**, (including practical subject) in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in *Clauses 5 and 7* in II/IV B.Tech.

11.3. A student shall be eligible for promotion to IV B.Tech. course if he/she **secures a minimum of 70% of the total number of credits from two regular & two supplementary examinations of I B.Tech. and two regular & one supplementary examinations of II B.Tech. 1st semester and one regular & one supplementary examinations of II B.Tech. 2nd semester** (including practical subjects) in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in *Clauses 5 and 7* in III B.Tech.

11.4. A student (Diploma Holder) admitted under lateral entry into II B.Tech. shall be eligible for promotion to IV B.Tech. course if he/she secures a minimum of 70% of the total number of credits from two regular & one supplementary examinations of II B.Tech. 1st semester and one regular & one supplementary examinations of II B.Tech. 2nd semester (including practical subjects) in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in *Clauses 5 and 7* in III B.Tech.

12.0 ELIGIBILITY FOR AWARD OF B.TECH. DEGREE

The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements.

12.1 The candidate must have satisfied the conditions for pass in all the subjects of all the years as stipulated in *clause 10.*

12.2. Maximum Time Limit for completion of B.Tech Degree
A Student, who fails to fulfill all the academic requirements for the award of the degree within eight academic years from the year of admission, shell forfeit his/her seat in B.Tech. course.

12.3 A student (Diploma Holder) admitted under lateral entry into II B.Tech., who fails to fulfill all the academic requirements for the award of the degree within six academic years from the year of admission, shell forfeit his/her seat in B.Tech. course.

13.0 AWARD OF CLASS

A candidate who becomes eligible for the award of B.Tech. Degree as stipulated in *Clause 12* shall be placed in one of the following Classes.

S.No.	Class	CGPA
1	First Class With Distinction	8.0 or more
2	First Class	6.5 or more but less than 8.0
3	Second Class	5.0 or more but less than 6.5
4	Pass Class	4.5 or more but less than 5.0

14.0. IMPROVEMENT OF CLASS

14.1. A candidate, after becoming eligible for the award of the Degree, may reappear for the University Examination in any of the theory subjects as and when conducted, for the purpose of improving the aggregate and the class. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the Degree.

However, this facility shall not be availed of by a candidate who has taken the Original Degree Certificate. Candidates shall not be permitted to reappear either for Sessional Examination or for University Examinations in Practical subjects (including Project Viva-voce) for the purpose of improvement.

14.2. A single **Grade sheet** shall be issued to the candidate after incorporating the **Credits and Grades** secured in subsequent improvements.

14.3. A consolidated **Grade Sheet** shall be issued to the candidate indicating the **CGPA of all the four years put together** along with the Provisional Certificate.

15. AWARD OF RANK

The rank shall be awarded based on the following:

15.1. Ranks shall be awarded in each branch of study for the top ten percent of the students appearing for the Regular University Examinations or the top ten students whichever is lower.

15.2. Only such candidates who pass the Final year examination at the end of the fourth academic year after admission as regular final year students along with the others in their batch and become eligible for the award of the Degree shall be eligible for the award of rank. The University Rank will be awarded only to those candidates who complete their degree within four academic years.

15.3. For the purpose of awarding rank in each branch, **the CGPA calculated based on the Grades** secured at the first attempt only shall be considered.

15.4. Award of prizes, scholarships, or any other Honors shall be based on the rank secured by a candidate, consistent with the desire of the Donor, wherever applicable.

16.0 SUPPLEMENTARY EXAMINATIONS

In addition to the Regular University Examinations held at the end of 1st year / each semester, Supplementary University Examinations will be conducted during the academic year. Such of the candidates taking the Regular / Supplementary University examinations as Supplementary candidates may have to take more than one University Examination per day.

17.0 TRANSITORY REGULATIONS

17.1. Candidates who studied the four-year B.Tech. Degree Course under Revised Regulations (RR)/ **Credit based Regulations(CR**) but who got detained in any year for want of attendance / minimum aggregate sessional marks may join the appropriate year / semester in the Semester system applicable for the batch and be governed by the Regulations of that batch from then on.

17.2. University Examinations according to **RR / CR** shall be conducted in subjects of each year five times after the conduct of the last set of regular examinations under those Regulations.

17.3. Candidates who have gone through the entire course of four academic years and have satisfied the attendance and minimum aggregate sessional marks **in 1st year/each semester under RR/CR**, but who are yet to pass some subjects even after the five chances stated in *Clause 17.2*, shall appear for the equivalent subjects in the Semester system, specified by the University / Board of Studies concerned.

18. 0 AMENDMENTS TO REGULATIONS

The University may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabi.

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ACHARYA NAGARJUNA UNIVERSITY: NAGARJUNA NAGAR
SCHEME OF INSTRUCTION AND EXAMINATIONS
FOR
B.TECH. BIOTECHNOLOGY
w.e.f. 2011-2012 (Credit Based Semester System)

I/IV B.TECH. BIOTECHNOLOGY - ANNUAL PATTERN
(For I/IV B.Tech. only)

S. No	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				
		Theory + Tutorial	Practicals	Duration of University Examination, Hrs	Sessional marks	University Marks	Total marks	Credits
1	BT101 Mathematics – I	3	-	3	30	70	100	4
2	BT102 Mathematics – II	3	-	3	30	70	100	4
3	BT103 Physics	3	-	3	30	70	100	4
4	BT104 Inorganic and Physical Chemistry	4	-	3	30	70	100	4
5	BT105 Technical English Communication Skills	3	-	3	30	70	100	4
6	BT106 Computer Programming with 'C'	3	-	3	30	70	100	4
7	BT107 Cell Biology	3	-	3	30	70	100	4
8	BT108 EngineeringGraphics **	2+4	-	3	30	70	100	4
9	BT151 Physics Laboratory	-	3	3	30	70	100	2
10	BT152 Chemistry Laboratory*	-	3	3	30	70	100	2
11	BT153 Workshop Practice*	-	3	3	30	70	100	2
12	BT154 Computer Programming Laboratory	-	3	3	30	70	100	2
Total		24+4	9	-	360	840	1200	40

* Alternate weeks.

** Two different question papers will be set for the University Examination. One question paper for CE, ME, EEE, ChE and BT branches and the University Examination will be conducted from 9.00 A.M. to 12.00 Noon. The second question paper will be set for ECE, EI, CSE & IT branches and the University examination be conducted from 2 P.M. to 5 PM.

SCHEME OF INSTRUCTION AND EXAMINATIONS
FOR
B.TECH. BIOTECHNOLOGY
w.e.f. 2011-2012 (Credit Based Semester System)

II/IV B.TECH. BIOTECHNOLOGY THIRD SEMESTER

S. No	Subject Code & Subject Name	Scheme of Instruction periods per week		Scheme of Examination				
		Theory + Tutorial	Practicals	Duration of University Examination	Sessional Marks	University Marks	Total	Credits
Theory								
01	BT 211 Object Oriented Programming	4	-	3	30	70	100	4
02	BT 212 Environmental Studies	4	-	3	30	70	100	4
03	BT 213 Electrical & Electronics Engineering	4	-	3	30	70	100	4
04	BT 214 Principles of Process Calculations	4+1	-	3	30	70	100	5
05	BT 215 Bio-Organic Chemistry	4+1	-	3	30	70	100	5
06	BT 216 Microbiology	4	-	3	30	70	100	4
Practical								
07	BT 251 Object Oriented Programming Laboratory	-	3	3	30	70	100	2
08	BT 252 Electrical & Electronics Laboratory	-	3	3	30	70	100	2
09	BT 253 Microbiology Laboratory		3	3	30	70	100	2
	Total	24+2	9		270	630	900	32

SCHEME OF INSTRUCTION AND EXAMINATIONS
FOR
B.TECH. BIOTECHNOLOGY
w.e.f. 2011-2012 (Credit Based Semester System)

II/IV B.TECH. BIOTECHNOLOGY FOURTH SEMESTER

S. No.	Subject Code & Subject Name	Scheme of Instruction periods per week		Scheme of Examination				
		Theory + Tutorial	Practicals	Duration of University Exam	Sessional Marks	University Marks	Total	Credits
Theory								
01	BT 221 Principles of Unit Operations	4	-	3	30	70	100	4
02	BT 222 Basic Functional Anatomy & Physiology	4	-	3	30	70	100	4
03	BT 223 Genetics	4	-	3	30	70	100	4
04	BT 224 Metabolomics	4+1	-	3	30	70	100	5
05	BT 225 Industrial Biotechnology	4	-	3	30	70	100	4
06	BT 226 Bio Analytical Techniques	4	-	3	30	70	100	4
Practical								
07	BT 261 Industrial Microbiology Laboratory	-	3	3	30	70	100	2
08	BT 262 Biochemistry Laboratory	-	3	3	30	70	100	2
09	BT 263 Communication Skills Laboratory	-	3	3	30	70	100	2
	Total	24+1	9		270	630	900	31

SCHEME OF INSTRUCTION AND EXAMINATIONS
FOR
B.TECH. BIOTECHNOLOGY
w.e.f. 2011-2012 (Credit Based Semester System)

III/IV B.TECH. BIOTECHNOLOGY FIFTH SEMESTER

S. No.	Subject Code & Subject Name	Scheme of Instruction periods per week		Scheme of Examination				
		Theory + Tutorial	Practicals	Duration of University Examination	Sessional Marks	University Marks	Total	Credits
Theory								
01	BT 311 Applied Mathematics & Bio Statistics	4	-	3	30	70	100	4
02	BT 312 Enzyme Engineering & Technology	4	-	3	30	70	100	4
03	BT 313 Fermentation Technology	4	-	3	30	70	100	4
04	BT 314 Chemical & Biochemical Thermodynamics	4+1	-	3	30	70	100	5
05	BT 315 Molecular Biology	4	-	3	30	70	100	4
06	BT 316 Immunology	4	-	3	30	70	100	4
Practical								
07	BT 351 Chemical Engineering Laboratory-I	-	3	3	30	70	100	2
08	BT 352 Bioanalytical Techniques Laboratory	-	3	3	30	70	100	2
09	BT 353 Immunology Laboratory	-	3	3	30	70	100	2
	Total	24+1	9		270	630	900	31

SCHEME OF INSTRUCTION AND EXAMINATIONS
FOR
B.TECH. BIOTECHNOLOGY
w.e.f. 2011-2012 (Credit Based Semester System)

III/IV B.TECH. BIOTECHNOLOGY SIXTH SEMESTER

S. No	Subject Code & Subject Name	Scheme of Instruction periods per week		Scheme of Examination				
		Theory + Tutorial	Practicals	Duration of University Examination	Sessional Marks	University Marks	Total	Credits
Theory								
01	BT 321 Mass Transfer Operations	4+1	-	3	30	70	100	5
02	BT 322 Bioinformatics	4	-	3	30	70	100	4
03	BT 323 Genetic Engineering	4	-	3	30	70	100	4
04	BT 324 Bioreactor Engineering	4	-	3	30	70	100	4
05	BT 325 Plant & Animal Biotechnology	4	-	3	30	70	100	4
06	BT 326 Elective-I	4	-	3	30	70	100	4
Practical								
07	BT 361 Bioprocess Laboratory-I	-	3	3	30	70	100	2
08	BT 362 Bioinformatics Laboratory	-	3	3	30	70	100	2
09	BT 363 Genetic Engineering Laboratory	-	3	3	30	70	100	2
	Total	24+1	9		270	630	900	31

SCHEME OF INSTRUCTION AND EXAMINATIONS
FOR
B.TECH. BIOTECHNOLOGY
w.e.f. 2011-2012 (Credit Based Semester System)

IV/IV B.TECH. BIOTECHNOLOGY SEVENTH SEMESTER

S. No	Subject Code & Subject Name	Scheme of Instruction periods per week		Scheme of Examination				
		Theory + Tutorial	Practicals	Duration of University Examination	Sessional Marks	University Marks	Total	Credits
Theory								
01	BT 411 Intellectual property rights & Bioethics	4	-	3	30	70	100	4
02	BT 412 Down Stream Processing	4	-	3	30	70	100	4
03	BT 413 Bioprocess Economics and Plant Design	4	-	3	30	70	100	4
04	BT 414 Protein Engineering	4	-	3	30	70	100	4
05	BT 415 Elective-II (Open Elective)	4	-	3	30	70	100	4
06	BT 416 Elective–III	4	-	3	30	70	100	4
Practical								
07	BT 451 Mini Project	-	3		100	-	100	2
08	BT 452 Chemical Engineering Laboratory-II	-	3	3	30	70	100	2
09	BT 453 Bioprocess Laboratory–II	-	3	3	30	70	100	2
	Total	24	9		340	560	900	30

SCHEME OF INSTRUCTION AND EXAMINATIONS
FOR
B.TECH. BIOTECHNOLOGY
w.e.f. 2011-2012 (Credit Based Semester System)

IV/IV B.TECH. BIOTECHNOLOGY EIGHTH SEMESTER

S. No.	Subject Code & Subject Name	Scheme of Instruction periods per week		Scheme of Examination				
		Theory + Tutorial	Practicals	Duration of University Examination	Sessional Marks	University Marks	Total	Credits
Theory								
01	BT 421 Industrial Management & Entrepreneurship Development	4	-	3	30	70	100	4
02	BT 422 Food Biotechnology	4	-	3	30	70	100	4
03	BT 423 Pharmaceutical Biotechnology	4	-	3	30	70	100	4
04	BT 424 Elective–IV	4	-	3	30	70	100	4
Practical								
05	BT 461 Down Stream Processing Laboratory	-	3	3	30	70	100	2
06	BT 462 Project Work	-	15	3	50	150	200	10
	Total	16	18		200	500	700	28

B.TECH. BIOTECHNOLOGY

LIST OF ELECTIVES

ELECTIVE-I

BT 326 A	Virology
BT 326 B	Spectroscopic Analysis of Biomolecules
BT 326 C	Metabolic Engineering
BT 326 D	Gene Therapy

ELECTIVE-II (Open Elective)

BT 415 A	Biosensors & Bioelectronics
BT 415 B	Computational Biology

ELECTIVE-III

BT 416 A	Genomics and Proteomics
BT 416 B	Cancer Biology
BT 416 C	Nanobiotechnology
BT 416 D	Environmental Biotechnology

ELECTIVE-IV

BT 424 A	Molecular Modeling & Drug Design
BT 424 B	Bioprocess–Modeling & Simulation
BT 424 C	Creativity, Innovation & New Product Development
BT 424 D	Biomedical Engineering

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BT-101	MATHEMATICS – I	L	T	P	M
	(Common for all branches)	3	0	0	100

UNIT-I

Ordinary differential equations: Introduction, Linear and Bernoulli's equations, Exact equations, equations reducible to exact equations, Orthogonal trajectories, Linear Differential equations: Definition, Theorem, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding the particular integral, Working procedure to solve the equation, Newton's law of cooling, Heat flow, Rate of Decay of Radio-Active Materials.

UNIT-II

Linear dependence of solutions, Method of variation of parameters, Equations reducible to linear equations, Cauchy's homogeneous linear equation, Legendre's linear equation Simultaneous linear equations with constant coefficients, Statistics: Method of least squares, Correlation, co-efficient of correlation (direct method only), lines of regression.

UNIT-III

Laplace Transforms: Introduction, Transforms of elementary functions, Properties of Laplace Transforms, existence conditions, Transforms of derivatives, Integrals, multiplication by t^n, division by t, Evaluation of integrals by Laplace Transforms, Inverse transforms, convolution theorem, Application to Differential equations with constant coefficients, transforms of unit step function, unit impulse function, periodic function. Convolution Theorem, Application to ordinary differential equations

UNIT-IV

Introduction and Euler's formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Even and Odd functions, Half range series Typical wave forms and Parseval's formulae, Complex form of the Fourier series Practical harmonic analysis

Text Book:

Higher Engineering Mathematics, B.S. Grewal, Khanna publishers, 39th edition, New Delhi

Reference Books:

1. Advanced Engineering Mathematics, Kreyszig.
2. A textbook of Engineering Mathematics, N.P. Bali

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-102	MATHEMATICS – II	L	T	P	M
	(Common for all branches)	3	0	0	100

UNIT-I

Matrices: Rank of a matrix, vectors, Elementary transformations, Solution of linear system of equations, Consistency of linear system of equations, System of linear homogeneous equations, Linear transformations, Characteristic equations, Properties of eigen values, Cayley- Hamilton theorem (without proof), Reduction to diagonal form reduction of Quadratic forms to canonical form, Nature of a quadratic form, Complex matrices.

UNIT-II

Differential Calculus: Rolle's Theorem (without proof), Lagrange's Mean value theorem (without proof), Taylor's theorem (without proof), Maclaurin's series, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT-III

Multiple Integrals: Double integrals, Change of order of integration, Double integrals in polar coordinates, Area enclosed by plane curves, Evaluation of triple integrals, Volume of solids, Change of variables.

Vector Calculus: Scalar and vector point functions, Del applied to scalar point functions. Gradient

UNIT-IV

Vector Calculus: Del applied to vector point functions, Physical interpretation of divergence, Del applied twice to point functions, Del applied to products of point functions, Integration of vectors, Line integral, Surfaces, Green's theorem in the plane (without proof), Stoke's theorem (without proof), Volume integral, Gauss divergence Theorem (without proof), Cylindrical Coordinates, Spherical polar coordinates.

Text Book:

Higher Engineering Mathematics, B.S.Grewal, 39th edition, Khanna publishers, New Delhi

Reference Books:

1. A textbook of Engineering Mathematics, N.P. Bali
2. Advanced Engineering Mathematics, Erwin Keyszing John Willy and sons.
3. Differential Calculus, Shanti Nayaran

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-103	PHYSICS	L	T	P	M
	(Common for all branches)	3	0	0	100

UNIT-I

Ultrasonics: Production of Ultrasonics by Magnetostriction & Piezoelectric oscillator methods, Detection of Ultrasonics by Kundt's tube and acoustic grating method, applications of Ultrasonics in engineering & medicine. Lissajous' figures for time periods with Ratios 1:1 and 1:2, applications of Lissajous' figures**.**

Optics: Superposition principle, Stokes principle (Phase change on reflection)-Interference in thin films due to reflected light (cosine law) -Michelson's interferometer principle, construction, working and applications (Determination of wave length of monochromatic source & for resolution of two closely lying wavelengths).

Diffraction: Fraunhoffer diffraction due to a single slit, Plane diffraction grating, resolving power of a grating using Rayleigh's criterion.

Polarization: Double refraction, Nicol prism, quarter wave plate, Production and detection of circular and elliptical polarizations (qualitative), Optical activity, Electro-optic and Magneto-optic effects (Kerr & Faraday effects).

UNIT-II

Electricity & Electromagnetism: Gauss's law in electricity (statement and proof) and its applications. Coulomb's law from Gauss law, line of charge, non-conducting infinite sheet, charged non-conducting sphere. Circulating charges and Cyclotron principle& working, Hall effect, Biot-Savart's law-B for a long wire and circular loop, Faraday's law of induction-Lenz's law-induced electric fields, Gauss' law for magnetism, Inductance, Energy storage in a magnetic field, Electromagnetic oscillations (quantitative), Displacement current, Maxwell's equations (Qualitative treatment), Electromagnetic waves equation and velocity, A.C. circuit containing series LCR circuit (Resonance condition).

UNIT-III

Modern Physics: Planck's theory of black body radiation, Dual nature of light, Compton effect, Matter waves-de Broglie's concept of matter waves-Davisson and Germer experiment, Heisenberg's uncertainty principle and applications (non existence of electron in nucleus, finite width of spectral lines). One dimensional time independent Schrodinger's wave equation, Physical significance of wave function, Particle in a box (one dimension), Radio Isotopes-applications in medicine and industry, Qualitative treatment (without derivation) of Fermi-Dirac distribution function and Fermi-energy level concept in semiconductors.

UNIT-IV

Advanced Physics: Lasers: Spontaneous emission, stimulated emission, Population inversion, Solid State (Ruby) laser, Gas (He-Ne) laser , Semiconductor (Ga-As) laser, Applications of lasers. Holography Principle, Recording, reproduction and applications.

Optical fibers: Structure of optical fiber, types of optical fibers, Numerical aperture, fiber optics in communication and its advantages

Superconductivity: First experiment, critical parameters (T_C, H_C, I_C) Meissner effect, types of superconductors, applications of Superconductors.

Optoelectronic devices: Qualitative treatments of-Photo diode, LED, LCD and Solar cell and its applications.

Nano Technology (Basic concepts only) and its applications.

Text Books:

1. Fundamentals of Physics, Part I and II, David Halliday and Resinick, 5th edition, John Willey and Sons
2. Engineering Physics, R. K. Gaur & S. L.Gupta, 8th edition, Dhanapath Rai Publications, New Delhi

Reference Books:

1. Physics for engineers, M.R.Srinivasan.
2. Engineering Physics, M.Arumugam.
3. Modern Engineering Physics, A.S Vasudeva

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-104 INORGANIC AND PHYSICAL CHEMISTRY L T P M
(Common for Chemical & Biotechnology branches) 4 0 0 100

PART – A: INORGANIC CHEMISTRY

UNIT - I

Mole concept, oxidation numbers, balancing of equations, stoichiometry (Mass-mass, Mass-volume, Volume–volume)

Chemical bonding: ionic and covalent bonding, Molecular orbital and valence bond approaches for diatomic molecules, VSEPR theory, Hybridization and shapes of molecules, Resonance, dipole moment, structure parameters such as bond length, angle & energy, Hydrogen bonding, Vanderwaal's interactions, Ionic solids, Ionic radii, lattice energy (Born-Haber cycle), Metal-ligand bonding and importance,

Planck's Quantum theory, Wave particle duality, Uncertainty principle, Quantum mechanical model of hydrogen atom, Periodic Table and properties, Ionization energy, Electron negativity, Atomic size, Coordination complexes, nomenclature, crystal field theory, color, geometry and magnetic properties.

UNIT- II

Chemistry of representative s and p- block elements: Electronic configuration, general properties and oxidation states, Oxides, Halides and Hydrides of Alkali, Alkaline earth metals, Boron-Aluminum, Carbon-Silicon, Nitrogen-Phosphorus, Sulphur.

d- block elements: Electronic configuration, general characteristics and oxidation states.

Inner transition elements: General discussion, oxidation states and Lanthanide contractions.

PART –B: PHYSICAL CHEMISTRY

UNIT-III

Thermodynamics: First law, reversible and irreversible processes, internal energy, enthalpy, Kirchoff's equation, heat of reaction, Hess's law, heat of formation,

Second law, entropy, free energy and work function. Gibb's-Helmholtz equation, Clausius-Clapeyron equation, free energy change and equilibrium constant, Trouton's rule, Third law of thermodynamics.

Phase and chemical equilibria: Phase rule, phase diagram of water, two component systems with a simple eutectic-Pb, Ag system and construction of phase diagram by thermal analysis.

Colligative properties: Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure (no thermodynamic derivations) elementary treatment of vapor pressure.

Chemical equilibria: Reversible reactions, law of mass action, Lechatelier principle, Effect of temperature on equilibrium-Van't Hoff equation, Ionic Equilibria: Solubility, solubility product, common ion effect, Hydrolysis of salts, pH, buffer and their application in chemical analysis, equilibrium constants (K_c, K_p, K_x) for homogeneous reactions.

UNIT-IV

Galvanic cells: Thermodynamics of galvanic cells, half cell potentials, e.m.f. of cells, Nernst equation, Commercial applications of galvanic cells

Electrolytes: Conductance, effect of concentration, Kohlrausch law.

Kinetics of chemical reactions: Rate constant, order of reaction, molecularity, activation energy, Zero, First and Second order kinetics and elementary enzyme reactions.

Catalysis: Characteristics of catalyst, promoter, negative catalyst, catalytic poison, heterogeneous catalysis, intermediate compound formation theory, activated complex theory, acid, base and enzyme catalysis.

Text Books:

1. A new concise Inorganic chemistry, J.D.Lee, ELBS and Van, 3rd edition, Nostrand Reinhold Co. Ltd., London.
2. Physical Chemistry, P.W.Atkins, 3rd Edition, Oxford University Press.

Reference Books:

1. University General Chemistry, C.N.R.Rao, MacMillan, India.
2. Elements of Physical Chemistry, Samuel Glastone and David Lewsis, 2nd edition MacMillan & Co., London.
3. Principles of Chemistry, Paul Ander & Anthony J.Sonnessa, Collier-MacMillan Ltd., London.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-105	PROFESSIONAL COMMUNICATION SKILLS	L	T	P	M
	I B.T./CE/Ch.E./CSE/ECE/EEE/EI/IT/ME	3	0	0	100

COURSE OBJECTIVE:

The course aims to inculcate a sense of professionalism among the students while emphasizing on the basic aspects of the language learning such as grammar and vocabulary building. It also aspires to train the students to meet the global challenges.

UNIT-1: SPEECH BUILDING

This arena refreshes the students in the usage of grammar and basics of communication in English. It also helps them start building up their vocabulary.

1. Speaking about oneself
2. Sentence and its types
3. Positive, Negative and Interrogative Sentences, Speaking in formal and informal contexts, Asking for opinion, Asking for information, Requesting and Seeking permission; Emphasising a point
4. A list of 100 Basic Words
5. One word substitutes

UNIT- II: BASIC LANGUAGE SKILLS

The emphasis is on Grammar and development of written and oral communication skills among students and equips them with the skills to overcome the cut throat competition in formal and informal situations in the present world.

1. Parts of speech
2. Tenses
3. Letter writing (Personal and Business)
4. Situational Dialogues
5. A list of 100 Basic Words

UNIT- III: ADVANCED LANGUAGE SKILLS

To develop two specific skills i.e. speaking and writing, using correct and good vocabulary to improve the communicative competence of learners in their discipline with glamour.

1. Antonyms
2. Paragraph Writing
3. Technical terms
4. Reading Comprehension
5. Correction of Sentences

UNIT- IV: COMMUNICATION SKILLS

Communication skills aim at making students familiar with various aspects of corporate world and the importance of verbal communication. It also provides intensive instruction in the practice of professional writing.

1. Essay writing
2. Corporate Information
3. Idioms
4. E-mail etiquette

Prescribed Textbook:

- Communication Skills for Engineers, K.R. Lakminarayana and T. Murugavel, Scitech Publications. ISBN: 9788183711548.

Reference Books:

- Communication Skills for Professionals, Nira Konar, PHI Publication.
- Competitive English for Professional Courses, J.K.Gangal, S.Chand Publication.
- English for Technical Communication: Volume 1&2 by K.R. Lakminarayana , Scitech Publications.
- Effective Technical Communication, M.Ashraf Rizvi,Tata Mc Graw Hill.
- Advanced Technical Communication, Kavita Tyagi, Padma Misra, PHI Publication.
- Word Power Made Handy, Dr. Shalini Verma,S.Chand Publication.

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Note:

L ----> Lecture hours/week
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BT-106	COMPUTER PROGRAMMING WITH C (Common for all branches)	L	T	P	M
		3	0	0	100

UNIT – I

Introduction: Computer Fundamentals: Computer & it's Components, Hardware/Software**,** Algorithm, Characteristics of algorithm, Flowchart, Symbols are used in flowchart, history of C, Basic structure of C, C language features.

C Tokens: Character set, Variables, Keywords, Data types and sizes, Type qualifiers, Numeric Constants and their forms of representation, Character Constants, String Constants, Declarations and Initialization of variables.

Operators & Expressions: Arithmetic operators, and expressions, Type-conversion rules, Coercion, Assignment operators and expressions, Increment and decrement operator, Conditional operator, Statements, Preprocessor directives, Input/ Output functions and other library functions. Relational operators and expressions. Boolean operators and expressions.

Programming Exercises:

C-Expressions for algebraic expressions, Evaluation of arithmetic and boolean expressions. Syntactic errors in a given program, Output of a given program, Values of variables at the end of execution of a program fragment, Filling the blanks in *a* given program, Computation of values using scientific and Engineering formulae, Finding the largest of three given numbers.

UNIT – II

Conditional Statements: Blocks, If-Else statement, Else-If statement and Switch statement.

Iterative Statements: While loop, For loop, Do-While loop, Break, and continue.

Arrays: One-dimensional and character arrays, Two-dimensional numeric arrays.

Programming Exercises

Computation of discount on different types of products with different ranges of discount Finding the type of triangle formed by the given sides, Computation of income-tax, Computation of Electricity bill, Conversion of lower case character to its upper case, Finding the class of an input character; Sum of the digits of a given number, Image of a given number, To find whether a given number is-prime; Fibonacci; abundant; perfect, Strong, Amstrong; deficient, Prime factors of a given number, Merging of lists, Transpose of a matrix, Product and sum of matrices, String processing, length of a string, comparison of strings, reversing a string, copying a string, Sorting of names using arrays, Graphics patterns, to print prime numbers and Fibonacci numbers in a given range and Amicable numbers.

UNIT–III

Functions: Function Definition, types of User Defined Functions, Parameter passing mechanisms, and simple recursion.

Scope & extent: Scope rules, Storage Classes, Multi-file compilation.

Pointers: Pointers Arithmetic, Character array of pointers, Dynamic memory allocation, array of Pointer, Pointer to arrays.

Programming Exercises

Recursive Functions: Factorial, GCD (Greatest Common Divisor), Fibonacci, to evaluate the pointer arithmetic expressions; An interactive program to perform Pointers & Functions-

Insertion sort, Bubble sort, Linear search Binary search, Computation of Statistical parameters of a given list of numbers, Counting the number of characters, words and lines in a given text, Table of values of f (x,y) varying x and y; Using Storage Classes to implement the multifile compilation; implement the string operations using Dynamic memory allocation functions;

UNIT – IV

Structures: Structures, Array of structures, structures within structures, Pointer to structures, self referential structures, Unions.

Files: File Handling functions, File error handling functions, Command-line arguments.

Programming Exercises:

Operations on complex numbers, operations on rational number (p/q form), Matrix operations with size of the matrix as a structure, Frequency count of keywords in an input program, Sorting a list of birth records on name and date of birth using File handling functions, Student marks processing, Library records processing, sorting on name, author, Copy one file to another.

Text Book:

Programming with C (Schaum's Outlines), Byron Gottfried, Tata Mcgraw-Hill.

Reference Books:

1. The C programming language, Kernighan B W and Ritchie O M, Prentice Hall.
2. Programming with C, K R Venugopal & Sudeep R Prasad, Tata Mcgraw-Hill.
3. 'C' Programming, K.Balaguruswamy, BPB
4. C Complete Reference, Herbert Sheildt, Tata Mcgraw-Hill

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-107	CELL BIOLOGY (Only for Biotechnology)	L T P M 3 0 0 100

UNIT – I

Cell Structure, Organelles and Their Functions: Molecule-organelle-cell-organism, Oparin and Haldane's theory of chemical evolution, Miller and Urey's experiment; Cell structure, Organisation in Bacteria, Yeast, higher plants and animal cells. Comparison of prokaryotic and eukaryotic cells; Organization, structure and functions of cell wall, plasma membrane, lysosomes, ribosomes, golgi complex, peroxisomes, glyoxysomes, mitochondria, plastids, endoplasmic reticulum, vacuoles, centrioles, cytoskeleton – composition, structure & functions of microtubules, microfilaments and intermediate filaments.

UNIT – II

Nucleus and Chromosomes: Nucleus–its ultrastructure, Nuclear envelope, Nucleoplasm, Nucleolus, Chromatin fibres, EM structure of chromosome, Types of Chromatin–Euchromatin and Heterochromatin, Nucleosomes and packing of DNA, Role of Histones and NonHistone proteins in structural organization of chromosomes, Types of chromosomes based on centromere, Giant chromosomes–polytene and lampbrush chromosomes.

UNIT – III

Cell Division and Cell Cycle: Cell cycle–General events of interphase, M-phase–Karyokinesis (prophase, metaphase, anaphase and telophase) and Cytokinesis, Mitosis–various stages and its significance, Meiosis and reproductive cycle; Kinds of Meiosis, Process of Meiosis–Heterotypic and Homotypic meiotic division, Significance of Meiosis, Differences between mitosis and meiosis.

Bacterial cell cycle, reproduction and growth co-ordination in bacteria, Eukaryotic cell cycle–check points, molecular basis of cell cycle regulation–cyclin dependent kinases (CDKs) and cyclins, MPF, APC, Apoptosis-cascade of reactions.

UNIT – IV

Bioenergetics: Outlines of thermodynamic principles, chemical equilibria, free energy, enthalpy, free energy changes in biological transformations, High-energy compounds, energy change-oxidation-reduction reactions, microsomal electron transport, organization of electron carriers and enzymes in mitochondria, classes of electron transferring enzymes, inhibitors of electron transport; mitochondrial transport systems-oxidative phosphorylation; photophosphorylation–cyclic and noncyclic; photorespiration.

Text Books:

1. The World of the Cell, Becker, Kleinsmith, Hardin.
2. Molecular Cell Biology, Darnell J, Lodish H, Baltimore D, W H Freeman, 1990.

Reference Books:

1. Cell Biology, Verma and Agarwal
2. Cell Biology, C.B. Powar
3. Cell Biology, De Robertis

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-108	ENGINEERING GRAPHICS	L	T	P	M
	(Common for all branches)	2	4	0	100

UNIT-I

General: Use of Drawing instruments, Lettering-Single stroke letters, Dimensioning-Representation of various type lines. Geometrical Constructions. Representative fraction.

Curves: Curves used in Engineering practice, conic sections, general construction methods for ellipse, parabola and hyperbola. Cycloidal curves-cycloid, epicycloid and hypocycloid, involute of circle and Archemedian spiral.

UNIT-II:

Method of Projections: Principles of projection, First angle and third angle projection of points. Projection of straight lines. Traces of lines.

Projections of Planes: Projections of planes, projections on auxiliary planes.

UNIT-III:

Projections of Solids: Projections of Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions.

Sections of Solids: Sections of Cubes, Prisms, Pyramids, cylinders and Cones.

True shapes of sections. (Limited to the Section Planes perpendicular to one of the Principal Planes).

UNIT-IV:

Development of Surfaces: Lateral development of cut sections of Cubes, Prisms, Pyramids, Cylinders and Cones.

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

UNIT-V:

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

UNIT-VI: (Demonstration only)

Computer aided drafting (Using any standard package): Setting up a drawing: starting, main menu (New, Open, Save, Save As etc.), Opening screen, error correction on screen, units, co-ordinate system, limits, grid, snap, ortho.

Tool bars: Draw tool bar, object snap tool bar, modify tool bar, dimension tool Bar

Practice of 2d drawings: Exercises of Orthographic views for simple solids using all commands in various tool bars.

Text Book:

1. Engineering Drawing, N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Anand.
2. AutoCAD 14 for Engineering Drawing Made Easy (Features AutoCAD 200), P.Nageswara Rao

Reference Book:

1. Engineering Drawing, K.L.Narayana & R.K.Kannaiah.
2. Engineering Graphics with AutoCAD 2002, James D. Bethune

Note:

1. Unit VI not to be included in the university theory examination. This unit is only for internal assessment
2. University Examination Question paper consists of FIVE questions, TWO questions from each unit with internal choice.
   (To be taught & examined in First angle projection)

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-151	PHYSICS LABORATORY (Common for all branches)	L T P M 0 0 3 100

1. **Compound Pendulum** - Measurement of g-value.
2. **Sonometer** - Determination of unknown frequency of tuning fork and verification of laws of transverse vibrations of a stretched string
3. **C.R.O** - Measurement of voltage, frequency and phase difference of an A.C. signal.
4. **Torsional Pendulum** - Determination of Rigidity modulus/damping coefficient.
5. **Newton's Rings** - Measurement of wavelength/Radius of curvature.
6. **Dispersive Power-** Determination of Dispersive power of prism.
7. **Diffraction Grating-** Determination of wavelength.
8. **Air Wedge** - Measurement of thickness of given wire.
9. **Field along the axis of a current carrying circular coil.** - Variation of intensity of magnetic field along the axis of circular coil.
10. **L.C.R** - Resonance Characteristics.
11. **Sensitive Galvanometer** - Figure of Merit.
12. **Hall Effect** - Measurement of Hall potential and Carrier concentration
13. **Carey Foster's bridge** - Measurement of temperature coefficient of resistance.
14. **Platinum resistance thermometer** - Measurement of room temperature.
15. **GM Counter** - Characteristics.
16. **Photo Tube** - Characteristics of photo tube/determination of planks constant.
17. Determination of band gap of semiconductors.
18. Optical Measurements with laser.
19. **Solar Cell** - Characteristics and Fill Factor determinations.
20. **Fiber Optics** - Numerical Aperture Calculations.

Note:
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M ----> Max.Marks

BT-152	CHEMISTRY LABORATORY (Common for all branches)	L	T	P	M
		0	0	3	100

List of Experiments

1. Estimation of total alkalinity of water sample
   a) Standardization of HCl solution b. Estimation of alkalinity

2. Determination of purity of washing soda

3. Estimation of Chlorides in water sample:
   a) Standardization of $AgNO_3$ solution b) Estimation of Chlorides

4. Determination of Total Hardness of water sample:
   a) Standardization of EDTA solution b) Determination of Total Hardness

5. Estimation of Mohr's salt-permanganometry
   a) Standardization of $KMnO_4$ solution b) Estimation of Mohr's salt

6. Estimation of Mohr's salt–Dichrometry
   a) Standardization of $K_2Cr_2O_7$ solution b) Estimation of Mohr's salt

7. Analysis of soil sample:
   a) Estimation of Ca and Mg b) Estimation of Organic matter

8. Determination of available chlorine in bleaching powder-Iodometry
   a) Standardization of Hypo solution b) Determination of Available chlorine

9. Determination of Iodine in Iodized salt

10. Determination of Iron (Ferrous and Ferric) in an iron ore by Permanganometry

11. Determination of Zn using Potassium ferrocyanide

12. Preparation of Phenol-formaldehyde resign

13. Conductometric titration of an acid vs. base

14. pH metric titrations of an acid vs. base

Demonstration Experiments

15. Potentiometric titrations: Ferrous vs. Dichromate

16. Spectrophotometry: Estimation of Mn/Fe

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-153	WORKSHOP PRACTICE (Common for all branches)	L 0	T 0	P 3	M 100

1. Carpentry

To make the following jobs with hand tools

a) Lap joint

b) Lap Tee joint

c) Dove tail joint

d) Mortise & Tenon joint

e) Gross-Lap joint

2. **Welding using electric arc welding process / gas welding.**

The following joints to be welded.

a) Lap joint

b) Tee joint

c) Edge joint

d) Butt joint

e) Corner joint

3. Sheet metal operations with hand tools.

a) Saw edge

b) wired edge

c) lap seam

d) grooved seam

e) funnel

4. House wiring

a) To control one lamp by aspt switch

b) To control two lamps by aspt switch

c) To assemble a fluorescent lamp fitting

d) Stair case wiring

e) Go down wiring

Note:
L ----> Lecture hours/week
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M ----> Max.Marks

BT-154 COMPUTER PROGRAMMING LABORATORY L T P M
(Common for all branches) 0 0 3 100

List of programs (to be recorded)

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

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

2. Write a C program to evaluate the following (using loops):
   a) $1 + x^2/2! + x^4/4!+$ upto ten terms
   b) $x + x^3/3! + x^5/5!+$ upto 7 digit accuracy
   c) $1+x+x^2/2! + x^3/3!+\ldots\ldots$ upto n terms
   d) Sum of 1 + 2+ 3 +……..+n

3) A menu driven program to check the number is:
   a) ..... Prime or not
   b) ..... Perfect or Abundant or deficient
   c)Armstrong or not
   d) ..... Strong or not
   e) ..... Fibonacci or not

4) A menu driven program to display statistical parameters (using one –dimensional array)
   a) Mean b) Mode c) Median d) Variance e) Standard deviation

5) A menu driven program with options (using one -Dimensional array)
   a) To insert an element into array
   b) To delete an element
   c) To print elements
   d) To print elements in reverse order
   e) To remove duplicates

6) A menu driven program with options (using two dimensional array)
   a) To compute A+B
   b) To compute A x B
   c) To find transpose of matrix A
   d) To Check A=B
   Where A and B are matrices. Conditions related to size to be tested

7) A menu driven program with options (using Two-dimensional Character arrays)
   a) To insert a student name
   b) To delete a name
   c) To sort names in alphabetical order
   d) To print list of names
   e) To print names having maximum length, min. length

8) A menu driven program (using pointers)
   a) Linear search b) Binary search c) Fibonacci search

9) A menu driven program with options (using Dynamic memory allocation)
   a) Bubble sort b) Insertion sort c) Selection sort

10) A menu driven program with options (using Character array of pointers)
   a) To insert a student name
   b) To delete a name
   c) To sort names in alphabetical order
   d) To print list of names
   e) To print names having maximum length, min. length

11) Write a program to perform the following operations on Rational numbers (using Structures & pointers):
   a) Read a Rational number
   b) Addition of two Rational numbers
   c) Subtraction of two Rational numbers
   d) Multiplication of two Rational numbers
   e) Division of two Rational numbers
   f) Display a Rational number

12) A Bookshop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book the sales person inputs the title and the author and the system searches the list and displays whether it is available or not. If it is not an appropriate message is displayed, if it is then the system displays the book details and request for the number of copies are required, if the requested copies are available the total cost of the requested copies is displayed otherwise the message "required copies not in stock" is displayed. Write a program for the above in structures with suitable functions.

13) Create a student data file (roll no., name, date of birth, rank) and code a program with options (use pointers & structures)
   a) Listing names, dob sorted on names
   b) Listing names, dob sorted on dob
   c) Listing names, dob sorted on names, dob

14) a) Write a C program To copy the one file contents to the another file (using command line arguments)
   b) Write a C Program to count the frequencies of words in a given file.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-211 OBJECT ORIENTED PROGRAMMING L T P M
4 0 0 100

UNIT – I

Introduction to OOPS: The origins of C++, What is Object Oriented Programming?, Some C++ fundamentals, A Closer look at Headers & Name Spaces, Introducing C++ Classes, Function overloading, Operator overloading, Inheritance, Constructors & Destructors, Two new Data types.

A closer look at Classes & Objects: Parameterized Constructors, Friend functions, Default function arguments.

Classes & Structures are related, Unions & classes are related, Inline functions, Passing objects to functions, Returning objects, Object assignment, Arrays of objects, Pointers to objects.

UNIT-II

Function & Operator Overloading: Overloading constructor functions, Localizing variables, Function overloading & Ambiguity, Finding the address of an overloaded function, The this Pointer, Operator overloading, References, Using reference to overload a unary operator, Overloading [], overloading ( ), Applying operator overloading.

Inheritance, Virtual Functions and polymorphism: Inheritance and the access specifiers, Constructors and Destructors in derived classes, Multiple Inheritance, Passing parameters to a basic class, Pointers and references to derived types, Virtual Functions, Why virtual functions?, Pure virtual functions and abstract types, Early Vs Late binding.

UNIT-III

The C++ 1/0 Class Library: C++ streams, The C++ Stream classes, Creating your own inserter and extractors, Formatting I/O, Creating your own manipulator functions, File I/O, Unformatted and Binary I/O.

Miscellaneous C+ + topics:

Dynamic allocation using new and delete, static class members, Virtual base classes, const member functions and mutable, volatile member functions, Using the asm keyword, linkage specification, The .* and ->* operators, Creating conversion functions, Copy constructors, Granting access, amespaces, Explicit constructors, typename and export, Differences between C and C++.

UNIT- IV

Templates: Generic Functions, Generic classes

Exceptions: Exception Handling, fundamentals, options The uncaught exception(), Applying exception Handling, and RTTI, casting operators

The standard Template Library and the String Class: An overview of the STL

Text Book:

1. The Complete Reference - Borland C++Builder, Herbert Schieldt.

Reference Books:

1. C++, How to Program, Dietel & Dietel
2. Programming in C++, Barkakati
3. Starting out with OOP in C+ +, Tony Gaddis, Tndy Walters, Godfrey Murganda, Dreamtech Publishing.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
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BT-212	ENVIRONMENTAL STUDIES (Common for all Branches)	L	T	P	M
		4	0	0	100

UNIT – I

Introduction: Definition, Scope and Importance

Ecosystems: Introduction, types, characteristic features, structure and functions of Ecosystems, Forest, Grassland, Desert, Aquatic (lakes, rivers and estuaries).

Natural Resources:

Land resources: Land as a resource, Common property resources, land degradation, soil erosion and desertification and Effects of modern agriculture, fertilizer, pesticide problems

Forest Resources: Use and over-exploitation, Mining and dams, their effects on forests and tribal people.

Water Resources: Use and over-utilization of surface and ground water, floods and drought, Water logging and salinity, Dams – benefits and costs, Conflicts over water.

Energy resources: Energy needs, Renewable and non-renewable energy sources, Use of alternate energy sources.

UNIT – II

Biodiversity and its Conservation: Value of biodiversity, consumptive and productive use, social, ethical, aesthetic and option values. Bio-geographical classification of India, India as a mega-diversity habitat.

Threats to bio-diversity: Hot spots, habitat loss, poaching of wildlife, loss of species, seeds, etc. conservation of biodiversity - In-situ and Ex-situ conservation.

Environmental Pollution: Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Solid waste management, composting and vermiculture, Urban and industrial wastes, recycling and re-use.

UNIT –III

Sustainability: Theory and practice, equitable use of resources for sustainable life styles.

Rain water harvesting, cloud seeding and watershed management, Water scarcity and ground water depletion.

Controversies on major dams: Resettlement and rehabilitation of people, problems and concerns. Nature of thermal pollution and nuclear hazards, Global warming, Acid rain, Ozone depletion. Green revolution. Population growth and environment. Environmental Impact Assessment.

UNIT – IV

Environmental acts: Water (Prevention and Control of pollution) act, Air (Prevention and Control of pollution) act, Environmental protection act, Wild life protection act, Forest Conservation act.

International Conventions: Stockholm Conference 1972 and Earth Summit 1992

Case Studies: Chipko movement, Narmada Bachao Andolan, Silent Valley Project, Madhura Refinery and Taj Mahal, Chernobyl Nuclear Disaster, Tehri Dam, Ralegaon Siddhi (Anne Hazare), Florosis and Bhopal Tragedy.

Field work

Visit to a local area to document environmental assets – river/ forest/ grassland / hill /mountain.

Study of local environment: common plants, insects, birds.

Study of simple ecosystems – pond, river, hill, slopes etc.

Visits to industries, water treatment plants, effluent treatment plants

Text Book:

1. Benny Joseph, Environmental Studies**,** Tata McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books:

1. Text Book of environmental studies, Erach Bharucha, UGC.
2. Environmental Studies, Anubha Kaushik and C. P. Kaushik.
3. A basic course in environmental studies, S. Deswal and A. Deswal, Dhanapath Rai & Co.
4. Essentials of environmental studies, Kurian Joseph and R.Nagendram, Pearson Education Pt Ltd, Delhi.
5. Environmental studies, R.Rajagopalan, Oxford University Press.
6. Environmental Pollution Control Engineering, C. S. Rao, Wiley Eastern Ltd., New Age International Ltd.,
7. Introduction to Environmental Science, Anjaneyulu Y, B S Publications
8. Principles of Environmental Studies, Manoharachary C and Jayarama Reddy P, B S Publications

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-213 ELECTRICAL & ELECTRONICS ENGINEERING L T P M
4 0 0 100

UNIT- I

Basic Electrical Circuits: Kirchoff's law

DC generators and Motors: Constructional features of DC machines and functions of component parts, Methods of excitation, Calculation of induced emf, Characteristics of shunt, series and compound generators and applications, Torque developed in a motor, Motor Starters, losses and efficiency calculations, Testing of DC machines.

Alternating currents: Definition of peak value, RMS value, average value, Form factor of alternate current, Behavior of resistance, Inductance and capacitance to sinusoidal voltage.

UNIT- II

Vector and J-notation as applied to the resolution of AC circuit, Vector diagrams, Single-phase series, Parallel and Series-parallel circuits.

Polyphase circuits: 3-phase supply, star-delta connections, Voltage, current and Power relationships.

Transformers: EMF equation, regulation, efficiency of single phase transformers, testing of transformers

Three-phase induction motors: Production of rotating magnetic field, Theory of slip-ring and squirrel cage induction motors, Torque-slip characteristics

UNIT- III

Electronic devices: Characteristics of Semiconductor junction, Diode and transistor, Zener diode, SCR, **Power supplies:** Half-wave and full-wave rectifiers, Bridge rectifier, Study of capacitance, inductance and filters, Voltage stabilization by Zener Diode

Transistor amplifiers: Classification, baising small signal- low frequency.

UNIT- IV

Oscillators: Classification, RC phase shift, Wien-bridge, Hartley and Colpitts oscillators

Electronic Measurements: Principles and applications of multimeters, VTVMs and CROs, Introduction to transducers and their applications.

Text Books:

1. Principles Electrical Engineering, V.K.Mehta & Rohit Mehta, S.Chand & Co., New Delhi
2. Basic Electronics, N.N.Bhargava & Kulasresta, Tata McGraw Hills, New Delhi

Reference Books:

1. Electrical Technology, H.Cotton, 7th edition, CBS publishers, New Delhi.
2. Applied Electronics, G.K Mithal, Khana Publishers.
3. Electronic devices and Circuits, Millman and Haiking, Tata McGraw Hills, New Delhi
4. Electronic Fundamentals and Applications, John D Ryder, PHI publishers, New Delhi

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P ----> Practical Hours/week
M ----> Max.Marks

BT-214 PRINCIPLES OF PROCESS CALCULATIONS

L	T	P	M
4	1	0	100

UNIT- I

Dimensions and System of Units: Fundamental quantities, derived quantities and conversions; SI and MKS system of Units; Basic Chemical Engineering calculations- Atomic, Molecular and Equivalent weights, molar concept, Concentration units for pure components, Vapor pressures, Moles, Mixers and solutions, Molarity, Molality, Normality and Partial pressures; Laws of Chemical Combination; Definition of Stoichiometry; Composition of mixers and solutions; Weight fraction; Mole fraction; Volumetric composition; Density and Specific gravity, Ideal gas law; Ideal mixtures and solution; Dalton's law of additive pressures; Amagots law of additive volumes.

UNIT- II

Vapour Pressure and Humidity: Vapor Pressure- Liquefaction & Liquid state, Vaporization, Boiling point, Effect of temperature on Vapor Pressure, Vapor Pressure plots, Vapor Pressure of immiscible liquids & solutions, Raoult's law and its limitations.

Humidity: Relative and Percent saturation, Dew point, Wet and dry bulb temperatures, use of humidity charts.

UNIT- III

Material Balances: Laws of conservation of mass, meaning of material balance and its applications, Process flow sheet, Drawing material balance on non reacting steady system, Conversion, yield, Limiting reactants, Excess reactants, Recycling, By-passing, Material balances on steady state reacting systems with recycling and By-passing.

UNIT- IV

Energy Balances: Law of conservation of energy, Meaning of energy balance and its importance, Inputs of energy balance, Specific heat and sensible heat, Latent heat and heats of transition, Sublimation, Enthalpy of solutions, Standard heats of formation, Standard heats of combustion, Standard heats of reaction, Hess's law, Kirchoff's law.

Text Book:

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

Reference Books:

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

Note:

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M ----> Max.Marks

BT-215	BIO-ORGANIC CHEMISTRY	L	T	P	M
		4	1	0	100

UNIT-I

Introduction To Bioorganic Chemistry: History of Organic and Bio organic chemistry; Uniqueness of carbon atom and general *c*haracteristics of organic compounds; Structure, Isomerism, Hybridization& functional groups of organic molecules; Properties of carbonyl, Acid, Ester, hydroxyl and amine functional groups, Classification of Biomolecules, structural and functional Biopolymers.

UNIT – II

Carbohydrates and Lipids: Classification, structure, stereochemistry and reactivity of carbohydrates, Study of glucose, fructose, maltose, sucrose, lactose, maltose, cellobiose, trehalose, isomaltose, sugar acids, aminosugars, Polysaccharides, Homopolysaccharides (starch, glycogen, cellulose, dextrin, inulin, Hetropolysaccharides (Hyaluronic acid, heparin, chondroitinsulfates, keratan sulfates); Lipids-Fatty acids, types of fatty acids, Isomerism of fatty acids, Alcohols-Types of alcohol in lipids, Classification of Lipids-Simple lipids, Fats and oils, Waxes, Compound lipids-Phospho lipids, Glycolipids, sulfolipids, plasmalogens, Derived lipids-cholesterol, lanosterol, ergosterol, 7-dehydrocholesterol, bile acids, C21, C19, C18, steroids, Terpenes, physical and chemical properties of lipids.

UNIT- III

Amino acids: Classification and structure of standard amino acids, occurrence of non-standard amino acids, physical and chemical properties-acid-base titrations of amino acids (Glycine, Histidine & Glutamic acid), Peptide bond- Structure, functions and biological peptides

Proteins: Classification and properties of proteins; protein structure-primary structure and its determination, helical-β-pleated structure; Ramachandran plot; super secondary structure, tertiary & quaternary structure of myoglobin and hemoglobin, Fibrous protein (Collagen).

Enzymes: Classification, Mechanisms of enzymes, allosteric enzymes, Isozymes.

UNIT-IV

Nucleic Acids: Structure and properties of nitrogen bases, nucleosides, nucleotides, polynucleotides; Nucleic acids- Structure of DNA, Watson & crick double helix, different forms of DNA; forces stabilizing structure of DNA, Physico-Chemical properties, Denaturation, hypo and hyper chromic effect, melting temperature (T_m) and its significance; Chemical differences between DNA and RNA and its significance; Structure of RNA, Different RNAs-mRNA, tRNA, rRNA, hnRNA Informosome etc.

Vitamins: Classification, structure, function and deficiency symptoms of Fat soluble vitamins-vitamin A, D, E, K; Water soluble vitamins- Vitamin B1, B2, B3, B5, B6, B7, B9, B12,and vitamin C.

Text Books:

1. Fundamentals of Biochemistry, J.L.Jain
2. Biochemistry, U. Satyanaryana

Reference Books:

1. Bioorganic Chemistry, H. Douglas
2. Principles of Biochemistry, AL Lehninger

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-216	MICROBIOLOGY	L	T	P	M
		4	0	0	100

UNIT- I

Introduction To Microbiology: Development of Microbiology-Antony Van Leiwenhoek, Louis Pasteur, Robert Koch, Iwanowskii, Edward Jenner, Microscopy- Parts and different types of Microscopes (Light and Electron);

Outline Classification of Organisms: Haeckel's three kingdom concept, Whittaker's five kingdom concept, Three domain concept of Carl Woose, Taxonomic ranks, Classification systems (Phylogenetic, Phenetic), Major characteristics used in taxonomy (Morphological, Physiological, Ecological, Biochemical, Immunological, Genetical and Molecular); **(Introduction to Bergey's system of classification- not for evaluation).**

UNIT- II

Major Groups of Microorganisms: General characters of major groups of bacteria-Archea bacteria, Eubacteria, Actinomycetes, Rickettsiae, Chlamydiae and Mycoplasms, General Properties of Viruses and Life cycles (Lytic and Lysogenic), General characters of fungi, Algae, Protozoa & Yeasts their important uses and their harmful effects.

UNIT- III

Nutrition and Growth of Microorganisms: Bacterial Nutrition-Nutritional classification of bacteria, Essential Macronutrients, Micronutrients and Growth factors, Bacterial Growth-Growth curve, Mathematical expression of growth, Measurement of microbial growth (Cell numbers and Cell mass), Chemostat, Turbidostat, Balanced and unbalanced growth, factors affecting bacterial growth (Solutes, Water activity, pH, temperature, oxygen concentration, osmotic pressure, radiation).

UNIT- IV

Growth, Cultivation of Microorganisms and Control of Microorganisms: Bacterial cultivation- Culture media (Liquid, Semi-solid and Solid media, Synthetic media and Complex media), Types of media (Simple, Routine lab, selective, Enrichment, Enriched, Differential, Transport, Indicator, Anaerobic, Sugar media), Isolation of pure cltures (Streak, Spread and pour plate methods). Anaerobic culture methods. Control of Microorginsms-Physical Methods (Heat, Filtration and Radiation), Chemical methods (Phenolics, Alcohols, Halogens, Heavy metals, Dyes, Quaternary Ammonium compounds, Aldehydes, gaseous agents), Maintenance and preservation of bacterial cultures, Techniques for staining of Bacteria-Fixation, Principle dyes, Simple, Differential, Negative and Spore staining.

Text Books:

1. Microbiology, Pelczar MJ, Chan ECS & Kreig NR, Tata McGraw Hill.
2. General Microbiology, Prescott and Dunn.
3. Microbiology (Principles & Explorations), Jacquelyn G Black

Reference Books:

1. Biology of Microorganisms, Brock, Prentice Hall Int. Inc.
2. General Microbiology, Hons G Schlege, Cambridge University Press.
3. General Microbiology, Roge Y Stainer, Macmillan.
4. Principles of Microbiology, Ronald M Atlas.
5. Microbiology (Essentials & Applications), Larry Mckane& Judy Kandel.
6. Foundations in Microbiology, Talaro K & Talaro A, WC Brown publishers, 1993.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
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M ----> Max.Marks

BT-251 OBJECT ORIENTED PROGRAMMING LAB

L	T	P	M
0	0	3	100

1. Implement the class “complex” for performing arithmetic with complex numbers.

2. Implement a class “rational” for performing arithmetic operations with fractions.

3. Implement a class “Huge” integer for performing addition and subtraction of huge integers.

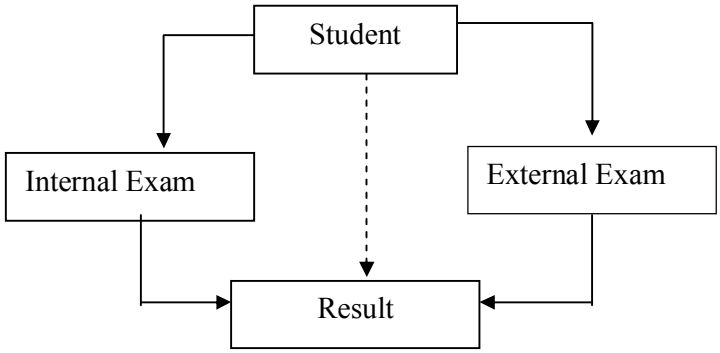
4. Write a program to simulate the Bank Account that allows operations like deposit, withdrawal, interest computation & showing current balance. Create a new account with opening balance as specified by bank. Compute interest on the minimum balance available in the account between 10^{th} and the last day of every month. Don’t allow the users of the class to manipulate the balance and minimum balance directly.

5. Define a class “Set” and write a program to implement the various set operations like insert, union, intersection, difference and complement.

6. Implement the above programs using Operator Overloading.

7. Implement a “String” class and write a program that reads set of strings, print them, sort them, print the sorted list, print the duplicates, print the frequency of each alphabet in all the names, print all substrings of each name (Use Operator Overloading).

8. Implement a C++ program consisting of Two base classes and One derived class. The base class BASIC_INFO contains the data members Name, Roll_no, and Sex. An another base class ACADEMIC_FIT contains the data members Course, Semester and Rank. The derived class FINANCIAL_ASSIT contains the data member Amount decides the data members of the base classes. The derived class has been declared as an array of class objects. The member functions are used to get information of the derived class from the keyboard and display the contents of the array of the class objects on the screen.



9. Write a c++ program to implement the above multipath inheritance, declaring the base class (i.e. Student) as virtual. Take functions as get_data () and put_data () and data members as required.

10. Create a class “Shape” Use this class to store two double type values that could be used to compute the area of figures. Derive three specific classes called triangle, rectangle and circle from the base class Shape. Add to the base class, a member function get_data() to initialize base class data members and another member function display_area() to compute and display the area of figures. Make display_area() as

virtual function and redefine this function in the derived classes to suit their requirements.

11. Write a c++ program to read a set of numbers upto N, where N is defined by the user and print the contents of the array in the reverse order using class templates.

12. Write a c++ program to perform the following using the function template concepts:
    a) to read set of integers
    b) to read set of floating point numbers
    c) to read set of double numbers individually.

    Find out the average of the non-negative numbers and also calculate the deviation of the numbers separately.

13. Implement "Vector" class Template along with exception handling and write a function template to sort elements in the Vector.

14. Implement a C++ program to define two classes. The base class FATHER and the derived class SON, having a protected data member of F_Age and S_Age respectively, and defining parameterized constructor in which you have to throw an exception based on the condition that F_Age > S_Age. Handle the exceptions for both the classes separately in main function. Use base class pointer variable to handle the functions of both the classes.

15. Implement a C++ program to read an array of class object of student_info such as name, age, sex, height and weight from the keyboard and to store them on a specified file using read() and write() functions. Again, the same file is opened for reading and displaying the contents of the file on the screen.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-252	ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY	L	T	P	M
		0	0	3	100

1. Study and Calibration of Ammeter, Voltmeter & Wattmeter
2. Measurement of low, medium and insulation resistance
3. Verification of KCL and KVL
4. Parameters of Choke coil
5. OC and SC tests on transformer
6. Load Test DC self excited machine
7. Swinburne test
8. 3-phase induction motor (Brake test)
9. Alternator regulation by synchronous Impedence method

Note:
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T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-253 MICROBIOLOGY LABORATORY

L	T	P	M
0	0	3	100

1. Microscopy, Calibration of Microscope & Measurement of Microorganisms
2. Identification of animal, plant & bacterial cells
3. Sterilization techniques (Dry & Wet)
4. Preparation of culture media (a) Broth (b) Agar and Culturing of microorganisms in nutrient broth and on agar plates; Maintenance & preservation of cultures
5. Identification of microorganism: Simple & Differential staining techniques
6. Hanging drop technique – study of motility of micro-organisms
7. Antibiotic tests- Disc diffusion method, minimum inhibitory concentration
8. Biochemical tests- IMVIC test, Catalase, Coagulase test, Gelatinase test, Oxidase.
9. A study of bacterial growth
10. Colony counters- Enumeration of Bacterial numbers by serial dilution
11. Tonicity of blood cells
12. Demonstration of living nature of plasma membrane.
13. Microtomy – Sectioning & Staining
14. Localization of lipids by Sudan black –B, proteins by Bromophenol blue, amidoblack-B

Note:
L ----> Lecture hours/week
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P ----> Practical Hours/week
M ----> Max.Marks

BT-221 PRINCIPLES OF UNIT OPERATIONS L T P M
4 0 0 100

UNIT- I

Basic Concepts in Chemical Engineering: Introduction, Unit Operations & Unit processes, Basic laws.

Basic Concepts in Flow of Fluids: Introduction, Nature of fluid, Viscosity, Flow field, Conservation of mass & energy, Friction losses in laminar flow through a circular tube (Hagen-Poiseuille equation), Pumping of fluids

UNIT-II

Basic Concepts in Heat Transfer: Introduction and Mechanisms of heat transfer; Conduction heat transfer (through slab, cylinder & Sphere); Conduction through solids in series, Convection – Convection Heat transfer coefficient, overall heat transfer coefficient , LMTD, Relation Between Individual & Overall Heat Transfer Coefficient, Introduction to radiation heat transfer, Chilling and freezing of food and Biological materials.

UNIT-III

Basic Concepts in Evaporation: Introduction, Types of evaporation equipment and operation methods; Overall heat transfer coefficients in evaporators; Calculation methods for single effect evaporators, Evaporation of biological materials.

Basic Concepts in Drying of process materials: Methods of drying, Equipment for drying; Free moisture content of materials; Concept of bound and unbound moisture content of biological materials; Rate of drying curves; Calculation methods for constant-rate & falling rate drying methods; Freeze drying of biological materials.

UNIT-IV

Basic Concepts in Mechanical Separation Methods: Introduction and Classification of Mechanical-Physical separation processes, Filtration in solid-liquid separation, Settling and sedimentation in Particle-Fluid separation, Centrifugal separation processes.

Text Books:

1. Introduction to Chemical Engineering, S K Ghosal, S K Sanyal & S Dutta, Tata McGraw Hill.
2. Transport processes and unit operations, Christie J Geankoplis, 3rd edition, Prentice Hall India Pvt. Ltd.

Reference books:

1. Unit operations in Chemical Engineering, W L McCabe & J C Smith, 7th Ed., McGraw Hill Intl. Ed.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-222 BASIC FUNCTIONAL ANATOMY & PHYSIOLOGY

L	T	P	M
4	0	0	100

UNIT- I

Anatomy& Physiology of Skeletal and Digestive Systems: Elementary Knowledge on Various parts of Human Body, systems and organs; General Structure and functions of various tissues of the human body; General structure and functions of Digestive system in Human Beings, General Mechanism of Digestion and Role of Various Gastro intestinal secretions and their role in the absorption and digestion of food. General Structure of Skeletal system. General Structure and composition of Bones and Types of Joints

UNIT-II

Anatomy & Physiology of Cardiovascular & Respiratory Systems: General Structure of Blood Circulation in Humans-Heart and major Blood vessel and their Functions, Special Properties of Cardiac Muscle and Pace Maker; Blood and Lymphatic System- Composition, Blood Groups, role of R.B.C and W.B.C- Mechanism of Blood Oxygenation; Blood Pressure and its Recording and regulating factors; General Structure of Respiratory System and Functions- Lungs and Trachea; Mechanism of Respiration.

UNIT-III

Anatomy& Physiology of Nervous System and Endocrine Systems: General Structure of Nervous System, Anatomy & physiology of Brain; Spinal Cord, Peripheral and Autonomous Nervous System; Neuro-Muscular Junction, Nerve Impulse, reflex arc. Basic Anatomy and types of Endocrine glands; Physiology of Endocrine glands and their hormones; General mechanism of Hormonal secretion; Basic Anatomy of Special Senses Eye, Ear, Tongue, Nose and skin

UNIT-IV

Anatomy & Physiology of Excretory & Reproductive Systems: General structure of various parts and Functions of Excretory system- Kidney and Urinary Bladder; General Structure and functions of Male and Female Reproductive System; Hormone production and Physiology of Menstruation and Fertilization, Mechanism of family planning.

Texts Books:

1. Human Anatomy and Physiology, Tortora GJ, Grabowski SR, John Wiley & Sons Inc.,
2. Anatomy and Physiology, Ross & Wilson

Reference Books:

1. Basic human Anatomy, Charles E. Tobin
2. An Introduction to Human Physiology, J. H Green
3. The Living Body, Best & Taylor

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-223	GENETICS	L	T	P	M
		4	0	0	100

UNIT-I

Classical Genetics and Gene Interactions: Mendel's experiments with Garden pea - Mono & Dihybrid crosses; Incomplete and Co-dominance, Polygenic inheritance and Pleiotropism with examples; Interaction of Genes – Complementary & Supplementary genes, Epistasis (dominant & recessive), Atavisms & Lethal genes; Pseudogenes, Overlapping genes & Split genes.

UNIT-II

Linkage, Crossing Over & Mutations: Chromosome theory of heredity, Linkage & crossing over - concept and significance; somatic or mitotic crossing over, genetic crossing over, significance of crossing over; Determination of linkage groups, and genetic mapping of Drosophila, Mutagens – their types & action; Classification of Mutations – Spontaneous & induced; Chromosomal Mutations (Eu & Aneuploidy), Gene or Point Mutations – Substitution mutations: Transition (Tautomerization, Ionisation, Base analogues & deamination), Transversion – Frame shift mutations. Applications of Mutations.

UNIT-III

Genetic Recombination & Mapping: Nucleic Acids as genetic material -Bacterial Transformation (Griffith's Effect), the Hershey-chase experiment; RNA as genetic material in small viruses; Structure & function of plasmids in general.
Types of Gene transfer: Transformation, Conjugation, F-mediated Sexduction, generalized & specialized Transduction; Mechanism of recombination & recombination frequencies; Mapping of bacterial chromosomes and construction of genetic map of *E.coli*- Benzer's classical studies on r-II region of T-4-phage, Complementation test, elucidation of T-4 genetic map. Genetic system of *Neurospora*; Extra chromosomal inheritance and Mitochondrial Genetics.

UNIT-IV
Sex Determination, Human Genetics & Population Genetics: Mechanism of sex determination in animals and plants; sex differentiation and development in humans. Dosage compensation, Mary F. Leon's hypothesis; sex linked disorders in human beings. Population – Gene pool, Gene frequency; Genetic equilibrium and Hardy-Weinberg Law.

Text Books:

1. Principles of Genetics, Gardner EJ, Simmons MJ & Snustad DP 1985
2. Genetics, V.B. Rastogi 1985
3. Principles of Genetics, Basu S.B. & Hossain M., 2004; Books & Allied Publishers Ltd.

Reference Books:

1. Genetics, Goodenough U, Hold Saunders International 1985
2. Genetics, Strickberger

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BT-224 **METABOLOMICS** **L T P M**
4 1 0 100

UNIT-I

Biochemistry of Carbohydrates and Lipids: Carbohydrate Metabolism– Glycolysis, glycogenolysis, HMP, Citric Acid Cycle (TCA Cycle) and Oxidative Phosphorylation; Metabolic Pathways– Biosynthesis of Glucose, Glycogen and starch; Lipid Metabolism– Catabolism of Fatty Acids, Triglycerol and Cholesterol Metabolism; Metabolic Pathways– Biosynthesis of Saturated and Unsaturated Fatty Acids, Cholesterol, triacyl glycerol, phospholipids and sphingolipids, ketongenesis; Glyco-conjugates- Proteoglycans, Glycoproteins and Glyco Lipids.

UNIT-II

Biochemistry of Proteins and Nucleic Acids: Amino acids metabolism– Biosynthesis of Amino Acids, Peptides; Catabolism of Carbon skeletons of Amino Acids– Transamination, Oxidative Deamination and Oxidative Decarboxylation, metabolic fate of amino acids; Nitrogen Excretion and Urea Cycle; Nucleic Acid Metabolism- Biosynthesis of Purine and Pyrimidine ribonucleotides, synthesis of Deoxyribonucleiotides, Degradation of Purine and Pyramidine Nucleotides, Genetic Disorders.

UNIT-III

Biochemistry of Photosynthesis: Photosynthesis – Photosynthetic pigments and photochemistry; Hill reaction; Photosynthetic reactioncenters- Phtosystem–I, phtosystem-II; Chloroplast- Organization of chloroplasts, chlorophylls trap solar energy; Oxygenic and anoxygenic Photosynthesis; Phtophosphorylation- Cyclic and Non-cyclic Photo Phosphorylation; Dark reaction- Carbon dioxide fixation in C_3 plats, (Calvin cycle) and C_4 pathy way (Hatch-Slack pathy); Phtorespiration; Synthesis of cell wall poly saccharides-plant cellulose and Bacterial prptidoglycan.

UNIT-IV

Biochemistry of Hormones Coenzymes and Metal Ions : Metal ions Biological Systems – Role of Iron, Zinc, Cobalt, Copper and Magnesium ,Calcium, phosphorus, sodium, Manganese, Iodine, Potassium, Chlorine, Cobalt, Fluorine, Sulfur; Coenzymes-Coenzymes in hydrogen transfer reactions(NAD+, FAD, Lipoic acid) and group transfer reactions(Biotin, TPP, Pydoxal phosphate, Coenzyme A, Tetrahydrofolic acid); Hormones- Classification of hormones-Based on the chemical nature and mechnism of action; Steroid hormones-Ovarian , Testicular, Adrenal cortical, Corpus luteal hormones; Peptide hormones-Hormones of the Pancreas, Hypophysis, Parathyroid, Gastrointestinal tract, Corpus luteum; Amino acid derivaties-Thyroidal, adrenal medullary hormones.

Text Books:

1. Principles of Biochemistry, David. L. Nelson and Michael. M. Cox
2. Outlines of Biochemistry, E.E Conn and P.K.Stumpf

Reference Books:

1. Biochemistry, Stryer.L
2. Harper's review of Biochemistry, Martin. D. W, Mayes. P. A and Rodwell. V. M

Note:

L ----> Lecture hours/week
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BT-225 INDUSTRIAL BIOTECHNOLOGY L T P M
4 0 0 100

UNIT-I

Introduction To Industrial Bioprocess :A historical overview of Industrial fermentation processes and products; Outline of the various unit operations involved in an integrated bioprocess; Role of Bioprocess engineer in biotechnology industry; Isolation, preservation and improvement of Industrial Microorganism for overproduction of Primary and Secondary metabolites. Areas of application of biotechnology.

UNIT-II

Production of Primary and Secondary Metabolites: A brief outline of processes for the production of some commercially important Organic acids (e.g. Citric acid, Lactic acid, Acetic acid): Amino acids (Glutamic acid, Lysine); Alcohols (Ethanol).
Study of Production processes for various classes of low molecular weight secondary metabolites- Antibiotics, Beta-lactams (Penicillins), Amino glycosides (Streptomycin), Macrolides (Erythromycin), Vitamins (B_{12})

UNIT-III

Isolation and Production of Bioproducts: Extraction and production of Enzymes- Proteases, Amylases, Lipases, Cellulases, Pectinases; Production of Commercially Valuable Bioproducts for Agricultural and Pharmaceutical Industries- Biopesticides, Biofertilizers and Plant growth factors, Natural Biopreservatives (Nisin), Biopolymers (Xanthan gum and PHB), Bioconversion reactions.

UNIT-IV

Bio-safety regulations:
Bio-safety regulation and national and international guidelines, r-DNA guidelines. Experimental protocol approvals, levels of containment, environmental aspects of biotech applications, use of genetically modified organisms and their release in environment, special procedures for r-DNA based product production; GMP, GLP, SOP.

Text Books:

1. Principles of Fermentation Technology, Stanbury PF, A Whitaker & GH Hall.
2. A Text Book of Biotechnology, Crueger & Crueger.
3. Industrial Microbiology, A.H Patel.
4. Bioethics & Biosafety- M.K.Sateesh

Reference Books:

5. Microbiology, Prescott and Dunn.
6. Microbial Biotechnology, Glazer A.N and Nikaido.
7. Industrial Microbiology, J.E Casida.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-226 BIO ANALYTICAL TECHNIQUES L T P M
4 0 0 100

UNIT-I

Isolation Techniques: Cell disruption- Importance, goals and types; Isolation of Biomolecules and cell organelles- Sedimentation- basic principles, sedimentation coefficient, Svedberg Unit, Centrifugation, various types of centrifuges, their uses, rotors, fixed angle, vertical, swing out, zonal rotors; preparative centrifugation, differential density gradient centrifugation, analytical ultra centrifugation; Materials used in preparation of density gradient- sucrose & cesium chloride.

UNIT-II

Separation Techniques: Partition coefficient, counter current distribution, partition chromatography, adsorption chromatography, Paper, TLC& GLC; Methods based on size- Gel permeation chromatography, principle, application- Molecular weight determination. Affinity chromatography, application & technique for purification of proteins and nucleic acids.

UNIT-III

Charge Based Separation Techniques: Principle and application of Ion exchange chromatography, use of ion exchange- cation & anion exchangers, pH and salt gradients for elution of proteins, amino acids and nucleotides. Electrophoresis- Migration of charged molecules in electric field-moving boundary, paper, cellulose acetate, starch gel electrophoresis, SDS PAGE, Determination molecular weight, isoelectric focusing and its significance. Identification of specific proteins by western blotting. Agarose gel electrophoresis- separation of DNA & RNA, by agarose gel electrophoresis, recovery of DNA fragments from agarose gels, southern & northern blot techniques and their significance, pulse field gel electrophoresis.

UNIT- IV

Spectrometric Identification Techniques: Basic concepts of spectroscopy, Visible & UV spectroscopy, Laws of photometry-Beer lamberts law; Principles and application of Colorimetry & Flame photometry, Nephlometry; Principles and applications of Atomic absorption spectrophotometry; Principles & applications of IR, ESR NMR & Mass spectroscopy..

Text Books:

1. Principles and Techniques of Practical Biochemistry (Wilson, Principles and Techniques of Practical Biochemistry), edited by Keith Wilson, John Walker, 5th edition, Cambridge University Press.
2. Fundamentals of analytical chemistry - Douglas A. Skoog, Donald M. West, F. James Holler, and Stanley R. Crouch, 8th edition, 2004

Reference Books:

1. Instrumental Methods of Analysis, Ewing
2. Instrumental Methods of Analysis, HH Willard, DL Merrit & JRJA Dean

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-261 INDUSTRIAL MICROBIOLOGY LABORATORY

L	T	P	M
0	0	3	100

1. Review of Basic microbiology techniques like Media preparation, Sterilization, Culturing of micro-organisms in media and on agar plates/slants/stabs etc.
2. Detection of number of bacteria in milk/fruit juice sample by Standard Plate Count method
3. Microbial cell growth kinetics
4. Determination of size and density of the microbial cells
5. Determination of DO, BOD & COD of water samples
6. Bacteriological examination of water by multiple tube fermentation tests
7. Preparation of pure cultures of micro-organisms producing Alcohol/Acetic acid/ Citric acid etc.
8. Production (Homolactic acid fermentation) and estimation of Lactic acid in shake flask cultures.
9. Isolation of antibiotic producing micro-organisms from soil
10. Production of Penicillin and testing of its anti-microbial activity
11. Isolation of lipolytic micro-organism from butter & Lipase production test
12. Detection of Nicotinic acid by Bioassay
13. Detection of Arsenic / copper using microbiological method
14. Preparation of pure culture of selected micro-organisms identified in bioremediation
15. Estimation of Phenol/Benzene/Ccl_4/ Petroleum degradation by chosen microbe
16. Isolation & pure culturing of micro-organism producing any industrially important protease and estimation of its proteolytic activity.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-262	BIOCHEMISTRY LABORATORY	L	T	P	M
		0	0	3	100

1. Units, Volume / weight measurements, concentration units, pH measurement, Preparation of buffers, reagents, sensitivity, specificity, precision and accuracy.

Qualitative Tests

2. Qualitative tests for carbohydrates,
3. Qualitative tests for Amino acids and proteins
4. Qualitative tests for Lipids.
5. Qualitative tests for Nucleic acids.

Quantitative tests

6. Estimation of Carbohydrates by Anthrone method, Benedict's method and DNS method.
7. Estimation of Glycine by Sorenson formal titration method.
8. Estimation of Amino acids by Ninhydrin method.
9. Estimation of Proteins by Biuret, Folin's and Bradford assay.
10. Determination of Iodine Number, Acid value and Saponification value of Fat.
11. Estimation of Cholesterol
12. Estimation of DNA and RNA by DPA method and Orcinol method
13. Estimation of Phosphorous.
14. Estimation of Calcium in foods and serum
15. Estimation of Ascorbic acid in foods

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-263 **COMMUNICATION SKILLS LABORATORY** **L T P M**
(Common to all branches except CSE / IT) **0 0 3 100**

Course Objectives:

The course mainly focuses on to improve the Linguistic Competence, Communicative Competence, Telephonic Skills, Interpersonal Skills and Soft Skills of the learners. Activities in the Communication and Soft Skills Lab will simulate actual discourses that students will engage in their interaction with their peers, teachers or strangers in their day-to-day situations.

By the time the students complete the course they would be able to identify and use the general features of discourse development, which may be, realized differently in different situations.

Syllabus:

Module-1: Phonetics
- a) Introduction to vowels and consonants
- b) Introduction to Accent, Intonation and Rhythm

Module-2: Presentation Skills
- a) Debate
- b) Paper Presentation:
  - i) Identification of source material
  - ii) Arrangement of Collected Data
- c) Extempore

Module-3: Employability Skills
- a) Resume Preparation
  - i) Identification of information
  - ii) Arrangement of collected data
- b) Group Discussions
- c) Interview Skills
  - i) Dress code
  - ii) Behavioral Skills

Module-4: Telephonic Skills
- a) Formal &Informal interaction
- b) Receiving Messages & Complaints

Module-5: Soft Skills
- a) Voluntary & Involuntary Body Language
- b) Self-Esteem
- c) Creative Thinking
- d) Team Management

Module-6: Interpersonal and Intrapersonal Skills
- a) Motivation

b) Stress Management

c) Negotiation Skill

d) Effective Listening

NOTE: 12 Lab Activities are minimum in Record (125 pages single side book) with contents: Name of the Activity, Source, Skill Improved.

Minimum Requirements:

The Communication and Soft Skills Lab shall need two labs. One is Communication Skills Lab with LAN facilitated 60 multimedia systems and English language software suggested by the concern faculty. The other, Conversational Skills Lab with 6 to 10 round tables, 60 movable chairs and audio-visual Devices with LCD Projector.

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Clarity Pronunciation Power
- The Rosetta Stone English Library
- Dorling Kindersley series of Grammar, Punctuation, Composition etc.
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge
- Language in Use, Foundation Books Pvt. Ltd with CD.
- Mastering English in Vocabulary, Grammar, Spellings, Composition
- Telephoning in English
- A Practical Course in Spoken English with CD by J.K. Gangal, PHI Publications.
- Communicate to Conquer: A Handbook of Group Discussions and Job Interviews with CD, PHI Publications.

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

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
3. Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
4. Speaking English Effectively by Krishna Mohan & NP Singh (Macmillan)

5. A Practical Course in English Pronunciation, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.

6. A text book of English Phonetics for Indian Students by T.Balasubramanian (Macmillan)

7. English Skills for Technical Students, WBSCTE with British Council, OL

8. Soft Skills: Know Yourself & Know the World, Dr.K.Alex, S.Chand Publications

9. The ACE of Soft Skills: Attitude, communication and Etiquette for Success, by Pearson Publications.

10. Converston Developing Soft Skills,4 th Edition,pearson Publication.

11. Manageing Soft Skills, K.R.Lakshminarayanan and T.Murugavel, Scitech Publications.

DISTRIBUTION AND WEIGHTAGE OF MARKS

Communication and Soft Skills Lab Practical Paper:

1. The practical examinations for the Communication and Soft Skills Laboratory shall be conducted as per the University norms prescribed for the Core Engineering Practical Sessions.

2. For the ***Communication and Soft Skills 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, 10 marks shall be awarded for day-to-day performance (i.e. Final Grade in the Record) and 15marks (including 5 Marks for attendance) to be awarded by conducting Internal Lab Test(s) by the teacher concerned. 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 50 marks, 40 marks shall be equally distributed to LSRW Skills and 10 marks for vice-a-voce.

BT-311 APPLIED MATHEMATICS & BIOSTATISTICS

L	T	P	M
4	0	0	100

UNIT-I

Partial Differential Equations: Formation of partial Differential Equations- Solution of Partial Differential Equations-

Equations solvable of direct integration- Linear Equation of 1st order- Homogeneous Linear Equations with Constant Coefficients-Rules for finding particular integrals.

Numerical Methods: Solutions of ordinary differential equations: Picards's method- Euler's method- Runge-Kutta method 2nd and 4th orders.

UNIT- II

Probability: Sample space and events, counting, probability, The Axioms of probability, some elementary theorems, conditional probability.

Probability Distributions: Random variables, Binomial Distribution, Hypergeometirc Distribution, mean and the Variance of a probability Distribution, Chebyshev's theorem, The Poisson approximation to the Binomial Distribution, Poisson process.

UNIT –III

Probability Densities and Sampling Distributions: Continuous Random Variables, Normal Distribution, Normal Approximation to the Binomial Distribution. Sampling Distributions: Populations and Samples; The sampling Distribution of the Mean (σ-known) – The sampling distribution of the Mean (σ-unknown) – The sampling Distribution of the Variance.

UNIT –IV

Interference: Interference Concerning Means: Point Estimation – Interval Estimation – Test of Hypotheses- Null Hypotheses and tests of Hypotheses, Hypotheses concerning one mean-The relation between teas and confidence intervals-Operating Characteristic Curves-Interface Concerning Two Means. Inferences concerning proportions: Estimation of proportions- Hypothesis concerning one proportion. Analysis of variance (ANOVA): Some general principles, completely Randomized Designs, Randomized Block Designs, Multiple comparisions.

Text Books:

1. Higher Engineering Mathematics, B.S.Grewal, 39th edition, Khanna publishers. (for Unit I)
2. Probability and statistics for Engineers, Miller & Freud 6th edition, A. Johnson, Pearson Education Asia (for Unit II, III, IV)

Reference Books:

1. Probability and Statistics, M.R. Spiegel, Schaum Series
2. Probability and Statistics for Engineers, Miller and Trend Kreyszig.
3. Introductory probability and Statistical Applications, K. Paul Meyer

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-312 ENZYME ENGINEERING & TECHNOLOGY

L	T	P	M
4	0	0	100

UNIT- I

Introduction To Enzymes: Enzymes- Introduction, Properties; Classification and Nomenclature of Enzymes with examples; Methods of characterization of enzymes- Enzymatic assays; Enzymes Applications- Industrial, Analytical and Diagnostic purposes. Single-substrate enzymatic reactions; Energetics of enzymatic reactions and enzyme-substrate complex formation; Concept of active site; Mechanisms of enzyme action; Specificity of enzyme action.

UNIT- II

Kinetics of Enzyme Action: Kinetics of single substrate reactions- Michaelis Menten, Brigg's Haldane Approaches- Mechanisms with examples & numericals; Turn over number; Estimation of Michaelis-Menten parameters- Graphical representation with numericals; Kinetics of Multi substrate reactions- mechanisms with examples & numericals; Types of enzyme inhibition – mechanisms with examples & numericals; Allosteric enzymes; Deactivation kinetics.

UNIT- III

Enzyme Immobilization & Enzyme Biosensors: Immobilization- Definition, Advantages & Disadvantages; Types of Immobilization Techniques- Physical and chemical - adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding with examples; Advantages and disadvantages of different immobilization techniques; Overview of applications of immobilized enzyme systems; Design of enzyme electrodes and their application as biosensors in industry, health care, and environment.

UNIT- IV

Kinetics of Immobilzed Enzyme Systems: Immobilized enzyme kinetics- Factors affecting; Effects of electrostatic potential on microenvironment- pH –Activity profile; Apparent Michaelis Constant; Mass Transfer effects on uncharged, charged supports; Effects of intra particle diffusion with uncharged supports; Formulation of dimensionless groups and calculation of Effectiveness Factors; Design of Simultaneous film mass transfer resistances; Effects of external environmental conditions on Immobilized enzyme activity.

Text Books:

1. Biochemical Engineering, Blanch & Clark
2. Enzyme Technology, Palmer.
3. Biochemical Engineering Fundamentals, Bailey & Ollis

Reference Books:

1. Principles of Biochemistry, A.Lehninger.
2. Biochemical Engineering, James Lee

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-313	FERMENTATION TECHNOLOGY	L	T	P	M
		4	0	0	100

UNIT- I

Introduction To Fermentation Processes & Media Design: The chronological development of fermentation industry; General requirements of fermentation processes; Main parameters to be monitored and controlled in fermentation processes; Aerobic and anaerobic fermentation processes and their applications

Medium requirements for fermentation processes; Carbon, Nitrogen, Minerals, Vitamins and other complex nutrients; Medium formulation for optimal growth and product formation; Examples of simple and complex media

UNIT-II

Stoichiometry & Kinetics of Microbial Growth: Stoichiometry of cell growth and product formation; Elemental balances; degree of reluctance of substrate and biomass; Yield coefficients of biomass and product formation; Maintenance coefficients; Batch, Fed-batch and Continuous Fermentation systems; Phases of cell growth in batch cultures

Simple unstructured kinetic models for microbial growth, Monad model, Growth of filamentous organisms, Growth associated and non-growth associated product formation kinetics (Leudking-Piret models), Substrate and product inhibition on cell growth and product formation; Introduction to structured models.

UNIT- III

Aeration and Agitation In Fermentations: Basic Mass transfer concepts, Correlations for mass transfer coefficients, Oxygen requirements, Oxygen transfer from gas bubble to cells, Oxygen transfer in fermentations, Bubble aeration and Mechanical agitation, Gas Hold up

Power consumption concepts; Determination of oxygen transfer rates, Estimation of K_La values by Dynamic gassing out, Sodium sulphite and Direct measurements; Other Factors affecting the values of volumetric mass transfer coefficients in fermentation vessels; Power requirement for mixing

UNIT- IV

Scale Up and Rheology In Fermentations: Scale up of fermentation processes, Principles, theoretical considerations and techniques used, Scale down methods, The Rheology of fermentation broths, Rheological models.
Measurement of rheological parameters; Rheological Control of fermentations. Mixing concepts; Residence time distributions, concentration, and temperature distributions; Improvement of mixing in fermentations.

Text Books:

1. Principles of Fermentation Technology, Peter F Stanbury
2. Bioprocess Engineering, Shuler and Kargi, Prentice Hall, 1992
3. Biochemical Engineering, Harvey W Blanch

Reference Books:

1. Biochemical Engineering, Aiba &Humphrey
2. Fundamentals of Biochemical Engineering, Bailey & Ollis
3. Biochemical Engineering, James Lee

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-314 CHEMICAL & BIOCHEMICAL THERMODYNAMICS L T P M

4 1 0 100

UNIT- I

First Law of Thermodynamics and Other Basic Concepts: Internal Energy, The First law of Thermodynamics, Energy balance for closed system, Thermodynamic state and state function, Equilibrium, The phase rule, The reversible process, Constant volume and Constant pressure process, Enthalpy, Heat Capacity, Mass and Energy balance for open systems

Volumetric Properties of Pure Fluids: PVT Behavior of pure substances, The Ideal gas, cubic equation of state.

UNIT-II

Second Law of Thermodynamics: Statements, Heat Engines, Entropy, Entropy changes of an Ideal gas, Mathematical Statement of second law of thermodynamics, Entropy balance for an open system.

Thermodynamic Properties of Fluids: Property relations for homogeneous phases, Residual properties, Principles of Bioenergetics.

UNIT- III

Solution Thermodynamics: Fundamental property relations, the chemical potential and phase equilibria, Partial properties, ideal gas mixture, fugacity and fugacity coefficient for species and species in solutions, the ideal solution, excess property, the excess gibbs energy and the activity coefficients.

UNIT- IV

Vapor – Liquid equilibrium: The nature of Equlibrium, The phase rule, Duhem's theorem, VLE, Models for Vapor liquid Equilibria, VLE by modifiee Raoul's law and introduction to Solid Liquid Equilibria.

Text Books

1. Introduction to Chemical Engineering Thermodynamics, J.M.Smith, H.C.Van Ness and M.M.Abbott, Sixth Edition, Tata McGraw Hill, 1995

Reference Books

1. Chemical Engineering Thermodynamics, Y.V.C.Rao, University Press
2. A Textbook of Chemical Engineering Thermodynamics, K.V.Narayanan, Eastern.
3. Lehninger Principles of Bio Chemistry, by David L Nelson, Michael M. Cox , 4th Edition

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-315	MOLECULAR BIOLOGY	L	T	P	M
		4	0	0	100

UNIT-I

DNA Structure, Replication: Structure of DNA-Watson & Crick's model; Types of DNA- A, B & Z; Denaturation and renaturation of DNA; Replication of DNA- continuous and discontinuous DNA synthesis, Experimental evidence for Semi conservative replication; Enzymology of replication & , complex replication apparatus; Replication models – uni & bi-directional replication, rolling circle and looped rolling circle replication.
DNA Damage and Repair: Types of DNA damages- deamination, alkylation, pyrimidine dimers; Biological indications of repair; Repair mechanisms-Light induced (Photoreactivation) and light independent (Excision, mismatch, recombination and SOS repair); ***rec*** gene and its role in DNA repair.

UNIT-II
Mechanism of Transcription: RNA Polymerases of Prokaryotic and Eukaryotic Organisms; Structure of Promoters-consensus sequences in prokaryotes and eukaryotes; Structural and functional features of RNA-rRNA, mRNA, tRNA; Transcriptional apparatus and proteins involved in transcription; Steps in Transcription- Initiation, Elongation and Termination; Prokaryotic & Eukaryotic transcription; Post Transcriptional Processing of Eukaryotic RNA: t-RNA, r-RNA, m-RNA (splicing mechanism); Concept of Ribozyme, Inhibitors of Transcription.

UNIT-III
Mechanism of Translation: Ribosome- Structural features of prokaryotic and eukaryotic ribosome; Genetic code- Triplet code, cracking of genetic code, features of genetic code, wobble hypothesis; Protein synthesis: Translation in prokaryotes and eukaryotes- initiation of translation, elongation of polypeptide chain, termination of translation. Post translational modifications (Phosphorylation, glycosylation); Inhibitors of Translation & Protein Synthesis.

UNIT-IV
Regulation of Gene Expression: Regulation of Gene expression in bacteria- Operon concept, inducible and repressible operons, positive and negative regulations, inducer, repressor & co-repressor molecules; Induction and catabolite repression of *lac* operon in *E.coli*; Repression and attenuation of *trp* operon in *E.coli*, repression Vs attenuation; Positive and negative controls in *ara* operon in *E.coli*; Eukaryotic Gene regulation – regulation of synthesis of primary transcripts; Transcriptional control by Hormones, transcriptional factors & methylation; Antisense RNA RNA interference.

Text Books:
1. Molecular biology, D. Freifelder
2. Molecular biology of the gene, Watson, Hopkins, Roberts & co

Reference Books:
1. Genes VIII, Benjamin Lewin.
2. Principles of Genetics, Gardner E J, Simmons M J & Snustad DP
3. Molecular Biotechnology – Principles & Applications of recombinant DNA, B.R. Glick & J.J. Pasternak, ASM Press.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-316 **IMMUNOLOGY** **L T P M**
4 0 0 100

UNIT-I

The Immune System: History of immunology, Structure, composition and functions of cells and organs involved in immune system- B-cells, T-cells, lymphocytes, phagocytes, auxiliary cells, soluble mediators - lymphokines, cytokines, interleukines; lymphoid organs- primary (thymus, bone marrow, bursa of fabricus) secondary (lymph node, spleen, MALT, GALT); Innate and acquired immunity; humoral and cell-mediated immunity; Immune responses- primary and secondary.

UNIT-II

Antigens, Antibodies and Reactions: Antigens- nature and properties; haptens Immunoglobulins- structure, heterogenecity, types, subtypes, theory of antibody synthesis; antibody production- hybridoma technique, catalytic abzymes. Complement system- structure, components, pathways and biological sequences of complement activation; Antigen–antibody reactions - agglutination, precipitation, complement fixation; and immuno electron microscopy, ELISA, RIA.

UNIT-III

Hypersensitivity and Vaccination: Hypersensitivity reaction- antibody mediated- anaphylaxis; antibody dependent cell toxicity; immune complex mediated reactions; cell mediated hypersensitivity reaction. Vaccines and toxids

UNIT- IV

Transplantation and Autoimmunity: Structure and functions of MHC and the HLA system and tissue transplantation; Tissue typing methods of organ and tissue transplantation in humans; organ verses host reaction and rejection; Autoimmunity - general account of autoimmune diseases; mechanism and therapy of rheumatoid arthritis; Tumour specific antigens. Tumour associated antigens- Alfa- foetoprotein (afp) and carcinoembryonic antigens.

Text Books:

1. Essentials of immunology, Roitt
2. Immunology, Kubey

Reference Book:

1. Immunology, J.T. Barret

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-351	CHEMICAL ENGINEERING LABORATORY-I	L	T	P	M
		0	0	3	100

1. Filtration of solid-liquid mixture
2. Sedimentation technique
3. Drying of wet solid materials
4. Lagged pipe heat transfer
5. Thermal conductivity of a metal rod.
6. Single effect evaporator
7. Agitated vessel
8. Composite wall
9. Unsteady State Heat Transfer
10. Drop wise & Film wise Heat Transfer
11. Reynold's Experiment
12. Bernoulli's Theorem
13. Heat Exchanger.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-352 BIOANALYTICAL TECHNIQUES LABORATORY

L	T	P	M
0	0	3	100

1. The calibration of pH meter and determination of pKa.
2. Estimation of unknown samples by using conductivity meter.
3. Demonstration of working principle of Biosensors.

Centrifugation Techniques

4. Isolation of cell organelles by centrifugal sedimentation.

Photometry Techniques

5. Estimation of different macromolecules by Visible spectrophotometer.
6. Verification of Lambert – Beers law by UV –VIS spectrophotometer.
7. Estimation of proteins & nucleic acids by U.V method.
8. Estimation of turbidity using Nephlometer.
9. Estimation of minerals by Flame photometry.

Chromatography Techniques

10. The separation of amino acids by Paper chromatography.
11. The separation of amino acids by Thin Layer chromatography.

Electrophoresis Techniques

12. The separation of different macromolecules by Agarose Gel Electrophoresis and SDS-PAGE.
13. Fractionation of Plasma Proteins by Paper Electrophoresis.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-353	IMMUNOLOGY LABORATORY	L	T	P	M
		0	0	3	100

1. ABO Blood Grouping
2. Identification of Rh factor
3. Radial Immuno Diffusion
4. Rocket immunoelctrophoresis (RIEP)
5. Quantitative precipitin Assay (QPA)
6. Ouchterlony Double Diffusion for Antigen Antibody Patterns (ODD)
7. Ouchterlony Double Diffusion for Antibody Titration
8. Immunoelectrophoresis (IEP)
9. Radial Immuno Diffusion test (RID)
10. Widal test
11. VDRL tests
12. Purification of lymphocytes from peripheral blood
13. Total count of RBC by Micropipette method
14. Total count WBC by Micropipette method
15. Differential count of WBC
16. Erythrocyte sedimentation rate
17. Blood pressure
18. Dot ELISA, Sandwich ELISA
19. Estimation of hemoglobin by Shali's method.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-321 MASS TRANSFER OPERATIONS

L	T	P	M
4	1	0	100

UNIT- I

Principles of Mass Transfer: Introduction to Mass transfer and Diffusion, Molecular diffusion in Gases, Molecular diffusion in Liquids, Molecular diffusion in Biological solutions and gels, Molecular diffusion in Solids, Inter phase mass transfer.

Gas – Liquid operations: Equilibrium relations between phases, Mass transfer between phases, Choice of solvent for absorption, Single stage and multi stage co current and counter current operations, equipments mechanically agitated vessels, packed columns and plate columns.

UNIT- II

Principles of VLE for Binary System: Phase rule and Raoult's law, Boiling point diagrams and x-y plots, Relative volatility, Flash distillation, Differential distillation, Simple steam distillation, Distillation with reflux and McCabe – Thiele method. Special Cases for rectification using McCabe – Thiele; Rectification with single side stream.

UNIT- III

Liquid – Liquid Extraction: Introduction to Extraction process, Equilibrium relations in extraction, Analytical and graphical solutions for single and multi stage operations co-current and counter current operations without reflux. Equipments for liquid-liquid extraction: mixer-settlers for extraction, Plate and Agitated Tower Contactors for Extraction, Packed and spray Extraction towers.

UNIT- IV

Leaching: Preparation of solid, steady and unsteady state operation, Shanks system, equipment, methods of calculation for single and multistage operations.

Crystallization: Crystal geometry, Equilibrium and yields, nucleation and crystal growth rates, controlled growth of crystals, incorporation of principles into the design of the equipment.

Text Books:

1. Transport processes and Unit operations, Christie J.Geankoplis
2. Mass Transfer operations, Robert E.Treybal, 3rd edition McGraw-Hill

Reference Books:

1. Unit operations of Chemical Engineering, Warren L, McCabe, Julian C. Smith, Peter Harriot, 7th Edition, McGraw-Hill.
2. Transport processes and Separation process principles, Christie Geankoplis, 4th edition, PHI

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-322	BIOINFORMATICS	L	T	P	M
		4	0	0	100

UNIT-I

Introduction To Bioinformatics & Sequencing Alignment and Dynamic Programming.: Need of Computers in Biotechnology Research; File Transfer Protocol (FTP), TELNET, HTTP; Bioinformatics- Introduction, Scope, Applications; Strings, Edit distance, String similarity- Methods; Pair wise Alignment-Local, Global alignment; Gap- Gap penalty; Parametric sequence alignments- Sub optimal alignments; Comparison of Pair wise and Multiple alignment.

UNIT- II

Biological Databases and Datamining: Biological Information on the web- Introduction to databases; Classification of Biological databases; Information retrieval from Databases; Sequence database search- FASTA, BLAST; Amino acid substitution matrices- PAM and BLOSUM; Data Mining and Visualization.

UNIT- III

Phylogenetic Analysis and Prediction: Understanding Evolutionary process; Origins of Molecular Phylogenetics; Common Multiple Sequence alignment methods; Methods of Phylogenetic analysis, Tree Evaluation, Problems in Phylogenetic Analysis- Maximum Parsimony and Maximum Likelihood methods, Automated Tools for Phylogenetic Analysis; Ultrametric trees and distances.

UNIT-IV

Genome Mapping and Prediction: DNA sequencing- Map assembly, cDNA sequencing, Genome sequencing; Genome Mapping; Comparative Sequence Analysis; Basis of Gene Prediction, Gene predictions- in Microbial genomes, Gene Prediction Methods, Other Gene Prediction Tools, Gene Annotation; Molecular predictions with DNA strings; Human Genome Mapping (HGP).

Text Books:

1. Bioinformatics: Methods and Applications, SC Rastogi, N Mendiratta & P Rastogi.
2. Bioinformatics Basics, Applications in Biological Science and Medicine, Hooman & co

Reference Books:

1. Algorithms on strings, trees and sequences, Dan Gusfield, Cambridge University Press, 1997.
2. Bioinformatics: A Machine learning approach, P.Baldi, S. Brunak, MIT press, 1988

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-323 **GENETIC ENGINEERING** **L T P M**
4 0 0 100

UNIT- I

Recombinant DNA Technology: Isolation and purification of DNA & RNA; Host Controlled restriction enzymes, their uses, target sites, Isoschizomers and Isocaudomers; Enzymes used in cloning and their properties - Polymerases, Ligases; Restriction enzymes- classification, nomenclature, DNA modification of restriction site; Phosphatases, Kinases and Nucleases; Restriction mapping; Template DNA Preparation; Cloning Strategies- Homopolymer tailing, Linker and adopter DNA molecules. Method of creating recombinant DNA molecules and safety guidelines.

UNIT- II

Cloning Vehicles & DNA Libraries: Cloning vehicles: Essential features of cloning vectors, plasmid vectors- pUC 18/19, Blue script vectors - pBR322; Cosmids, Phagemids- M13 derived vectors, BACs, YACs, PACs, MACs - essential features and their use in construction of genomic library and cDNA library, expression vectors- Baculovirus expression vectors. Vectors for cloning genes in plants - CaMV and TMV. Blotting techniques- Southern, Northern, Western.

UNIT- III

PCR – A Powerful Tool: PCR and its applications including Environmental and Diagnostic; PCR Principle, methodology, designing of primers; Identification of PCR products; Analysis of PCR Products – Sequencing, Labeling & Purification; In vitro expression of PCR Products; PCR mutagenesis; RT-PCR, Multiplex PCR, Molecular markers, RFLP, RAPD, AFLP, VNTRs ; Gene chip and Microarray.

UNIT- IV

Cloning Methods & Applications: Cloning methods of PCR products into hosts (Prokaryotic & Eukaryotic) - Transformation, conjugation and Transduction; Particle Bombardment; Selection and screening of clone with desired gene.

Methods of gene sequencing: Maxam-Gilbert and Sanger's dideoxy chain termination method and automated sequencing. Applications of Gene cloning in medicine, Agriculture and animal husbandry.

Text books:

1. Gene manipulations, S.B. Primrose, R.W. Old.
2. PCR, MJ McPherson & SG Moller, BIOS Scientific Publishers Ltd.
3. Molecular Biotechnology, Bernard R.Glick, Jack J.Pasternak.

Reference Books:

1. Genetic Engineering, S.Mitra
2. Genes VIII, B.Lewin
3. Biotechnology, B.D.Singh.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-324 BIOREACTOR ENGINEERING L T P M
4 0 0 100

UNIT- I

Introduction to Reaction Kinetics: Types of reaction, order of reaction, the M-M constant, k_m .The effect of temperature on reaction rate. Rate equations and Reaction mechanisms; Interpretation of batch reactor data, constant volume batch reactor, integral method of analysis of data for reversible and irreversible reactions.

UNIT- II

Bioreactor Systems & Aseptic Transfers: Definitions, Differences and similarities between chemical and bioreactors, Steady state and unsteady systems, Classification of bioreactors.

Aseptic operation of a Reactor with Ancillary fittings like sampling point; Aseptic transfer of spore suspension; Transfer of inoculums from seed tank to fermentor. Thermal death kinetics of microorganisms; Batch and continuous heat sterilization of liquid media; Sterilization of air

UNIT-III

Designing of Bioreactors: Design equations for enzyme reactors, batch growth of microorganisms, Design equation of a plug flow reactor; Design of CSTR with washout concept;
Stirred tank reactors with recycle of biomass; Continuous stirred tank fermentors in series without and with recycle of biomass; Estimation of kinetic parameters.

UNIT- IV

Multiphase Bioreactors: Different types of reactors: Cell lift reactor, Multi purpose tower reactor, Liquid impelled loop reactor, Pumped tower loop reactor, Fluidized-bed reactor, Packed bed reactor, Bubble-column reactors, Airlift reactors.

Animal and plant cell reactor technology- Environmental requirements for animal cell cultivation, reactors for large-scale production using animal cells, plant cell cultivation.

Text Books:

1. Coulson & Richardson's Chemical Engineering, Volume-3, J.F. Richardson, J. H. Harker and J. R. Backhurst, 4th edition, Elsevier.
2. Chemical Reaction Engineering, Octave Levenspiel, 3rd edition, Wiley Eastern
3. Biochemical Engineering, Aiba &Humphrey

Reference Books:

1. Fundamentals of Biochemical Engineering, Bailey& Ollis
2. Biotechnology and Biochemical Engineering Hand Book, Atkinson & Mavituna
3. BioReaction Engineering, Kargi and Schuler

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-325 PLANT & ANIMAL BIOTECHNOLOGY

L	T	P	M
4	0	0	100

UNIT-I

Tissue Culture & Applications: Introduction to cell and tissue culture; Tissue culture media (composition and preparation); Plant Tissue Culture: Initiation and maintenance of callus and cell suspension culture, organogenesis, somoclonal variations, cybrids, haploid production and synthetic seeds.

UNIT-II

Plant Genetic Engineering: Gene transfer and cloning- Agarobacterium mediated; Types of plant vectors and their use in genetic manipulation; Herbicide tolerance; Insect resistance; Viral resistance; Development of disease resistance plants by introducing *Bacillus thuringenesis* genes. Plant Vaccines.

UNIT-III

Animal Cell and Tissue Culture: History and scope of animal cell and tissue culture; advantages and disadvantages of tissue culture; laboratory facilities for tissue culture; the substrate on which cells grow; treatment of substrate surfaces; Feeder layers on substrates; The gas phase for tissue culture; Culture media for cells and tissues; Cell culture procedures. Tissue culture (Slide, Flask and test tube cultures); Organ culture; Whole embryo culture, Tissue engineering (Artificial Skin and artificial Cartilage). Micro-carrier culture; Cell synchronization; Cell growth, growth factors and cell transformation.

UNIT-IV

Cell Lines, Cloning and Gene Transfer: Disaggregation (Enzymatic and Mechanical) of tissue and Primary culture; Culture cells and evolution of cell lines; Maintenance of cultures-Cell lines; Cloning of cell lines; Large scale cultures in Biotechnology; Somatic cell fusion; Gene transfer or Transfection (using Eggs and cultured stem cells); targeted gene transfer; Transgenic animals (Mice, Sheep, Pig, Rabbit, Goat, Cow and fish). Application of animal cell culture; Mammalian cell products; Viral vaccines produced from animal cell cultures.

Text Books:

1. Principles of Plant Biotechnology An introduction to Genetic Engineering in Plants, Mantal S.H. Mathews J.A., Mickee R.A., Blackwell Scientific publications.
2. Revolution in Biotechnology, Cambridge University Press.
3. Animal Biotechnology, Murray Moo-Young
4. General Virology, Luria & Darnell.

Reference Books:

1. Plant Genetic Engineering, Cambridge University Press.
2. Biochemistry, Stryer.
3. Molecular Biotechnology, B Click and JJ Pasternak,

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-326(A) **ELECTIVE – I :: VIOROLOGY**

L	T	P	M
4	0	0	100

UNIT- I

Introduction To Virology: Brief outline of Discovery of Viruses; Properties of Viruses; Morphology of Viruses- Structure, Capsid Architecture, Envelopes and peplomers; Chemistry of Viruses- Viral Proteins, Genome- Structure and Types; Study of sub viral agents- Brief account on Diseases caused by Viroids- PSTV, Cadang cadang; Prions- Scrape, Cruetzfeldy jakob. Satellite viruses; Satellite RNA's.

UNIT- II

Cultivation of Viruses: General Methods of cultivation of viruses- in Embryonated eggs, cultivation of animal and plant viruses; Isolation and purification of viruses- plant viruses, animal viruses; Criteria of purity, Maintenance and preservation of infectivity; Characterization of viruses- Elctron microscopy, X-ray crystallography, sedimentation analysis; Enumeration viruses- By electron microscopy, plaque assay, acid end point method, Haemagglutinin assay; Detection of viruses- By serological characterization, detection of viral antigen, detection of viral nucleic acid; chemical determination Ultra structure and life cycles of Bacteriophages- M13, Mu, T3, T4 & lambda

UNIT- III

Plant Viruses: Taxonomy; Symptoms of diseases caused by plant viruses (Morphological, Physiological and Histological); Ultra structure and life cycles of TMV and CaMV; transmission of plant viruses- Mechanical and biological (vector and non-vector); Basic control measures of plant diseases- vector and chemical control.

UNIT- IV

Human Viruses: Taxonomy; Ultra structure and brief account on life cycles of RNA viruses- Polio, Influenza, Measles, Rota virus and HIV; Ultra structure and brief account on life cycles of DNA viruses- Vaccina, HSV, Adeno, SV40 and Hepatitis Virus; Viral vaccines- types and preparation of conventional vaccines.

Text Books:

1. Introduction to Modern Virology, Dimmock N J, Primrose S B, 4th edition, Blackwell Scientific Publications, Oxford.
2. Medical Virology, Morag C, Timbury M, Chrchill Livingstone, London
3. Functionals of Plant Virology, Mathews RE, academic Press, San Diego.

Reference Books:

1. Text Book on Principles of Bacteriology, Virology and Immunology, Edward Arnold, London.
2. An introduction to viruses, S B Biswas, Amita Biswas

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-326(B) SPECTROSCOPIC ANALYSIS OF BIOMOLECULES L T P M

4 0 0 100

UNIT- I

Introduction To Spectroscopy and Infrared Spectroscopy: Interaction of radiation with matter, Definitions- Frequency, Wavelength, Wave Number; Types of Electromagnetic radiation; Interparticle forces and energies; energy levels; Population of energy levels, Scattering, Absorption and Emission. Measurement of Infrared spectrum; Physical basis of infrared spectra; Infrared of polyatomic molecules; Biological examples; Infrared of oriented samples.

UNIT- II

Ultraviolet & Visible Spectroscopy: Electronic energy levels; Electronic transitions; Selection regime, Absorption range of biological chromophores; Transition metal d-d transition; Charge transfer spectra; Application of UV spectra to proteins; Properties associated with the transition dipole moment and interaction between them, Measurement of molecular dynamics by Fluorescence spectroscopy.

UNIT- III

Nuclear Magnetic Resonance Spectroscopy: The Phenomenon; Magnetization-Measurement; Spectral Parameters in NMR, Intensity, Chemical Shift, Spin-spin coupling, T1 and T2 relaxation times, Line widths, Nuclear over Hauser effect, Chemical exchange paramagnetic centers, Applications of NMR in Biology, assignment in NMR, Studies of Macromolecules, Ligand binding, Ionization studies and pH kinetics, Molecular Motion.

UNIT- IV

Electron Paramagnetic Resonance Spectroscopy: Introduction- Resonance condition; Measurement- Spectral Parameters; Intensity g values; Spectral Anisotropy, Time scale of EPR, Spin labels, Transition metal ions, Spin trapping.

Text Books:

1. Biological Spectroscopy, Campbell ID, Dwek RA, Benjamin Cummins and Co., 1986.
2. Physical Chemistry, Atkins PW, Oxford IV edition, 1990.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-326 (C) **METABOLIC ENGINEERING** **L T P M**
4 0 0 100

UNIT- I Metabolic Engineering: Metabolic Engineering- Importance; Review of Cellular Metabolism- Transport processes, Fueling reations, Biosynthetci reactions, Polymerization, Growth Energetics; comprehensive Models for cellular reactions; Material Balances and Data consistency; Regulation of Metabolic pathways- regulation of enzyme activity, enzyme concentration, global cell level, metabolic networks.

UNIT- II Metabolic Pathway Manipulations: Enhancement of product yield and productivity; extension of substrate range; Extension of product spectrum and novel products; Improvement of cellular properties; Xenibiotic degradation; Metabolic pathway synthesis Algorithm, Case study-Lysine Biosynthesis.

UNIT- III Metabolic Flux Analysis (MFA): MFA- Theory, over-, under-determined systems, Sensitivity analysis; Methods for experimental determination of metabolic fluxes by Isotope Labeling; Applications of Metabolic Flux Analysis- Lysine biosynthesis in *C. glutamicum*; Validation of Flux estimates by ^{13}C labeling studies.

UNIT- IV Metabolic Control Analysis (MCA): MCA- fundamentals, flux coefficients determination, linear and branched pathways; Analysis of structure of metabolic networks, case study- Aromatic amino acid biosynthetic pathway; Flux analysis of metabolic networks- Bottom-Up approach, Bottom-Down approach, case study; Control analysis to intermetabolite reaction group, Flux optimization.

Text Books:
1. Metabolic Engineering- Principles and Methodologies- G.N.Stephanopolous, A.A. Aristidou, J.Nielsen, Elsevier.
2. Advances in Biochemical Engineering and Biotechnology- Volume 73 (Metabolic Engineering), Springer.

Reference Books:
1. Metabolic Engineering- Sang Yup Lee, E. Terry Papoutsakis, Marcel Dekker, 1999
2. The metabolic pathway engineering handbook , Part 1- D Smolke Christina, Christina D. Smolke, CRC Press, 2010

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-326(D)	GENE THERAPY	L	T	P	M
		4	0	0	100

UNIT-I

Introduction To Gene Therapy: General principles of Gene Therapy. Diseases that could be treated by gene therapy. Current Clinical trials study of SCID, Parkinson Disease and AIDS. DNA–based gene therapy.. Reporter genes and their significance in Gene therapy. *Ex vivo* and *In vivo* Gene Therapy.

UNIT-II

Gene Delivery Methods and Targetting: Gene Delivery Methods-Viral and Nonviral. Mechanical methods of delivery. Gene delivery to skin, use of liposomes as drug delivery system. How to target vector to the particular cell. Tissue specific promoters. Vectors as ligands for cellular receptors.

UNIT-III

Gene Therapy and Diagnostic Aids: Disease prevention by vaccines (DNA vaccines), Disease diagnosis probes, Monoclonal antibodies, interferon- application in Disease Diagnosis, Antisense Nucleotides Technology- Gene Silencing, RNAi and Ribozyme as therapeutic agents, Disease targets, Augmentation therapy.

UNIT-IV

Gene Therapy and Pharmacokinetics: Cancer gene therapy & Pharmacokinetics of Gene. Genetic Pro-drug Activation Gene Therapy. GT methods to overcome chemotherapy resistance of tumors. Biological response modifiers. Oncolytic virus- based strategies of tumor treatment.

Text Books:

1. Pharmaceutical biotechnology, Purohit, Kulkarni, Saluja, Agrobios.
2. Drug delivery and targeting, Hillery
3. Controlled and novel drug delivery, Jain
4. Drug Delivery, M. Salztman
5. Gene Therapy and Gene Delivery Systems, D. Schaffer and W. Zhou

Reference Books:

1. The basic science of gene therapy, Mulligan-1993 Science,
2. Drug discovery and design, AP publisher
3. Comprehensive biotechnology, Vol.3, Murray Moo, Young, Permagon Press

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-361	BIOPROCESS LABORATORY-I	L	T	P	M
		0	0	3	100

1. Preparation of Buffers.
2. Effect of pH on enzyme activity.
3. Effect of Temperature on enzyme activity.
4. Effect of substrate concentration on enzyme activity.
5. Effect of time interval on enzyme activity.
6. Evaluation of enzyme kinetic parameters (Michaeli-Menten approach)
7. Kinetic studies of enzyme inhibition.
8. Deactivation kinetics
9. Enzyme/cell immobilization
10. Determination of growth curve of a supplied microorganism and to determine substrate degradation profile.
11. Estimation of growth kinetic parameters (Monod's approach).
12. Growth of *E.coli DH5α* in batch culture.
13. Fed batch culture techniques
14. Formulation of simple and complex culture media for fermentations.
15. Bioreactor instrumentation and control.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-362	BIOINFORMATICS LABORATORY	L	T	P	M
		0	0	3	100

1. Searching Bibliographic databases for relevant information.
2. Sequence retrieval from DNA & Protein databases.
3. Pair wise comparison of sequences- EMBOSS.
4. Sequence similarity tools- BLAST & FASTA
5. Multiple Sequence Alignment & Phylogenetic Analysis- CLUSTAL
6. Protein Databank retrieval and visualization.
7. Structure Exploration of Proteins.
8. Restriction Mapping.
9. Identification of Genes in Genomes.
10. Primer Design.
11. Proteomic studies.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-363 GENETIC ENGINEERING LABORATORY

L	T	P	M
0	0	3	100

1. Isolation & visualization of Genomic DNA from bacteria
2. Isolation & visualization of Genomic DNA from animals
3. Isolation & visualization of Genomic DNA from plants
4. Isolation & visualization of RNA from yeast.
5. Isolation of amylase from saliva and sweet potato.
6. Isolation & visualization of plasmids on agarose gels.
7. Restriction mapping of DNA fragments
8. Transformation, screening for recombinants.
9. Western blotting technique.
10. Isolation of proteins by Paper, Agarose, PAGE, SDS- PAGE & staining by silver staining, Coomassie brilliant blue staining
11. Cloning& screening methods for clones.
12. Amplification of DNA fragments by Polymerase Chain Reaction (PCR).
13. Analysis of Recombinant Proteins using PAGE.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-411 INTELLECTUAL PROPERTY RIGHTS & BIOETHICS

L	T	P	M
4	0	0	100

UNIT- I

Intellectual Property Rights: Introduction, forms of Intellectual property, international & regional agreements/ treaties in IPR; IPR related Legislations in India; IPR and Agricultural Technology- implications in India and other developing countries; GATT, TRIPS, and WIPO;

UNIT- II

Patents and Patent processing: Introduction, Essential requirements, Patent application, Procedures and granting, Patent search, PCT, UPOV, Patents in Biotechnology and controversies involved.

UNIT- III

Other IPR issues:

Trade Secrets, Copy Rights, Trade Marks and their legal implications; Farmer's Rights, Plant Breeder's rights; Traditional knowledge and their commercial exploitation and protection.

UNIT- IV

Bioethics: Stem cell research and ethical issues; Ethical issues in use of animals in research and testing; ethical issues in research involving human participants; Protecting Genetic Privacy; Gene testing – Pros & Cons. Human Cloning & Human Dignity – an ethical enquiry; Ethical, Legal and Social Issues (ELSI) concerning recent advancements in key areas of biotechnology- pre-natal diagnostics.

Text Books:

1. Bioethics and Biosafety- M.K.Sateesh, I.K. International, New Delhi.
2. Intellectual property rights on Biotechnology, Singh K, BCIL, New Delhi
3. Biotechnologies in developing countries present and future, Sasson A, UNESCO Publications.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-412	DOWN STREAM PROCESSING	L	T	P	M
		4	0	0	100

UNIT- I

Role of Downstream Processing In Biotechnology: Role and Importance of Downstream Processing in Biotechnological Processes; Characterization of Bio Processes, Biomolecules and fermentation broths; Recovery in modern versus classical biotechnology; Selection of operations in separation processes; Characteristics of Bioseparations; Chemical, Physical, and Biochemical concepts in Isolation and purification of proteins; Few case studies.

UNIT- II

Primary Separation and Recovery Processes: Cell Disruption methods for intracellular products- Mechanical methods and Chemical treatment; Removal of Insolubles- biomass (and Particulate debris) separation techniques; Flocculation and Sedimentation of biological solutions; Design of industrial Centrifuges and Filtration equipment.

UNIT- III

Product Enrichment Operations: Membrane-based separations- Principles of Micro-filtration, Ultra-filtration, Dialysis, Electro dialysis, Reverse Osmosis, Pervaporation; Theory, design and configuration of membrane separation equipment, Applications; Aqueous Two-phase extraction of proteins; Precipitation of proteins with salts and organic solvents; Adsorption processes- introduction, types, isotherms.

UNIT- IV

Product Purification and Polishing: Chromatographic separations- Principles; Elution Chromatography, Ion exchange chromatography & Chromatofocusing; RPC, HIC, IMAC, Bio-affinity Chromatography; Electrokinetic methods of Separations; Final Product Polishing- Crystallization and Drying of biological materials, Lyophilization; Formulation Strategies.

Text Books:

1. Bioseparations- Principle & Techniques, B.Sivasankar, PHI
2. Separation processes in Biotechnology, J M Asenjo, Marcel-Dekker.

Reference Books:

1. Product Recovery in Bioprocess Technology, BIOTOL series, Butterworth Heinmann.
2. Bioseparations-Downstream Processing for Biotechnology, Paul A Belter, E L Cussler,
3. Wei-shou Hu, Wiley Interscience Publications.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-413 BIOPROCESS ECONOMICS & PLANT DESIGN

L	T	P	M
4	0	0	100

UNIT- I

Economic Evaluation: Capital cost of a project; Interest calculations, nominal and effective interest rates; basic concepts in tax and depreciation; Measures of economic performance, rate of return, payout time; Cash flow diagrams; Cost accounting-balance sheet and profit loss account; Break even and minimum cost analysis.

UNIT- II

Bioprocess Economics: BioProducts regulations; Economic analysis of bioprocess; Capital, overhead and manufacturing costs estimation; Case studies of antibiotics, recombinant products, single cell protein, anaerobic processes and other fine chemicals.

UNIT- III

Introduction To Plant Design: Process design development: design procedures, design information and flow diagrams, material and energy balances, comparison of different process and design specifications; Optimization; General design considerations: Health and safety hazards, Environment protection, plant location and plant layout, plant operation and control;

UNIT- IV

Basic Design Problems: Design examples on continuous fermentation, aeration, and agitation; Design calculation of filter for air sterilization; Design of batch and continuous sterilizers; Design calculations for immobilized enzyme kinetics; Practical considerations in designing of Bioreactor/Fermentor construction. Introduction to different types of valves, pumps, steam traps, spargers and impellers used in fermentation industries; Design exercise on trickle flow fermentor; Problems associated with design equations.

Text Books:

1. Plant design and Economics for Chemical Engineers-Peters& Timmerhaus
2. Biochemical Engineering, Aiba &Humphrey
3. Biochemical Engineering, Harvey W Blanch

Reference Books:

1. Fundamentals of Biochemical Engineering-Bailey & Ollis
2. Biochemical Engineering, Atkinson

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-414	PROTEIN ENGINEERING	L	T	P	M
		4	0	0	100

UNIT-I

Basic Structural Principles: Amino acids-their structure and physicochemical properties; Peptide units as building blocks- importance of cysteines, Glycine and metal atoms in protein structure; Protein secondary structural elements, Ramachandran plot; Motifs-coiled coil, four helix bundle with examples; β-strands – hair pin β, β-α- β, Greek key, Jelly roll; Protein folding-non-covalent forces involved in protein folding.

UNIT-II

Protein Structural Classes Protien structural classes- α domain structure-myo and hemoglobins (globin fold); Geometric considerations in α helix packing; Evolutionary significance of hydrophobic core; Sickle cell hemoglobin. α/ β structures-pyruvate kinase, carboxypeptidase; β structures – Neuraminidase, γ-crystallin, hemagglutinin; Chaperones involved in protein folding; Dynamic aspects of protein structure; methods for detection, purification and characterization of proteins; Study of protein structure and organization.

UNIT – III

Structure & Functional Relationship of Proteins: DNA binding proteins, prokaryotic and Eukaryotic transcription factors, DNA polymerases, membrane proteins and receptors, bacterio rhodopsin, photosynthetic centers, A brief description of of epidermal growth factors, insulin and PDGF receptors and their interaction effectors, immunoglobulins, nucleotide binding proteins, serine proteases, Ribonucleotide reductase, Lysozyme;

UNIT – IV

Protein Design, Engineering and Targeting: Design and synthesis of peptides, applications of peptides in biology; Examples of engineered proteins- insulin and antibodies; protein degradation and turn over; Intracellular digestion of proteins in lysosomes; Signal sequences in protein targeting; SRP; Mechanism of targeting – Cytosolic proteins, Membrane bound proteins and Secretory proteins; Post translational modifications-phosphorylation and Glycosylation; Protein targeting in Bacteria, Mitochondria and Chloroplast of eukaryotes.

Text Books:

1. Introduction to Protein Structure, Carl Branden and John Tooze, 2nd edition
2. Biochemistry, TM Devlin 5th Edition

Reference Books:

1. Biochemistry, Lubert Stryer 4th Edition
2. Proteins, Creighton

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-415 (A)	ELECTIVE – II (OPEN ELECTIVE)	L	T	P	M
		4	0	0	100

Refer Annexure

BT-416 (A) ELECTIVE – III GENOMICS & PROTEOMICS

L	T	P	M
4	0	0	100

UNIT- I

Genome Organization: Genome organization- Prokaryotic genome; Prokaryotic gene structure and Eukaryotic genome; Eukaryotic gene structure. Repetitive DNA (Junk DNA), Transposable elements and their implication, genome variation.

UNIT- II

Genome Mapping Techniques: Genome mapping-physical and genetic maps. Top down and bottom up approach; linking and jumping of clones. Placing small fragments on maps; STS assembly; gap closure; pooling strategies; Cytogenetic mappping techniques.

UNIT-III

Gene Sequencing & Prediction & Expression: Sequencing DNA, Genome Projects of Microbes and higher organisms- Plant, Animal and Human; Gene prediction- Intrinsic & extrinsic, codon bias, pattern recognition, laboratory based approaches, Feature- based approaches, homology based approaches and statistical and HMM based approaches.
Methods of studying Gene Expression; DNA and protein Micro arrays- Basics and application, SAGE.

UNIT- IV Proteomics

Pharmacogeomics; Single Nucleotide Polymorphism; Disease Genes and their identification; Technologies used in proteomics study- 2D gel electrophoresis; Isotope coded affinity tags; Mass spectrometry-principles of MALDI-TOF; Electrospray ionization (ESI); Tandem mass spectrometry (MS/MS); peptide mass fingerprinting. Protein-protein interactions.

Text Books:

1. Genomics and Proteomics-Functional and Computational Aspects, S Sahai, Plenum Publications, 1999.
2. Biotechnology and genomics, P.K.Gupta.

Reference Books:

1. Genomics, Cantor& Smith, John Wiley & sons,.
2. Proteomics, Pennington & Dunn, BIOS Scientific publishers,
3. Introduction to proteomics, Liebler, Humana press.
4. Functional genomics- Hunt & Livesey, oxford university press
5. Principles of genome analysis & genomics, Primrose & Twyman, Blackwell publishing Co.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-416 (B) ELECTIVE – III :: CANCER BIOLOGY

L	T	P	M
4	0	0	100

UNIT- I

Fundamentals of Cancer Biology: Regulation of cell cycle, Mutations that cause changes in signal molecules, Effects on receptor, Signal switches, Tumor suppressor genes, Modulation of cell cycle in cancer, Different forms of cancer, Diet and cancer.

UNIT- II

Principle S of Carcinogenesis: Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-ray radiation- mechanism of Carcinogenesis.

UNIT- III

Principles of Molecular Cell Biology of Cancer: Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, Detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes. Oncogenes / Proto Oncogene activity. Growth factors related to transformations.

UNIT- IV

Cancer Metastasis and Treatment: Clinical significance of invasion, Heterogeneity of metastatic phenotype, Metastatic cascade, Basement Membrane disruption, Three-step theory of invasion, Proteinases and tumor cell invasion.
Different forms of therapy- Chemotherapy, Radiation therapy. Detection of cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

Text Book:

1. An Introduction to Cellular and Molecular Biology of Cancer- Oxford Medical Publications.

Reference Books:

1. Virology-A practical approach, Maly B.W.J., IRL Press, Oxford.
2. Introduction to Modern Virology, Dunmock N.J and Primrose.S.B., Blackwell scientific Publications. Oxford.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-416 (C) ELECTIVE – III :: NANOBIOTECHNOLOGY

L	T	P	M
4	0	0	100

UNIT- I

Introduction to Bio/Nanomaterials: Course Outline and Terminology, Biomaterials and their Properties, Nanomaterials and their Properties, DNA Technology.

UNIT- II

Micro/Nano Fabrication and Detection: Micro Fabricated Biosensors, Cell patterning and Micro fabricated Cell Culture Systems, Cell Mechanotransduction.

UNIT- III

Nanomedicine: Micro and Nanoelectromechanical systems in medicine and surgery, Molecular Imaging.

UNIT-IV:

Cell and Bionano Engineering–Applications: Tissue Engineering and Artificial cells, Micro and Nano for Cell Biology, Smart Drug, Nan biosensor, Nanotechnology in Cancer

Texts Books:

1. Nanoscale Technology in Biological Systems, R. S., Prinz, F. B., and Smith, R. L. (eds.) CRC Pres, ISBN:0849319404.
2. Nanotechnology A Gentle Introduction to the Next Big Idea, Ratner, M. and Ratener, D., Prentice Hall, ISBN:

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-416(D) ELECTIVE- III:: ENVIRONMENTAL BIOTECHNOLOGY L T P M

4 0 0 100

UNIT- I

Biological Waste Water Treatment: Biological processes for domestic and industrial waste water treatment; Aerobic systems- Activated sludge process, trickling filters, Biological filters, Rotating biological contactors (RBC), Fluidized bed reactor (FBR), Expanded bed reactor, Inverse fluidized bed biofilm reactor (IFBBR), Packed bed reactors, Air sparged reactors; Anaerobic biological treatment- contact digesters, Packed column reactors, UASB.

UNIT- II

Bioremediation: Introduction; Constraints and priorities of Bioremediation, Biostimulation of naturally occurring microbial activities; Bioaugmentation; Insitu, Exsitu, Intrinsic and Engineered Bioremediation; Solid phase bioremediation- Land farming, Prepared beds, Soil pipes, Phytoremediation, Composting, Bioventing and Biosparging; Liquid phase bioremediation- suspended bioreactors, Fixed biofilm reactors.

UNIT- III

Metal Biotechnology and Biofuels: Mining and metal biotechnology; Microbial transformation; Accumulation and concentration of metals; Metal leaching; Extraction and future prospects.

Microorganisms and energy requirements of mankind; Production of non-conventional fuels- Methane (Biogas); Hydrogen Alcohols and Algal Hydrocarbons. Use of Microorganism in augmentation of petroleum recovery.

UNIT- IV

Hazardous Waste Management: Introduction- Xenobiotic compounds; Recalcitrants- hazardous wastes- Biodegradation of xenobiotics; Biological detoxification- market for hazardous wastes management; Biotechnology application to hazardous waste management; Examples of biotechnological applications to hazardous waste management; Cyanide detoxification; Detoxification of oxalate, Urea, etc.; Toxic organics- Phenols.

Text Books:

1. Environmental Biotechnology, S.N. Jogdand, Himalaya Publishing House
2. General Microbiology, Stanir R Y, Ingraham J L, Wheelis ML & Painter RR, McMillan publications.
3. Environmental Biotechnology, Foster CF, John Ware DA, Ellis Horwood Ltd.

Reference Books:

1. Biotechnology and Biodegradation, Advances in Applied Biotechnology series Vol-4, Karnely D, Chakrabarthy, Omen GS, Gulf publications Co., London.
2. Bioremediation Engineering: Design and Application, John T, Cookson Jr., McGraw Hill, Inc.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-451	MINI PROJECT	L	T	P	M
		0	0	3	100

Purpose

The Term Paper helps to supplement the final year Project Work of the B.Tech. students. It helps to identify their Research area/topic and complete the groundwork and preliminary research required for it comfortably. It trains the students to make use of Research Tools and Material available both in print and digital formats.

Procedure

The topic of Term Paper is chosen from the B.Tech. curriculum. Based on the topic a hypothesis is to be made by the student. The hypothesis may be a null hypothesis also. The students are then required to collect literature and support information for their term paper from Standard Reference Books, Journals, and Magazines- both printed and online. Each student should refer to a minimum of 5 reference sources outside their prescribed text books. The students also present their papers with the help of Power Point slides/ OHP.

The Term Paper contains

- The Aim and Objective of the study
- Rationale behind the study
- Literature Review
- Hypothesis and Discussion
- Conclusion
- Bibliography
- Appendix with support data (Illustrations, Tables, Graphs, etc.)

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-452 CHEMICAL ENGINEERING LABORATORY –II

L	T	P	M
0	0	3	100

1. Diffusion of organic vapor in air
2. Liquid- liquid diffusivity
3. Surface evaporation
4. Wetted wall column
5. Simple distillation
6. Steam distillation
7. Packed bed distillation
8. Liquid- liquid equilibrium
9. Liquid- liquid extraction
10. Vapor liquid equilibrium
11. Batch reactor
12. Continuous stirred tank reactor
13. Saponification in a tubular reactor
14. Mixed flow reactors in series
15. Temperature dependency
16. Flow control system
17. Level control system
18. Temperature control system

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-453	BIOPROCESS LABORATORY – II	L	T	P	M
		0	0	3	100

1. Sterilization techniques and thermal death kinetics
2. Medium optimization: Plackett-Burman design.
3. Studies on batch reactor.
4. Estimation of kinetic parameters in Chemostat.
5. Kinetic studies on fed-batch fermentation.
6. Estimation of residence time distributions.
7. Determination of volumetric mass transfer coefficient by dynamic gassing out technique.
8. Determination of volumetric mass transfer coefficient by sulphate oxidation technique.
9. Study of the rheological parameters in fermentation broths.
10. Determination of power number.
11. Studies on immobilized enzymes/cells in packed bed reactor.
12. Studies on immobilized enzymes/cells in fluidized bed reactor.
13. Kinetic studies in air lift fermentor.
14. Design exercises on fermentors.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-421	INDUSTRIAL MANAGEMENT & ENTERPRENURESHIP DEVELOPMENT	L	T	P	M
		4	0	0	100

UNIT- I

Forms of Business Organization and Marketing Management and General Management: Salient features of Sole Proprietorship, Partnership, Joint Stock Company; Private Limited and Public Limited companies; Cooperative and Government owned companies; Merits and Demerits of above types; Functions of Marketing; Concepts of Selling and Marketing-Difference; Market Research; Product pricing; Distribution channels; Marketing mix (4 **P**s); Advertising and sales promotion; Product life cycle.
Management definition, functions of management and principles of management

UNIT- II

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

UNIT- III

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

UNIT- IV

Entrepreneur Development- Ii: Project Report and Techno economic feasibility assessment; Project identification for planning, project formulation; Project appraisal-Financial and environmental; Small scale industries- Role of SSI, Growth and Performance of SSIs in India. Reasons for sickness in SSIs; Steps to be taken for minimizing sickness in SSIs; Scope for self employment of Engineers.

Text Books:

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

Reference Books:

1. Operations Management, Joseph G Monk.
2. Production, Planning and Control, Samuel Eilon.
3. Marketing Management, Phillip Kotler.
4. Financial Management I.M.Pandey.
5. Projects, Prasanna Chandra.
6. The Essence of Small Business, Barrow colin.

7. Small Industry Ram K Vepa.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-422	FOOD BIOTECHNOLOGY	L	T	P	M
		4	0	0	100

UNIT- I

Food Processing and Preservation: Biotechnology in relation to the food industry; Nutritive value of the food; Types of Microorganisms associated with food, its sources, types and behavior in foods. Food colors and Flavors, Enzymes and chemicals used in food processing; food Preservation

UNIT- II

Fermented Food Products: Microbial culture used in Food Industry; Bioprocessing and fermentation of meat, vegetables & Fruits, dairy products, cereals, legumes, and nuts, Beverages, carborated non-alcoholic beverages and related products of baking.

UNIT- III

Food Spoilage and Food Microbiology: Food Spoilage, Food borne illness; Food Quality & Quality control; HFCS (High Fructose Corn Syrup), Mycoprotiens and Single cell Protein production, Genetically modified foods.

UNIT- IV

Food Processing Operations: Food engineering operations: Characteristics, Cleaning, Sorting and Grading of Food Raw Materials; Food Conversion operations: Size reduction, Mixing, Emulsification, filtration, membrane separation, Centrifugation, extraction and Crystallization; Microwave heating, Thermal inactivation of microorganisms, Freezing and thawing of foods.

Text Books:

1. Biotechnology: Food fermentation, V.K Joshi & Ashok Pandey
2. Food Processsing and preservation, B.Sivasankar

Reference Books:

1. Food Biotechnology, Roger Angold, Gordon Beech & Taggart.
2. Basic Food Microbiology, George J Banward, CBS publishers.
3. Modern Food Microbiology, James M Jay, CBS publishers.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-423	PHARMACEUTICAL BIOTECHNOLOGY	L	T	P	M
		4	0	0	100

Unit- I Fundamentals of Pharmacy Practice

Pharmacy- Basic considerations, Origin of Pharmaceutical Biotechnology- Importance and future aspects. Drug education and Drug Regime, Drug development process. Source of Drugs. Production of recombinant proteins- Insulin, Interleukin, Interferons; Production of Vaccines and Antibodies.

Unit- II Pharmacokinetics and design of CTDD

ADME properties- Mechanism of Drug Absorption, Distribution of drugs, Drug metabolism (Biotransformation of drugs), Excretion of drugs, Pharmacokinetics, Drug Interactions and Adverse Drug Reaction. Controlled Release Medication- Design and Drug release patterns and significance. Controlled drug delivery systems- Oral, Parenteral, Transdermal, Ophthalmic, Intravaginal and Intrauterine Drug Delivery systems.

Unit- III Pharmaceutical dosage forms

Materials, methods of formulation & Quality control Tests for Tablets, Capsules, Parenteral formulations, ophthalmic, Oral liquids, Emulsions, Aerosols, and Ointments. Packing and packaging techniques. Blood products and plasma substitutes.

Unit-IV Pharmacotherapeutics

Pharmacology of Opoid and Non-Opoid Analgesics (NSAIDS), Drugs acting on Central Nervous System and Cardiovascular System, Gastrointestinal System, and Urinary System, Hormone, Hormone antagonists and Hormone Replacement Therapy, Anesthetics and Antidiabetic drugs.

Text Books:

1. **Biopharmaceuticals, Biochemistry & Biotechnology** – Garry Walsh
2. **Biopharmaceutics and Pharmacokinetics - A Treatise**- DM Brahmankar, Sunil B Jaiswal
3. **The Theory and Practice of Industrial Pharmacy**- Leon Lachman, Libermann.
4. **Essential of Medical Pharmacology** – K.D. Tripathi

References:

1. **The Science and Practice of Pharmacy (Vol. I & II)**- Remington.
2. **Indian Pharmacopeia**

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-424(A) ELECTIVE-IV :: MOLECULAR MODELING & DRUG DESIGN

L	T	P	M
4	0	0	100

UNIT- I

Empirical Force Fields and Molecular Mechanisms: Bond Stretching- Angle bending- Torsional I terms; Out of plane; Bonding Motions; Electrostatic interactions; Vander Walls interactions; Effective pair potentials; Hydrogen Bonding; Simulation of liquid water.

UNIT- II

Computer Simulation Methods: Calculation of thermodynamic properties; Phase space; Practical aspects of computer simulation; Boundaries monitoring Equilibrium; Long range process; Analyzing results of simulation and estimating errors.

UNIT- III

Molecular Dynamics Simulation Methods: Molecular Dynamics using simple modules; Molecular Dynamics with continuous potentials; Running Molecular Dynamics Simulation; Constant Dynamics; Time dependent properties; Molecular Dynamics at constant temperature and pressure.

UNIT- IV

Monte Carlo Simulation Methods: Metropolis methods; Monte Carlo simulation of molecules; Monte Carlo simulation of Polymers; Calculating Chemical potentials; Monte Carlo simulation of molecular dynamics.

Text Books:

1. Molecular Modeling Principles and Applications, AR Leach, Longman, 1996.
2. Molecular Dynamics Simulation- Elementary Methods, John Wiley and Sons, 1997.

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-424(B) BIOPROCESS MODELING AND SIMULATION

L	T	P	M
4	0	0	100

UNIT – I

Concepts of Modeling and Simulation: Modeling- Introduction, Metabolic structure, Balance equations, Mass Balances, Stoichiometric relations, Elemental balances, NAD(P)H, ATP balances, Limiting steps, Reactor and measurement Equations; Introduction- Simulation, Continuous Processes, Parameter Estimation, Model Verification, Decomposition, Model Discrimination; Optimization- Static, Dynamic.

UNIT – II

Modeling and Simulation In Biological Reaction Engineering: Mathematical models, Digital Simulation- examples; Unstructured growth model with bottle-neck kinetics; Model extension for Diauxic growth; Model of a control system for Dissolved oxygen; Modeling and Simulation of a pH-dependent bioprocess- Enzymatic conversions; state and parameter estimation in bioreactors.

UNIT – III

Modeling of Waste Treatment System: Neural Networks- Introduction, Theory; Use of Neural Networks in the Analysis and Prediction of Activated Sludge process; Biofilm and Anaerobic Reactors.

UNIT – IV

Modeling of Bioprocess System: Bioreactor analysis and Bioprocess modeling; Modeling of Upstream and Downstream processing; Structured model applications; Enzyme Reaction kinetics in aqueous and non-aqueous phases and yields; Cost evaluation of Xanthan Biopolymer.

Text Books :

1. Process Computations in Biotechnology, T.K.Ghose, TMH publishing company Ltd.
2. Process Modeling simulation and control for chemical engineers, W.L.Luyben, 2nd edition. McGraw Hill.

Reference Books:

1. Process Dynamics : Modeling, Analysis and simulation, B.W.Bequette, Prentice Hall
2. Computational Methods for Process Simulation, W. Fred Ramirez (Betterworthus Series in Chemical Engineering)

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-424 (C) CREATIVITY, INNOVATION & NEW PRODUCT DEVELOPMENT

L	T	P	M
4	0	0	100

UNIT- I

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

UNIT- II

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

UNIT- III

New Product Development and Planning: Research and new product development; Patent- Patent search; Patent laws; International codes for patents; Intellectual Property Rights (IPR).

Design of Proto type, Testing, Quality standards; Marketing research; Introducing new concepts-GMP.

UNIT- IV

Laboratory: Creative Design, Model Preparation, Testing; Cost evaluation; Patent application; Good Laboratory Practice (GLP).

Text Books:

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

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-424(D) BIOMEDICAL ENGINEERING

L	T	P	M
4	0	0	100

UNIT - I

Biomaterials: Introduction - Material Science and Classes of Materials used in Medicine: Polymers, Metals and Plastics, Ceramics. Treated Natural Materials, Tissue Reaction. Sterilization of Biomaterials. Steam Sterilization. Ethylene Oxide Treatment, Gamma Irradiation, Formaldehyde Treatment. Mechanical Properties of Materials - Experimental Stress Analysis and Material Testing. Tissue Reactions and Blood Compatibility. Practical Aspects of Biomaterials - Cardio Vascular Implants.

UNIT II –

Biomechanics: Scope of Mechanics in Medicine - Orthopaedics, Cardiology, Exercise Physiology, Surgery, Biomechanics in Orthopaedics - Principles, Joints, Fracture, Internal and External Fixation, Prosthetic Design. Biomechanics of Degenerative Disorders, Gait Analysis, Biofluid Mechanics, Biomechanics and Accident Investigation.

UNIT III –

Analytical and Diagnostic Equipments for Blood: Blood Flow meters- different types – cardiac output measurement- different techniques – pulmonary function analysers – spirometers –Electrophoresis and applications of Electrophoresis. Blood gas analysers – pH measurement pCO3 measurement pO3 measurement – oximeters- Blood cell counters- methods- Coulter Counters- automatic recognition and differential counting- audiometers.

UNIT IV

Analytical and Diagnostic Equipments for Heart: ECG recorders - Generation of ECG wave form and its physical correlations. Detection, amplification and recording of ECG. Detection of arrhythmias. Ambulatory ECG. Basics of vector cardiograph. Principles of Electromyographs - Detection and applications - Measurement principles of Electro encephalography and applications.

Text Books:

1. Bio-materials – Science, J.B.Park
2. Biomechanics Engineering, Sahay and Saxena Plenum Press 1984.
3. Biomechanics of Medical Devices, D N Ghista , Macel Dekker , 1982
4. Handbook of Bio-Medical Instrumentation, Khandpur R S, Tata McGraw Hill

Reference Books:

1. Biomedical Engineering and Instrumentation, Joseph Bronzino, PWS Engineering, Boston
2. Medicine & Clinical Engineering, Jacobson & Websler
3. Biomedical Instrumentation and Measurements, Leslie Cromwell

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT 461	DOWN STREAM PROCESSING LABORATORY	L	T	P	M
		0	0	3	100

1. Cell Disruption by Sonication.
2. Cell Disruption by Enzymatic Reaction.
3. Micro filtration.
4. Ultra filtration.
5. Aqueous Two-phase Extraction.
6. Dialysis.
7. Ammonium Sulphate Precipitation.
8. Isoelectric Precipitation.
9. Ion Exchange Chromatography.
10. Affinity Chromatography.
11. High Pressure Liquid Chromatography.
12. Gas Chromatography.
13. Adsorption Chromatography.
14. Gel Exclusion Chromatography.
15. Crystallization.
16. Freeze Drying.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT 462	PROJECT WORK	L	T	P	M
		0	0	15	200

In the final semester of B.Tech. (Biotechnology) curriculum, every student has to carry out a Project Work in the relevant and/or applied areas of Biotechnology. In this context, students will have significant (but not unlimited) flexibility and freedom of choice in the selection of specific research area/topic. Depending on the student(s) interest, there may be individual/team projects, and each team comprises maximum of Three (3) students.

Before going in to the genera requirements for a project and guidelines for report preparation, students are urged to note that BT 462 is a 12 hours per week practical subject, as such, a student is expected to devote about 150 hours towards the project work. Out of the 13 weeks available in the final semester, the first week is spent in making project allocation. Thus, the student(s) get only 12 weeks for working on the project, including the submission of the final report. Accordingly, they may use the following weekly schedule as a framework for their preparation:

Week – 1 : Preliminary Reading
Week – 2 : Basic plan of attack
Week – 5 : Standardizing the methodology
Week – 7 : Analyzing the results
Week – 9 : Basic plan of report
Week – 10 : Drafting the report

For different projects the scheduling might be very different, e.g., more theory-oriented projects would require a lot more reading and probably much less writing. Your supervisor wills advise you on how expectations differ in your particular project.

Completing the project should entail the following genera requirements:

- Identifying the research area to work in, selecting the topic, and understanding the scope of the project.
- Deciding on the technique/process/product to be carried out.
- Finding and collecting information relevant and appropriate to the topic (Literature Review).
- Analyzing and interpreting the selected information.

- Planning and designing the work.
- Producing the project report at the end of semester.

- In general, Project Reports should
- Communicate conceptual understanding of the Biotechnological Problem/ topic that student has chosen,
- Clearly demonstrate the techniques/ principles/ methodology/ process/ design part, and
- Describe in general terms/ tests, which have been performed in an attempt to validate the correct operation of Project solution.

At the end of semester, each student has to present the work to an expert committee for awarding the (external) marks. However, the Sessional marks will be awarded as per the University regulations.

Note:
L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

ANNEXURE

BT-415 (A)	ELECTIVE – II (OPEN ELECTIVE) BIOSENSORS & BIOELECTRONICS	L	T	P	M
		4	0	0	100

UNIT- I

Introduction: Introduction to Biosensors, Advantages and Their Limitations, Various components; Biocatalysis based biosensors, Bioaffinity based biosensors and Microorganisms based biosensors; Biologically active material and analyte; Types of membranes used in biosensor constructions.

UNIT- II

Transducers in Biosensors and Applications of Biosensors: Various types of transducers; Principles and applications- Colorimetric, Optical, Potentiometric, Amperometric, Conductometric, Resistometric, Piezoelectric, Semiconductor, Impedimetric, Mechanical and Molecular electronic based transducers. Chemiluminiscence based biosensors.

Biosensors in clinical chemistry, medicine and health care; Biosensors for veterinary, agriculture and food; Low cost biosensors for industrial processes for online monitoring; Biosensors for environmental monitoring.

UNIT- III

Molecular Electronics: Potential advantages and development towards a biomolecular computer; Development of Molecular arrays as a memory stores; Molecular wires and switches; Mechanisms of Unit assembly.

UNIT- IV

Design for A Biomolecular Photonic Computer: Assembly of photonic Biomolecular memory store; Information Processing; Commercial prospects for Biomolecular computing systems.

Text Books:

1. Biotechnology the Science and Business, Moses V, Cape RE, Academic Publishers.
2. Biosensors for environmental Monitoring, Bilitewski U, Turner APF, Harwood.
3. Biosensors for Analytical Monitoring: EPA Biosensor Group, Rogers KR, Mascini M

Note:

L ----> Lecture hours/week
T ----> Tutorial hours/week
P ----> Practical Hours/week
M ----> Max.Marks

BT-415 (B) **ELECTIVE – II (OPEN ELECTIVE)** **L T P M**

COMPUTATIONAL BIOLOGY

4 0 0 100

UNIT I

Computational Biology: Introduction, Scope & Significance; DBMS with reference to Biological Data- Data Abstraction, Database System Architecture; Modern Taxonomical Methods; Introduction to Biodiversity Informatics: Databases, National, Regional and Global Diversity Information Systems and Networks.

UNIT II

Prediction of Protein Structure and Modeling: Statistical Methods of Chou and Fasman; Classification of Three Dimensional Structures of Proteins Prediction of Structural Classes, Motifs, Folds and Domains, Classification of Three Dimensional Structures in Brookhaven Protein Data Bank (HSSP, SCOP, FSSP, CATH); Protein Structure Prediction: Structural Alignment Methods, Homology Modeling.

UNIT III

Computational Biology Tools: Bioinformatics Tools (Tree View, Phylip, Modeller, SPDBV, Autodoc, SAR & QSAR), Algorithms (Monte Carlo, Metropolis Algorithms), Introduction of Statistical Analysis Tools (MAT LAB, SAS, Mathematica, Prostat); Introductory to Computer Aided Drug Design (CAMD, ADME Prediction).

UNIT IV

Applications: Chemiinformatics in Biology, Conventions for representing molecules; Cheminformatics resources, Bioinformatics in pharmaceutical industries, Bioinformatics in immunology, Bioinformatics in agriculture Bioinformatics in forestry, Geoinformatics, Legal, ethical and commercial ramifications of bioinformatics, Biosensing.

Text Books:

1. Bioinformatics: Methods and Applications, SC Rastogi, N.Mendiratta & P Rastogi; PHI, New Delhi.
2. Ullman, J.D. Principles of Database Systems. Galgotia, New Delhi.
3. Tisdall, D., 2003 Mastering Perl for Bioinformatics. O'Reilly.
4. Baxevanis, A.D. and Francis Ouellette, B.F.2004 Bioinformatics: A practical Guide to the analysis of Genes and Proteins. Second Edition, Willey.
5. David W.Mount, Bioinformatics Sequence and Genome Analysis, Cold Spring, Harbor Laboratory Press.

References:

1. Hassan, A.S. 2004 Bioinformatics: Principles and Basic Internet. Trafford Publishing
2. Kohane, I.S., Kho, A. and Buthe, A.J. 2002 Microarrays for an Integrative Genomics. Barnes
3. & Noble, MIT Press.
4. Graur, D. and Li, W-H. 2000 Fundamentals of Molecular Evolution. Sinauer Ass., USA
5. Date, C.J. An Introduction to Database Systems, Vol I & II. Addison Wesley.